European Optical Society

Coherence for Europe ®

EOSAM 2014

15-19 September 2014, Berlin Adlershof, City of Science, Technology and Media

PROGRAMME

Sponsors:

Co-operating Organisations:

VENUE

©WISTA-MANAGEMENT GmbH

The EOSAM conference takes place in Berlin Adlershof, Germany's leading Science- and Technology Park with 1.000 businesses and 16 scientific institutes. More than 25.000 people work and study here. The Berlin-Brandenburg region is home to one of the most signifycant clusters for optics technologies in Europe. Many of these businesses are based at Adlershof. Companies such as AEMtec, Astro- und Feinwerktechnik, Bruker AXS Microanalysis, First Sensor Technology, Jenoptic Diode Lab, LLA Instruments, great eyes GmbH und Laser Technik Berlin (LTB) are situated here. The businesses are joined by the university and non-university research institutes, including Berlin Humboldt University's Physics Institut, the Helmholtz Centre for Materials and Energy, the Max-Born-Institute for Non-Linear Optics and Short Pulse Spectroscopy and the Ferdinand-Braun-Institute, the Leibniz-Institute for Microwave Technology.

Venue Address:
Adlershof con.vent.
Rudower Chaussee 17, 12489 Berlin
http://www.adlershof.de, www.adlershof-convent.de

TOURISTIC HIGLIGHTS

Berlin Television Tower - Symbol of the capital Berlin

Anyone who has ever been to Berlin has seen it. Indeed, it is hard to imagine not being able to take notice of it. No wonder - the Berlin Television Tower, which is 368 metres tall, is the highest publicly accessible building in Europe. But it's even more than that.

© Berlin Partner / FTB-Werbefotografie

Brandenburg Gate

While the only remaining city gate of Berlin formerly used to represent the separation of the city between East and West Berlin, since the Berlin Wall came down in 1989 the Brandenburg Gate has now come to symbolise German unity. In addition, this gate made of sandstone is one of the finest examples of German classicism.

© Berlin Partner / Scholvien

Gendarmenmarkt - An ensemble full of harmony

Many Berliners believe that the Gendarmenmarkt is the most beautiful place in Germany and indeed in all of Europe. Well, however that might be, it really is a must-see for all visitors to Berlin. This is the case because the Gendarmenmarkt is a beautiful example of an architectural ensemble full of harmony and it includes both the French and the German cathedral as well as the Concert House.

© Berlin Partner / FTB-Werbefotografie

DISCOVER BERLIN

For more sights and information, visit www.visitberlin.de

GETTING AROUND

1 **Adlershof con.vent.**
Rudower Chaussee 17, 12489 Berlin
http://www.adlershof.de
www.adlershof-convent.de

2 **HZB/ BESSY**
Albert-Einstein-Straße 15
12489 Berlin-Adlershof (6 minutes walk from Adlershof con. Vent.)

3 **Zentrum für Photovoltaik und Erneuerbare Energien**
Johann-Hittorf-Strasse 8
12489 Berlin
(10 minutes walk from Adlershof con. vent.)

4 **S-Bahn Adlershof**

Getting to Adlershof

By public transport it takes
10 min from Flughafen Schönefeld
30 min from Alexanderplatz
and 40 min from central train station Hauptbahnhof

By Public transport:
You can get to Adlershof via
S-Bahn – S8, S9, S45, S46 // Via U-Bahn – U7 towards Rudow, and then via connecting busses 162 or 260 to Adlershof // Via tram: 60 or 61 towards Max-Born-Straße.

By car:
From the Berliner Ring or inner city motorway (Stadtautobahn), head towards Schönefeld Airport. Take the exit 'Adlershof' // From Alexanderplatz, take the B96a towards Schönefeld Airport. When you reach S-Bahnhof Adlershof, turn right into Rudower Chaussee. You have reached your destination.

See **detailed maps and more info:** http://www.adlershof.de/en/direction-maps/bus-train/

Accommodation

Rooms in the following hotels were available for EOSAM attendees with special prices until 15 August 2014 :

Dorint Hotel, Adlershof, Berlin
Tel. +49 (0)30 678220
Address: Rudower Chaussee 15, 12489 Berlin, Germany
Website: http://hotel-berlin-adlershof.dorint.com/

Adapt Apartments, Adlershof, Berlin
Address: Erich-Thilo-Straße 3, 12489 Berlin, Germany
Website: http://www.adaptberlin.de

Park Inn by Radisson Hotel Berlin Alexanderplatz
Tel. +49 (0)30 2389 4333
Adress: Alexanderplatz 7, 10178 Berlin, Germany
Website: http://www.parkinn-berlin.de/default-de.html

InterCityHotel Berlin Brandenburg Airport
Tel.: +49 (0)30 7565751 353
Address: Seegraben 2, 12529 Schönefeld, Germany
Website: http://www.berlin-brandenburg-airport.intercityhotel.de

NH Berlin Treptow
Tel: +49 (0)30 639030
Address: Spreestraße 14, 12439 Berlin, Germany
Website: http://www.nh-hotels.com/nh/en/hotels/germany/berlin/nh-berlin-treptow.html

INFORMATION FOR AUTHORS AND ATTENDEES

ORAL PRESENTATIONS

Time slots: Presenting authors are allotted 15 minutes (12 minutes presentation plus 3 minutes for discussion). Please plan your presentation accordingly to meet the 15 minute maximum.

Presentation upload: Speakers are requested to upload their presentation to the computer in the meeting room well in advance to their talk.

Presentation format: Please bring your presentation on a USB mass storage, CD-ROM or DVD and include all video files. File formats: ppt, pptx and pdf. A Windows-based presentation computer will be provided.

For Mac users: To make sure your presentation is displayed correctly, please:

- bring your presentation as a pdf-file with fonts embedded or
- restrict yourself to Arial/Times New Roman (not Times)/Courier New (not Courier)/Symbol/Wingdings when creating your ppt- or pptx-file.

Technical equipment: Technical equipment (presentation computer, video projector) will be available on-site.

POSTER PRESENTATIONS

There will be one poster session during EOSAM 2014.

Poster session: Wednesday, 17 September 12:45 – 14:45 CEST

Posters may be set up starting 11:15 on Wednesday, 17 September and should be completely set up no later than 12:45 that day.
Poster authors are requested to be present at their posters during the official poster session. Please prepare and print your poster in advance to the conference. Poster set-up and removal is in the responsibility of the authors.
Any posters left on the boards at the close of the poster session will be discarded. Poster numbers will be displayed on the poster boards to show authors where to place their poster.
Required poster size: The posters should have a size of DIN A1 (594 x 841 mm) or DIN A0 (841 x 1189 mm) in a portrait format (no landscape format). Pins will be provided by the organiser.

REGISTRATION & FEES

At least one author of an accepted presentation is requested to register properly in advance to the conference.
The registration fee includes full-time admission to all topical meetings and sessions, summer school, the industrial exhibition, welcome reception, EOS Annual General Assembly, and the matchmaking event. Registration is necessary for all topical meetings and accompanying events. Please remember to register separately for the welcome reception and the matchmaking event.

REGISTRATION FOR CONFERENCE: www.conftool.com/eosam2014
REGISTRATION FOR WELCOME RECEPTION: http://www.epic-assoc.com/events/?at=104
REGISTRATION FOR MATCHMAKING EVENT: http://www.b2match.eu/eosam2014

EOS REGISTRATION DESK

On-site registration hours

Monday, 15 Sept	08:00 - 16:30	HZB/ BESSY, Albert-Einstein-Straße 15, 12489 Berlin-Adlershof (6 minutes walk from Adlershof con. Vent.)
Tuesday, 16 Sept.	08:00 - 17:00	Adlershof con.vent. Event and Visitor's Center, Rudower Chaussee 17
Wednesday, 17 Sept.	08:00 - 17:30	Adlershof con.vent. Event and Visitor's Center
Thursday, 18 Sept.	08:30 - 17:00	Adlershof con.vent. Event and Visitor's Center
Friday, 19 Sept.	08:00 - 15:30	Adlershof con.vent. Event and Visitor's Center

Information / Receipts / Confirmation of attendance
Attendees requiring a payment receipt or confirmation of attendance may obtain these documents on-site at the EOS registration desk.
Please note: Cash will not be accepted at the registration desk.
Only credit cards will be processed. The only acceptable credit cards are VISA and Mastercard.

EOS CONFERENCE DIGEST

The registration fee includes access to accepted abstracts of all topical meetings held at EOSAM 2014. The abstracts can be found on EOSAM website: www.myeos.org/eosam2014

The EOS does not publish conference proceedings with extensive papers. Authors who wish to publish in-depth papers are welcome to take advantage of the special publication offer from JEOS:RP (see next paragraph). This publication offer is an option but no obligation.

JEOS:RP - SPECIAL PUBLICATION OFFER

Attendees of EOSAM 2014 are welcome to submit a paper to the Journal of the European Optical Society - Rapid Publications (JEOS:RP). JEOS:RP is a peer-reviewed open-access journal which is listed with ISI Journal Citation Reports.

Publish your research with JEOS:RP

JEOS:RP EOS
ww.jeos.org

New impact factor
2013: 1.152

EOS European Optical Society
JOURNAL OF THE EUROPEAN OPTICAL SOCIETY
RAPID PUBLICATIONS

Discounted publication rates for attendees of EOSAM 2014

Special publication rates:

(incl. 20 % discount)

- **320 €** (non-member rate)
- **280 €** (member rate)

Paper submission deadline:

31 October 2014

The paper submitted must be an original contribution that is connected **to the topics of this EOS event**.

Journal Management Contact: Hannele Karppinen
Email: jeos-rp@myeos.org | Phone: +358 50 571 9227

www.jeos.org

EOSAM 2014 SPECIAL EVENTS

PHOTONICS ENTREPRENEURSHIP DAY/ WELCOME RECEPTION BY EPIC AND BERLIN BRANDENBURG PHOTONICS CLUSTER
The Photonics Entrepreneurship day and EOS Welcome Reception is open to all attendees and exhibitors of EOSAM 2014.
Date: Monday, 15 September
Time: 17:00-21:00
Location: Zentrum für Photovoltaik und Erneuerbare Energien
Johann-Hittorf-Strasse 8
12489 Berlin. (10 minutes walk from EOSAM location)

17:00 Welcome reception with snacks and drinks
18:00 Keynotes and interactive panel discussion with the participation of:
Andreas Nitze, CEO, Berliner Glas
Bjoern Bollendorff, CEO, Panono
Carlos Lee, Director General, EPIC
Milton Chang, CEO and serial entrepreneur, Incubic
Thomas Laurent, CTO and Founder, Eagleyard
Wolfgang Gries, CEO and Founder, DirectPhotonics
19:30 Networking reception

EOS ANNUAL GENERAL ASSEMBLY
The EOS Annual General Assembly is open to all EOS members, attendees and exhibitors of EOSAM 2014.
Date: Tuesday, 16 September
Time: 18:30 - 20:30
Room: Bunsen Hall

EOS FELLOWS 2013/2014 AWARD CEREMONY
The EOS Fellows for the years 2013 & 2014 and the awarding of their fellowship diplomas.
Date: Tuesday, 16 September
Time: 18:30-20:30
Room: Bunsen Hall

MATCHMAKING EVENT BY BERLIN PARTNER
Date: 17-18 September
Time: Wednesday 09:00-13:00 and 14:00-17:00
Thursday 09:00-13:00 and 14:00-17:00
This 2-day matchmaking event, parallel to EOSAM topical meetings and industrial exhibition, is a quick and easy way to meet potential cooperation partners.
Register for this event separately from the conference registration (free registration): http://www.b2match.eu/eosam2014

CONFERENCE DINNER
Separate Registration necessary, see www.myeos.org/events/eosam2014
Date: Wednesday, 17 September
Time: 20:30-23:00

EOS INTERNAL MEETINGS

Date: Monday, 15 September
Time: 8:00-18:00
Room: PTB/MLS
Seminar Room (Room No. 1.10)
Magnusstraße 9
12489 Berlin-Adlershof

JEOS:RP EDITORIAL BOARD MEETING

Date: Monday, 15 September
Time: 8:00-9:30
Room: PTB/MLS
Seminar Room (Room No. 1.10)

EDITORIAL TEAM OF JEOS:RP MEETING

Date: Monday, 15 September
Time: 9:30-11:00
Room: PTB/MLS
Seminar Room (Room No. 1.10)

EOS EXECOM MEETING

Date: Monday, 15 September
Time: 11:00-12:30
Room: PTB/MLS
Seminar Room (Room No. 1.10)

EOS INDUSTRIAL ADVISORY COMMITTEE MEETING

Date: Monday, 15 September
Time: 13:00-14:30
Room: PTB/MLS
Seminar Room (Room No. 1.10)

EOS SCIENTIFIC ADVISORY BOARD MEETING

Date: Monday, 15 September
Time: 14:30-16:00
Room: PTB/MLS
Seminar Room (Room No. 1.10)

EOS BOARD MEETING

Date: Monday, 15 September
Time: 16:00-18:00
Room: PTB/MLS
Seminar Room (Room No. 1.10)

EOSAM SUMMER SCHOOL

Date: Monday, 15 September
Time: 08:15-17:30
Location: HZB/BESSY, Lecture Hall (Room No. 3147) and
HZB/BESSY, PTB Seminar Room (Room No. 3221)
Albert-Einstein-Straße 15
12489 Berlin-Adlershof (6 minutes walk from EOSAM location)

EOSAM 2014 includes for the first time a Summer School on "Novelties in OPTICS and PHOTONICS".
The Summer School is held on Monday, 15 September and is kindly hosted by PTB. The Summer School includes 10 tutorials on topics related to the main sessions (also called TOMs) of EOSAM 2014. The objective is to teach the backgrounds followed by main current applications related to the upcoming TOMs.

The Summer School is in particular of interest for PhD students and Post-docs, but other attendees of EOSAM 2014 are also welcome. All participants registered at the conference and completed their fees will receive free entrance to the EOSAM 2014 Summer School, however, additional registration for the Summer School is necessary www.conftool.com/eosam2014.

TECHNICAL PROGRAM OF TUTORIALS
MONDAY, 15 SEPTEMBER 2014

LOCATION: HZB/BESSY, Lecture Hall (Room No. 3147), Albert-Einstein-Straße 15, 12489 Berlin-Adlershof

8:15-8:30 Opening by Dr. Mathias Richter of the Physikalisch-Technische Bundesanstalt (PTB) in Berlin.

8:30-10:30 **Tutorial on Guided Wave Optics (TOM1) and Silicon Photonics (TOM2)**
Jean-Emmanuel Broquin IMEP-LAHC, Grenoble (FR)

10:30-12:00 **Tutorial on Biophotonics and Medical Applications (TOM4)**
Michael Pircher, Medical University Vienna (AT)

12:00-13:00 LUNCH BREAK

13:00-14:30 **Tutorial on Photonic Crystals and Plasmonic Applications (TOM5)**
Rachel Grange, Friedrich-Schiller-University Jena (DE)

14:30-16:00 **Tutorial on Lens and Look: Optics for Cinematography (TOM6)**
Peter C. Slansky, University of Television and Film, Munich (DE)

16:00-17:30 **Tutorial on Organic Optoelectronics and Photonics (TOM7)**
Wolfgang Kowalsky, Innovation GmbH, Heidelberg (DE)

IN PARALLEL:

LOCATION: HZB/BESSY PTB Seminar Room (Room No. 3221), Albert-Einstein-Straße 15, 12489 Berlin-Adlershof

8:30-10:30 **Tutorial on Optics Fabrication (TOM3)**
Oliver Fahnler, Fisba Optik (CH)

10:30-12:00 **Tutorial on Finite-element Methods for Simulating Nano-optical Devices (TOM 9)**
Sven Burger, Zuse Institute & JMCwave, Berlin (DE)

12:00-13:00 LUNCH BREAK

13:00-14:30 **Tutorial on Active and Adaptive Optics (TOM8)**
Michel Verhaegen, TU Delft, Delft University of Technology (NL)

14:30-16:00 **Tutorial on Utilizing Aspheres in Optical Design (TOM 3)**
Ulrike Fuchs, Asphericon (DE)

16:00-17:30 **Tutorial on Ophtalmic Imaging Using Diffractive Optics (TOM10)**
Zeev Zalevsky, Faculty of Engineering, Bar-Ilan University, Ramat-Gan (IL)

EOSAM 2014 EXHIBITION

In 2014, an EOS organised exhibition will be held alongside the annual meeting to bridge the gap between science and industry. The EOSAM 2014 exhibition offers an excellent platform for gaining visibility and networking.

EXHIBITION OPENING HOURS

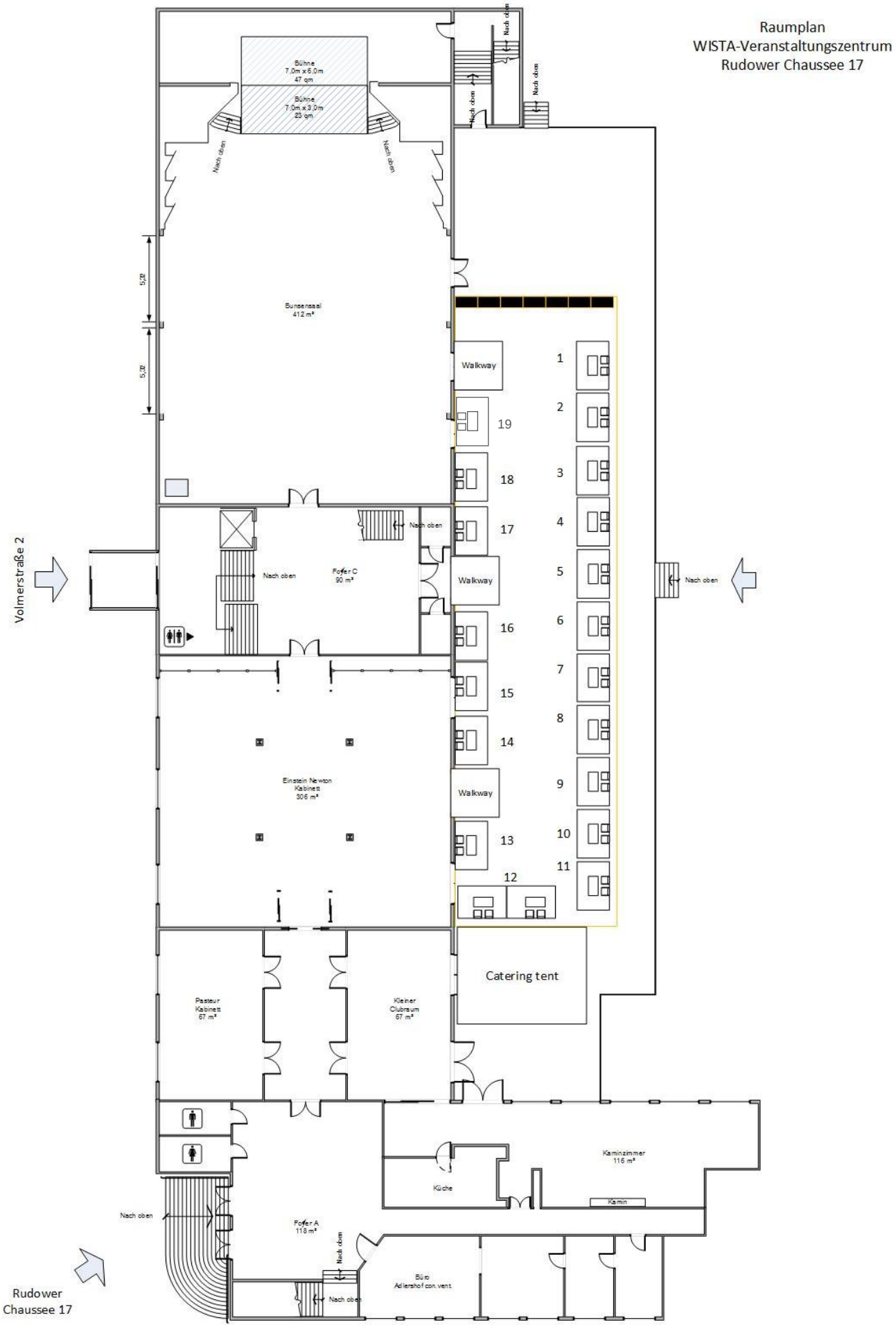
Date	Time
Wednesday, 17 Sept.:	10:30 - 17:30
Thursday, 18 Sept.:	11:00 - 17:30

Visit all exhibitors at EOSAM 2014 here:
www.myeos.org/events/eosam2014_exhibition

Exhibitors:

asphericon
acal bfi imagine optic
ALPAO
BERLINER GLAS
Berlin Partner for Business and Technology
CHINESE LASER PRESS
focal innovating vision & optics
finetech
FRT the art of metrology™
greateyes
HOLOEYE
ilis
JEOS:RP EOS ww.jeos.org
LIGHT TEC
LIGHTTRANS
Ocean Optics
OHARA®
QIOPTIQ Photonics for Innovation An Excelitas Technologies Company
SPINNER

HALL PLAN - TERASSE



Exhibitors

Booth no	Company name
1.	CLP Chinese Laser Press
2.	LightTrans Virtuallab UG
3.	FRT, Fries Research&Technology
4.	Finetech GmbH&Co.KG
5.	Berliner Glas KGaA
6.	LIGHT TEC
7.	HOLOEYE Photonics AG
8.	ALPAO
9.	ilis gmbh
10.	Qioptiq Photonics GmbH&Co.KG
11.	Acal BFi Germany GmbH &Imagine Optic SA
12.	asphericon GmbH
13.	Berlin Partner for Business and Technology
14.	Spinner GmbH
15.	OHARA GmbH
16.	Focal Vision & Optics
17.	Ocean Optics BV
18.	greateyes GmbH
19.	JEOS RP & EOS

EXHIBITORS

Acal BFi Germany GmbH # 11

Photonik
Oppelner Str. 5
82194 Gröbenzell
Germany
Phone: +49 8142 6520 0
E-Mail: sales-de@acalbfi.de
Website: www.acalbfi.de

Acal BFi is the European leader in advanced technology solutions. The Photonics portfolio includes a wide range of Wavefront Sensors and Adaptive Optics from IMAGINE OPTIC as well as Spectrometers, Optical Components, Lasers and Imaging Devices.

ALPAO # 8

345 rue Lavoisier
38330 Montbonnot
France
Phone: +33 476 890 965
E-Mail: contact@alpao.fr
Website: www.alpao.com

ALPAO is a manufacturer of adaptive optics products for use in research and industry. Our main products are fast deformable mirrors with large strokes, wavefront sensors, and complete adaptive optics system. These products are specially designed for astronomy, ophthalmology, microscopy, wireless optical communications, and laser applications.

asphericon GmbH # 12

Stockholmer Str. 9
07747 Jena
Germany
Phone: +49 3641 3100 500
E-Mail: sales@asphericon.de
Website: www.asphericon.de

asphericon is among the technological leaders in the field of asphere manufacture. asphericon assists its customers from the initial optic design, via manufacturing and coating, full-surface interferometric measuring and documentation, through to the assembly of optical modules and their optical characterization.

Berliner Glas KGaA Herbert Kubatz GmbH & Co # 5

Waldkraiburger Strasse 5
12347 Berlin
Germany
Phone: +49 30 60905 0
E-Mail: photonics@berlinerglas.de
Website: www.berlinerglasgroup.com

BERLINER GLAS develops, produces and integrates optics, mechanics and electronics into innovative system solutions. As OEM partner from prototyping to volume production, BERLINER GLAS serves innovative customers in various market segments – semiconductor industry, medical technology, laser and space technology and analytics.

Berlin Partner für Wirschaft und Technologie GmbH # 13

Fasanenstr. 85
10623 Berlin
Germany
Phone: +49 30 46302 456
E-Mail: gerrit.roessler@berlin-partner.de
Website: www.berlin-partner.de

Berlin Partner for Business and Technology offers business and technology promotion for companies, investors and science institutes in Berlin. With carefully tailored services and excellent links to research, our experts provide an outstanding range of offerings to help companies launch, innovate, expand and secure their economic future in Berlin.

As a unique Public Private Partnership, Berlin Partner for Business and Technology is a cooperation between the Berlin State Senate and over 200 companies dedicated to promoting their city. Berlin Partner is also responsible for the German capital's global marketing, for example with the successful "be Berlin" campaign.

Finetech GmbH&Co.KG # 4

Wolfener Str. 32/34
12681 Berlin
Germany
Phone: +49 30 93 66810
E-Mail: finetech@finetech.de
Website: www.finetech.de

Finetech is a globally operating manufacturer of equipment for sub-micron precision bonding and packaging of electronic, optical and hybrid assemblies. The modular FINE-

EXHIBITORS

PLACER® systems support numerous bonding technologies for a wide range of applications and tailor-made equipment solutions.

Focal Vision & Optics # 16

Instituten weg 25 A
7521 PH Enschende
Netherlands
Phone: +31 53 428 7882
E-Mail: robert.evers@focal.nl
Website: www.focal.nl

Focal Vision & Optics is a Design and Engineering company specialized in the design and delivery of accurate optical precision measurement systems. Systems comprise of optical components, off-the self selected or custom made if needed, and advanced vision algorithms delivering the actual data results. We were founded in 2008, employ 18 professionals in optics, pattern recognition and system integration and roll -out. Branches in which we are active are: industrial automation, precision defect detection, semiconductor qualification tools and medical optics device development.

FRT, Fries Research & Technology GmbH # 3

Friedrich-Ebert-Straße
51429 Bergisch Gladbach
Germany
Phone: +49 2204 84 3205
E-Mail: abholte@frt-gmbh.com
Website: www.frt-gmbh.com

Fries Research & Technology GmbH (FRT) offers a comprehensive range of metrological surface measuring systems for the non-destructive investigation of topography, profile, film thickness, roughness, abrasion and many other properties. More than 500 reputable international companies from the automotive, semiconductor, MEMS, optical, photovoltaic and many other industries equip their R&D and production departments with FRT metrology systems. FRT operates from Bergisch Gladbach, Germany and maintains subsidiaries in China, Switzerland and the United States. Additionally, FRT provides a distribution and service network in the USA, Asia and Europe.

greateyes GmbH # 18

Rudower Chaussee 29
12489 Berlin
Germany
Phone: +49 30 6392 6237
E-Mail: info@greateyes.de
Website: www.greateyes.de

Greateyes develops, manufactures and markets high-performance scientific cameras. They are used as precise detectors in a wide range of imaging and spectroscopy applications. Furthermore the company manufactures electroluminescence and photoluminescence inspection systems and offers a number of related services.

HOLOEYE Photonics AG # 7

Albert-Einstein-Str. 14
12489 Berlin
Germany
Phone: +49 30 6392 3660
E-Mail: contact@holoeye.com
Website: www.holoeye.com

HOLOEYE Photonics AG offers design and production services of diffractive micro-optical elements (DOE), Spatial Light Modulators (SLM) which are based on high-resolution translucent or reflective microdisplays and a great variety of LCOS microdisplay types and products as OEM solution in higher quantities.

ilis gmbh # 9

Konrad-Zuse-Str. 22
91052 Erlangen
Germany
Phone: +49 9131 974 7790
E-Mail: info@ilis.de
Website: www.ilis.de

ilis develops, produces and distributes software solutions, measuring systems as well as automated polarimeter systems for quality assurance in the glass and optical industry.

EXHIBITORS

JEOS:RP - Journal of the European Optical Society: Rapid Publications # 19

Länsikatu 15
80110 Joensuu
Finland
Phone: +358 50 595 4348
E-Mail: jeos-rp@myeos.org
Website: www.jeos.org

JEOS:RP is the online Journal of the European Optical Society: Rapid Publications covering a large scope of research in optics and photonics. JEOS:RP is a peer-reviewed open-access journal which is listed with ISI Journal Citation Reports. ISSN 1990-2573.

LIGHT TECH # 6

POLE D'ACTIVITES HYEROIS, 1128 ROUTE DE TOULON
83400 HYERES
France
Phone: +33 494 12 18 48
E-Mail: nevi.ferrer@lighttec.fr
Website: www.lighttec.fr

Light Tec is an Engineering company providing optical design tools and connected services. Since 1999, we provide cutting edge tools for cutting edge design. During those past years, more than 2000 companies purchased design or measurement tools from Light Tec.

Products guide: Optical design software: Code V, LightTools, RSOFT
Scattering measurements systems: Reflet, Mini-Diff

Optical Engineering Services and measurement services

LightTrans Virtuallab UG # 2

Kahlaische Straße 4
07745 Jena
Germany
Phone: +49 3641 53129 50
E-Mail: service@lighttrans.com
Website: www.lighttrans.com

LightTrans offers the optical design and simulation software VirtualLab™ 5. VirtualLab™ enables the analysis and development of micro optics, laser systems, gratings, laser cavities, ultra-short pulses, homogenization systems and metrology systems including diffraction and interference effects.

Ocean Optics BV

Sales # 17

Maybachstrasse 11
73760 Ostfildern
Germany
Phone: +31 26 3190500
E-Mail: info@oceanoptics.eu
Website: www.oceanoptics.com

Ocean Optics is the inventor of the world's first miniature spectrometer and a global leader in photonics for research, life sciences, quality assurance, education and OEM applications. Our extensive line of complementary technologies includes spectrometers, chemical sensors, metrology instrumentation, optical fibres and thin films and optics.

OHARA GmbH # 15

Im Langgewann 4
65719 Hofheim
Germany
Phone: +49 6192 9650 50
E-Mail: info@ohara-gmbh.com
Website: www.ohara-gmbh.com

Ohara GmbH began operations in Germany in January, 1990. We are located in Hofheim which is a small city near Frankfurt and Wiesbaden.

Qioptiq Photonics GmbH & Go. KG # 10

Köningsallee 23
37081 Göttingen
Germany
Phone: +49 551 6935 0
E-Mail: sales@qioptiq.de
Website: www.qioptiq.com

Qioptiq, an Excelitas Technologies Company, designs and manufactures photonic products and solutions that serve a wide range of markets and applications in medical and life science, industrial manufacturing, defense as well as aviation and aerospace.

EXHIBITORS

Shanghai Institute of Optics and Fine Mechanics,
Chinese Academy of Sciences
Chinese Laser Press # 1

No. 390, Qinghe Road, Jiading district
201800, Shanghai
China
Phone: +86 21 6991 8198
E-Mail: wxf@siom.ac.cn
Website: www.opticsjournal.net

Chinese Laser Press (CLP) was established by Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, and Chinese Optical Society in 2009, with the key business of publishing journals in both traditional and digital models. Currently, CLP publishes six journals and a magazine, which enjoy high reputation and impact in the optics community. The website sponsored by CLP, with address of www.opticaljournal.net, contains thousands of articles from more than 48 excellent optical journals, and the latest information in optics industry. CLP is dedicated to constructing a potential optical publishing group with high global influence.

Spinner GmbH # 14

Erzgiessereistrasse 33
80335 München
Germany
Phone: +49 89 12601 0
E-Mail: info@spinner-group.com
Website: www.spinner-group.com

SPINNER rotary joints are mainly used in civilian and military radar systems as well as in communications systems. All major German airports are equipped with our products to ensure the air control systems have reliable RF transmission. SPINNER offers a broad range of advanced coaxial, optical and waveguide components for radar - and communication systems.

To develop the fiber optic rotary joints, SPINNER has been able to fall back on more than 20 years of experience in the field of optical transmission systems. As a significant supplier of complex optical systems, we have the necessary knowledge to optimize the critical assembly processes. We are proficient in the packaging of integrated circuits, which is needed to adjust and fix the optical components with micrometer precision.

FOREWORD BY THE GENERAL CHAIRS

The EOS Annual Meeting (EOSAM) has established itself as a major European event for the European optics and photonics community. This year the sixth issue of EOSAM is held between September 16-19 in Adlershof in Berlin.
Adlershof is one of the largest and fastest growing science and technology parks in Germany where more than 24,000 people are working, of whom 9,000 are students. Photonics and optics is one of the six focus areas of Adlershof. On over 4 there are the Humboldt University, 10 non-university research institutes such as the German Aerospace Center, the Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy and the German Metrology Institute PTB (Physikalisch-Technische Bundesanstalt). Furthermore, there are 459 companies among which more than hundred in the field of media and IT in the so-called Media City.
EOSAM2014 is held in the Event Centre of Adlershof (con.vent.) in the German capital. Fifteen years after the re-unification of Germany, Berlin has become a thrilling metropolis with exciting new architecture as well as many historic sites and interesting museums.
EOSAM2014 consists of eleven topical meetings (TOMs) and a poster session, which cover most of current optics and photonics. The TOMs vary from highly scientific ones to TOMs orientated towards industrial applications. It has become a highly appreciated tradition that the opening talk of EOSAM is given by one of the leaders of the Photonic Unit of the European Commission. This time Dr. Ronan Burgess, Deputy Head of the Photonics Unit will give us information about Horizon2020 and calls coming up in the field of optics and photonics. The highly successful session on "Grand Challenges in Optics" will again be held, this time consisting of four exciting talks. New is TOM 11, held on Friday September 19, and dedicated to the dissemination of EU projects. New is also the day of tutorials for newcomers to the field, which is held on Monday September 15, i.e. on the day before the official start of the conference. During this day, which is kindly hosted by PTB, distinguished scientists lecture on all the main topics of the conference. The lectures are free to attend for all participants of EOSAM2014 but additional registration through the website is necessary. In the evening of Monday September 15, Berlin Partner for Business and Technology organizes a network evening event with food and drinks: "Photonics Day of Entrepreneurship", in the Helmholtz Center for Photovoltaic and Renewable Energy at Adlershof. This event is free for all participants of EOSAM2014. On Tuesday evening September 16 the EOS Annual Assembly is held for the members of the EOS. On Wednesday evening September 17 the conference dinner is held for which separate registration is required.
So EOSAM2014 consists of a week full of interesting optics and photonics talks and tutorials as well as networking and social events. We wish you a fruitful week and an enjoyable stay in Berlin!

Paul Urbach, Seppo Honkanen and Rainer Schuhmann

EOSAM 2012 CHAIRS

General Chair
Paul Urbach
TU Delft (NL)
EOS President

General Co-chair
Seppo Honkanen
University of Eastern Finland (FI)

Local Chair
Rainer Schuhmann
Berliner Glas KGaA (DE)

OVERVIEW: EOSAM 2014 AT A GLANCE

Eleven Topical Meetings:

- TOM 1 – Guided-Wave Optics
- TOM 2 – Silicon Photonics
- TOM 3 – Optical System Design and Tolerancing
- TOM 4 – Biophotonics and Medical Optics
- TOM 5 – Metamaterials, Photonic Crystals and Plasmonics: Fundamentals and Applications
- TOM 6 – Optics for Cinematography and Video
- TOM 7 – Energy Harvesting and Organic Photonics
- TOM 8 – Active and Adaptive Optics
- TOM 9 – Frontiers in Optical Metrology
- TOM 10 – Diffractive Optics
- TOM 11 – Special session for partners in an EU project to disseminate their project

- EOSAM Summer School
- Photonics Entrepreneurship Day/ Welcome Reception by EPIC and Berlin Brandenburg Photonics Cluster
- EOS Annual General Assembly
- INDUSTRIAL EXHIBITION
- Matchmaking event by Berlin Partner
- Conference Dinner
- Session: Grand Challenges in Optics

TOM 1 – Guided Wave-Optics

18 September

The focus of this topical meeting is to explore new trends and applications in the field of Guided-Wave Optics (excluding Si-Photonics having its own topical meeting). New developments on fiber and waveguide lasers, fiber non-linearities, nanophotonics materials and devices, as well as on sensor and Telecom applications will be discussed.

CHAIRS

Seppo Honkanen
University of Eastern Finland (FI)

Franko Küppers
Darmstadt University of Technology (DE)

INVITED SPEAKERS

Light manipulation through surface modes in dielectric multilayers
Emiliano Descrovi, DISAT - Politecnico di Torino (IT)

Rogue waves in Optics
Goëry Genty, Tampere University of Technology (FI)

Glass integrated optics: from telecom to sensors
Jean-Emmanuel Broquin, IMEP-LAHC, Grenoble (FR)

Lithium Niobate Nanophotonics : When Optics beats technology
Maria-Pilar Bernal, FEMTO-ST, Besancon (FR)

Fiber lasers and electro-optic polymer/Si waveguide modulators and their applications
Nasser Peyghambarian, University of Arizona (US); Aalto University (F); University of Eastern Finland (FI)

Optical turbulence and synchronisation in fiber lasers
Stefan Wabnitz, Università di Brescia (IT)

Modulating light with 2D materials
Zhipei Sun, Aalto University (FI)

PROGRAMME COMMITTEE

Gualtiero Nunzi Conti
Instituto di Fisica Applicata Nello Carrara (IT)

Matthieu Roussey
University of Eastern Finland (FI)

Nadège Courjal
FEMTO-ST Institute (FR)

Robert Norwood
University of Arizona (US)

Karl-Friedrich Klein
Technische Hochschule Mittelhessen (DE)

TOPICS

- Optical fiber fabrication and devices
- Specialty optical fibers
- Integrated optics: design, fabrication and devices (other than Si-photonics)
- Guided-wave sensors, based on fibers and planar waveguides (other than Si-
- photonics)
- Fiber lasers and related components and phenomena
- Telecom optics, devices and sub systems

TOM 2 - Silicon Photonics

16-17 September

The focus of this topical meeting will be to explore new developments and applications in the field of silicon photonics and related areas, ranging from optical interconnects to sensing applications. Potential topics include, but are not limited to the design, simulation, modeling and fabrication of optical interconnects, (all) optical (on chip) routing architectures and technologies as well as related design concepts for high speed, low power photonic integrated circuits (PICs). Also (CMOS-compatible) optical sources and detectors and the optimization of light emission and absorption for data processing using materials such as SiGe or III/IVs etc. will be discussed. Following the developments described above, optical on chip data processing including nanoscale quantum optics and all the way to optical computing may lead to disruptive technologies to be discussed at the conference. Advanced monolithic or hybrid processing techniques for the fabrication of photonic structures on Si such as 3D-Laser-lithograhy, nano-imprint techniques or self-assembly as well as developments in nano photonic materials with tailored optical properties (e.g. optical polymers or fibres) and photonic sensor applications will be considered.

PLENARY SPEAKER

Photonics for computing applications and the need for electro-optical integration
Bert Offrein, IBM Research, Rüschlikon (CH)

INVITED SPEAKERS

III-V integration on silicon: monolithic or bonding?
Dries van Thourhout, University of Ghent (BE)

New perspectives in silicon micro and nanophotonics
Ivo Rendina, Institute of Microelectronics and Microsystems of CNR-Italy, Napoli (IT)

Photonic BiCMOS – a new flavor of Silicon Photonics
Lars Zimmermann, Leibniz-Institut für innovative Mikroelektronik (IHP), Frankfurt Oder (DE)

The future of Silicon Photonics
Lionel Kimerling, Massachusetts Institute of Technology (MIT), Cambridge (US)

Integration of Ultra-Low Loss Waveguides with Silicon Photonics
Martijn Heck, Aarhus University (DK)

CMOS compatible biophotonics based on SiN waveguides
Pol van Dorpe, IMEC Leuven (BE)

CHAIRS

Ralf B. Bergmann
BIAS - Bremer Institut für angewandte Strahltechnik GmbH. and University of Bremen (DE)

Graham Reed
University of Southampton (GB)

PROGRAMME COMMITTEE

Antti Säynätjoki,
Aalto University (FI)
Concita Sibilia,
University of Rome (IT)
Franz Hutter,
IMS-Chips, University Stuttgart (DE)
Gunter Roelkens,
Ghent University (BE)
José Capmany,
ITEAM Research Institute Universidad Politecnica de Valencia (ES)
Klaus Petermann,
Technical University, Berlin (DE)
Mike Wale,
Oclaro Technology Plc. (UK)
Roberta Ramponi,
Politecnico di Milano (IT)
Seppo Honkanen,
University of Eastern Finland (FI)
Stefan Maier,
Imperial College London (GB)
Walter Lang,
IMSAS, University Bremen (DE)

TOPICS

- Design, simulation and fabrication for Si-photonics
- Optical interconnects
- High speed, low power PICs
- Monolithic or hybrid (CMOS-compatible) optical sources and detectors (SiGe, III/V, alt. Mat. etc.)
- Optical computing
- Monolithic or hybrid fabrication for photonic structures on Si (3D-Laser-litho-grahy and nano-imprint, etc.)
- Nano photonics tailored for Si-Photonics (photonic crystals, nonlinear optics, etc.)
- Assembly and packaging
- Future Si-photonic manufacturing (e.g. foundry concepts or alternative approaches)

TOM 3 - Opticsl System design and Tolerancing

16-19 September

The goal of this topical meeting is to give an overview about future trends and what is going on in optical and optomechanical system design, both for imaging systems as well as for non-imaging systems. TOM3 will show how upcoming technologies enable innovative optical designs for new applications. The challenges of cost-effective manufacturability and testing methods will be discussed, based on a smart tolerancing process and well-adapted alignment strategies.

PLENARY SPEAKER

The evolution of a New High NA Catadioptric Design
David Shafer,Shaferlens (US)

INVITED SPEAKERS

Free Form Surfaces in Imaging Optics
Alexander Epple, Johannes Ruoff, Carl Zeiss SMT AG (DE)

The Larange Invariant- a Bridge Between Imaging and Illumination Design
Alois Herkommer, Universität Stuttgart (DE)

Broadening the Design Focus with Computational Imaging
Andy Harvey, University of Glasgow (GB)

Engineering Design for Consumer Optics
Anurag Gupta, Google (US)

Optical Design and Prototyping of Plenoptic Imaging Systems
Chir Weei Chang, Industrial Technology Research Institute, Hsinchu (TW)

Optics Standards for the Global Optics Marketplace
David Aikens, Savvy Optics (US)

Optical Design and Evaluation of Large-magnification and High-definition Rigid Endoscope
Dewen Cheng & Yongtian Wang, Beijing Institute of Technology (CN)

Monge-Ampere Equation in Illumination Optics
Jan ten Thije Boonkkamp, Technical University of Eindhoven (NL)

Design of a Manufacturable Freeform Three-Mirror Imaging Telescope
Jannick Rolland, University of Rochester (US)

Optimization of As-Built Performance
John Rogers, Synopsys (US)

Metrology for Asphere and Freeform Optics by UA3P
Keishi Kubo, Panasonic Corp. (JP)

Are Freeform Telescopes more alignment sensitive?
Kevin Thompson, Synopsys (US)

Optical design for Head Mounted Displays using free-form optics
Koichi Takahashi, Olympus Corp. Tokyo (JP)

Optimization with Global Explorer for the lens design
Masaki Isskihiki

Photomask challenges of EUV technology
Massimiliano Pindo, TPI, Dresden (DE)

Köhler Integration in Color Mixing Collimators
Oliver Dross, Philips Lighting (NL)

CHAIRS

Wilhelm Ulrich
Carl Zeiss AG (DE)

Kimio Tatsuno
Koga Research Institute Inc., Tokyo (JP)

PROGRAMME COMMITTEE

Andrew Wood,
Qioptiq (UK)
Irina Livshits,
NRU-ITMO, University of St. Petersburg (RU)
Julius Muschaweck,
ARRI (DE)
Jyrki Kimmel,
Nokia (FI)
Kimio Tatsuno,
Koga Research Institute Inc., Tokyo (JP)
Rob Bates,
Five Focal LLC (US)
Ruben Mohedano,
LPI (ES)
Rung-Ywan Tsai,
Industrial Technology Research Institute, Hsinchu (TW)
Stefan Bäumer,
TNO (NL)
Wilbert Ijzermann,
Philips Lighting (NL)
Wilhelm Ulrich,
Carl Zeiss AG (DE)
Wolfgang Vollrath,
KLA-Tencor (DE)
Yasuhiro Ohmura,
Nikon (JP)
Yongtian Wang,
Beijing Institute of Technology (CN)

TOPICS

- Optical & optomechanical system design
- Tolerances
- Error budgeting
- Technological and manufacturing aspects
- Alignment strategies
- Digital correction means
- Cost considerations
- Standardization
- Including both imaging and non-imaging optics (with applications in lighting)

TOM 3 - Optical System design and Tolerancing

16-19 September

The goal of this topical meeting is to give an overview about future trends and what is going on in optical and optomechanical system design, both for imaging systems as well as for non-imaging systems. TOM3 will show how upcoming technologies enable innovative optical designs for new applications. The challenges of cost-effective manufacturability and testing methods will be discussed, based on a smart tolerancing process and well-adapted alignment strategies.

INVITED SPEAKERS

Progress in High-luminance LEDs to benefit Etendue-critical Systems
Peter Brick, Osram (DE)

State of the Art and Future Trends for Automotive Lighting
Stephan Berlitz, Audi AG (DE)

Wavefront Control Technology using Spatial Light Modulator in Bio and Medical Imaging
Takashi Inoue, Hamamatsu Photonics K.K. (JP)

A Surface-resolved Approach for Analysis and Correction of Secondary Color
Thomas Nobis, Carl Zeiss AG (DE)

Spectrum-sensitive OCT microscope using visible LEDs
Toshiaki Iwai

Optical Mass Storage using Polarization Holography
Toyohiko Yatagai, Utsunomiya University of Tokyo (JP)

Don't guess: use physics for white LED lighting
Willem Vos, University of Twente (NL)

Optical Design and Manufacturing Requirements for High- Performance Microscope Objectives
Wolfgang Vollrath, KLA-Tencor (DE)

High Density Holographic Data Storage Using Shift and Peristrophic Multiplexing with Spherical Reference Wave
Zenta Ushiyama, Tyco Corp. (JP)

TOM 4 - Biophotonics and Medical Optics

16-17 September

The focus of this topical meeting is to explore new trends and applications in the field of Biophotonics and Medical Optics. New developments in optical control of cells, biomarkers, fluidics and lab on a chip devices as well as new approaches to tissue imaging and cell functionality will be discussed.

CHAIRS

Johannes de Boer
VU University Amsterdam (NL)

Martin Leahy
National University of Ireland, Galway (IE)

Alexander Heisterkamp
Gottfried Wilhelm Leibniz Universitaet (DE)

PLENARY SPEAKER

Advances in Multispectral Optoacoustic Tomography
Vasilis Ntziachristos, Technical University of Munich, Munich (DE)

INVITED SPEAKERS

Quantitative relation between tissue organization and optical properties derived from Optical Coherence Tomography images
Dirk-Jan Faber, Academic Medical Center, Amsterdam (NL)

Biophotonics for tissues disease assessment
Francesco Pavone, University of Florence (IT)

Quantitative phase imaging of cells in 2, 3, and 4 dimensions
Gabriel Popescu, University of Illinois at Urbana-Champaign (USA)

New insight into corneal micro-structure with polarization-resolved second harmonic generation microscopy
Gael Latour , Ecole Polytechnique, Laboratory for Optics and Biosciences, CNRS, INSERM, Palaiseau (FR)

Heartbeat OCT
Gijs van Soest, Erasmus Medical Center, Rotterdam (NL)

Spatiotemporal Optical Coherence Manipulation
Maciej Wojtkowski, University of Torun (PL)

Adaptive optics en-face OCT/SLO: latest developments
Michael Pircher, Medical University Vienna (AT)

Digital Adaptive Optics Optical Coherence Tomography
Rainer Leitgeb, Medical University Vienna (AT)

PROGRAMME COMMITTEE

Adrian Podoleanu,
University of Kent (GB)
Gereon Huttmann,
University of Lubeck (DE)
Michael Pircher,
Medical University Vienna (AU)
Robert Huber,
University of Lubeck (DE)

TOPICS

- Optical control of cells, optogenetics
- Photoporation Biomarkers for optical techniques
- Studies of cells and single molecules
- Lab-on-a-chip optofluidic devices
- Microfluidic biosensors
- Fabrication technologies for optofluidics
- Optical Coherence Tomography technical advances, functional OCT, catheter development
- Optical Coherence Tomography in clinical practice, translational research
- Optical Coherence Tomography in

TOM 5 - Metamaterials, Photonic Crystals and Plasmonics: Fundamentals and Applications

16-18 September

TOM5 is related to light matter interaction at subwavelength and deep-subwavelength scales. It features three main topics — photonic crystals, metamaterials, plasmonics — as well as newest research directions and significant research directions in these fields. Where are photonic and electromagnetic nano structures headed? What are their recent breakthroughs? What are their future resources and uses? Plan to attend TOM5 for answers to these questions and many more. See you there.

PLENARY SPEAKER

Optical Invisibility Cloaking
Martin Wegener, the Karlsruhe Institute of Technology (KIT) (DE)

INVITED SPEAKERS

Locally Resonant Metamaterials: Focusing, Imaging and Manipulating Waves at the Deep Subwavelength Scale
Geoffroy Lerosey, Institut Langevin - ESPCI ParisTech and CNRS (FR)

Collective plasmonic/photonic resonances coupled to luminescent molecules: from quantum critical phenomena to applications
Jaime Gómez Rivas, Eindhoven University of Technology (NL)

Extreme plasmonics in atomic-scale materials
Javier Garcia de Abajo, ICFO (ES)

Optical signal processing using Fano effects in photonic crystals
Jesper Mork, Technical University of Denmark (DK)

Toward active control of Terahertz waves using graphene-based meta-surfaces
Lei Zhou, Fudan University (CN)

Large suppression of quantum fluctuations of light from a single emitter by an optical nanostructure
Mario Agio, National Institute of Optics (CNR-INO) (IT)

Active Plasmonics in semiconductor-metal hole arrays (Joint invited talk with TOM 10)
Martin Van Exter, Leiden University (NL)

Bringing photonic sub-wavelength structures to application
Uwe Zeitner, Fraunhofer Institute for Applied Optics and Precision Engineering (DE)

CHAIRS

Philippe Lalanne
Institute d'Optique (FR)

Larry Yuan
Shenzhen University China (CN)

Paul Urbach
Delft University of Technology (NL)

PROGRAMME COMMITTEE

Anatoly Zayats,
King's College London (UK)
Cefe López,
Instituto de Ciencia de Materiales de Madrid (CSIC) (ES)
Concita Sibilia,
Sapienza University of Rome (IT)
J.J. Greffet,
Institut d´Optique (FR)
Joseph Braat,
Delft University of Technology (NL)
Larry Yuan,
Shenzen University (CN)
Paul Urbach,
Delft University of Technology (NL)

TOPICS

- Photonic crystals and wires, optical microcavities, slow light
- Subwavelength metal surfaces, plasmonic crystals
- Transport in quasiperiodic and random photonic systems
- Negative- and zero- refractive index and other metamaterial concepts
- Active and tunable optical metamaterials
- Electromagnetic field confinement and enhancement
- Evanescent fields and optical imaging
- Nanomanipulation with light
- Quantum and nonlinear optics in nanostructures, optical antennas
- Nanophotonics for energy conversion applications
- Nanophotonics for bio- and chemosensing applications
- Theory and modelling for nanophotonics and metamaterials

TOM 6 - Optics for Cinematography and Video

19 September

The scope of this topical meeting is to bring together experts around the application of optics in the field of cinematography and video. Different aspects of the production of moving images will be covered, including optics used in and around the camera as well as optics used for displaying the images to the viewer, e.g. in projection and display devices.
Furthermore, this topical meeting is aiming for a discussion of current and future creative requirements of cinematographic productions in terms of creating a desired 'look' using optics.

PLENARY SPEAKER

Development of Motion Picture Camera Zoom Lenses
Iain A. Neil, Scotoptix, Commugny (CH)

INVITED SPEAKERS

4K and HFR: The Trouble with Sharpness
Christian Iseli, Zurich University of the Arts (ZHdK) (CH): 4K and HFR

Cine Lens Quality
Ian Marshall, BAE Systems (UK) : Double Vision

Lens - Pixel - Look. Camera Optics beyond 4K and UHD
Peter C. Slansky, HFF - University of Television and Film, Munich (DE)

CHAIRS

Matthias Pesch
ARRI, Munich (DE)

Peter C. Slansky
HFF - University of Television and Film Munich (DE)

PROGRAMME COMMITTEE

Iain Neil, Scotoptix,
Commungny (CH)

Michael Pfeffer,
University of Applied Sciences Ravensburg-Weingarten (DE)

Norbert Kerwien,
Carl Zeiss AG (DE)

TOPICS

- Optics for digital and analogue cinematography and video
- Camera-optics (prime and zoom lenses, anamorphic systems, optics for 4K+ systems)
- Stereoscopic 3D Imaging
- Optics for UHDTV video systems
- Camera sensor technology (4K, 6K, 8K)
- Projection optics for 4K+ systems
- Projector types, such as general video, DLP, LCoS
- Cinematography and video: New trends to meet cinematographic needs
- 'Look creation' and lens selection

TOM 7 - Energy Harvesting and Organic Photonics

17-19 September

Organic materials have a number of ideal features for light matter interaction that pose them as best candidate for many photonic applications in communication and energy. Yet applications, albeit very successful, are still a few. This topical meeting aims to collect the community of material scientists working in the field and with an interest towards application in photonics, in order to have an up dated view of the state of art and a vision for the future.

PROGRAMME COMMITTEE

David Beljonne,
Université de Mons (BE)
David Lidzey,
University of Sheffield (UK)
Giuseppe Gigli,
Università del Salento (IT)
Graham Turnbull,
University of St. Andrews (UK)
Guglielmo Lanzani,
Politecnico di Milano (IT)
Henry Snaith,
University of Oxford (UK)
Joachen Feldmann,
Ludwig Maximilians University, Munich (DE)
Joseph Zyss,
Molecular Quantum Photonics Laboratoty (FR)
Larry Lüer,
IMDEA-Nanociencia Institute

CHAIRS

Guglielmo Lanzani
Istituto Italiano di Tecnologia, (IT)

David Lidzey
University of Sheffield (GB)

Davide Comoretto
University of Genova (IT)

PLENARY SPEAKER

Squeezing light into nanogaps: plasmonics in the sub-nm, single moleclue and quantum domains
Jeremy Baumberg, Cambridge University (GB)

INVITED SPEAKERS

Christoph J. Brabec, Friedrich-Alexander University, Erlangen-Nürnberg (DE)

Self-Organised Metal-Dielectric Plasmonic Nanopatterns
Francesco Buatier de Mongeot, University of Genova (ITA)

The power of intermolecular interactions in organic semiconductors: from threaded molecular wires to PCBM single crystals
Franco Cacialli, University College London (GB)

Massive scale production and installation of flexible printed solar cells
Fredrik Krebs, Technical University of Denmark (DK)

Hybrid photoconverters from molecular dyes and photosynthetic microorganisms
Gianluca Farinola, University of Bari (IT)

Organic semiconductor light sources for visible light communications
Graham Turnbull, University of St. Andrews (GB)

Structural and Electronic Properties in Polymer-Based Solar Cells: A Theoretical Insight
Jérôme Cornil, Université de Mons (BE)

Photocatalysis with Semiconductor Nanocrystals
Jochen Feldmann, Ludwig-Maximilians University Munchen (DE)

Jordi Martorell, Institut de Ciències Fotòniques (ES):

Light management with flexible organic photovoltaic devices
Olle Inganäs, Linköping University (SE)

Structural properties of molecular thin films for organic electronic applications
Roland Resel, Graz University of Technology (AT)

Emerging topics in organic polaritons
Stephane Kena-Cohen, Polytechnique Montreal (GB)

PROGRAMME COMMITTEE (continued)

Margherita Zavelani-Rossi,
Politecnico di Milano (IT)
Michele Muccini,
Institute for Nanostructured Materials, CNR Bologna (IT)
Neil Greenham,
University of Cambridge (UK)
Olle Inganäs,
Linköping University (SE)
René Janssen,
Eindhoven University of Technology (NL)

TOPICS

- Spectroscopy of functional organic materials
- Organic lasers and optical amplifiers
- Organic photonics: self-assembled vs top-down patterning
- OLEDs and OLETs
- Transport and conduction in organic devices
- Spectroscopy of functional organic materials
- Photovoltaics, dye-sensitised solar cells and photodetectors
- Organic optical or electrical sensors
- Organic micro and nano-cavities, organic photonic crystals
- Hybrid organic / inorganic systems / biological devices and systems
- Theory of optical and electronic excitations

TOM 8– Active and Adaptive Optics

16-17 September

Scope of this topical meeting is to bring together different fields of expertise in the fundamentals as well as in application of adaptive and active optics. Such applications are mainly but not limited to microscopy, beam-shaping, imaging in scattering media, metrology, medical applications and astronomy.
Special emphasis will be put on the enabling technologies for such applications. Thus, novel adaptive optical elements, algorithms and sensors to generate the required signal and the required optical setup for their proper system integration will be the focus of this topical meeting.
Furthermore, this platform is dedicated to bring together researchers from universities and institutes with industrial representatives fabricating adaptive optical elements and costumers offering products applying adaptive optical technology. Hence, this event is dedicated to provide an inspiring atmosphere to discuss and generate promising future applications within this field.

PLENARY SPEAKER

High resolution imaging with scattered light
Allard Mosk, University of Twente (NL)

INVITED SPEAKERS

Light-sheet microscopy using holographically shaped beams
Alexander Rohrbach, University of Freiburg (DE)

Adaptive optics scanning ophthalmoscopy
Alfredo Dubra, Medical College of Wisconsin (US)

Applying optical time reversal to tackle biomedical challenges
Changhuei Yang, California Institute of Technology (US)

Deeper insight with MEMS based illumination
Christoph Skupsch, Fraunhofer Institute for Photonic Microsystems, Dresden (DE)

Adaptive optics for super-resolution microscopy
Martin Booth, University of Oxford (GB)

The soft side of Adaptive Optics: does it enable hard results
Michel Verhaegen, Delft University of Technology (NL)

CHAIRS

Joerg Petschulat
Carl Zeiss AG (DE)

Allard Mosk
University of Twente (NL)

PROGRAMME COMMITTEE

Martin Booth,
University of Oxford (UK)

Chris Dainty,
University College London (UK)

Michel Verheagen,
Delft University of Technology (TUDelft) (NL)

Joerg Muetze,
Carl Zeiss AG (DE)

Joerg Petschulat,
Carl Zeiss AG (DE)

TOPICS

- Astronomy
- Microscopy
- Adaptive and active optics for imaging
- Adaptive and active optics for sensing
- Adaptive and active optics for manufacturing
- Adaptive and active optics for non-imaging in particular lighting and illumination

TOM 9 - Frontiers in Optical Metrology

18-19 September

The topical Meeting Frontiers in Optical Metrology is organised in 2014 for the first time as part of the EOSAM 2014. This conference is dedicated to establishing a forum to present and discuss various different aspects of applied optical metrology techniques. This includes basic methods, fundamental limits, measurement techniques and their applications,foundations of applied metrology as well as future trends and topics. Optical metrology methods are in general fast, non-destructive, reliable, flexible and can nevertheless reach a very high level of sensitivity. Therefore, their use in industrial applications, such as process development or production control, is continuously increasing. Concurrently, the metrological requirements are soaring rapidly, leading to a strong demand both on methodical extensions and improved metrology methods. To exploit the full potential of optical metrology it is a prerequisite for traceable and comparable measurements to be able to fully understand the optical measurement process, which requires a reliable modeling or simulation of the optical measurement process.
Further important topics are, for example, the development and verification of quantitative optical inspection methods, remote sensing and the challenges of imaging as well as non-imaging metrology systems and their applications to difficult measurands, such as complex 3D structures, aspheres or free-form surfaces. The proceeding miniaturization in many areas, leading to nanosized structures with sub-nano measurement uncertainties, as well as the potential and challenges of quantum enhanced optical sensors are just as interesting as provocative for optical metrology.
The EOSAM is an excellent opportunity not only to focus on the frontiers of optical metrology, but also to interact with many international experts on neighboring topics, such as Optical System Design, Biophotonics, Metamaterials or Diffractive Optics.
We are looking forward to meeting you in Berlin.

CHAIRS

Bernd Bodermann
Physikalisch-Technische Bundesanstalt (PTB) (DE)

Omar El Gawhary
VSL, Dutch Metrology Institute (NL)

PROGRAMME COMMITTEE

Axel Wiegmann,
Physikalisch-Technische Bundesanstalt (PTB) (DE)
Dirk Voigt,
VSL Dutch Metrology Institute (NL)
Jens Flügge,
Physikalisch-Technische Bundesanstalt (PTB) (DE)
Martin Foldyna,
École Polytechnique (FR)

PLENARY SPEAKER

Rules for Optical Testing
H. Philip Stahl, NASA MSFC, SPIE President (US)

INVITED SPEAKERS

Ptychography - 3D phase-sensitive lensless imaging
John Rodenburg, Sheffield University (GB)

Metrology with Synchrotron Radiation at PTB
Matthias Richter, Physikalisch-Technische Bundesanstalt (DE)

High-resolution dynamic 3D-shape measurement
Gunther Notni, Universität Jena (DE)

Sub-Heisenberg estimation strategies: are they attainable?
Vittorio Giovannetti, Scuola Normale di Pisa (IT)

TOPICS

- Modelling of light-structure interaction
- Quantitative optical inspection methods
- High-NA systems
- 3D-Metrology
- Forms and surfaces metrology
- Quantum enhanced optical sensors
- Optical length metrology
- Aberrations retrieval
- Remote sensing
- Scatterometry
- Ellipsometry
- Interferometry and holography
- Deflectometry

TOM 10 - Diffractive Optics

17-19 September

Topical meetings in Diffractive Optics in this series have been organized on eight occasions before, in most cases under the auspices of EOS (Savonlinna 1997, Jena 1999, Budapest 2001, Oxford 2003, Warsaw 2005, Barcelona 2007, Koli 2010, Delft 2012). This time, Diffractive Optics has been added as one new TOM in the 2014 EOSAM.

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Institut d'Optique (FR)

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Fraunhofer Institute for Applied Optics and Precision Engineering (DE)

Yves Jourlin,
Université Jean Monnet/ CNRS (FR)

PLENARY SPEAKER

Advanced astronomical observatories using binary diffractive optics
Webster Cash, University of Colorado (US)

INVITED SPEAKERS

Customised laser modes by dynamic and geometric phase control
Andrew Forbes, Council for Scientific and Industrial Research (ZA)

Shaping femtosecond beams with spatial light modulators
Gladys Minguez-Vega, Universitat Jaume I (ES)

Design and fabrication of the diffractive optical elements on curved surface by interference
Juan Liu, Beijing Institute of Technology (CN)

Efficient and broadband blazing with artificial dielectrics
Philippe Lalanne, Institute d'Optique (FR)

Diffraction grating-coupled plasmon-polariton surface waves
(Joint invited talk with TOM 5)
Piotr Wróbel, University of Warsaw (PL)

Full view-angle 3D display with computer-generated holograms based on rigorous diffraction theory
Toyohiko Yatagai, Utsunomiya University (JP)

High efficiency optical nano-focusing using diffractive binary optics
Haifeng Wang, University of Shanghai for Science and Technology (CN)

TOPICS

- Modelling of diffractive optics
- Diffractive optics and polarization
- Scattering by diffractive optical elements
- Inverse problems in diffraction optics
- Fabrication and characterisation, measurement and inspection
- Adaptive and switchable diffractive optics
- New materials for diffractive optics including metamaterials
- ences, sensing, solid state lighting, and solar photonics.

TOM 11 - Special Session for partners in an EU project to disseminate their results

19 September

CHAIRS

Paul Urbach
TU Delft (NL)
EOS President

Seppo Honkanen
University of Eastern Finland (FI)

INVITED SPEAKERS

EMRP Joint Research Project Scatterometry
Bernd Bodermann

Modeling
Scatterometry for diffractive optics
Short wavelength scatterometry

Adoption of the Foundry Model to Photonics: The Integrated EU Project PARADIGM

Platform technologies and capabilities
Norbert Grote

Design platform for generic photonic integrated circuits
Twan Korthorst

From design to real PICs
Ronald Brooke

Exploitation opportunities of PARADIGM
Katarzyna Lawniczuk

Large-area Nano-photonic Chemical Sensors – FP7-PHOTOSENS Project
Pentti Karioja

Control the flow of light and manipulate its polarization state on polymer-based photonic integration platform – FP7-PANTHER project
Ziyang Zhang

LightSWORDS: a non axial-symmetric Lens that mIGHT be a Satisfactory Way Of Reducing age Degradation of Sight
Andrzej Kolodziejczyk

GRAND CHALLENGES IN OPTICS SESSION

19 September

For the fourth time, a special session of EOSAM is dedicated to the "Grand Challenges in Optics". In this session world-class speakers are going to talk about technologies which are revolutionary, uncommon and not realizable to date, but can pave the way for an even brighter future in optics and photonics.

CHAIRS

Paul Urbach
University of Delft (NL)

Hans-Peter Herzig
Ecole Polytechnique Fédérale de Lausanne (EPFL)(CH)

PLENARY SPEAKERS

The mechanical properties of light
Tobias Kippenberg, Ecole Polytechnique Fédérale de Lausanne (EPFL), (CH)

Attosecond Nanophotonics
Matthias F. Kling, Ludwig-Maximilians-Universität München (DE)

Negative optical forces
Aristide Dogariu, The University of Central Florida (US)

Challenges and Opportunities for Photonics
Markus Weber, Carl Zeiss AG (DE)

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Daily Overview

Schedule also available on EOSAM website: http://www.myeos.org/events/eosam2014

Date: Tuesday, 16/Sep/2014

8:30 - 8:40	EOSAM 2014: Opening Speech Location: Bunsen Hall				
8:40 - 9:25	Plenary: Ronan Burgess Location: Bunsen Hall				
9:25 - 10:10	Plenary TOM2: Bert Offrein Location: Bunsen Hall				
10:10 - 10:55	Plenary TOM8: Allard Mosk Location: Bunsen Hall				
10:55 - 11:20	Coffee Break				
11:20 - 12:50	TOM2 S01: Si Photonic Systems and Devices I Location: Room Pasteur Chair: Ralf B. Bergmann	TOM3 S01: Optical System Design and Tolerancing Location: Hall Hans Grade Chair: Kimio Tatsuno Chair: Oliver Dross	TOM4 S01: Optical Coherence Tomography technical advances, functional OCT, catheter development Location: Room Einstein	TOM5 S01: Plasmonics 1 Location: Bunsen Hall	TOM8 S01: Active and Adaptive Optics Location: Room Newton
12:50 - 13:45	Lunch Break				
13:45 - 14:30	Plenary TOM5: Martin Wegener Location: Bunsen Hall				
14:40 - 16:10	TOM2 S02: ePIXfab Workshop: Fabrication and Packaging Services in Silicon Photonics Location: Room Pasteur	TOM3 S02: Optical System Design and Tolerancing Location: Hall Hans Grade Chair: Willem Vos Chair: Ruben Mohedano	TOM4 S02: Microscopy and Optical Coherence Tomography of the Eye Location: Room Einstein	TOM5 S02: Subwavelength device Location: Bunsen Hall	TOM8 S02: Active and Adaptive Optics Location: Room Newton
16:10 - 16:30	Coffee Break				
16:30 - 18:00	TOM2 S03: Si Photonic Systems and Devices II Location: Room Pasteur Chair: Graham Trevor Reed	TOM3 S03: Optical System Design and Tolerancing Location: Hall Hans Grade Chair: Ulrike Fuchs Chair: Peter Brick	TOM4 S03: Microscopy and Optical Coherence Tomography of the Eye (Continued)/ Tissue optics, imaging, sensing and diagnosis Location: Room Einstein	16:30-17:45 TOM5 S03: Slow light in Nanostructures Location: Bunsen Hall	TOM8 S03: Active and Adaptive Optics Location: Room Newton
18:30 - 20:30	EOS AGA: EOS Annual General Assembly with EOS Fellows ceremony Location: Bunsen Hall				

Date: Wednesday, 17/Sep/2014

8:20 - 9:05	**Plenary TOM3: David Shafer** Location: Bunsen Hall Chair: Wilhelm Ulrich Chair: Andrew Paul Wood				
9:15 - 10:45	9:15– 10:30 **TOM2 S04: III-V, Ge, a-SI and nano-Wires** Location: Room Pasteur Chair: Antti Säynätjoki	**TOM3 S04: Optical System Design and Tolerancing** Location: Hall Hans Grade Chair: Masaki Isshiki Chair: Julio Chaves	9:15– 10:30 **TOM4 S04: Tissue optics, imaging, sensing and diagnosis (continued)** Location: Room Einstein	**TOM5 S04: Nonlinear Nano** Location: Bunsen Hall	**TOM8 S04: Active and Adaptive Optics** Location: Room Newton
10:45 - 11:15	Coffee Break				
11:15 - 12:45	11:15-12:15 **TOM2 S05: Biophotonics** Location: Room Pasteur	11:15-12:55 **TOM3 S05: Optical System Design and Tolerancing** Location: Hall Hans Grade Chair: Kevin P Thompson Chair: Chir-Weei Chang	**TOM4 S05: Studies of cells and single molecules** Location: Room Einstein	**TOM5 S05: Complex transport I n Nanostructures** Location: Bunsen Hall	
12:45 - 14:45	Lunch Break: Poster Session (all TOMs) Location: Room Newton				
14:45 - 15:30	**Plenary TOM4: Vasilis Ntziachristos** Location: Bunsen Hall				
15:40 - 17:10		**TOM3 S06: Optical System Design and Tolerancing** Location: Hall Hans Grade Chair: Alois M. Herkommer Chair: Johannes Ruoff	15:40-16:40 **TOM4 S06: Microfluidic biosensors** Location: Room Einstein	**Joint session S01: TOM 5 and TOM 10** Location: Bunsen Hall	**TOM7 S01: Organic Photonics** Location: Room Newton Chair: luigino criante
17:10 - 17:30	Coffee Break				
17:30 - 19:00		**TOM3 S07: Optical System Design and Tolerancing** Location: Hall Hans Grade Chair: Wolfgang Vollrath Chair: Dewen Cheng		**Joint session S02: TOM 5 and TOM 10** Location: Bunsen Hall Chair: Jari Turunen Chair: Pedro ANDRES	**TOM7 S02: Organic Polaritons** Location: Room Newton Chair: David George Lidzey
20:30	Conference Dinner				

Date: Thursday, 18/Sep/2014

9:00 - 9:45	**Plenary TOM7: Jeremy Baumberg** Location: Bunsen Hall				
9:55 - 11:25	**TOM1 S01: Sensor and Telecom applications** Location: Small Club room Chair: **Seppo Honkanen**	**TOM3 S08: Optical System Design and Tolerancing** Location: Hall Hans Grade Chair: **Stefan Bäumer** Chair: **Toshiaki Iwai**	**TOM5 S06: Plasmonics 2** Location: Room Einstein	**TOM7 S03: Organic Photonics for communications** Location: Room Newton Chair: **Stéphane Kéna-Cohen**	**TOM 10 S01: Focusing** Location: Bunsen Hall Chair: **Webster Cash**
11:25 - 11:55	Coffee Break				
11:55 - 13:25	**TOM1 S02: Nanophotonics** Location: Small Club room Chair: **Matthieu Roussey**	**TOM3 S09: Optical System Design and Tolerancing** Location: Hall Hans Grade Chair: **Jyrki Kimmel** Chair: **Herbert Gross**	**TOM5 S07: Metamaterial** Location: Room Einstein	**TOM7 S04: Nanocrystals** Location: Room Newton Chair: **Jeremy J. Baumber**	**TOM 10 S02: Modelling and Characterisation** Location: Bunsen Hall Chair: **Piotr Wrobel** Chair: **Uwe D. Zeitner**
13:25 - 14:25	Lunch Break				
14:25 - 15:10	**Plenary TOM10: Webster Cash** Location: Bunsen Hall				
15:20 - 16:50	**TOM1 S03: Nonlinear fiber optics** Location: Small Club room	**TOM3 S10: Optical System Design and Tolerancing** Location: Hall Hans Grade Chair: **John R. Rogers** Chair: **Florian Bociort**	**TOM7 S05: Photovoltaics 1** Location: Room Newton Chair: **Jochen Feldmann**	**TOM9 S01: Innovative metrology approaches and chemical sensing** Location: Room Pasteur	**TOM 10 S03: Beam Shaping** Location: Bunsen Hall Chair: **Gladys Mínguez-Vega**
16:50 - 17:10	Coffee Break				
17:10 - 18:40	**TOM1 S04: Guided-wave structures and devices** Location: Small Club room Chair: **Seppo Honkanen**	**TOM3 S11: Optical System Design and Tolerancing** Location: Hall Hans Grade Chair: **David M Aikens** Chair: **Thomas Nobis**	**TOM7 S06: Organic Bio Photonics** Location: Room Newton Chair: **Francesco Buatier de Mongeot**	**TOM9 S02: Advances in Scatterometry 1** Location: Room Pasteur	**TOM 10 S04: Materials and Devices** Location: Bunsen Hall

Date: Friday, 19/Sep/2014

8:20 - 9:05	**Plenary TOM6: Iain A. Neil** Location: Bunsen Hall				
9:15 - 10:45	9:15-11:00 **TOM3 S12: Optical System Design and Tolerancing** Location: Hall Hans Grade Chair: **Yongtian Wang** Chair: **Yasuhiro Ohmura**	**TOM6 S01: Optics for Cinematography and Video** Location: Room Pasteur	**TOM7 S07: Photovoltaics 2** Location: Room Newton Chair: **Gianluca Maria Farinola**	**TOM 10 S05: Beams and propagation** Location: Bunsen Hall Chair: **Haifeng Wang** Chair: **Pedro ANDRES**	**TOM11 S01: Dissemination of EU projects** Location: Small Club room Chair: **Paul Urbach**
10:45 - 11:15	Coffee Break				
11:15 - 13:15	**Session: Grand Challenges in Optics** Location: Bunsen Hall Chair: **Paul Urbach** Chair: **Hans Peter Herzig**				
13:15 - 14:05	Lunch Break				
14:05 - 14:50	**Plenary TOM9: H. Philip Stahl** Location: Bunsen Hall				
15:00 - 16:30	**TOM6 S02: Optics for Cinematography and Video** Location: Arsenal Cinema	**TOM7 S08: Photovoltaics 3** Location: Room Newton Chair: **Jerome Cornil**	**TOM9 S03: Advances in Scatterometry 2** Location: Room Pasteur	**TOM 10 S06: Modelling Stategies for Diffractive Devices and Materials** Location: Bunsen Hall Chair: **Toyohiko Yatagai** Chair: **Benfeng Bai**	**TOM11 S02: Dissemination of EU projects** Location: Small Club room Chair: **Seppo Honkanen**
16:30 - 16:45	Coffee Break				
16:45 - 18:15	**TOM6 S03: Optics for Cinematography and Video** Location: Arsenal Cinema	**TOM7 S09: Organic electronics** Location: Room Newton Chair: **Jordi Martorell**	**TOM9 S04: Surface Topography and Interferometry** Location: Room Pasteur	**TOM 10 S07: Emerging Applications** Location: Bunsen Hall Chair: **Juan Liu** Chair: **Pierre Chavel**	**TOM11 S03: Dissemination of EU projects** Location: Small Club room Chair: **Paul Urbach**

Date: Tuesday, 16/Sep/2014

8:30 - 8:40 EOSAM 2014: Opening Speech
Bunsen Hall

8:40 - 9:25 Plenary: Ronan Burgess
Bunsen Hall

9:25- 10:10 Plenary TOM2: Bert Offrein
Bunsen Hall

Photonics for computing applications and the need for electro-optical integration

Bert Jan Offrein
IBM Research GmbH, Switzerland

Optical interconnects offer fundamental advantages compared to electrical signal communication in terms of the bandwidth x length product, propagation loss and other aspects. In computing systems, optical links are now widely deployed for rack-to-rack communication using active optical cables. To further enhance system performance, optical transceivers will have to be much more closely integrated with the processor package. For a cost-effective application of such concepts, electro-optical integration at the chip-, package- and board-level is required. The status of optical communication in computing systems will be reviewed and a technology roadmap will be presented, accompanied with examples.

10:10- 10:55 Plenary TOM8: Allard Mosk
Bunsen Hall

High resolution imaging with scattered light

Allard P. Mosk
University of Twente, Netherlands, The

The propagation of laser light in scattering media can be controlled by shaping the incident wavefront. This control is based on the realization that scattering by stationary randomness performs a random linear transformation on the incident light modes. Wave front shaping effectively inverts this transform and has given rise to a surge of fundamental studies of light propagation and new methods of imaging and focusing through turbid media and multimode optical fibers. I will discuss how wavefront shaping enables fundamental studies of light transport as well as new applications.

10:55- 11:20 Coffee Break

11:20 - 12:50

Room: Pasteur	Room: Hans Grade	Room: Einstein	Room: Bunsen Hall	Room: Newton
TOM2 S01: Si Photonic Systems and Devices I Session Chair: **Ralf B. Bergmann**	**TOM3 S01: Optical System Design and Tolerancing** Session Chair: **Kimio Tatsuno** Session Chair: **Oliver Dross**	**TOM4 S01: Optical Coherence Tomography technical advances, functional OCT, catheter development**	**TOM5 S01: Plasmonics 1**	**TOM8 S01: Active and Adaptive Optics**
Invited talk **11:20** **New perspectives in silicon micro and nanophotonics** Ivo Rendina, **Maurizio Casalino, Luca De Stefano, Emanuela Esposito, Vito Mocella, Ilaria Rea, Silvia Romano** National Research Council, Italy, Microelectronics and Microsystems Institute In this communication, the perspectives of silicon micro and nanotechnology in manipulating light for sensing and detection purposes are discussed. Moreover, some new possibilities offered by the hybrid integration with new materials such as titania and graphene are reported.	Invited talk **11:20** **Optical Mass Storage using Polarization Holography** Toyohiko Yatagai Utsunomiya University, Japan The use of polarization techniques in holographic data storage is discussed. Two types of architectures, on-line holography, called retardagraphy, and off-axis one, are presented. Angular and shift multiplexing techniques, as well as polarization multiplexing, are developed to increase storage capacity. Some experimental results are presented for an optical mass data storage system.	Invited talk **11:20** **Spatiotemporal Optical Coherence Manipulation** Maciej Wojtkowski Nicolaus Copernicus University, Poland Propagation of light through scattering media is usually treated as random process and very often is described by mathematical tools of statistics. Recent publications have revised our knowledge about the basics of light-matter interactions in classical regime. In this contribution I will present the novel spatio-temporal optical coherence manipulation technique (STOC), which allows to tailor the second-order	Invited talk **11:20** **Extreme plasmonics in atomic-scale materials** Javier García de Abajo ICFO - The Institute of Photonic Sciences, Spain The recent observation and extensive theoretical understanding of plasmons in graphene has triggered the search for similar phenomena in other atomically thin materials, such as noble-metal monolayers and molecular versions of graphene. Here, we will discuss the challenges and opportunities introduced by these types of materials, including their application to quantum optics, electro-optical devices, and sensing.	Invited talk **11:20** **Adaptive optics for super-resolution microscopy** **Brian Patton, Daniel Burke,** Martin Booth University of Oxford, United Kingdom High resolution microscopy relies on the use of high quality optics with the goal of obtaining diffraction-limited operation, working at the physical limits imposed by the wavelength of the light. Yet in many cases this goal is not achieved as aberrations, distortions in the optical wavefront, blur the focus and reduce the resolution of the system. Aberrations can arise from imperfections in the optics, but are often introduced by the specimen, particularly when imaging thick speci-

Room: Pasteur

Invited talk

11:50
Silicon Photonic System Optimization

Lionel C. Kimerling
Massachusetts Institute of Technology, United States of America

Historical scenarios exist for system-driven technology transitions: i) long haul fiber; ii) WDM via EDFA; iii) chip-level copper interconnects; iv) multicore processors. Today, energy-per-function and hardware power density represent fundamental technical limits to scaling communication and computation capacity. High bandwidth photonic communication and self-aware computational resource management are the enablers of the current technology transition. The endpoint of the transition envisioned for 2035 will be global systems, encompassing the entire planet, that are comprised of billions of processing, storage and network elements.

12:20
Compact low-loss delay lines on a micron-scale SOI platform

Matteo Cherchi[1], Mikko Harjanne[1], Sami Ylinen[1], Konstantinos Vyrsokinos[2], Markku Kapulainen[1], Tapani Vehmas[1], Timo Aalto[1]
[1]VTT Technical Research Centre of Finland, Finland; [2]Aristotle University, Thessaloniki, Greece

Long spiral waveguides with small footprint and low-loss were fabricated on a micron-thick SOI platform. In particular, an interferometer delayed by a 1.21 cm long low-loss spiral was measured to ensure more than 15 dB extinction and it was employed to successfully demodulate 7.1 Gbps DPSK signals.

Room: Hans Grade

Invited talk

11:50
High Density Holographic Data Storage Using Shift and Peristrophic Multiplexing with Spherical Reference Wave

Zenta Ushiyama[1,2], Manabu Yamamoto[1]
[1]Department of Applied Electronics, Tokyo University of Science; [2]TYCO Optics Corporation

Holographic data storage is a promising technology that provides very large data storage capacity, and the multiplexing method plays a significant role in increasing this capacity. In the present study, we propose a shift-peristrophic multiplexing technique that uses spherical reference waves, and experimentally verify that this method efficiently increases the data capacity. This method achieves more than 1 Tbits/inch2 data density recording. Furthermore, a capacity increase of several TB per disk is expected by maximizing the recording medium performance.

12:20
Color mixing by means of a mixing chamber and array of secondary optics

Julio Chaves[1], Ruben Mohedano[1], Pablo Benitez[2], Juan C. Miñano[2], Waqidi Falicoff[2], Aleksandra Cvetkovic[1], Juan Vilaplana[1]
[1]Light Prescriptions Innovators, Europe; [2]Light Prescriptions Innovators, LLC

Color mixing is challenging and different approaches are used to deal with it, such as mixing rods, integrators or mixing chambers. In this paper we present a combination of mixing chamber and thin secondary optics that give the light engine a considerable flexibility. LEDs are placed inside a white, highly reflective mixing chamber whose top lid has apertures covered by an array of micro lenses that produces a desired intensity pattern. By replacing the LEDs, mixing chamber lid or micro lens array, the output pattern may be

Room: Einstein

coherence properties of a light beam. With the use of an interferometric setup we show that the basic measure of the contrast of interference fringes, i.e., Michelson's visibility, can be controlled across the interference pattern by modulating the phase of the spectral degree of coherence. This method can be applied to imaging in scattering media by 3D phase localization using spatio-temporal coherence.

11:50
Utilization of high spatial frequency information to increase sensitivity of optical coherence tomography

Sergey Alexandrov, James McGrath, Hrebesh Subhash, Martin Leahy
National University of Ireland in Galway, Ireland

We demonstrate that high spatial frequency signal, which provides information about submicron structure, can be extracted from the OCT interference signal to the image domain and mapped into the corresponding location within 3D image. As a result, depth-resolved nanoscale structural alterations can be detected from a single scan.

12:05
Coherent Signal Composition and Global Phase Correction in Signal Multiplexed Polarization Sensitive Optical Coherence Tomography

Jianan Li, Johannes F de Boer
VU University Amsterdam, Netherlands, The

We show that the Signal to Noise ratio of the structural information in polarization sensitive Optical Coherence Tomography (PS-OCT) can be improved by up to 3.35 dB by taking advantage of the structure of this Jones matrix, imposed by the propagation and scattering properties of the sample. We demonstrate that the Jones Matrices are all in the shape of

Room: Bunsen Hall

11:50
Angular Magneto-induced Anisotropy of Voigt Effect and other Magneto-optical Phenomena in Metamaterials with Periodic Nanostructures

Yakov M. Strelniker[1], David J. Bergman[2], Anna O. Voznesenskaya[3]
[1]Bar-Ilan University, Israel; [2]Tel Aviv University, Israel; [3]St. Petersburg State University of Information Technologies, Mechanics and Optics, Russia

The rotation and ellipticity of polarization of the light propagating through a metamaterial film with periodic nanostructure for arbitrary direction of the applied static magnetic field is studied. In the Voigt configuration the strong dependencies of the above mentioned effects on the direction of the applied field are found.

12:05
Surface Plasmon absorption around subwavelength apertures in metal films

Olga Lozan[1], Mathias Perrin[1], Buntha Ea-Kim[2], Jean-Michel Rampnoux[1], Stefan Dilhaire[1], Philippe Lalanne[3]
[1]Laboratoire Onde et Matière d'Aquitaine, CNRS-Université de Bordeaux, France; [2]Laboratoire Charles Fabry, CNRS-IOGS-Université Paris XI, Institut d'Optique, Palaiseau, France; [3]Laboratoire Photonique, Numérique et Nanosciences, CNRS-IOGS-Université de Bordeaux, Institut d'Optique d'Aquitaine, Talence, France

We study via thermoreflectance the heat dissipated by the scattered electromagnetic field of isolated subwavelength apertures at metal surfaces. In contrast to the common belief that the intensity of waves decrease with the distance, we reveal that the dissipated heat remains constant over a spatial interval of a few tens of wavelengths.

Room: Newton

mens. Adaptive optics was introduced into microscopy in order to overcome these problems. Various adaptive schemes have been developed for a range of different modalities including confocal, multiphoton and widefield microscopes with applications in biological and other areas. We present recent developments in adaptive optical methods for super-resolution nanoscopy. In particular, this includes new image-based adaptive schemes for stimulated emission depletion (STED) microscopy and single molecule localisation microscopes, such as PALM or STORM.

Invited talk

11:50
Adaptive optics scanning ophthalmoscopy

Alfredo Dubra
Medical College of Wisconsin, United States of America

Scanning adaptive optics ophthalmoscopy allows imaging the living retina with near diffraction-limited resolution when simultaneous correction of aberrations in the pupil and image planes is achieved. In this work, we will illustrate the application of such instruments to study healthy and diseased eyes using confocal reflectance, single-photon fluorescence, dark-field and non-confocal split-detection.

12:20
Electrically tunable lenses employed in confocal laser scanning microscopy

Jürgen Czarske[1], Nektarios Koukourakis[1], Markus Finkeldey[2], Moritz Stürmer[3], Christoph Leithold[1], Nils Gerhardt[2], Ulricke Wallrabe[3], M. R. Hofmann[2], Andreas Fischer[1]
[1]TU Dresden, Germany; [2]Ruhr-University Bochum; [3]University of Freiburg

The employment of electrically tunable lenses in confocal microscopy

Room: Pasteur

12:35
Thermo-optic tunable and UV-trimmable wavelength multiplexing filters based on amorphous-SOI

Timo Lipka, Lennart Wahn, Lennart Moldenhauer, Hoc Khiem Trieu
Hamburg University of Technology, Germany

We demonstrate cascaded optical add/drop filters for wavelength-division multiplexing based on CMOS-backend compatible and low-loss hydrogenated amorphous silicon material platform. Compact microring and racetrack resonators with wide FSRs of >8.4nm, drop port extinction ratios of >20dB, and 3dB bandwidths of 0.18-0.3nm that allow to distribute and multiplex optical data signals were fabricated. Low-footprint wavelength multiplexer with up to eight-channels were realized on a dense 100GHz grid. Fabrication imperfections were counterbalanced either by thermo-optic tuning or by a permanent device trimming with UV-irradiation. The trimming method allows to significantly reduce the steady-state power consumption of the devices.

Room: Hans Grade

varied. This opens the possibility to have interchangeable parts for different situations. Small movements of the parts relative to each other allows some beam steering. Sizable gaps between LEDs ease the heat sinking.

12:35
Reflector surface segmentation method based on the source luminance distribution

Núria Tomás-Corominas, Josep Arasa
Universitat Politècnica de catalunya, Spain

A segmentation method for reflectors based on the source luminance distribution is presented to be used in a reflector design process. The segmentation method is independent from the merit function used to shape the facets and also independent from the mapping process.

Room: Einstein

an SU(2) matrix, which is key to understanding the coherent composition. We also discuss a global phase of the Jones matrix and the corresponding correction method in PS-OCT.

Invited talk

12:20
Heartbeat OCT

Gijs van Soest
Erasmus MC, Netherlands, The

Intravascular OCT has produced profound new insights in the pathophysiology of coronary artery disease, and has shown to be very useful for guiding coronary interventions. In this talk I will discuss some progress beyond the state of the art, focusing on techniques for tissue characterization and the development of an extremely fast OCT system, designed to overcome cardiac motion artefacts.

Room: Bunsen Hall

12:20
Plasmonic planar antenna for spectral tunable and efficient linear polarization conversion

Quentin Lévesque[1,2], Mathilde Makshiyan[2], Bouchon Patrick[1], Fabrice Pardo[2], Riad Haïdar[1], Jean-Luc Pelouard[2]
[1]ONERA, France; [2]LPN/CNRS, France

The design of metasurfaces able to efficiently control the polarization state of an electromagnetic wave is of importance for various applications. We demonstrate both theoretically and experimentally that plasmonic planar antennas based on metal-insulator-metal resonator can convert efficiently the linear polarization in the infrared (3-10µm) with a wide angular tolerance. Indeed, we show that for a L-shaped antenna, the engineering of the geometry results to a nearly total polarization conversion over a 1µm-wide spectral band ([3.25-4.25] µm) with a mean polarization conversion efficiency of 95%.

12:35
Field enhancement and funneling of light in combinations of MIM resonators

Paul Chevalier[1,2], Patrick Bouchon[1], Riad Haïdar[1], Fabrice Pardo[2]
[1]ONERA, The French Aerospace Lab, 91761 Palaiseau, France; [2]Laboratoire de Photonique et de Nanostructures, Route de Nozay, 91460 Marcoussis, France

Plasmonic metal-insulator-metal resonators can be designed to totally absorb an
incident light. A combination of such antennas within a sub-wavelength period allows a sorting of the absorbed photons as a function of their wavelength. These structures also exhibit a high electric field enhancement in tiny volumes. We show that this enhancement can be even stronger when the resonator are illuminated with a focused light.

Room: Newton

bears a huge potential for creating fast, compact and agile devices, e.g. for handheld patient-side microscopy. For such a task we present a Confocal microscope employing Adaptive Lenses (CAL).

12:35
Non-common path aberration correction in a confocal adaptive optics ophthalmoscope

Yusufu N. Sulai[1], Alfredo Dubra[2,3,4]
[1]University of Rochester, The Institute of Optics, United States of America; [2]Medical College of Wisconsin, Department of Ophthalmology, United States of America; [3]Medical College of Wisconsin, Department of Biophysics, United States of America; [4]Marquette University, Department of Biomedical Engineering, United States of America

We demonstrate the correction of non-common path aberrations (NCPAs) between the imaging and wavefront sensing channels in a confocal adaptive optics ophthalmoscope. The approach corrects the aberrations in the illumination arm of the imaging channel by maximizing an image sharpness metric as opposed to a previously published intensity maximization method. We validate the method by correcting 0.25 diopters of cylinder that had been purposely introduced into the system as NCPA. The NCPAs native to our adaptive optics ophthalmoscope were estimated to be within the diffraction limit.

12:50 - 13:45 Lunch Break

13:45– 14:30 Bunsen Hall

Plenary TOM5: Martin Wegener

Optical Invisibility Cloaking

Robert Schittny, Muamer Kadic, Martin Wegener
Karlsruhe Institute of Technology (KIT), Germany

We review our experimental work on three-dimensional visible-frequency invisibility cloaking.

Free-space invisibility cloaks, which are macroscopic, three-dimensional, broadband, passive, and that work for all directions and polarizations of light, are not consistent with the laws of physics – at least not within the regime of ballistic light transport according to the Maxwell equations. We show both theoretically and experimentally that they are possible in the regime of diffusive transport of light according to Fick's diffusion equation.

14:40 - 16:10

Room: Pasteur	Room: Hans Grade	Room: Einstein	Room: Bunsen Hall	Room: Newton

TOM2 S02: ePIXfab Workshop: Fabrication and Packaging Services in Silicon Photonics

The main topic of this interactive workshop is the fabrication and packaging offering in silicon photonics, which is a rapidly growing research area with significant market opportunities. The full path from basic research to volume products is analysed in the presentations that cover the launch of the first silicon photonics prototyping run in 2002, as well as the commercial exploitation visions of the industry.

Each presentation is followed by a short discussion with the audience. The first part of the workshop addresses the market opportunities and industrial interests in silicon photonics, and also gives an overview of ePIXfab as the pioneer in providing prototyping services for both academic and industrial users. The second part addresses the 220 nm SOI technology that can be accessed through mature multi-project wafer (MPW) runs covering both passive and active waveguide circuits. Here the main focus is on fabrication services offered by IMEC, Leti and IHP. The third and final part of the workshop deals with the low-loss micron-scale SOI platform, where MPW access was recently opened by VTT, and with silicon photonics packaging. These emerging technologies try to bridge the gap between low-cost chip

TOM3 S02: Optical System Design and Tolerancing

Session Chair: **Willem Vos**
Session Chair: **Ruben Mohedano**

Invited talk

14:40 The Monge-Amp\`{e}re equation in non-imaging optics

Jan ten Thije Boonkkamp[1], Corien Prins[1], Wilbert IJzerman[2], Teus Tukker[3]
[1]Eindhoven University of Technology, Netherlands, the; [2]Philips Lighting, Netherlands, the; [3]Philips Research, Netherlands, the

We present two alternative numerical methods for the Monge-Amp\`{e}re equation, that describes the

shape of an optical surface which converts a parallel beam of light into a desired target distribution. The

first method is a finite difference method based on the diagonalization of the Hessian matrix. The second method is a least-squares method, where we first compute a mapping from source to target, and subsequently compute the shape of the optical surface. We demonstrate the performance of both methods for some examples.

TOM4 S02: Microscopy and Optical Coherence Tomography of the Eye

Invited talk

14:40 Digital Refocusing and Aberration Correction in Optical Coherence Tomography

Rainer A. Leitgeb, Abhishek Kumar, Daniel Fechtig
Medical University Vienna, Austria

Aiming for isotropic high resolution in Optical Coherence Tomography (OCT) calls for strategies to overcome the tradeoff between lateral resolution and depth of focus. Digital enhancement either using inverse OCT signal reconstruction (ISAM), holoscopy, or digital adaptive optics yields a dramatic enhancement of depth of field without sacrificing lateral resolution. Digital aberration correction has the additional advantage of overcoming the complexity of adaptive optics assisted OCT designs. We review different approaches for digital refocusing and aberration correction in optical coherence tomography and microscopy, compare their performance, and give an outlook of this active field of development.

TOM5 S02: Subwavelength device

Invited talk

14:40 Bringing photonic subwavelength structures to application

Uwe D. Zeitner, Torsten Harzendorf, Thomas Paul, Dirk Michaelis, Frank Fuchs
Fraunhofer Institute of Applied Optics and Precision Engineering, Germany

Photonic sub-micrometer structures have proven their huge potential to provide a great flexibility for the realization of novel optical functions with strong relevance for applications. In the past, however, the fabrication technology for such structures often suffered from being either suitable only for very specific structure geometry or strongly limited in their efficiency to fabricate the high-resolution structures on application relevant areas. In the presentation we will show new technological developments of direct write lithography methods which can efficiently scale up the fabrication process for photonic subwavelength structures. Several application examples will be given ranging from high-resolution and high-efficiency gratings to different plasmonic polarization devices.

TOM8 S02: Active and Adaptive Optics

Invited talk

14:40 Deeper insight with MEMS based illumination

Christoph Skupsch[1], Jörg Heber[1], Florian Rückerl[2]
[1]Fraunhofer IPMS, Germany; [2]Institut Pasteur, France

Integrating MEMS in an optical beam line allows the precise steering and structuring of light. We present diffractive micromirror arrays for enhanced illumination in a microscope setup. The illumination pattern, the beam angle, the intensity, and the pulse duration can be modulated continuously and independently in the kHz range. This new modulator prepares striking enhancements in fluorescence microscopy.

Invited talk

15:10 Light-sheet microscopy using holographically shaped beams

Alexander Rohrbach
University of Freiburg, Germany

Light sheet microscopy provides wide-field optical sectioning at high speeds and low light exposure. Ideally the sample is illuminated by a thin, homogeneous light sheet. However, the following two factors limit the image quality: First, the redistribution of the illumination light due to scattering causes a non-uniform intensity, broadens the sheet, and thereby

Room: Pasteur

fabrication and the assembly of silicon photonics modules that also provide electrical and optical I/O coupling to the SOI chips.

14:40
EPIC and ePIXfab: How the European industry can exploit silicon photonics?
Carlos Lee, EPIC

14:55
Past, present and future of ePIXfab
Pieter Dumon, IMEC

15:10
Active & passive waveguide circuits on 220 nm SOI from IMEC and Leti
Pieter Dumon, IMEC

15:25
Silicon photonics developed on a SiGe:C BiCMOS pilot line
Lars Zimmermann, IHP

15:40
Micron-scale SOI platform for low-loss circuits and broadband I/O coupling
Timo Aalto, VTT

15:55
Packaging of silicon photonic chips
Timo Aalto, VTT

Room: Hans Grade

Invited talk

15:10
Progress in high-luminance LEDs to benefit etendue-critical systems
Peter Brick, Ulrich Streppel, Stefan Morgott, Alexander Günther
OSRAM Opto Semiconductors GmbH, Germany

LEDs have become the dominating source in the lighting world. Given the diversity of applications, different LED parameters are emphasized. Luminous efficacy, wall-plug efficiency, thermal resistance, forward voltage, permissible junction temperature, lifetime, cost, color gamut, and device volume - each has its respective merits. In addition there is a considerable number of optical systems positioned at the etendue limit. Since neither space constraints nor angular admittance can be relaxed for those, the only way to realize high brightness systems is by employing high luminance LEDs and chips. In the following, three representative examples are highlighted.

15:40
Improving focus quality by beam shaping with aspherical surfaces
Ulrike Fuchs, Sven Wickenhagen
asphericon GmbH, Germany

The potpourri of aspherical surfaces offers many possibilities in optical design, even the chance for flexible beam shaping setups. Since these are refractive optical elements the beam shaping is robust with respect to wavelength changes. Above this, it can be utilized to improve focus quality significantly.

Room: Einstein

15:10
A new pediatric vision screening device employing polarization-modulated, retinal-birefringence-scanning-based strabismus detection and bull's eye focus detection with an improved target system
Kristina Irsch[1,2], Boris Gramatikov[1], Yi-Kai Wu[1], David Guyton[1]
[1]The Wilmer Eye Institute, The Johns Hopkins University School of Medicine, United States of America; [2]Centre d'Investigation Clinique, CHNO des Quinze-Vingts, France

We present a new pediatric vision screening device that employs polarization-modulated retinal birefringence scanning for strabismus detection, and double-pass focus detection using a bull's eye photodetector conjugate to the light source and an improved target system with accommodative control. The performance of the new Pediatric Vision Screener is demonstrated in adult volunteers and pediatric patients.

15:25
Polarization resolved multiphoton imaging
Tobias Ehmke[1], Andreas Knebl[1], Tim Heiko Nitzsche[1], Alexander Heisterkamp[1,2,3]
[1]Friedrich-Schiller-Universitaet Jena, Germany; [2]Leibniz Universitaet Hannover, Germany; [3]REBIRTH Excellence Cluster, Germany

Multiphoton microscopy has become a powerful tool in medical diagnosis. All signals detected in the microscope are based on higher order polarization terms and thus directly connected to higher order nonlinear susceptibilities. Since these susceptibilities are dependent on the polarization of the incoming electrical field second harmonic generation microscopy on corneal tissue was performed with radially and azimuthally polarized vortex beams. As a result the switching

Room: Bunsen Hall

15:10
Enhanced two photon absorption in a metallic resonant structure for infrared detection
Benjamin VEST[1], Benjamin PORTIER[2], Julien JAECK[1], Riad HAIDAR[1,3], Fabrice PARDO[2], Jean-Luc PELOUARD[2], Emmanuel ROSENCHER[1,3]
[1]ONERA - The French Aerospace Lab, F-91761 Palaiseau, France; [2]Laboratoire de Photonique et de Nanostructures (LPN-CNRS), Route de Nozay, 91460 Marcoussis, France; [3]Ecole Polytechnique, Département de Physique, 91128 Palaiseau, France

We present a GaAs photodetector dedicated to the enhancement of two-photon absorption for infrared detection purpose. It consists in a GaAs layer deposited on a gold mirror, and recovered with a metallic subwavelength grating. A two order of magnitude increase in the TPA signal has been numerically and experimentally demonstrated.

15:25
Recycling radio waves with smart walls
Matthieu Dupre, Nadege Kaina, Geoffroy Lerosey, Mathias Fink
Institut Langevin, ESPCI ParisTech, France

We propose to use electronically reconfigurable ultrathin metasurfaces as smart walls to reflect more intelligently the waves in indoor environments. We experimentally prove at 2.47 GHz that it is possible to use these as spatial microwave modulators, using a simple energy feedback. In particular, we show that we can enhance the transmission between two antennas by orders of magnitude or locally conceal a volume from the penetration of waves in a typical office room. We also provide a theoretical model of wavefront shaping in reverberating media.

Room: Newton

limits the penetration depth. Second, the diffraction of the illumination beam leads to an increase of the light sheet's thickness when the beam's depth of field is increased, i.e. optical sectioning depends on the extent of the imaged area along the illumination axis.

15:40
Adaptive self-reconstruction of non-diffracting ultrashort laser pulses with MEMS axicons
Alexander Treffer[1], Martin Bock[1], Stefan König[1], Jens Brunne[2], Ulrike Wallrabe[2], Ruediger Grunwald[1]
[1]Max Born Institute for Nonlinear Optics and Short-Pulse Spectroscopy, Germany; [2]University of Freiburg – IMTEK, Department of Microsystem Engineering, Laboratory for Microactuators, Freiburg, Germany

New types of reflective MEMS enable an adaptive self-reconstruction of quasi-nondiffracting ultrashort pulses. The recovery of few-cycle interference patterns in second order noncollinear autocorrelation was studied with a linear MEMS axicon.

15:55
Bio-inspired hyper spectral imaging
Erik Foerster[1], Benjamin Ryba[1], Moritz Stürmer[2], Ulrike Wallrabe[2], Robert Brunner[1]
[1]University of Applied Sciences Jena, Germany; [2]IMTEK, University Freiburg, Laboratory for Microactuators, Freiburg, Germany

We showed, what is possible to build a bio inspired hyper spectral imaging system. To correct the fast front group a tilting mount is useful and the partial images will be taken sequently and combined externally. This fundamental principle is bio inspired from the mantis shrimp. For registration the spectrum a flexible PDMS-Grating is used. The effect

Notes:

Room: Hans Grade

15:55
A new computational method for optical design based on the Liouville equation

B.S. van Lith[1], J.H.M. ten Thije Boonkkamp[1], W.L. IJzerman[1,2], T.W. Tukker[1,2]
[1]Technical University of Eindhoven, Netherlands, The; [2]Philips Lighting

We have developed a novel method for computing the performance of a given optical illumination system. Our method is based on the Liouville equation instead of the more conventional ray tracing. This turns the problem of tracing many rays into solving a single hyperbolic PDE. However, optical elements are described by discontinuous jumps in refractive index, which leads to complications in the numerical scheme. We can overcome these difficulties by locally using Snell's law and the law of specular reflection. We end up with a solver that enables us to quickly obtain global information.

Room: Einstein

of the z-polarization component after strong focusing with high-NA objective lenses by changing the polarization state from radial to azimuthal could be shown. This can help to enable the determination of yet unknown susceptibilities.

Invited talk

15:40
Adaptive optics en-face OCT/SLO: latest developments

Michael Pircher
Medical University of Vienna, Austria

In vivo imaging of the human retina with cellular resolution can be achieved by a combination of adaptive optics (AO) with optical coherence tomography (OCT). Thereby, even smallest structures of the retina such as rods or cones can be resolved. However, the high transverse resolution results in a limited depth of focus. Therefore only part of the recorded OCT volume will be in focus and imaged sharply. En-face OCT overcomes this limitation as the focal plane can be simultaneously shifted with the coherence gate which enables recording of entirely sharp OCT volumes of the retina. Another advantage of this technique is the fast en-face imaging capability that allows studying dynamic processes such as blood flow with cellular resolution. Latest developments of this imaging technology together with representative image data are presented.

Room: Bunsen Hall

15:40
Hollow waveguides as polarization converting elements

Stefan F. Helfert
FernUniversität in Hagen, Germany

In structures with a form-birefringence waves with perpendicular polarization travel with different phase velocities. With suitable design, these structures can be used as polarization converting elements. In this presentation we investigate the use of hollow waveguides for this purpose. Compared to e.g. sub-wavelength gratings, structures with larger difference of the phase velocities can be designed, needing shorter lengths.

15:55
Gyrotropy in Achiral Materials: the Coupled Oscillator Model

T. W. H. Oates, T. Shaykhutdinov, T. Wagner, A. Furchner, K. Hinrichs
Leibniz Institut für Analytische Wissenschaften, Germany

Extrinsic chirality is measured and simulated upon reflection from split ring resonators under oblique illumination. The first and third modes of the resonator display opposite signs of circular dichroism. A coupled oscillator model is developed to elegantly explain the observations. The model is easily adapted to other achiral materials, such as the water molecule.

Room: Newton

works by pressing the profile to degrease the diffracting efficiency. An extern calibration by a spectral lamp is necessary because of the corresponding location to the wavelength on the CCD camera.

16:10 - 16:30 Coffee Break

16:30– 18:00

Room: Pasteur

TOM2 S03: Si Photonic Systems and Devices II

Session Chair: **Graham Trevor Reed**

Invited talk

16:30
Integration of Ultra-Low Loss Waveguides with Silicon Photonics

Martijn J. R. Heck

Room: Hans Grade

TOM3 S03: Optical System Design and Tolerancing

Session Chair: **Ulrike Fuchs**
Session Chair: **Peter Brick**

Invited talk

16:30
Don't guess; use physics for white LED lighting

Room: Einstein

TOM4 S03: Microscopy and Optical Coherence Tomography of the Eye (Continued)/ Tissue optics, imaging, sensing and diagnosis

16:30
Fiber-based polarization-sensitive OCT of the human retina with correction of system polarization distortions

Room: Bunsen Hall

TOM5 S03: Slow light in Nanostructures

Invited talk

16:30
Optical signal processing using Fano effects in photonic crystals

Jesper Mork[1], Yi Yu[1], Mikkel Heuck[1], Hao Hu[1], Yaohui Chen[1], Weiqi Xue[1], Christophe

Room: Newton

TOM8 S03: Active and Adaptive Optics

Invited talk

16:30
Applying optical time reversal to tackle biomedical challenges

Changhuei Yang
California Institute of Technology, United States of America

Room: Pasteur

Aarhus University, Denmark

The invention of the silicon nitride based ultra-low loss waveguide (ULLW) platform, with losses below 0.1 dB/m, heralds a new range of applications for photonic integrated circuits. I will review first the ULLW technology, and show its unique advantages with respect to passive components, such as delay lines, resonators and filters. Then I will review the hybrid and heterogeneous integration of the ULLW technology with (hybrid) silicon photonics. Hereafter, I will discuss the opportunities that this technology offers to various high-performance applications, such as low-noise lasers and oscillators, high-resolution radars and gyroscopes, and high-bandwidth photonic analog-to-digital converters.

17:00
Fiber Grating Coupler on SOI for the Excitation of LP00, LP11,a, LP11,b and LP21,a Fiber Modes

Benjamin Wohlfeil[1], Sven Burger[2], Frank Schmidt[2], Lars Zimmermann[3], Klaus Petermann[1]

[1]TU Berlin, Germany; [2]Zuse Institut Berlin, Germany; [3]IHP GmbH, Germany

A single standard sized fiber grating coupler capable of exciting several LP fiber modes simultaneously in both TE and TM polarizations is presented. Simulations show a high overlap between the emitted field and fiber modes.

17:15
Low Loss Silicon Optical Modulator with Node-Matched-Diode

Christoph Theiss[1], Sebastian Kupijai[1], Hanjo Rhee[1], Aws Al-Saadi[1], Hans Joachim Eichler[1], Ulrike Woggon[1], Bernd Tillack[2], Lars Zimmermann[3], Harald Richter[3], David Stolarek[3], Stefan Meister[1]

[1]TU Berlin IOAP, Germany; [2]TU Berlin HFT4, Ger-

Room: Hans Grade

Willem Vos[1], Teus Tukker[2], Vanessa Leung[1], Maryna Meretska[1], Allard Mosk[1], Ad Lagendijk[1], Wilbert IJzerman[3]

[1]Complex Photonic Systems (COPS), MESA+ Institute for Nanotechnology, University of Twente, P.O. Box 217, Enschede 7500 AE, The Netherlands; [2]Philips Research, High Tech Campus 34, Eindhoven 5656 AE, The Netherlands; [3]Philips Lighting, High Tech Campus 44, Eindhoven 5656 AE, The Netherlands

We study light transport in white light emitting diodes (LEDs). Using nanophotonic diffusion theory, we derive the transport and absorption mean free paths from first principles. We find that both transport and absorption mean free paths are on the order of the phosphor plate thickness. Phosphors in commercial LEDs operate within an intriguing low-albedo range near 0.7. We discuss how essential parameters, that can be derived from first principles, control the optical properties of a white LED.

Invited talk

17:00
Köhler Integration in Color Mixing Collimators

Oliver Dross

Philips, Netherlands, The

Köhler integrating lenslet arrays can provide collimated beams that are perfectly color mixed from an array of RGB LEDs. The integration can be achieved with a double sided lenslet plate after collimation, with lenslet arrays integrated into certain collimators or close to the LEDs before collimation with a double sided lenslet shell. In all cases a suitable lenslet tessellation must be provided with a design process that ensures that all sources are contained within the so called integration zone. Such integrators outperform concepts using mere diffusion or mixing chambers.

Room: Einstein

Boy Braaf[1], Koenraad A. Vermeer[2], Mattijs de Groot[1], Kari V Vienola[1,2], Johannes F de Boer[1,2]

[1]LaserLaB, Department of Physics and Astronomy, VU University Amsterdam, The Netherlands; [2]Rotterdam Ophthalmic Institute, Rotterdam, The Netherlands

In polarization-sensitive optical coherence tomography (PS OCT) the use of single-mode fibers can cause wavenumber-dependent polarization distortions. This problem is addressed by a novel Jones matrix analysis method that spectrally analyses the polarization states of the sample surface and deeper located birefringent tissue structures. The novel Jones matrix method reduced noise and corrected erroneous offsets on the measured double-pass phase retardation, diattenuation and relative optic axis orientation. The increased accuracy of tissue polarization measurements is potentially interesting for the early detection and monitoring of pathological changes in neurodegenerative diseases such as glaucoma.

Invited talk

16:45
Quantitative relation between tissue organization and optical properties derived from Optical Coherence Tomography images

Dirk Faber, Mitra Almasian, Nienke Bosschaart, Ton van Leeuwen

Academic Medical Center, Netherlands, The

The OCT derived backscattering and scattering coefficient of discrete random media of identical spheres are adequately described by Mie theory in combination with the pair distribution function and structure factor in the Percus-Yevick approximation. This links optical properties to micrometer-scale organization of tissue.

Room: Bunsen Hall

Peucheret[2], Leif Oxenløwe[1], Kresten Yvind[1]

[1]Technical University of Denmark, Denmark; [2]University of Rennes 1, France

We suggest and experimentally demonstrate a photonic crystal structure, where a waveguide and a nanocavity are coupled in such a manner that Fano effects can be realized in a robust and controllable manner. It is found that Fano structures show superior performance compared to conventional cavity based switches that display a Lorentzian response. Error-free all-optical switching of a 10 Gbit/s signal is experimentally demonstrated. The shape of the Fano response curve is shown to lead to an inherent reduction of patterning effects, which is important for further increasing the device speed.

17:00
The dielectric photon "speed bump"

Rémi Faggiani, jianji Yang, Philippe Lalanne

LP2N, France

We propose a new device for reinforcing light-matter interaction, which relies on a sudden slowdown of the light, a propagation at slow speed in a short section offering a strong density of photonic states, and followed by a sudden speeding up. The structure, designed in a photonic-crystal waveguide platform, is only a few wavelengths long and offers slowdown factors of 100-1000.

17:15
Slowing microwaves with deeply subwavelength metamaterial waveguides

Nadège KAINA, Mathias FINK, Geoffroy LEROSEY

ESPCI ParisTech, France

We study resonant wire media that are scaled at very subwavelength scales. We show

that introducing local defects permits to guide the

Room: Newton

We appear opaque because our tissues scatter light very strongly. Interestingly, optical scattering is deterministic and can be time-reversed in much the same way a ricocheting billiard ball can be made to retrace its trajectory if nudged appropriately. I will discuss our recent results of using ultrasound tagging in combination with digital optical phase conjugation to focus light tightly and deeply within biological tissues. This technology exploits the time-symmetry property of optical scattering and is called time-reversal ultrasound-enabled (TRUE) optical focusing.

Conceptually, out technology is similar to a vehicle's headlight that can dynamically adapt to the characteristics of a changing fog to render a tightly focused spot of light deep within the fog.

17:00
Optical detection and imaging in complex media: how the memory effect can help overcome multiple scattering

Dayan Li, Amaury Badon, Geoffroy Lerosey, Claude Boccara, Mathias Fink, Alexandre Aubry

ESPCI ParisTech, France

We report on imaging in random scattering media. Our approach is based on the measurement of a reflection matrix between a spatial light modulator and a camera. We take advantage of the memory effect to filter the multiple scattering noise and improve the detection and imaging of objects embedded in scattering media.

17:15
Imaging through scattering media by exploiting transmission matrix correlations

Benjamin Judkewitz[1,2]

[1]Charité / NeuroCure Cluster of Excellence, Berlin, Germany; [2]California Institute of Technology, Pasadena, USA

Controlling light propagation across scattering me-

Room: Pasteur | Room: Hans Grade | Room: Einstein | Room: Bunsen Hall | Room: Newton

many; [3]IHP Frankfurt / Oder, Germany
We present a silicon optical modulator based on a node-matched diode (NMD) geometry in a Fabry-Pérot resonator. NRZ data transmission of 10 Gb/s is demonstrated that exhibits an extinction rate of 7.0 dB with only low intrinsic optical losses of 3.2 dB.

17:30
High-quality silicon slot waveguide ring resonator filled by atomic layer deposition

Anton Autere[1], Lasse Karvonen[1], Antti Säynätjoki[1], Matthieu Roussey[2], Elina Färm[3], Marianna Kemell[3], Xiaoguang Tu[4], Tsung-Yang Liow[4], Guo-Qiang Lo[4], Mikko Ritala[3], Markku Leskelä[3], Seppo Honkanen[2], Zhipei Sun[1]
[1]Aalto University, Finland; [2]University of Eastern Finland, Finland; [3]University of Helsinki, Finland; [4]Institute of Microelectronics, A*STAR, Singapore
Slot waveguide based ring resonators filled with different materials by atomic layer deposition (ALD) were fabricated and characterized. The largest obtained quality factor (Q-factor) was 29 866. Our results demonstrate that ALD can be used to create slot waveguide ring resonators with relatively high Q-factors, which can open new possibilities for various photonic applications (e.g., optical sensing).

17:45
Optical Vector Matrix Multiplier for On-Chip Computation

Vijay V. Parsi Sreenivas[1], Mike Bülters[2], Gerrit Dumstorff[3], Aditya Chauhan[2], Alberto Garcia-Ortiz[4], Ralf B. Bergmann[1,2]
[1]University of Bremen, Applied Optics,Faculty [1]Physics/Electrical Engineering, Otto-Hahn-Allee 1, 28359 Bremen, Germany; [2]Bremer Institut für angewandte Strahltechnik GmbH (BIAS), Klagenfurter Str. 2, 28359 Bremen,

17:30
An approach to generate colored images with PMD-cameras

Henrik Lietz, Jörg Eberhardt, Jörg Baumgart
University for Applied Science Ravensburg-Weingarten, Germany
There are different methods for image detection of three-dimensional environments. PMD cameras measure the running time of light (Time-of-Flight) for each pixel. For this, they use an active illumination unit. Because of their NIR light sources, only gray-scale images can be generated. This contribution describes an approach how to generate colored three-dimensional images by only replacing the illumination unit. There, the object scene is illuminated with the additive primary colors (RGB) successively. The camera takes images for each illumination situation and superimpose them afterwards.

17:45
Optimized sparkling lenses with omnidirectional intensity distributions for retrofit lamps

Tobias Christian Schmidt
OSRAM, Germany
For LED lamps (retrofits) made to replace incandescent lamps with clear bulbs, brilliant sparkling appearance is often desired, which makes it extraordinary difficult to achieve uniform omnidirectional intensity distributions. OSRAM develops sparkling lenses with improved omnidirectional intensity distribution.

Invited talk

17:15
New insight into corneal micro-structure with polarization-resolved second harmonic generation microscopy

Gael Latour[1,2], Aurelie Benoit[3], Ivan Gusachenko[1], Jean-Marc Allain[3], Marie-Claire Schanne-Klein[1]
[1]Ecole Polytechnique, Laboratory for Optics and Biosciences, CNRS, INSERM, Palaiseau, France; [2]Universite Paris Sud, Laboratoire IMNC, CNRS, Orsay, France; [3]Ecole Polytechnique, Solid Mechanics Laboratory, CNRS, Ecole des Mines, Palaiseau, France
Cornea is mainly composed of stacked lamellae containing aligned nanometer-thick collagen fibrils, which determines the optical and mechanical properties of this tissue. Polarization-resolved second harmonic generation (P-SHG) microscopy provides two types of information on the cornea physiology without any preparation or staining: the orientation of the collagen fibrils and the local disorder within the focal volume, obtained from the ratio of the nonlinear susceptibility components. The 3D architecture of the stroma can then be fully characterized. Furthermore, combination of mechanical assays and P-SHG provides multiscale information about the macroscopic mechanical response and the 3D microscopic organization of the stroma.

17:45
Design of a Compact Optical Sensor for Heat Flux Measurement in Biological Tissue

Victor Argueta[1], Celia Sanchez-Perez[2]
[1]Alma College, United States of America; [2]Universidad Nacional Autonoma de Mexico, Mexico
The composition and structure of biological tissue affects its thermal properties. To characterize these thermal properties can give an insight on the physiology of a specif-

waves with a transverse confinement
of the order of one period in any direction, independently of the spatial organization of the medium. We prove that the propagation within these waveguides exhibit a very low group velocities that can be tuned by modifying the geometrical and frequency parameters of the neighboring wires. We present simulation and experimental results.

17:30
Bloch Surface Based Platform for Optical Integration

Richa Dubey, Elsie Barakat, Hans Peter Herzig
École polytechnique fédérale de Lausanne, EPFL, Switzerland
Dielectric multilayers sustaining Bloch surface waves are studied as a platform for planar integrated optics. Adding an additional dielectric layer on the platform modifies the local effective index enabling a direct manipulation of the surface waves. These waves can be manipulated by patterning optical components on top of the platform. In this work, we investigate the properties of high refractive index material (TiO2) as an active top layer of the platform. We studied the propagation length and effective refractive index for different thicknesses of TiO2. We aim to characterize optical components with the help of multi-heterodyne scanning near-field optical microscopy.

dia by wavefront shaping holds great promise for a wide range of applications in biomedical imaging, but finding the right wavefront to shape is a challenge when the scattering transmission matrix is not known. Correlations in transmission matrices, especially the so-called memory-effect, have been exploited to address this limitation. However, the classical memory-effect applies to thin scattering layers at a distance from the target, which precludes its use within thick scattering media such as biological tissue. Here, we report on analogous transmission matrix correlations within thick anisotropically scattering media, with potential applications for biomedical imaging.

17:30
Retrieving time-dependent Green's functions in optics with low-coherence interferometry

Amaury Badon, Geoffroy Lerosey, Claude Boccara, Mathias Fink, Alexandre Aubry
Institut Langevin, France
We report on the passive measurement of time-dependent Green's functions in optics with low-coherence interferometry. Inspired by previous studies in acoustics and seismology, we show how the correlations of a broadband and incoherent wave-field can directly yield the Green's functions between scatterers of a complex medium.

17:45
Coherent nanoprobes down to 22 nm diameter for turbid media imaging

Eugene Kim[1,2], Andrea Steinbrück[1], Maria Teresa Buscaglia[3], Vincenzo Buscaglia[3], Thomas Pertsch[1], Rachel Grange[1]
[1]Institute of Applied Physics, Abbe Center of Photonics, Friedrich Schiller University, Albert-Einstein-Strasse 15, 07745 Jena, Germany.; [2]Vollmer Lab of

Room: Pasteur	Room: Einstein	Room: Bunsen Hall	Room: Newton

Germany; [3]University of Bremen, Institute for Microsensors, Actuators and System, Microsystems Center Bremen (MCB), 28359 Bremen, Germany; [4]University of Bremen, Institute for Electrodynamics and Microelectronics, Group of Integrated Digital Systems, 28359 Bremen, Germany

We present a novel design for an optical vector matrix multiplier that enables miniaturization of optical data and signal processing systems. A proof-of-concept design was realized using LCD display pixels as binary controlling elements with the backlight as the source. It will be further improved by integrating surface mounted diodes on the display.

ic organs. This work presents the optical characteristics and performance for an optical sensor used to measure heat flux by beam deflection in biological tissue.

Nanophotonics and Biosensing, Max-Planck Institute for Science of Light, Günther-Scharowsky-Str. 1, 91058 Erlangen, Germany.; [3]Institute for Energetics and Interphases, Department of Genoa, National Research Council, Via de Marini 6, I-16149 Genoa, Italy.

We demonstrate second-harmonic generation (SHG) from barium titanate nanoparticles down to 22 nm in diameter. As expected from quadratic nonlinear effects, the SHG signal decreases with the 6th power of the particle

18:30 - 20:30 **EOS AGA: EOS Annual General Assembly with EOS Fellows ceremony**

Bunsen Hall

Notes

Date: Wednesday, 17/Sep/2014

8:20 - 9:05
Bunsen Hall

Plenary TOM3: David Shafer

Session Chair: **Wilhelm Ulrich**
Session Chair: **Andrew Paul Wood**

The Evolution of a New High NA Catadioptric Design

David Shafer
David Shafer Optical Design, United States of America

The Evolution of a New High NA Catadioptric Design

A variety of new high NA catadioptric designs are shown, with an emphasis on the evolution in the thinking that produced them.

There are several patented catadioptric designs I did for the semiconductor inspection industry that are .90 NA or greater, have a large field size, small obscuration, simple construction, and which work in a broad deep UV spectral band. What these objective lens designs usually lack is an external pupil and that may then require a separate pupil relay system when an external pupil is needed for Fourier processing or for a scan mirror. These objective designs also usually have some very tight tolerances. .

This talk will describe the evolution of some new designs, all of which have an external pupil and also usually better tolerances. The emphasis will be on the thinking about aberration theory and various optimization methods that were used to develop the new designs. Some designs are corrected for primary and secondary axial and lateral color with just a single glass type.

9:15 - 10:45

Room: Pasteur	Room: Hans Grade	Room: Einstein	Room: Bunsen Hall	Room: Newton

TOM2 S04: III-V, Ge, a-SI and nano-Wires

Session Chair: **Antti Säynätjoki**

9:15 Invited talk

III-V integration on silicon: monolithic or bonding ?

Dries Van Thourhout[1,2], Shahram Keyvaninia[1,2], Martijn Tassaert[1,2], Thijs Spuesens[1,2], Gunther Roelkens[1,2], Bin Tian[1,2], Zhechao Wang[1,2], Marianna Pantouvaki[3], Joris Van Campenhout[3], Clement Merckling[3]
[1]Photonics Research Group, Ghent University - imec, Belgium; [2]Center for Nano- and Biophotonics, Ghent University, Belgium; [3]IMEC, Belgium

We are developing different technologies for integrating III-V lasers with silicon waveguides. Heterogeneous integration using wafer bonding technologies is well established now and the focus is on new device types including tunable lasers and multi-wavelength lasers. Recently we also started work on monolithic integration using direct epitaxy on silicon. In this presentation we will report recent results on low threshold nanowire lasers monolithically grown on silicon.

TOM3 S04: Optical System Design and Tolerancing

Session Chair: **Masaki Isshiki**
Session Chair: **Julio Chaves**

Invited talk

9:15

State of the art and future trends for automotive lighting

Stephan Berlitz
Audi AG, Germany

Lighting technology is a field in which Audi is well ahead of the competition. The brand already offers LED headlights in many model series. They define the appearance of the cars, and because they illuminate the road so well, they also make a major contribution to active safety. With its numerous innovations, Audi has raised the profile of lighting technology in the international automotive industry.

Audi is already developing the lighting technologies of tomorrow. Three central themes are emerging. The Audi lighting of the future will react even more intensively to environmental conditions, it will communicate in various ways with its surroundings and thereby help to further increase active safety.

With the Matrix LED headlights, Audi has already indicated that the lighting of the future will feature full

TOM4 S04: Tissue optics, imaging, sensing and diagnosis (continued)

9:15

Lab on a Chip dye laser tunable microcavity: towards a fully integrated light source

Luigino Criante[1,4], Sara Lo Turco[1,2], Krishna Chaitanya Vishnubhatla[1], Roberta Ramponi[1,2,3], Francesco Simoni[4]
[1]Italian Institute of Technology, Italy; [2]Dip. di Fisica, Politecnico di Milano; [3]Istituto di Fotonica e Nanotecnologie – CNR; [4]Dip. di Scienze e Ingegneria della Materia, dell'Ambiente ed Urbanistica and CNISM, Univ. Politecnica delle Marche

We report the fabrication of a tunable microfluidic dye laser, combining the femtosecond laser micromachining with the holographic lithography, aiming at obtaining high quality DBR (Distributed Bragg Reflector) microcavities, integrated in a Lab on Chip.

TOM5 S04: Nonlinear Nano

9:15 Invited talk

Toward active control of Terahertz waves using graphene-based metasurfaces

Lei Zhou
Fudan University, China, People's Republic of

Metasurfaces are ultra-thin metamaterials composed by artificial planar meta-atoms arranged in some specific macroscopic orders, and were found to exhibit extraordinary capabilities to control electromagnetic (EM) waves. However, so far the realized systems are all passive devices. Here, we combine graphene with metasurfaces to achieve active control of EM waves in THz domain. We experimentally demonstrate that a maximum reflection phase modulation of 360 degrees can be achieved with such a device via changing external gate voltage. Our discovery paves the road for many applications in THz domain, some of which will be discussed with more details in the conference.

TOM8 S04: Active and Adaptive Optics

9:15 Invited talk

The soft side of Adaptive Optics: does it enable hard results

Michel Verhaegen
Delft University of Technology, Belgium

High resolution imaging instruments suffer from aberrations induced by the imperfections of the instrument, the medium and/or the subject under investigation. For example in ground based Telescopes the aberrations are induced by the turbulence in the atmosphere. Other example occur e.g. in microscopy, lithography and optical coherence tomography. An active approach to compensate these aberrations is with adaptive optics (AO). The hardware that is used is a deformable mirror (actuator) and a wavefront (sensor). The success of the application of AO not only depends on the selection of the hardware, but also on the design of the control methodology to retrieve the necessary information from the sensor in order to enable to make maximal use of the capabilities of the actuator. In this presentation a number of examples are given from the experience build

Room: Pasteur

9:45
Germanium modulation via the free carrier plasma dispersion effect

Milos Nedeljkovic[1], Richard Soref[2], Goran Z Mashanovich[1]
[1]University of Southampton, United Kingdom; [2]University of Massachusetts at Boston, USA

Germanium has recently begun attracting attention for mid-infrared photonics due to its wide transparency range (2-16µm). In many photonic systems modulation is a key function, and in germanium, as in silicon, the most useful modulation mechanism is likely to be the free carrier plasma dispersion effect. However, until now this effect has not been quantified. Here we calculate the size of the plasma dispersion effect by using a combination of literature experimental data, and extrapolation using first principles theoretical calculations. We discuss the consequences for modulators based on free-carrier absorption in germanium, and compare them to similar devices in silicon.

10:00
Photonic nanowire in a slotted photonic crystal cavity on silicon-inorganic hybrid platform

Arijit Bera, Matthieu Roussey, Petri Stenberg, Markku Kuittinen, Seppo Honkanen
University of Eastern Finland, Finland

We present the proof of principle of enhanced light-matter interaction in a slotted photonic crystal structure covered by TiO2. A silicon nanowire is designed within the photonic crystal cavity, to evanescently guide light through the cover material. The fabricated structure is also presented.

Room: Hans Grade

-electronic control, making new dynamic features even more versatile.

Audi's next steps will be laser headlights for the high beam and innovative interior lighting.

Invited talk

9:45
The Lagrange invariant – a bridge between imaging and illumination design

Alois M. Herkommer
Universität Stuttgart, Institut für Technische Optik, Germany

In imaging design a well-known conserved quantity is the Abbe-invariant, also known as the Lagrange invariant. It is related to the field size and numerical aperture of an optical system. The corresponding quantity in illumination design is the generalized etendue. Both are related and thus a generalized approach for the analysis of imaging and illumination systems can be found. We show that the linear and non-linear transformation properties of the generalized etendue allow insight into aberrations and limitations within imaging and illumination systems. Due to the general approach this might also be a promising approach to several “hot” topics in optical design, such as aberration measures in freeform optical systems, or the treatment of extended sources in illumination systems.

10:15
The design process of non-imaging optics using optimization and freeform-deformation

Simon Wendel, Cornelius Neumann
Karlsruhe Institute of Technology, Germany

Designing non-imaging optical systems for general lighting applications often contains optimization methods. For instance, applying these powerful tools can increase the performance of given initial designs of lenses or reflector surfaces.

Room: Einstein

9:30
Wavelength selective light harvesting by binary Fresnel lenses in optofluidics chips fabricated by femtosecond laser micromachining

Surya S. K. Guduru[1,2], Francesco Scotognella[1,2], Luigino Criante[1], Rebeca Martinez Vazquez[3], Roberta Ramponi[2,3], Krishna Chaitanya Vishnubhatla[1,4]
[1]CNST@PoliMi, Istituto Italiano di Tecnologia; [2]Politecnico di Milano, Italy; [3]Istituto di Fotonica e Nanotecnologie - CNR; [4]Department of Physics, Sri Satya Sai Institute of Higher Learning

We envisage the fabrication of an integrated optofluidic chip consisting of a microchannel, a 1D polymeric photonic crystal (1DPC) on the surface of the chip with Binary Fresnel lenses (BFL) on the top. We intend to demonstrate wavelength selective light harvesting and filtering in such a device configuration.

Invited talk

9:45
Biophotonics for tissues disease assessment

Francesco Saverio Pavone
LENS, Italy

We will show an overview on the applications of these techniques in the field of biomedical imaging. In particular, tumor detection in tissue imaging applications will be shown in different fields, from urology to gastrointestinal surgery, dermatology, cardio vascular and brain surgery.

Morpho-functional characterization of tissue pathologies will be displayed as an interesting tool for tumor early diagnosis.

In the last part of the talk, a fiber based endoscope based on multidimensional spectral detection (one photon fluorescence, lifetime and Raman detection) will be described with particular applications to tumor assessment.

Room: Bunsen Hall

9:45
Modal method for Second Harmonic Generation in multilayered media

Sébastien Héron[1,2], Patrick Bouchon[1], Fabrice Pardo[2], Jean-Luc Pelouard[2], Riad Haïdar[1]
[1]ONERA-The French Aerospace Lab, France; [2]Laboratoire de Photonique et de Nanostructures (LPN-CNRS), France

A numerical modal method to study Second Harmonic Generation (SHG) in periodic multilayered media is depicted. The latter maps the electromagnetic fields through eigenmodes computation and a scattering matrix algorithm. It acts as a tool for tailoring nanostructure for the purpose of nonlinear effects enhancement.

10:00
Size effects on bifurcations in nonlinear slot waveguides

Wiktor Walasik[1,2], Yaroslav Kartashov[2], Gilles Renversez[1]
[1]Université d'Aix-Marseille & CNRS, France; [2]ICFO & Universitat Politecnica de Catalunya, Spain

We study the nonlinear waves propagating in symmetric metal slot waveguides with a Kerr-type dielectric core. We developed two independent semi-analytical models to describe the properties of such waveguides. We have found new higher order nonlinear modes and studied the influence of the slot width on the observed bifurcations. Using the capacity of our models to tackle finite size nonlinear region, we show that the first nonlinear asymmetric mode dispersion curves have invariant parts with respect to the core width. We describe accurately these parts using analytical formulae based on a simple physical model.

Room: Newton

up in the Delft Center of Systems and control in the design of control methodologies for improved AO.

9:45
LCOS Spatial Light Modulators and Applications in Adaptive Optics

Grigory Lazarev, Sven Krüger, Andreas Hermerschmidt
HOLOEYE Photonics AG, Germany

In the recent years the LCOS technology made a significant progress towards affordable high-resolution flexible phase-modulating devices for broad spectral band. These devices find its applications in the adaptive optics and digital holography.

10:00
Improvement of fidelity in digital phase conjugation by parallel alignment of two phase-only spatial light modulators

Atsushi Shibukawa[1], Atsushi Okamoto[1], Yuta Goto[1], Akihisa Tomita[1], Kunihiro Sato[2]
[1]Hokkaido University, Japan; [2]Hokkai-Gakuen University, Japan

In a conventional digital phase conjugation system, only the phase of an input light is time-reversed. This deteriorates phase conjugation fidelity and is effective in only specific cases where the input light has uniformly-distributed scattered wavefront. To overcome these difficulties, we present a digital phase conjugate mirror based on parallel alignment of two phase-only spatial light modulators (SLMs), in which both amplitude and phase of the input light can be time-reversed. Experimental result showed that, in the case of phase conjugation through a holographic diffuser with diffusion angle of 0.5 degree, background noises decrease to 65% by our digital phase conjugation mirror.

Room: Pasteur

10:15
Numerical modeling of amorphous silicon-based electro-optic devices

Sandro Rao, Francesco Giuseppe Della Corte
Università degli Studi "Mediterranea", Italy

An efficient set-up for mixed electro-optic simulations, in both steady state and transient conditions, of free carrier injection- or depletion-based hydrogenated amorphous silicon waveguide integrated optical modulators is presented.

Room: Hans Grade

While optimization itself can be automated, choosing proper parameters and boundary conditions suited for a specific lighting application is a challenging task. This is especially true, if free-form surfaces are involved.

This contribution presents the OFFD as a non-imaging design approach using the concept of Free-Form Deformation (FFD) in conjunction with customized optimization algorithms to create efficient optical free-form surfaces.

10:30
Common-path spectral domain low-coherence dynamic light scattering measurement

Yusuke Izutani[1,2], Toshiharu Watarai[1], Toshiaki Iwai[1]
[1]Tokyo University of Agriculture and Technology, Japan; [2]Otsuka Electronics Co.,Ltd., Japan

We propose a new type of the spectral domain low-coherence dynamic light scattering system equipped with a common optical path, which means that both the signal and reference lights are guided through a same optical fiber. This system provides us the stable measurements against the exogenous noise such as environmental vibration.

Room: Einstein

10:15
Gas Temperature Measurements via Frequency Comb Spectroscopy

Andreas Hänsel, A. D. Verhoeven, Alberto Maran, Remo G. S. van den Hoek, Adonis Reyes-Reyes, Nandini Bhattacharya, H. Paul Urbach
TU Delft, Netherlands, The

We report gas temperature measurements for a two component gas mixture using frequency comb spectroscopy. Two virtually imaged phase arrays are used simultaneously, to spectroscopically observe the gas species. The measurements are integrative in nature and are intended for better refractive index determination for length measurements.

Room: Bunsen Hall

10:15
Second harmonic generation from self-organized ZnO-ZnWO4 eutectic composite

Alessandro Belardini[1], Grigore Leahu[1], Marco Centini[1], Concita Sibilia[1], D. A. Pawlak[2], M. Gajc[2], P. Osewski[2], K. Sadecka[2], A. Stefanski[2], A. Kłos[2]
[1]Sapienza Università di Roma, Italy; [2]Institute of Electronic Materials Technology (ITME), Warsaw, Poland

Here we report the experimental observation of second harmonic generation in a eutectic mixture of ZnO and ZnWO4 crystalline phases. Second harmonic measurements at 800-400nm show the good crystal quality of the obtained self assembled sample. Among the second harmonic signal also a narrow transmission peak around 400nm is present acting as a natural optical filter.

10:30
Second-harmonic generation in GaP nano-waveguides

Marcin Swillo, Reza Sanatinia, Srinivasan Anand
Royal Institute of Technology (KTH), Sweden

The crystal symmetry and waveguide geometry are utilized to investigate the surface and the bulk contributions to second-harmonic generation in GaP nano-waveguides. Modal analysis and polarization measurements demonstrate surface enhanced optical nonlinearity and ways to engineer the overlap of optical fields.

Room: Newton

10:15
Defining the constraints of an adaptive optics system applied to free-space optical satellite and aircraft data downlinks

Carlos Eduardo Carrizo, Ramon Mata Calvo, Dirk Giggenbach
Deutsches Zentrum für Luft - und Raumfahrt (DLR), Germany

Adaptive Optics (AO) applied to free-space optical (FSO) communications aims to maximize either the power coupled into a single -mode fiber (SMF) or the heterodyne efficiency in coherent-based communications. LEO satellites and aircraft downlinks have to deal with low elevation angles because of the link geometry and short contact time. Due to strong scintillation and phase singularities, below 20°, traditional Shack-Hartmann sensors perform poorly. GEO satellite downlinks have to deal with very low received power levels. Here, we briefly explain the challenges to be addressed by an AO system for communication purposes.

10:30
Interferometric measurements through a dynamic fluid interface using adaptive optics

Jürgen Czarske, Hannes Radner, Christoph Leithold, Lars Büttner
TU Dresden, Germany

We present an adaptive interferometer, based on a MEMS deformable mirror, for undisturbed measurements through dynamic gas -liquid interfaces. Precise flow velocity data are captured, which are important for a better understanding of convection processes.

10:45- 11:15 Coffee Break

11:15 - 12:45

Room: Pasteur	Room: Hans Grade	Room: Einstein	Room: Bunsen Hall	Notes:

TOM2 S05: Si-Photonic Systems and Devices III, Biophotonics

Session Chair: **Dries Van Thourhout**

Invited talk

11:15 Photonic BiCMOS – a new flavor of Silicon Photonics

Lars Zimmermann[1], Dieter Knoll[1], Stefan Lischke[1], Marcel Kroh[1], Despoina Petousi[1], Mai Christian[1], Georg Winzer[1], Harald Richter[1], Bernd Tillack[1,2], Andrzej Gajda[2], Karsten Voigt[2], Klaus Petermann[2]

[1]IHP GmbH, Germany; [2]Technische Universitaet Berlin, Germany

Future communication systems will require the integration of photonic functionality with broadband electronic circuitry allowing for high-speed analogue and digital signal processing, to enable subsystems with low footprint, low power consumption and high efficiency. We are developing a new technology to implement such solutions by monolithic integration of photonic devices in a high-performance BiCMOS process. In this talk we shall provide results of a first learning cycle of fully integrated transmit and receive devices realized in photonic BiCMOS technology.

Invited talk

11:45 CMOS compatible biophotonics based on SiN waveguides

Pol Van Dorpe

imec, Belgium

Biophotonic based sensing or imaging relies often on expensive and bulky equipment. Integrated optics solutions could alleviate both cost and equipment size, by integrating a lot of the optical functionality on chip. Even more so, it is beneficial to integrate this optical functionality directly on top of a CMOS chip, that can detect the light and process the information. We have developed a 200 mm

TOM3 S05: Optical System Design and Tolerancing

Session Chair: **Kevin P Thompson**

Session Chair: **Chir-Weei Chang**

Invited talk

11:15 Optimization with Global Explorer for the lens design

Masaki Isshiki

Isshiki Optics, Japan

The optimization method damped least squares method (DLS) was almost completed late in the 1960's. DLS has been overwhelming in the local optimization technology. After that, various efforts were made to seek the global optimization. They came into the world after 1990 and the Global Explorer (GE) was one of them invented by the author to find plural solutions, each of which has the local minimum of the merit function. The robustness of the designed lens is also an important factor as well as the performance of the lens; both of these requirements are balanced in the process of optimization GE2 (the second version of GE).

After using GE for many years some ideas will be shown to improve this method further.

Invited talk

11:45 Optimization of As-Built Performance

John R. Rogers

Synopsys, United States of America

The traditional process for designing an optical system is to first design the best possible system consistent with the budgetary and packaging constraints of the project, and then in a second step, decide on a set of tolerances that must be held during fabrication and assembly. In this paper, we review approaches to the optimization of as-built (i.e., post-tolerance)

TOM4 S05: Studies of cells and single molecules

Invited talk

11:15 Quantitative phase imagining (QPI) in two, three, and, four dimensions

Gabriel Popescu

University if Illinois at Urbana-Champaign, Finland

Most living cells do not absorb or scatter light significantly, i.e. they are essentially transparent, or phase objects. Quantifying cell-induced shifts in the optical path-length permits nanometer scale measurements of structures and motions in a non-contact, non-invasive manner. Spatial Light Interference microscopy (SLIM) is a highly sensitive QPI method. Due to its sub-nanometer pathlength sensitivity, SLIM enables interesting structure and dynamics studies over broad spatial (nanometers-centimeters) and temporal (milliseconds-weeks) scales. I will review our recent results on applying SLIM to basic cell studies, as well as high-throughput screening and tissue diagnosis.

11:45 Quantitative phase imaging with fully and partially coherent light

Jose A. Rodrigo, Tatiana Alieva

Universidad Complutense de Madrid, Spain

We present a fast iterative non-iterferometric technique for quantitative phase imaging working under both fully and partially coherent sample illumination. The partial coherence significantly reduces the speckle noise and other undesirable distortions typical in coherent laser imaging. A programmable low-cost system comprising an electrically tunable lens (ETL) and sCMOS camera, has been developed for its experimental demonstration. This setup

TOM5 S05: Complex transport in Nanostructures

Invited talk

11:15 Locally Resonant Metamaterials: Focusing, Imaging and Manipulating Waves at the Deep Subwavelength Scale

Geoffroy Lerosey, Fabrice Lemoult, Nadège Kaina, Mathias Fink

Institut Langevin - ESPCI ParisTech and CNRS, France

In this talk I will present some of our recent works on metamaterials based on resonant unit cells. I will show how the use of time dependent and broadband wavefields, in conjunction with those metamaterials, permits to beat the diffraction limit from the far field for imaging or focusing purposes. I will introduce the idea of resonant metalens, first demonstrated in the microwave domain, and explain its principles.

11:45 Molding light transport in disordered photonic structures

Kevin Vynck[1,2], Gaurasundar M. Conley[1,3], Filippo Pratesi[1], Matteo Burresi[1,4], Diederik S. Wiersma[1,4]

[1]European Laboratory for Non-linear Spectroscopy (LENS), Univ. Florence, Italy; [2]Laboratoire Photonique, Numérique et Nanosciences (LP2N), CNRS - IOGS - Univ. Bordeaux, France; [3]Physics Department, Univ. Fribourg, Switzerland; [4]National Institute of Optics (INO), CNR, Italy

We theoretically investigate the effect of structural correlations on light transport in 2D disordered photonic structures. Our semi-analytical analysis reveals that short-range correlations make it possible to go from a weakly diffusive to a strongly localized regime very easily. The effect is confirmed by numerical FDTD simulati-

Room: Pasteur | Room: Hans Grade | Room: Einstein | Room: Bunsen Hall | Notes:

CMOS compatible SiN waveguide platform with low losses at visible wavelengths. In this talk we will discuss the current component library and the applications that are envisioned.

12:15
Numerical Simulation of Silicon-Organic Hybrid Slot-Waveguides

Patrick Steglich, Yazmin Padilla Michel, Claus Villringer, Silvio Dümecke, Sigurd Schrader
Technische Hochschule Wildau, Department for Photonics, Laser and Plasmatechnologies, Wildau, 15475, Germany

In this work silicon-organic hybrid (SOH) slot-waveguides are numerical analyzed by employing a FEM-software. SOH technology combines the widely used silicon technology with organic materials which are expected to have an exceptional high electro-optical coefficient. Slot-waveguides are the key element in order to integrate organic materials in silicon photonics. The major advantage of slot-waveguides is the fact that the guided light is confined in between two silicon rails where the organic cladding material is located. Effective refractive index and effective nonlinear area of a slot-waveguide are calculated for different geometrical parameters and by variation of the organic material refractive index.

12:30
SOI Nano Rib Waveguides for Bio Sensing Applications

Matthias Jäger[1], Jürgen Bruns[1], Harald Richter[2], Klaus Petermann[1]
[1]Technische Universität Berlin, Fachgebiet Hochfrequenztechnik, Berlin, 10587, Germany; [2]IHP GmbH, Frankfurt (Oder), 15236, Germany

Micro ring resonators based on nano rib waveguides are produced and tested in direct comparison with nano wire based micro ring resonators. Nano

performance, with particular emphasis paid to global optimization aimed at finding low-sensitivity configurations. In particular, we include a new method that allows the as-built performance to be directly targeted in optimization.

12:15
Saddle-point methods for systematic design

Florian Bociort[1], Pascal van Grol[2], Irina Livshits[3], Zhe Hou[1], Yifeng Shao[1], Paul Urbach[1]
[1]TU Delft; [2]TNO Science and Industry; [3]ITMO

We give examples showing how, by using certain special properties of the lens design landscape, saddle-point methods can find good lens designs. A systematic design procedure for a wide-angle pinhole lens and the automatic generation of a 9-lens system from a 4-lens system are discussed.

12:30
Fast checking of lens thickness profile using light losses when lenses are dipped in colored liquid

Josep Arasa[1], Carles Pizarro[1], Nuria Tomas[1], Jordi Romero[2,3], Alfonso Sanchez[2]
[1]Univesitat Politecnica de Catalunya, Spain; [2]Ascamm Technological Center, Spain; [3]Universitat Autonòma de Barcelona, Spain

The lens thickness profile is useful information during the manufacturing process. We present a method that uses the changes of light losses recorded in an image when a lens is dipped on it. The method can be applied in all the manufacturing stages of the lenses independently of the surface roughness.

can be easily included into standard optical microscopes.

12:00
Label free spectroscopic discrimination of cell populations in a co-culture model

Francesca Romana Bertani[1], Elisabetta Botti[2], Antonio Costanzo[2], Marco D'Alessandro[1], Luisa Ferrari[1], Valentina Mussi[1], Stefano Selci[1]
[1]I.S.C. - C.N.R., Italy; [2]Unit of Dermatology-NESMOS Department, Rome University "La Sapienza", Italy

We present single cell optical spectra from keratinocytes and melanoma cells co cultures acquired with hyperspectral confocal microscopy to assess the nature of cells by correlating images and single cell localized reflectance spectra.
We have seeded separately a HaCaT cell line and a primary melanoma cell line, then put together and imaged the two populations using analysis of hyperspectral reflectance data to classify any single cell. We have shown that analysis of data from hyperspectral imaging of single cell reflectance spectra in the VIS-NIR range may lead to cell classification even in absence of exogenous dyes and molecular absorption bands.

12:15
Nano-Confined Polymer Structures for Adhesive Protein Binding

Richard Wollhofen[1], Clemens Wolfesberger[1,2], Bianca Buchegger[1], Jaroslaw Jacak[1,2], Thomas A. Klar[1]
[1]Johannes Kepler University Linz, Austria; [2]Upper Austria University of Applied Sciences

We present a stimulated emission depletion (STED) lithography approach for the fabrication of sub-100 nm polymeric structures. Protein-adhesive polymers allow for biofunctionalization down to a single protein

ons.

12:00
Lessons from Nature: Optimized Multiple Light Scattering in White Beetles

Matteo Burresi[1,2], Lorenzo Cortese[1], Mathias Kolle[4], Peter Vukusic[5], Diederik Wiersma[1,3], Ullrich Steiner[6], Silvia Vignolini[6]
[1]European Laboratory for Non-linear Spectroscopy (LENS), 50019 Sesto Fiorentino (FI), Italy.; [2]Istituto Nazionale di Ottica (CNR-INO), Largo Fermi 6, 50125 Firenze (FI), Italy.; [3]Università di Firenze, Dipartimento di Fisica e Astronomia, 50019 Sesto Fiorentino (FI), Italy.; [4]School of Engineering and Applied Sciences Harvard University 29 Oxford St., Cambridge, MA, 02138, USA and Department of Mechanical Engineering, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA 02139, USA; [5]Thin Film Photonics, School of Physics, Exeter University, Exeter EX4 4QL, UK.; [6]Cavendish Laboratory, Department of Physics, University of Cambridge, J. J. Thomson Avenue, Cambridge CB3 0HE, U.K.

By making use of ultrafast measurements, we reveal the optical mechanism which lays behind the extremely bright whiteness of certain white beetles. We found clear fingerprints of optimization by evolution in the realization of the peculiar disordered structure which gives rise to a pronounced multiple light scattering.

12:15
Photonic structures with transverse randomization

Martin Boguslawski, Sebastian Brake, Patrick Rose, Falko Diebel, Cornelia Denz
Institute of Applied Physics, Germany

We present both experimental and numerical

Room: Pasteur	Notes:	Room: Einstein	Room: Bunsen Hall	Notes:
rib waveguide based sensors show a reduced sensitivity, but compensate for that with lower losses and therefore higher Q-factors as well as a reduced production complexity.		level. **12:30** **Lenseless Cell-Microscope for Live Cell Imaging of Cell Cultures** Moritz Hubl Fraunhofer IZM, Germany A novel cell microscope combines holographic imaging of cells with a thermoelectric cooling system and automated cell segmentation for live cell imaging inside the cell incubator. The lensless Cell-Microscope offers new dimensions of imaging and analysing cultivating cells in long-term studies over a big field of view.	results of light propagation in transverse random photonic media generated by optical induction methods. Our approach of using nondiffracting writing light fields offers a huge flexibility to realize these versatile structures. **12:30** **Homogenization of periodic to random complex structures** Simon Félix[1], Agnes Maurel[2], Jean-Francois Mercier[3] [1]LAUM, Le Mans, France; [2]Institut Langevin, France; [3]POems/ENSTA, France We present a study of propagation in complex structures, with unit cell made of periodic or more complex arrangement, including random arrangement. The structures are homogenized such that it is described in terms of homogeneous anisotropic media. Such approach is shown to be efficient to accurately describe several configurations: the existence of surface wave plasmons, the effect of roughness at the interface between two dielectric (related to the Brewster angle for instance), as the extraordinary non resonant transmission. Comparison with direct numerics is presented in these examples.	

12:45 - 14:45 Lunch Break: Poster Session (all TOMs)
Room: Newton

Plenary TOM4: Vasilis Ntziachristos

14:45 - 15:30

Bunsen Hall

Advances in Multispectral Optoacoustic Tomography

Vasilis Ntziachristos

Helmholtz Zentrum München / Technische Universität München, Germany

This talk describes current progress with methods and applications for in-vivo optical and opto-acoustic imaging in cancer and outlines how new optoacoustic and fluorescence imaging concepts are necessary for accurate and quantitative molecular investigations in tissues. The development of multi-spectral optoacoustic tomography (MSOT) brings unprecedented optical imaging performance in visualizing anatomical, physiological and molecular imaging biomarkers. Attractive features of the method include 10-100 microns resolution through several millimeters to centimeters of tissue and real-time imaging. In parallel clinical translation of targeted fluorescent probes opens new ways in the interventional detection of cancer in surgical and endoscopic optical molecular imaging.

15:40 - 17:10

Room: Hans Grade

TOM3 S06: Optical System Design and Tolerancing

Session Chair: **Alois M. Herkommer**
Session Chair: **Johannes Ruoff**

Invited talk

15:40 Design of a Manufacturable Freeform Three-Mirror Imaging Telescope

Jannick Rolland
University of Rochester, United States of America

A system that demonstrates the potential for phi polynomial freeform surfaces to revolutionize optical design forms was conceived in 2010. Since, it has been fabricated, tested, and assembled. The system is now operational as a fully unobscured all-reflective telescope with a 10° full field of view operating at F/1.9.

Invited talk

16:10 Are freeform telescopes more alignment sensitive?

Kevin P Thompson[1,2], Kyle Fuerschbach[2], Jannick P Rolland[2]
[1]Synopsys, Inc., United States of America; [2]University of Rochester, Institute of Optics, United States of America

A first in class all freeform surface imaging telescope was recently completed at the University of Rochester. This paper will compare the alignment sensitivity of this fully unobscured, dramatically wide field all-reflecting all Fringe Zernike freeform surface imaging telescope with a more traditional three mirror anastigmat (TMA) form using nodal aberration theory (NAT).

16:40 A freeform telescope for pushbroom remote sensing intruments

Bob Kruizinga, David Nijkerk, Huib Visser
TNO, Netherlands, The

Telescopes for spatial

Room: Einstein

TOM4 S06: Microfluidic biosensors

15:40 Integrated biosensors for multi-parameter diagnostics based on inverted ridge waveguide ring resonators

Moritz Kleinert, Ziyang Zhang, Crispin Zawadzki, David de Felipe, Alejandro Maese Novo, Walter Brinker, Daniel Pergande, Norbert Keil
Fraunhofer Institute for Telecommunications - Heinrich Hertz Institute, Germany

In this paper we propose a novel inverted waveguide layout for microring resonator biosensors (MRR). The properties of these structures are investigated and a CRP measurement using a silicon nitride MRR biosensor is shown.

15:55 Reproducible SERS substrates for quantitative analysis of biomolecules

Peter Reader-Harris[1], Anna Chiara De Luca[2], Michael Mazilu[1], Stefania Mariggio[2], Daniela Corda[2], Andrea Di Falco[1]
[1]University of St Andrews, United Kingdom; [2]National Research Council, Italy

We report on a substrate which enables reproducible surface enhanced Raman spectroscopy. We demonstrate the quantitative analysis of the concentration of three component mixtures including a potential cancer marker, to an accuracy of 6%, with a detection limit of 200 nM, in near physiologically relevant conditions.

16:10 A plasmonic optofluidic device for multiplexing heat-induced applications

Andrea Steinbrück[1], Jae-Woo Choi[2], Stefan Fasold[1], Christoph Menzel[1], Anton Sergeyev[1], Thomas Pertsch[1], Rachel Grange[1]

Room: Newton

TOM7 S01: Organic Photonics

Session Chair: luigino criante

Invited talk

15:40 The power of intermolecular interactions in organic semiconductors: from threaded molecular wires to PCBM single crystals

Giulia Tregnago[1], Giuseppe Maria Paterno'[1], Nico Seidler[1], Valentina Robbiano[1], Michael Wykes[2], David Beljonne[3], Franco Cacialli[1]
[1]University College London, United Kingdom; [2]Madrid Institute for Advanced Studies, IMDEA Nanoscience, C/Faraday 9, Campus Cantoblanco, 28049 Madrid, Spain; [3]Laboratory for Chemistry of Novel Materials, Université de Mons, 20, Place du Parc, 7000 Mons, Belgium

please see attached

16:10 Fabrication of polymer inverse opals with linear and nonlinear optical functionalities using a sandwiching approach

Pieter-Jan Demeyer, Stefaan Vandendriessche, Kevin Bogaerts, Thierry Verbiest, Koen Clays
Katholieke Universiteit Leuven, Belgium

We developed a novel method to fabricate inverse opals. An epoxy melt is sandwiched between two silica opals and cured. After etching, a freestanding inverse opal film without overlayers is obtained. A large variety of optical functions can be integrated into the inverse opal by doping the epoxy melt before infiltration. This method produces materials that combine both structural and inherent optical functions. As such, it forms a suitable research platform for the study of light-matter interactions in 3D photonic crystals, leaving ample room for creativity.

Notes:

Room: Bunsen Hall

Joint session S01: TOM 5 and TOM 10

Invited talk

15:40 Active Plasmonics in semiconductor-metal hole arrays

Martin van Exter, Vasco Tenner, André van Delft, Michiel de Dood
Leiden University, Netherlands, The

We study surface plasmons on 2-dimensional arrays of sub-wavelength holes in a gold film deposited on an optically-excited semiconductor. At sufficiently strong pump power, these structures exhibit surface plasmon lasing in an intriguing spatial mode with a donut-shaped emission profile and a radial polarization. These properties, and others, show that our surface plasmon laser operates as a two-dimensional distributed feedback laser. We will discuss how additional information on the nature of the surface plasmons on the hole array can be obtained by studying the complex plasmonic band structure of the device below its lasing threshold.

16:10 Coherent perfect absorption of light by nanoparticles

Brian STOUT
Aix-Marseille University - Institut Fresnel, France

Coherent `Perfect' Absorption (CPA) corresponds to a fundamental upper bound of the absorption cross section, □abs ≤3□2/8□. CPA constrains the absorber permittivity to specific values, but these values can be found in a few materials at certain wavelengths or designed as effective parameters at any wavelength.

Room: Hans Grade

scanning hyperspectral remote sensing instruments require a large across track FOV. Compared to the 1st generation TNO telescope of this type a dramatic performance increase (ground resolution) was achieved by changing both mirrors into freeforms.

16:55
Optical design of the laser tomography test bed for extremely large telescopes

Kristina Uhlendorf[1], Rodolphe Conan[2], Francois Rigaut[2], Rusty Gardhouse[2]
[1]Jenoptik Optical Systems GmbH, Germany; [2]The Australian National University, Australia

The Advanced Instrumentation and Technology Center (AITC) at The Australian National University is building a Laser Tomography Adaptive Optics test bed for extremely large telescopes, especially the Giant Magellan Telescope. In the paper the optical design of the LTAO demonstrator and its challenges are discussed.

Room: Einstein

[1]Institute of Applied Physics, Abbe Center of Photonics, Friedrich Schiller University, Jena, Germany; [2]Swiss Federal Institute of Technology Lausanne (EPFL), Optics Laboratory, School of Engineering, Lausanne, Switzerland

We present an optofluidic chip based on plasmonic nanodot arrays with resonances in near infrared. The plasmonic structures act as converters of laser light into heat. We determine threshold powers for heat-induced effects and show that 30-40 nm from resonance no heat-induced effects are visible allowing for multiplexing chip applications.

16:25
Optofluidic label-free biosensor based on a-Si:H photonic resonators embedded in silicon microfluidic channels

Timo Lipka, Lennart Moldenhauer, Lennart Wahn, Hoc Khiem Trieu
Institute of Microsystems Technology, Hamburg University of Technology, Germany

We present label-free lab-on-chip biosensors that are based on low-loss hydrogenated amorphous silicon photonic resonators which are embedded in silicon/glass microfluidic channels. The biosensor is based on evanescent field refractive index sensing and allows to detect biomolecular binding to the functionalized resonator surface with detection limits in the sub-femtogram region. The biosensor was optically characterized by in-situ monitoring the wavelength shift due to bovin serum albumin protein (BSA) adsorption supplied to a 10 µm radius ring resonator via the microfluidc channels.

Room: Newton

16:25
Photoluminescence and radiative-rate modifications of a luminescent conjugated polymer infiltrated into silicon rugate filters

Valentina Robbiano[1], Salvatore Surdo[2], Giancarlo Canazza[3], Shabbir Mian[4], Davide Comoretto[3], Giuseppe Barillaro[2], Franco Cacialli[1]
[1]Department of Physics & Astronomy and London Centre for Nanotechnology, University College London, Gower Street, London WC1E 6BT, United Kingdom; [2]Dipartimento di Ingegneria della Informazione, Università degli studi di Pisa, via G. Caruso 16, 56126 Pisa, Italy; [3]Dipartimento di Chimica e Chimica Industriale, Università degli Studi di Genova, via Dodecaneso 31, 16146 Genova, Italy; [4]Department of Physics, McDaniel College, Westminster MD 21157, USA

We report on the modification of the photoluminescence (PL) and decay rates of a green-emitting commercial luminescent polymer (F8BT, Poly[(9,9-di-n-octylfluorenyl-2,7-diyl)-alt-(benzo[2,1,3]thiadiazol-4,8-diyl)]) infiltrated into one-dimensional (1D) Porous Silicon Photonic Crystals (PS-PhCs), known as rugate filters.

16:40
Melt-Extruded Films of a Commercial Polymer with Intense Chiral Optical Response of Achiral Guests

Paola Rizzo
Dipartimento di Chimica e Biologia, Università di Salerno, Via Giovanni Paolo II 132, 84084 Fisciano (SA), Italy, Italy

s-PS films of different thickness, constituted by a racemic polymer and achiral chromophores, which exhibit intense chiro-optical responses for both host and guest peaks in the IR as well as in the UV -Visible regions, have been studied.The extrinsic

Notes:

Room: Bunsen Hall

16:25
A Quasi Normal Mode Analysis of Plasmonic Resonators Coupled to Quantum Sources

Jianji Yang[1], Mathias Perrin[2], Philippe Lalanne[1]
[1]LP2N, Institut d'Optique d'Aquitaine, Univ. Bordeaux, CNRS, 33405 Talence, France; [2]LOMA, Univ. Bordeaux, CNRS, 33405 Talence, France

Plasmonic resonators coupled to a single quantum emitter have been studied with brute force numerical simulation. By using the recently developed quasi-normal mode theory, we gain an important insight on the properties of the hybrid system and its coupling to an injected light beam.

16:40
Evidence of extraordinary optical extinction through dual metallic gratings

Clément Tardieu[1,2], Grégory Vincent[1], Thomas Estruch[1], Julien Jaeck[1], Nathalie Bardou[2], Stéphane Collin[2], Riad Haïdar[1]
[1]ONERA - The French Aerospace Lab, France; [2]Laboratoire de Photonique et de Nanostructures - CNRS

We present the experimental evidence of extraordinary optical extinction through encapsulated dual metallic gratings, in the mid-infrared range for transverse magnetic-polarized wave illumination. An extraordinary optical transmission due to guided mode resonance is also shown. The angular dependance of these phenomena is revelead and a study for transverse electric-polarized wave illumination shows an absence of extraordinary optical extinction for this polarisation state.

16:55
Flat lensing described by small angle phase behavior

Peter Ott[1], Mohammed H. Al Shaks[2], Kenneth J. Chau[2]

Notes:

Room: Newton

and extensive nature of their chiral-optical response has been evidenced

16:55
Thin porous structures containing liquid crystals: a key technology for low voltage tuning capability of photonics devices

Luigino Criante[1], Francesco Scotognella[2]
[1]Politecnico di Milano, Italy; [2]Center for Nano Science and Technology@PoliMi, Istituto Italiano di Tecnologia, Italy

We have demonstrated colour tunability with electric field in a photonic crystal/liquid crystal composite. With only 8 V we observe a shift of 8 nm nanometers towards the blue. This device can be very interesting for the realization of low-cost and low consuming portable displays.

Notes:

Room: Bunsen Hall

[1]Heilbronn University, Germany; [2]The University of British Columbia

Flat lensing is the ability of homogeneous, flat, layered media to generate a real image. This phenomenon was introduced in connection with a negative effective index. In this contribution a definition of flat lensing based on the behavior of the phase of the exiting wave is proposed and validated.

17:10 - 17:30 Coffee Break

17:30- 19:00

Room: Hans Grade

TOM3 S07: Optical System Design and Tolerancing

Session Chair: **Wolfgang Vollrath**
Session Chair: **Dewen Cheng**

Invited talk

17:30
Free Form Surfaces in Imaging Optics

Alexander Epple, Johannes Ruoff
Carl Zeiss SMT GmbH, Germany

Known for a long time in non-imaging optics, free form surfaces are progressively used in imaging optics. We will give an overview about several aspects from design, state-of-the-art systems and surface description. Emphasis will be on a designers view on the free form surfaces.

Invited talk

18:00
Metrology for Asphere and Freeform optics by UA3P

Keishi Kubo
Panasonic Production Engineering Co.,Ltd., Japan

Recently the demand of the metrology for large asphere and freeform optics are increasing for digital camera and other category. We have developed new technology having the accuracy is less 0.1um and scanning speed is 30mm/s using the linear motor and the air bearing system based on the He-Ne stabilized frequency laser coor-

Room: Newton

TOM7 S02: Organic Polaritons

Session Chair: **David George Lidzey**

17:30
Emerging topics in organic polaritons

Invited talk

Stéphane Kéna-Cohen
Polytechnique Montréal, Canada

Organic polaritons are formed when the light-matter interaction in a film or microcavity becomes so strong that it must be treated non-pertubatively. Polaritons, the resulting mixed light-matter particles, can then exhibit a number of distinct phenomena. We will show how organic films can be used to study room-temperature analogs to Bose-Einstein condensation, demonstrate nonlinear interactions in such systems and discuss the onset of spontaneous coherence. We will also show applications in the linear regime such as the use of polaritons to enhance the photoluminescence quantum efficiency of organic thin films and electroluminescence in the ultrastrong coupling regime.

18:00
Ultrastrong light-matter coupling in electroluminescent organic microcavities

Marco Mazzeo[1], Salvatore Gambino[2], Armando Genco[3], Omar Di Stefano[4], Salvatore Savasta[4], Salvatore Patane[4], Gianni

Room: Bunsen Hall

Joint session S02: TOM 5 and TOM 10

Session Chair: **Jari Turunen**
Session Chair: **Pedro ANDRES**

17:30
Diffraction grating-coupled plasmon-polariton surface waves

Invited talk

Piotr Wrobel, Tomasz Stefaniuk, Tomasz Szoplik
University of Warsaw, Poland

Plasmonics is a new and promising field of research dealing with investigation of properties of surface plasmon-polariton (SPP) waves at the metal-dielectric interfaces. SPPs can be excited using electron beam or through coupling light wave to plasmon wave. The wavevector k0 of light beam propagating in free space is shorter than that of plasmon kSPP. To overcome this momentum mismatch diffraction grating coupling is frequently used. It makes use of the reciprocal vector of the grating constant to shift the wavevector of impinging light to the desired value of kSPP. In this paper we discuss various applications of SPP waves excited by means of diffractive structures.

Room: Hans Grade

dinate measurement system. By using this technology, we have developed form measurement machine UA3P-650H, having larger measurement area XY 500mm and Z 120mm for asphere and freeform surfaces.

And for the increasing demand of the measurement accuracy for mobile and smart phone aspherical lenses, we have developed new technology and machine UA3P-3000 to reduce the measurement error of friction force having the measurement area XY 30mm and Z 20mm. So we can improve the measurement accuracy up to 0.1um at 70degree inclined optical surface in bidirectional measurement path both downward and upward.

18:30
Fresnel lens sidewall design for imaging optics

Toru Fujii[1], Alain Goulet[1], Ken Hattori[1], Kunio Konno[1], Akira Tanaka[1], Richard Bosmans[1], Masayasu Sawada[2], Hiroki Yazawa[3]
[1]Nikon and Essilor International Joint Research Center Co., Ltd, Japan; [2]Nikon System Inc., Mathematical analysis Department, Japan; [3]Nikon Corp., MS laboratory, Japan

We developed a ray tracing simulation tool for imaging systems including a Fresnel lens with a quasi-arbitrary sidewall structure. A Fresnel lens for reducing refractive noise with limited structure freedom was produced. A camera image was taken using digital camera and was compared to an image obtained with a single spherical lens.

18:45
Optical modelling and design of freeform optical surfaces using anisotropic Radial Basis Functions

Milan Maksimovic
Focal-Vision and Optics, Netherlands, The

We demonstrated use of anisotropic Radial Basis Functions (RBFs) in the modeling and design of freeform optical surfaces on selected optical designs where local control of optical properties and optimization for off-axis fields is targeted. Particularly, novel method based on Fibonacci grids for placement of RBF nodes was introduced and compared to other approaches. This choice proved to be more robust solution with smaller number of suitably chosen RBFs needed to achieve good accuracy in surface approximation. We explored several strategies for optimal shape parameter determination using numerical experiments and compared results with theoretical predictions.

Room: Newton

Lerario[2], Dario Ballarini[1], Daniele Sanvitto[1], Giuseppe Gigli[1]
[1]CNR-Nano Lecce, Italy; [2]CBN, Istituto Italiano Tecnologia, Via Barsanti 1, 73010 Lecce, Italy; [3]Dipartimento di Matematica e Fisica "Ennio De Giorgi", Università del Salento, Via Monteroni, 73100 Lecce, Italy; [4]Dipartimento di Fisica e Scienze della Terra, Università di Messina, Viale F. Stagno d'Alcontres 31, 98166 Messina - Italy

We report a polariton organic microcavity with a Rabi splitting beyond 1.12 eV and a record value of the normalized coupling ratio of 60%. We show several striking features of the USC regime such as the observation of a forbidden microcavity polariton gap. Thanks to electrical doping of transport layers we have realized a p-i-n OLED with a record coupling ratio of 50% at room temperature. These USC devices exhibit a dispersion-less angle-resolved electroluminescence with a sharp emission (FWHM at 25meV) that can be exploited for the realization of novel monochromatic optoelectronic devices.

18:15
Direct Net Gain Measurements in Organic Microcavities

Christian Tzschaschel, Markas Sudzius, Andreas Mischok, Michael Bretschneider, Hartmut Fröb, Karl Leo
Institut für Angewandte Photophysik, Technische Universität Dresden, Germany

In this work, a new gain measurement technique is presented, which allows direct investigations of net gain dynamics in microcavities below the lasing threshold. It involves an in-depth analysis of the line shape of the cavity mode. Results are presented for the organic host-guest systems Alq3:DCM and T3:DCM.

18:30
Bloch Surface Wave Polaritons

Giovanni Lerario[1], Alessandro Cannavale[1,2], Dario Ballarini[2], Lorenzo Dominici[1,2], Dario Gerace[3], Marco Liscidini[3], Milena De Giorgi[2], Daniele Sanvitto[2], Giuseppe Gigli[1,2,4]
[1]CBN-IIT, Istituto Italiano di Tecnologia, Via Barsanti, 73010 Lecce, Italy; [2]NNL, Istituto Nanoscienze—Cnr, Via Arnesano, 73100 Lecce, Italy; [3]Dipartimento di Fisica, Università di Pavia, via Bassi 6, I-27100 Pavia, Italy; [4]University of Salento, Via Arnesano, 73100 Lecce, Italy

Mixed light-matter excitations, also called polaritons, arise from the strong coupling of excitonic optical transitions and electromagnetic modes. Most of the research on this field has been focused on planar microcavities; here we show the formation of room temperature propagating polariton states arising from the strong coupling between excitons in J-aggregating molecules and a Bloch surface wave generated at the interface of a distributed Bragg reflector. These polariton modes reveal long lasting space propagation at the surface plane of the sample. This result paves the way for further research on polariton devices that could allow propagation up to macroscopic distances.

Room: Bunsen Hall

18:00
250 nm period grating transferred by proximity i-line mask-aligner lithography

Yannick Bourgin[1], Thomas Käsebier[1], Uwe Zeitner[1,2]
[1]Friedrich-Schiller University Jena, Germany; [2]Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

A method based on a binary phase-mask combined with a suitable illumination setup is used to fabricate 250 nm period diffraction gratings by using proximity i-line diffractive mask-aligner lithography. The transfer of the printed grating into the fused silica wafer is a step toward the theoretical i-line lithography resolution.

18:15
Fluorescence beaming assisted by surface waves on dielectrics

angelo angelini[1], natascia de leo[2], peter munzert[3], luca boarino[2], fabrizio giorgis[1], emiliano descrovi[1]
[1]politecnico di torino, Italy; [2]INRIM, italy; [3]Fraunhofer IOF, Germany

Fluorescence beaming assisted by Bloch Surface Waves (BSW) is experimentally demonstrated by using subwavelength ring gratings on dielectric multilayers. Upon a local excitation, fluorescence is near-field coupled to BSW and then diffracted in free space along arbitrary directions.

18:30
Plasmon-triggered switching between propagating diffraction orders at a metal grating

Jean Sauvage-Vincent[2], Valery Petiton[2], Yves Jourlin[1], A. V. Tishchenko[1], Isabelle Verrier[1], Olivier Parriaux[1]
[1]Lab Hubert Curien CNRS University of Lyon, France; [2]Hologram Industrie

A new non-localized plasmonic effect taking place at a simple sinusoidal metal grating is disclosed whereby the incident power is swapped between the 0th and -1st diffraction orders upon a wavelength or angular shift with the astonishingly low-loss mediation of the +1st or -2nd order plasmon coupling.

18:45
Spatial coherence of light in disordered media

Kevin Vynck[1,2], Romain Pierrat[1], Rémi Carminati[1]
[1]Institut Langevin, ESPCI ParisTech, CNRS, France; [2]Laboratoire Photonique, Numérique et Nanosciences (LP2N), CNRS - IOGS - Univ. Bordeaux, France

The spatial coherence of light in uncorrelated disordered media is investigated theoretically. The spatial field correlation matrix is derived analytically using a multiple scattering theory for polarized light and is found to be strongly anisotropic, a feature that is inherent to the vector nature of light.

Notes:

Room: Newton

18:45

A polymer-based functional pattern on one-dimensional photonic crystals for fluorescence control

serena ricciardi[1], paola rivolo[1], francesca frascella[1], valeria moi[1], angelo angelini[1], peter munzert[2], natascia de leo[3], luca boarino[3], fabrizio giorgis[1], emiliano descrovi[1]
[1]politecnico di torino, Italy; [2]Fraunhofer IOF, Germany; [3]INRIM, Italy

We introduce the use of a patterned polymer-based surface functionalization of dielectric multilayer for controlling the emission direction of fluorescent proteins via coupling to two Bloch Surface Waves (BSW). Each BSW relates to a micrometric region on the multilayer, characterized by a different chemical feature. for similar purposes. In this case, photonic modes for fluorescence coupling are provided by means of periodic arrangements of dielectric materials such as gratings or multilayers [2]. Photonic crystals provide several advantages such as a lower absorption in the visible range, spectral and polarization tunability. In addition, a wider range of surface functionalization chemistry can be used for sensing.

20:30-23:00 Conference Dinner

Date: Thursday, 18/Sep/2014

9:00- 9:45
Bunsen Hall

Plenary TOM7: Jeremy Baumberg

Squeezing light into nanogaps: plasmonics in the sub-nm, single moleclue and quantum domains

Jeremy J. Baumber
University of Cambridge, United Kingdom

Coupling between plasmonic nano-components generates strongly red-shifted resonances combined with intense local field amplification on the nanoscale. This allows directly seeing molecules as well as excitations in semiconductors. We have recently explored plasmonic coupling which can be tuned dynamically, through reliable bottom-up self-assembly. The crucial aspect of these systems is the extreme sensitivity to separation, and how quantum tunneling starts to be directly seen at room temperature in ambient conditions. We recently demonstrated how quantum plasmonics controls the very smallest space that light can be squeezed into below 1nm. We also demonstrate the possibility to track individual molecules for long periods using the extreme enhancements. We show how the new generation of 2D semiconductors can couple to such nano-scale gaps utilizes our nanoparticle on mirror geometry.

9:55 - 11:25

Room: Small Club Room	Room: Hans Grade	Room: Einstein	Room: Newton	Room: Bunsen Hall

TOM1 S01: Sensor and Telecom applications

Session Chair: **Seppo Honkanen**

9:55 Invited talk

Fiber lasers and electro-optic polymer/Si waveguide modulators and their applications

Nasser Peyghambarian
University of Arizona, College of Optical Sciences, USA; Dept. Micro and Nano Sciences, Aalto University, Helsinki, Finland; Dept. Physics and Mathematics, U. Eastern Finland, Joensuu, Finland

This talk will be focused on (1) fiber lasers and their bio-medical applications, (2) electro-optic polymer modulators for telecom applications. Phosphate, telluride, and fluoride glasses allow new fiber laser frequencies. Some nonlinear effects including optical parametric oscillators (OPO), SRS and SBS extend the operating wavelengths while others like SBS prevent high power operation. Our recent advances in fiber lasers will be summarized including demonstration of a synchronously pumped fiber optical parametric oscillator (FOPO) operating in the normal dispersion regime. The second part of the talk will focus on the use of EO polymers with r33 of = 200-300pm/V (r33 of LiNbO3 = 30pm/V) in polymer/Si nanowire modulators as well as centimeter-length modulators will be described. Polymers low dielectric constant and low capaci-

TOM3 S08: Optical System Design and Tolerancing

Session Chair: **Stefan Bäumer**
Session Chair: **Toshiaki Iwai**

9:55 Invited talk

Optical design for Head Mounted Displays using free-form optics

Koichi Takahashi
Olympus Corporation, Japan

The two types of HMDs using the free-form optics that are miniaturized high-performance HMDs for information terminal monitor and the wide-FOV, high-presence HMD for virtual reality were designed and prototyped.

10:25 Invited talk

Engineering Design for Consumer Optics

Anurag Gupta
Google, United States of America

In most consumer products involving optics, like every other subsystem in the product, optical design constitutes a minor fraction in the overall value proposition and yet the optical designers handle disproportionately larger risk due to fragmented manufacturing base and limited understanding of optics by others. Optical engineers thus need to consider system engineering challenges beyond just the optical performance for the most effective design. The optical design workflow as part of the overall engi-

TOM5 S06: Plasmonics 2

9:55 Invited talk

Large suppression of quantum fluctuations of light from a single emitter by an optical nanostructure

Diego Martin Cano[1,3], Harald R. Haakh[1], Karim Murr[2,3,5], Mario Agio[2,3,4]
[1]Max Planck Institute for the Science of light, Germany; [2]National Institute of Optics (CNR-INO); [3]Center for Quantum Science and Technology in Arcetri (QSTAR); [4]European Laboratory for Nonlinear Spectroscopy (LENS); [5]Universita di Firenze, Dipartimento di Fisica ed Astronomia

We investigate reduced quantum fluctuations of the electromagnetic field in resonance fluorescence from a single emitter coupled to an optical nanostructure. A high degree of control over such squeezed states of light is demonstrated, opening the pathway to its manipulation and applications on the nanoscale in state-of-the-art setups.

10:25

Field enhancement and funneling of light in combinations of MIM resonators

Paul Chevalier[1,2], Patrick Bouchon[1], Riad Haïdar[1], Fabrice Pardo[2]
[1]ONERA, The French Aerospace Lab, 91761

TOM7 S03: Organic Photonics for communications

Session Chair: **Stéphane Kéna-Cohen**

9:55 Invited talk

Organic semiconductor light sources for visible light communications

Graham A Turnbull[1], Pavlos Manousiadis[1], Shuyu Zhang[1], Hyunchae Chun[2], Sujan Rajbhandari[2], M Tariq Sajjad[1], Dimali Amerasinghe[1], Grahame E Faulkner[2], Clara Orofino[3], Diego Cortizo-Lacalle[3], Alexander L Kanibolotsky[3], Peter J Skabara[3], Dominic C O'Brien[2], Ifor D W Samuel[1]
[1]University of St Andrews, UK; [2]University of Oxford, UK; [3]University of Strathclyde, UK

We report the demonstration of organic semiconductors as fast colour-convertors in hybrid LEDs for free-space visible light data communications. We show that these materials can enable much higher data transmission rates than is possible with conventional LED phosphors. We also report the demonstration of directional light emission using organic and hybrid LEDs with imprinted photonic crystals.

10:25

Long pulse polymer laser dynamics & photophysics

Guy Whitworth[1], Alexander Kanibolotsky[2], Peter

TOM 10 S01: Focusing

Session Chair: **Webster Cash**

9:55 Invited talk

High efficiency optical nano-focusing using diffractive binary optics

Haifeng Wang, Dawei Zhang, Songlin Zhuang
University of Shanghai for Science and Technology, People's Republic of China

We investigated different approaches to the high efficiency tight focusing of laser beams: amplitude, phase and polarization modulation; nonlinear absorption; random scattering; surface Plasmon resonance, and etc.. And came out with a method to focus visible light down to 20nm size using diffractive binary optics.

10:25

Demonstration of an optimised focal field with long focal depth and high transmission obtained with the Extended Nijboer-Zernike theory

Sander Konijnenberg, Lei Wei, Nitish Kumar, Luca Cisotto, Silvania Pereira, Paul Urbach
TU Delft, Netherlands, The

An extended depth of focus is obtained by shaping the input field at the lens. The appropriate pupil functions are found with an optimization algorithm that uses the Extended Nijboer-Zernike theory. An out-

Room: Small Club Room

tance make them suitable for >100G telecom applications.

Invited talk

10:25
Glass Integrated Optics: from Telecom to sensors.

Jean-Emmanuel Broquin[1,2], Elise Ghibaudo[1,2], Lionel Bastard[1,2], Davide Bucci[1,2]
[1]Univ. Grenoble Alpes, IMEP-LAHC, F-38000 Grenoble, France; [2]CNRS, IMEP-LAHC, F-38000 Grenoble, France

Since the first proof of concept in the 1970, ion exchange on glass has been extensively studied in order to realize waveguides on glass waferss. This quite low-cost technology is today mature and can be used in several areas ranging form telecom to sensors. In this talk, we will show how a local modification of a glass wafer composition can be employed to realize high quality waveguides. Then, we will review how these waveguides have been used to realize DFB lasers for airborne LIDAR, pulsed lasers for Supercontinuum generation, optofluidic sensors for nuclear plants and 3D integrated hybrid devices.

10:55
Polymer-based tunable laser for coherent optical communications

David De Felipe, Crispin Zawadzki, Ziyang Zhang, Moritz Kleinert, Walter Brinker, Wolfgang Rehbein, Martin Moehrle, Norbert Keil
Fraunhofer Heirich Hertz Institute, Germany

A hybrid InP/Polymer tunable laser based on a dual three-section DBR structure is presented. Optical power higher than 20 mW, linewidth narrower than 700 kHz and tuning along C-band have been demonstrated, proving its suitability for its use in DWDM coherent optical networks as both local oscillator and modulator feeder.

Room: Hans Grade

neering or system design effort is discussed with examples.

10:55
Finding the compromise between tightening tolerances and using compensators

Kristina Uhlendorf, Karin Achilles, Jan Werschnik, Torsten Erbe, Lutz Reichmann
Jenoptik Optical Systems GmbH, Germany

Tolerancing as well as the development of a proper alignment and adjustment concept are besides the actual design of the optical system major parts of the optical design process. Technology limits of the manufacturing of optical and mechanical elements and the cost of these technologies are constraints to be considered by the optical engineer to find a good compromise between tightening tolerances and the usage of compensators. In the paper we will discuss this process for a UV microscopic objective.

11:10
The use of annular lenses in wide angle optical systems

Andrey Pravdivtsev
R & D Group "Constructive Cybernetics", Russian Federation

The report addresses questions of field congruence during optimization and technological aspects of annular lenses in the frontal part of wide angle optical systems. Changes in spot diagrams for overlapping fields in an optical system with continuous field of view are shown.

Room: Einstein

Palaiseau, France; [2]Laboratoire de Photonique et de Nanostructures, Route de Nozay, 91460 Marcoussis, France

Plasmonic metal-insulator-metal resonators can be designed to totally absorb an incident light. A combination of such antennas within a sub-wavelength period allows a sorting of the absorbed photons as a function of their wavelength. These structures also exhibit a high electric field enhancement in tiny volumes. We show that this enhancement can be even stronger when the resonator are illuminated with a focused light.

10:40
Switching surface resonance between layers in the EOT configuration and its applications

Lei Wei[1], Nandini Bhattacharya[1], Paul Urbach[1], Pieter de Bokx[2]
[1]Delft University of Technology, The Netherlands; [2]Phillips Innovation Services, The Netherlands

We study the Extraordinary Optical Transmission (EOT) phenomenon in the mixed surface plasmon polariton(SPP) and cavity mode(CM) regime. By changing the excitation condition of different CMs inside the slit, a switching of surface resonance between layers is achievable due to the coupling of SPP and CM. And we will show some of the possible applications based on this phenomena.

Invited talk

10:55
Collective plasmonic/photonic resonances coupled to luminescent molecules: from quantum critical phenomena to applications

Jaime Gomez Rivas
FOM Institute AMOLF, Netherlands, The

We investigate the coupling of collective resonances in periodic arrays of metallic nanoparticles to luminescent molecules. For low molecular concentrations the system resides in the weak coupling re-

Room: Newton

Skabara[2], Ifor Samuel[1], Graham Turnbull[1]
[1]University of St Andrews, United Kingdom; [2]University of Strahclyde, United Kingdom

Using a combination of low threshold polymer gain media and a GaN diode laser pump, we investigate the long pulse operation of polymer lasers. The effects of triplet excitons are observed to terminate lasing and a management system is explored in order to extend towards continuous wave (cw) operation.

10:40
Organic Random Lasers

Neda Ghofraniha[1], Ilenia Viola[2], Giuseppe Gigli[3], Claudio Conti[4]
[1]CNR-IPCF Rome, Italy; [2]CNR-NANO Lecce, Italy; [3]Univ. del Salento and CNR-NANO Lecce, Italy; [4]Univ. La Sapienza and CNR-ISC Rome, Italy

We will report on the realization and characterization of different novel disordered organic lasers. We will show that our proposed photonic devices can be made flexible and with designed shape and that the emission properties can be finely modulated by the structure and the geometry of the biodegradable and biocompatible materials.

10:55
Optical Amplification and Stability of Spiro-quaterphenyl Compounds and Blends

Thomas Fuhrmann-Lieker, Julia Lambrecht, Nicolai Hoinka, Antje Wiske, Marija Kiurski, Mohamed Abdel-Awwad, Hans Wilke, Ferdinand Messow, Thomas Kusserow, Hartmut Hillmer, Josef Salbeck
University of Kassel, Germany

In this contribution, we present a systematic investigation of a series of spiroquaterphenyl compounds optimized for solid state lasing in the UV region. Amplified spontaneous emission (ASE)

Room: Bunsen Hall

come of the algorithm has been demonstrated experimentally. Applications may be found in for example microscopy.

10:40
Advanced 3D holographic beam shaping for optical trapping

Jose A. Rodrigo[1], Tatiana Alieva[2]
[1]Universidad Complutense de Madrid, Spain; [2]Universidad Complutense de Madrid, Spain

We present a technique that allows for efficient and fast generation of laser beams shaped in 3D along arbitrary curves, where the beam's intensity and phase can be designed according to the standing application. It is experimentally demonstrated that the beam's intensity and phase gradients trap and move particles along the 3D curve, respectively, even against the beam propagation direction (tractor beam).

10:55
Application of micro solid immersion lens as probe for near-field scanning microscopy

Silvania F Pereira, Alberto da Costa Assafrao, Nitish Kumar, H. Paul Urbach
Delft University of Technology, Netherlands, The

We present an experimental and theoretical study of the immersing properties of a micron-sized solid immersion lens (μ-SIL) and evaluate its capabilities of functioning as a near-field probe. The immersed spot is used to investigate the visibility of a periodic grating structure. Results show an improvement in the visibility by approximately 30% when compared to confocal microscopy.

Room: Small Club Room

11:10
Cavity-less generation of ultra-short Nyquist sinc-shaped pulses based on intensity modulators and four-wave mixing

Armand Ali Vedadi, Steevy Cordette, Mohammad Amin Shoaie, Camille-Sophie Brès
EPFL, Switzerland

A scheme is suggested in order to generate ultra-short high quality sinc pulses using intensity modulators and four-wave mixing. It allows for the realization of phase-locked rectangular frequency combs exceeding 250 GHz at a flexible repetition rate. An instance at 10 GHz repetition rate and 270 GHz bandwidth is implemented.

Room: Einstein

gime. Therein, we demonstrate a 60 fold photoluminescence enhancement in the forward direction using high quantum efficiency molecules. This enhancement is due to the resonant excitation and decay of the molecules coupled to collective plasmonic/photonics resonances. By increasing the concentration of emitters, we demonstrate the strong coupling between excitons and surface plasmons. Implications for quantum condensation and solid state lighting are discussed.

Room: Newton

thresholds in the order of 1 µJ/cm2 are obtained in neat films and blends. For preventing crystallization and shifting the emission peak towards lower wavelengths, doping in transparent matrices is an useful option.

11:10
Digital imaging based on UV-light induced conductance change in titanium dioxide

Maddalena Binda[1], Dario Andrea Nicola Natali[1,2], Giovanni Matteo Salvi[2], Marco Sampietro[1,2]
[1]Center for Nano Science and Technology, Istituto Italiano di Tecnologia, Italy; [2]Dipartimento di Elettronica, Informazione e Bioingegneria, Politecnico di Milano, Italy

We exploit UV-light induced n-doping of titanium dioxide to develop photosensitive devices where the light gives rise to a permanent change of the conductance of the active material, rather than being converted in transitory photocurrent as in conventional photodiodes (PD). We exploit this feature to demonstrate a novel approach to digital imaging where pixel structure is strongly simplified: while in PD arrays an addressing element for each pixel is needed to isolate the PD until readout, here a cross-bar architecture is adopted with no need for the addressing element. We demonstrate imaging capability by prototypical matrix of such pixels.

Room: Bunsen Hall

11:10
The optical vortex internal scanning method

Jan Masajada, Agnieszka Popiołek-Masajada, Ireneusz Augustyniak
Wroclaw University of Technology, Poland

The optical vortex can be used for scanning the microscopic objects. While being scanned the singular point moves inside the stationary focused beam. We investigate this process both by solving the diffraction integrals and experiment. We discuss its application to superresolving microscopy.

11:25 - 11:55 Coffee Break

11:55- 13:25

Room: Small Club Room

TOM1 S02: Nanophotonics

Session Chair: **Matthieu Roussey**

Invited talk

11:55
Light manipulation through surface modes in dielectric multilayers

Emiliano Descrovi
politecnico di torino, Italy

One-dimensional photonic crystals (1DPC) sustaining

Room: Hans Grade

TOM3 S09: Optical System Design and Tolerancing

Session Chair: **Jyrki Kimmel**
Session Chair: **Herbert Gross**

Invited talk

11:55
Broadening the design focus with computational imaging

Andrew Robert Harvey[1], Nick Bustin[2], Guillem

Room: Einstein

TOM5 S07: Metamaterial

11:55
Optical Helmholtz resonator for giant field enhancement

Paul Chevalier[1,2], Patrick Bouchon[1], Riad Haïdar[1], Fabrice Pardo[2]
[1]ONERA, The French Aerospace Lab, 91761 Palaiseau, France;

Room: Newton

TOM7 S04: Nanocrystals

Session Chair: **Jeremy J. Baumber**

Invited talk

11:55
Photocatalysis with Semiconductor Nanocrystals

Jochen Feldmann
LMU, Germany

I will review our scientific work on photocatalytic

Room: Bunsen Hall

TOM 10 S02: Modelling and Characterisation

Session Chair: **Piotr Wrobel**
Session Chair: **Uwe D. Zeitner**

11:55
Generalized Source method for ultrafast rigorous modeling of pixelated DOEs with sub-wavelength feature size

Room: Small Club Room

either TE or TM Bloch Surface Waves (BSWs) offer new opportunities for light management at the nanoscale. BSWs can be considered as the dielectric equivalent of Surface Plasmon for metals. Compared to SPPs, BSWs present some advantages, such as low losses, long propagation lengths, polarization and spectral tunability.
Here an overview of recent results on light manipulation through BSWs is provided. Specifically, the confinement and guidance of BSWs on nanometric relieves and the BSW coupling of fluorescence from dyes on structured 1DPC is considered. In addition, non-planar geometries for 1DPC sustaining BSW will be presented.

Invited talk

12:25
Modulating light with 2D materials

Zhipei Sun
Department of Micro- and Nanosciences, Aalto University, Finland

Graphene and other two-dimensional (2D) crystals have attracted considerable attention for various photonic and optoelectronic applications, due to their unique optical and electronic properties. Light modulation is crucial for a variety of applications, such as optical telecommunication. Here, this talk will give a general overview of 2D materials based optical modulators. Such modulators can be integrated into various photonic systems (e.g., optical fibers, silicon waveguides) for ultrafast pulse generation [4-5] with broadband tenability [6].

Invited talk

12:55
Lithium niobate nanophotonics: when optics beats technology

Maria-Pilar Bernal, Wentao Qiu, abdoulaye ndao, clament guyot, nadege courjal, fadi baida
Institut FEMTO-ST, CNRS UMR 6174, France

Lithium niobate is of great interest to the optics com-

Room: Hans Grade

Carles[1], James Downing[3], Andy Wood[1]
[1]Glasgow University, United Kingdom; [2]Qioptiq, St Asaph, United Kingdon; [3]St Microelectronics, Edinburgh, United Kingdom

While the performance of imaging systems is fundamentally limited by diffraction, the design and manufacture of practical systems is intricately associated with the control of optical aberrations. Traditional optical design typically aims for a compact point-spread function across an extended field of view in the presence of chromatic aberrations and imperfect manufacture. In the design of computational imaging systems, a more pertinent criteria is the overall system PSF, or modulation-transfer function, and the optical PSF is only an intermediate measure of the transfer of information via the detector to post-detection digital recovery of a high-quality image. Synergistic combination of innovative optical design with computational image recovery promises high performance imaging from cheaper, lighter and more compact optics. We describe practical multi-aperture, multi-scale and hybrid-imaging systems.

Invited talk

12:25
Optical design and prototyping of plenoptic imaging systems

Chir-Weei Chang, Chuan-Chung Chang, Kuang-Vu Chen, Yen-Chang Wang, Chih-Cheng Hsu, Hsin-Yueh Sung
Industrial Technology Research Institute, Taiwan, Republic of China

In this paper, an integrated simulation platform has been developed for designing plenoptic imaging systems. We present a design approach to the novel digital imaging system by using commercial optical software ZEMAX merged with MATLAB based image processing software for the joint digital-optical design process. Several prototypes using the design platform have been constructed, including traditional plenoptic camera, focused plenoptic

Room: Einstein

[2]Laboratoire de Photonique et de Nanostructures, Route de Nozay, 91460 Marcoussis, France

Inspired by the acoustic Helmholtz resonator, we propose a slit-box electromagnetic nanoantenna able to concentrate the energy into a deep sub-wavelength volume. This design gives birth to giant field intensity enhancement throughout the slit. The resonance itself exhibits unusual properties which could be of great interest for applications requiring extreme light concentration, such as SEIRA, non-linear optics and biophotonics.

12:25
Tailoring optical spectra of 3-dimensional colloidal photonic crystals by attaching metal films

Sergei G. Romanov, Ulf Peschel
University of Erlangen-Nuremberg, Germany

Fabrication of hybrid plasmonic-photonic crystals by assembling of a metal film at a surface of 3-dimensional photonic crystals allows to engineer the hybrid's optical spectra by stronger light confinement and opening channels of the resonance light transfer.

12:40
A 1D stratified model applied to the reflection spectra of an opal as a prototype of a photonic crystal and extension to a resonant infiltration

isabelle maurin, Elias moufarej, Athanasios laliotis, Daniel bloch
Laboratoire de physique des lasers, CNRS, Université Paris 13, Sorbonne Paris Cité,France

A one-dimensional stratified effective index model permits to evaluate quantitatively the major properties of reflection spectra of an opal deposited on a substrate. The interface with the substrate is essential, and reveals a general problem for the optics of a photonic crystal. It is

Room: Newton

water splitting utilizing colloidal semiconductor nanocrystals decorated with catalytic metal clusters. In particular CdS nanorods and TiO2 nanoparticles will be discussed. Key issues are the role of hole scavangers, the size and density of catalytic clusters, relaxation dynamics of electrons and holes and dependencies on external parameters such as pH.

12:25
Type II CdTe-Cu2-xTe nano-heterostructures with excitonic and plasmonic properties

Ilka Kriegel[1,2], Andreas Wisnet[3], Ajay Ram Srimath Kandada[4], Francesco Scotognella[2], Francesco Tassone[4], Christina Scheu[3], Hui Zhang[5], Alexander O. Govorov[5], Jochen Feldmann[1], Jessica Rodríguez-Fernández[1]
[1]Department of Physics and CeNS, Ludwig-Maximilians-Universität München, Munich, Germany; [2]Dipartimento di Fisica, Istituto di Fotonica e Nanotecnologie CNR, Politecnico di Milano; [3]Department of Chemistry and CeNS, Ludwig-Maximilians-Universität München, Munich, Germany; [4]CNST of IIT@POLIMI, Milano, Italy; [5]Department of Physics and Astronomy, Ohio University, Athens, Ohio 45701, USA

We present a theoretical and experimental study of the role of the excitonic and plasmonic contribution to the optical response of CdTe-Cu2-xTe nano-heterostructures. This study is very interesting for the application of type II chalcogenide–chalcogenide heterostructures based on Cu and Cd for photovoltaic and photocatalytic applications.

12:40
Synthesis of functionalized squaraines for cosensitization and complex sensitizers with QDs

Nadia Barbero[1], Jinhyung Park[1], Lioz Etgar[2], Vladi-

Room: Bunsen Hall

Thomas Kämpfe[1], Alexandre Tishchenko[1], Wiebke Eckstein[2], Yves Jourlin[1]
[1]Laboratoire Hubert Curien, UMR CNRS 5516, France; [2]Institute of Applied Physics, Friedrich Schiller University, Max-Wien-Platz 1, 07743 Jena, Germany

Large, 2d-pixelated DOEs with subwavelength feature sizes are bringing the common rigorous calculation methods to their limits regarding memory usage and computation time. The generalized source method (GSM) breaks through this limitation, allowing for reasonable calculation times on a standard PC.

12:10
Fast and efficient modeling of metallic gratings diffraction with metric sources

Alexey A. Shcherbakov[1], Alexandre V. Tishchenko[2]
[1]Moscow Institute of Physics and Technology, Russian Federation; [2]University Jean Monnet (member of the University of Lyon), France

In this work we extend previously developed efficient numerical method for metal grating diffraction calculation to the 2D gratings case. The method is based on the generalized source method, curvilinear coordinate grating representation, and concept of generalized metric sources.

12:25
Effective modal method by B-spline expansion for crossed surface-relief gratings

Gerard Granet
Blaise Pascal University, France

B-spline basis expansion is for the first time successfully employed in a modal method aimed at rigorously modelling the electromagnetic response of crossed surface-relief gratings.

Room: Small Club Room

munity due to its large electro-optic and non-linear coefficients and has applications in piezoelectric, acousto-optic, pyroelectric and photorefractive devices.

However, the realisation of high aspect ratio submicron structure in LN is up to date a challenging problem due to its resistivity towards standard machining techniques.

I will present novel tunable lithium niobate photonic crystal devices. Slow light propagation allows enhancement of the tunability, thus, spectacular increase on the acoustic, electro-optic and pyroelectric properties of the nanodevices is obtained.

Room: Hans Grade

camera and compact microscope. Both the simulated and experimental results demonstrate opportunities for optimization of the novel imaging system for practical applications. Some of the possible applications based on this technique are also investigated.

12:55
Optical Design with Volume Scattering Characterization Method

Quentin KUPERMAN
LIGHT TEC, France

Volume scattering materials are becoming more and more used as LED market is growing, especially in the automotive field. In the past, Light Tec has worked on volume scattering materials characterization using Mie theory. With new software techniques for volume scattering simulation, we tried to see the benefits from one of them: Gegenbauer. Using sample's BSDF measurements with Reflet Bench and optical simulation software, we achieved a very good correlation between volume scattering model and real measurements, within 5% precision. Thanks to this, it is now possible to make virtual prototyping using custom shape volume scattering materials.

13:10
Layered polymeric GRIN lenses and their benefits to optical designs

Andrew Martyn Boyd
Qioptiq, United Kingdom

Gradient Index or GRIN lenses have been known for many years to provide performance benefits to optical systems. The primary barrier to widespread adoption of this technology has been the cost and complexity of manufacture. Recent developments in layered polymer GRIN technology (known as L-GRIN) have the potential to overcome this barrier. This paper reviews the benefits and versatility of

Room: Einstein

successfully extended to a resonant infiltration situation.

Room: Newton

mir Lesnyak[3], Pierluigi Quagliotto[1], Michael Grätzel[2], Claudia Barolo[1], Guido Viscardi[1]
[1]University of Torino, Italy; [2]EPFL, Switzerland; [3]TU, Dresden

A demonstration on how to harvest the light up to the NIR region using a FRET complex sensitizer is presented. The 'click reaction' was used in order to combine inorganic materials (which are used as donors) and squaraine dyes (used as acceptors) in FRET based DSCs.

Invited talk

12:55
Self-Organised Metal-Dielectric Plasmonic Nanopatterns

Francesco Buatier de Mongeot
Università di Genova, Italy

Self-organised approaches for the synthesis of plasmonic nanocluster arrays supported on low-cost dielectric substrates (glass slides, polymer films, polystyrene opals) are optimised in view of photon harvesting applications. The arrays exhibit electrical and optical performances competitive with the best TCOs employed in photovoltaic or OLED applications. Additionally the nanoclusters exhibit a tunable broadband plasmonic response, a crucial issue in view of plasmon enhanced bio-sensing applications like SERS.

Room: Bunsen Hall

12:40
Degree of polarization measured by beam self-interference

Kimmo Saastamoinen, Lasse-Petteri Leppänen, Tero Setälä, Ari T. Friberg
University of Eastern Finland, Finland

Electromagnetic coherence theory implies that a light beam's degree of polarization is obtained from the modulations of the polarization Stokes parameters when the beam interferes with itself. We present the foundations and show associated interferometric measurements, with comparison to conventionally found degree of polarization.

12:55
Goniometric scatterometer for detailed characterization of diffractive optical elements

Hannu Husu[1], Toni Saastamoinen[2], Janne Laukkanen[2], Samuli Siitonen[3], Jari Turunen[2], Antti Lassila[1]
[1]Centre for metrology and accreditation; [2]University of Eastern Finland; [3]Nanocomp Oy Ltd

Summary
Customers set strong quality requirements for diffractive optical element manufacturers regarding the optical functionality, which is strongly affected by the nanoscale structure. Traditional techniques are not optimal for the measurement of the detailed structure, whereas optical scatterometry would be a very suitable tool.

13:10
Strategies for characterization of partially coherent beams based on phase-space tomography

Tatiana Alieva, Alejandro Cámara, Jose A. Rodrigo
Universidad Complutense de Madrid, Spain

We discuss the advantages of recently developed phase-space tomography methods and the related experimental setups for practical quantitative cha-

Room: Hans Grade

Room: Bunsen Hall

this method to visible waveband optical systems. A variety of lens designs based on this manufacturing technique have been developed. We present the optical performance of these lens designs and comment on the challenges of producing them in commercial optical design software.

racterization of the spatial structure of partially coherent optical beams, including its local coherence properties. The considered techniques are experimentally verified.

13:25 - 14:25 Lunch Break

14:25- 15:10 Bunsen Hall

Plenary TOM10: Webster Cash

Advanced Astronomical Observatories Using Binary Diffractive Optics

Webster Cash
University of Colorado, United States of America

Diffractive optics have the distinct quality of being inexpensive compared to conventional optics, particularly when large sizes are needed. As astronomers routinely push to ever-larger apertures, the astronomy community has become more interested in using diffractive optics, particularly in space where their low areal density provides another major advantage. I will discuss some recent advances in design of diffractive optics and then show how they were applied to starshades - the only currently viable approach to characterizing Earth-like planets. I will then go on to discuss a new concept that can be used to inexpensively boost the diffraction-limited resolution of telescopes at all wavelengths.

15:20 - 16:50

Room: Small Club Room

TOM1 S03: Nonlinear fiber optics

Session Chair: Franko Küppers

15:20 Invited talk

Rogue waves in optics

Goëry Genty
Tampere University of Technology, Finland

We review current research on optical rogue waves in optics with emphasis on fiber systems. We discuss the different regimes of propagation and show that the amplification of noise on top of a continuous wave background can lead to the emergence of highly-localized structures with abnormal intensity. We focus on the physics of the underlying localization mechanisms and discuss possible analogies with the oceanic case.

Invited talk

15:50

Optical turbulence and synchronisation in fiber lasers

Stefan Wabnitz
Università di Brescia, Italy

We analyse the nonlinear evolution of modulation instability in fiber lasers

Room: Hans Grade

TOM3 S10: Optical System Design and Tolerancing

Session Chair: **John R. Rogers**
Session Chair: **Florian Bociort**

Invited talk

15:20

Optics Standards for the Global Optics Marketplace

David M Aikens
Savvy Optics Corp., United States of America

Standards in optics have been fragmented and regional for more than 50 years. While ISO standards are common in Europe, American MIL standards have been used elsewhere. This dichotomy impedes commerce in optics. Now, we are finally moving towards a single set of standards for optics which can be used globally, and which will facilitate commerce and streamline business in the optics industry in the US and elsewhere.
This talk describes the benefits of global standards, the current state of standardization in optics, and explains the changes that are in process and are yet to come.

Room: Newton

TOM7 S05: Photovoltaics 1

Session Chair: **Jochen Feldmann**

15:20 Invited talk

Christoph J. Brabec, Friedrich-Alexander University, Erlangen-Nürnberg, Germany

15:50

Interfacial Modeling of Lead Iodide Perovskite and Organic Charge Transporting Heterostructures

Jun Yin[1], Daniele Cortecchia[2], Anurag Krishna[2], Shi Chen[1], Nripan Mathews[3], Andrew C. Grimsdale[3,4], Cesare Soci[1]
[1]Division of Physics and Applied Physics, School of Physical and Mathematical Sciences, Nanyang Technological University, 21 Nanyang Link, Singapore 637371; [2]Interdisciplinary Graduate School, Energy Research Institute at NTU (ERI@N), Nanyang Technological University, Singapore 639798; [3]Energy Research Institute @ NTU (ERI@N), Research Technoplaza, Nanyang Tech-

Room: Pasteur

TOM9 S01: Innovative metrology approaches and chemical sensing

Invited talk

15:20

Sub-Heisenberg estimation strategies: are they attainable?

Vittorio Giovannetti
Scuola Normale Superiore, Italy

Sub-Heisenberg strategies claim to achieve a phase estimation error smaller than the inverse of the mean number of photons employed (Heisenberg bound). It is possible to show that one can achieve a comparable precision without performing any measurement, just using the large prior information that sub-Heisenberg strategies require. For uniform prior these strategies cannot achieve more than a fixed gain of about 1.73 over Heisenberg-limited interferometry. These results extend also beyond interferometry: the effective error in estimating any parameter is lower bounded by a quantity proportional to the inverse expectation value (above a ground state) of the generator of translations of the parameter.

Room: Bunsen Hall

TOM10 S03: Beam Shaping

Session Chair: **Gladys Mínguez-Vega**

Invited talk

15:20

Shaping femtosecond beams with spatial light modulators

Gladys Mínguez-Vega[1], Omel Mendoza-Yero[1], Jorge Pérez-Vizcaíno[1], Rocío Borrego-Varillas[2], Pedro Andres[3], Jesús Lancis[1]
[1]Universitat Jaume I, Spain; [2]Dipartimento di Fisica, Politecnico di Milano, Italy; [3]Universitat de València, Burjassot (València), Spain

The generation of femtosecond laser pulsed beams with a user defined shape in the spatial and/or in the temporal domain is a matter of great interest in several hot topics of research such as high-speed microprocessing or multiphoton microscopy. In this talk we will show how diffractive optics in general, and phase-only spatial light modulators in particular, may help us to achieve this goal.

leading to chaotic or noise-like pulse emissions. We present the phase transition diagram among different regimes of chaotic emission in terms of the key cavity parameters: amplitude or phase turbulence, and spatio-temporal intermittency. Next we show that nonlinear polarization coupling in a vector fiber ring laser may lead to synchronization of spatio-temporal chaos into a wide variety of ordered states of antiphase orthogonal polarization temporal domains. Stable vector temporal structures include stable lattices of solitons, trains of coupled dark and bright solitary waves and polarization domain walls.

16:20
Generation of correlated photon pairs by spontaneous four-wave mixing in liquid-core photonic crystal fibres

Margaux Barbier[1], Isabelle Zaquine[2], Philippe Delaye[1]
[1]Laboratoire Charles Fabry, Institut d'Optique, CNRS, Univ Paris-Sud, 2 avenue Augustin Fresnel, 91127 Palaiseau, France; [2]LTCI/CNRS, Télécom Paristech, 46 rue Barrault, 75013 Paris, France

We present the first experimental demonstration to our knowledge of the generation of correlated photon pairs by spontaneous four-wave mixing in a liquid-core photonic crystal fibre. Thanks to the specific Raman properties of liquids, this original architecture opens the way for the development of high quantum quality photon pair sources.

16:35
Stimulated Raman scattering with large Raman shifts with liquid core Kagome fibers

Minh Châu Phan Huy[1], Philippe Delaye[1], Gilles Pauliat[1], Benoit Debord[2], Frédéric Gérôme[2], Fetah Benabid[2], Sylvie Lebrun[1]
[1]Laboratoire Charles Fabry, Institut d'Optique CNRS, Univ Paris-Sud,

Invited talk

15:50
A lens-resolved approach for analyzing and correcting secondary axial color

Thomas Nobis
Carl Zeiss AG, Germany

Secondary color strongly depends on appropriate glass choice during optical design. The specific impact of individual lenses to the overall correction can be revealed by a lens-resolved analysis of secondary color, leading to a better understanding of the principle of correction. Therefore, thick-lens contributions to secondary color are presented, utilizing a suitable definition for secondary color when residual primary color is present. Several design examples illustrate the systematic impact of glass choice on the overall color correction.

16:20
Generalized Surface Aberration Contributions

Herbert Gross, Chang Liu
FS University Jena, Germany

An approach for the formulation of surface aberration contributions in an optical system under generalized conditions is developed and tested. A ray trace based model following the Aldis theorem is successfully investigated. A special representation helps to visualize the aberration contributions of every surface with spatial resolution. The transverse Aberration contributions are exact and not limited in order. The method helps in analyzing 3D systems in particular with freeform surfaces regarding sensitivities and tolerancing. This attempt is considered as an alternative to the 6th order expansion approach. Some examples show the usefulness of this method.

nological University, Nanyang Drive, Singapore 637553; [4]School of Materials Science and Engineering, Nanyang Technological University, Nanyang Avenue, Singapore 639798

Solution-processable organic-inorganic hybrid solar cells based on the lead iodide perovskite (CH3NH3PbI3) exhibit remarkably high power conversion efficiency (PCE). The key issue for optimizing PCE is to match energy positions of electronic bands and their alignment with energy levels of adjacent organic hole and electron transporting layers.In this work, we developed an organic/perovskite interfacial modeling that can be extended to a wide range of interfaces and suggests that perovskite crystallization and surface orientation are extremely important design parameters to optimize charge separation and extraction in hybrid solar cells.

16:05
Spray-Deposited Planar Heterojunction Perovskite Solar Cells

Alexander T Barrows[1], Andrew J Pearson[1], Chan K Kwak[2], Alan D F Dunbar[2], David G Lidzey[1]
[1]Department of Physics and Astronomy, University of Sheffield, United Kingdom; [2]Department of Chemical and Biological Engineering, University of Sheffield, United Kingdom

We have fabricated efficient planar heterojunction perovskite solar cells using the scalable technique of ultra-sonic spray-coating for the deposition of the photoactive CH3NH3PbI3-xClx layer. Casting solvent and deposition temperature have been optimised leading to a maximum power conversion efficiency of over 11%.

15:50
High-Speed Fiber-Coupled THz Time-Domain Spectrometer

Almut Nast, Nico Krauß, Thomas Dekorsy
University of Konstanz, Germany

We present a high speed fiber-coupled THz time-domain spectrometer with more than 3 THz spectral range. Within an acquisition time of about 200 s the power spectrum reaches a dynamic range over 60 dB in the frequency range from 0.2 to 2.5 THz.

16:05
Resonant cavity Raman gas probe

Jostein Thorstensen, Karl Henrik Haugholt, Alain Ferber, Kari Anne Hestnes Bakke, Jon Tschudi
SINTEF, Norway

A Raman gas probe based on a resonant fabry-perot cavity has been constructed, using low-cost components. Measurements on lab air indicate a detection limit of around 0.5 % for 30 second measurement time. The detection limit can be greatly reduced by improving collection of scattered light, and by increasing laser power.

16:20
Optomechanical motion sensors

Felipe Guzman, John Melcher, Gordon Shaw, Jon Pratt, Jacob Taylor
National Institute of Standards and Technology, United States of America

Compact optical cavities can be combined with motion sensors to yield unprecedented resolution and SI-traceability in areas such as acceleration sensing and atomic force microscopy AFM, among others. We have incorporated Fabry-Perot fiber-optic micro-cavities onto low-loss monolithic fused-silica mechanical oscillators, demonstrating exquisite sensitivities better than 200am/rtHz in displacement, and acceleration sensing levels below 100 nano-g/rtHz over a 10kHz bandwidth. Similar

15:50
Generation and analysis of standard and elegant Gaussian beams

Christina Alpmann, Christoph Schöler, Cornelia Denz
University of Muenster, Germany

Three-dimensional holographic beam shaping is a highly topical field with interdisciplinary applications. We propose the holographic generation of standard and elegant Gaussian beams, compare and analyze their propagation behavior and show their application in optical micro manipulation.

16:05
Flexible and efficient spatial light manipulation based on a Multi-Plane Light Converter

Pu Jian[1], Guillaume Labroille[1], Bertrand Denolle[1], Nicolas Treps[2], Jean-François Morizur[1]
[1]CAILabs, France; [2]Laboratoire Kastler Brossel

A technique for shaping the spatial profile of single-mode and multimode light beams is validated. This technique, based on successive reflections on spatial phase masks integrated in a multipass cavity, has very limited losses (fidelity of 92%) and is able to implement arbitrary unitary transformations.

16:20
Comparative study of refractive and diffractive homogenizers for broadband pulses

Manisha Singh, Jani Tervo, Jari Turunen
University of Eastern Finland, Finland

A general formulation for shaping broadband pulsed fields is discussed. A comparative study is made to illustrate that, contrary to the common belief, diffractive beam shaping elements work for broadband fields with symmetric spectra in essentially the same way as refractive elements do. Examples are given for

Notes:

Room: Hans Grade

16:35
Optical glass: tolerances and accuracy of Abbe number

Uwe Petzold[1], Ralf Jedamzik[1], Peter Hartmann[1], Steffen Reichel[1,2]
[1]SCHOTT AG, Germany; [2]University of Applied Sciences Darmstadt, Germany

Highly chromatic corrected optical systems rely on a precise Abbe number of optical glasses. The just introduced narrowest tolerance for the Abbe number requires improved knowledge about its uncertainty. For a set of optical glasses the uncertainty is analyzed on the basis of a high number of long time reproducibility measurements.

Room: Newton

Invited talk

16:20
Structural and Electronic Properties in Polymer-Based Solar Cells: A Theoretical Insight"

Jerome Cornil
University of Mons, Belgium

In this contribution, we will first review our recent advances in the theoretical description at the atomistic level of the crystalline packing of polymer chains in solar cells. We will then describe the electronic parameters governing the rate of free charge generation based on simulations performed on prototypical P3HT/PCBM blends; this analysis will also be extended to hot dissociation processes.

Room: Pasteur

tests have been conducted with novel AFM test probes.
We will present our results on novel optomechanical devices that offer both, high sensitivity and direct SI-traceability in very simple and compact devices.

16:35
Laserbased ultrasonics for metrology applications

Nico Krauss, Almut Nast, Thomas Dekorsy
University of Konstanz, Germany

The optical generation and detection of ultrasound by absorption of ultrashort laser pulses provides access to technological relevant material parameters. We present a high speed pump probe system and demonstrate thickness measurements of EUV mirrors with kHz scan rates and sub-nm thick-

Room: Bunsen Hall

the transformation of iso-diffracting pulses into flat-top shapes.

16:35
Coherence manipulation by subwavelength metallic gratings

Toni Saastamoinen, Hanna Lajunen
University of Eastern Finland, Finland

We study the coherence changes in partially coherent beams transmitted through binary metallic subwavelength gratings by rigorous numerical simulations. It is shown that by choosing suitable parameters for the grating, the effective degree of coherence of the beam can be significantly increased.

16:50 - 17:10 Coffee Break

17:10– 18:40

Room: Small Club Room

TOM1 S04: Guided-wave structures and devices

Session Chair: **Seppo Honkanen**

17:10
High order fiber mode coupling to high-Q microresonators

Daniele Farnesi[1], Francesco Chiavaioli[2], Franco Cosi[2], Giancarlo Righini[1], Silvia Soria[2], Cosimo Trono[2], Gualtiero Nunzi Conti[2]
[1]Centro Studi e Ricerche “Enrico Fermi”, Italy; [2]Istituto di Fisica Applicata "Nello Carrara", Italy

We demonstrate coupling from fiber cladding modes to high-Q silica microspherical resonators. An LP fiber mode is selectively excited by a long period grating (LPG) and brought close to radiate at an adiabatically tapered section of the fiber, where coupling to a microsphere whispering gallery mode (WGM) takes place. The taper is about one order of magnitude thicker than typical fiber tapers used for coupling

Room: Hans Grade

TOM3 S11: Optical System Design and Tolerancing

Session Chair: **David M Aikens**
Session Chair: **Thomas Nobis**

Invited talk

17:10
Optical Design and Manufacturing Requirements for High Performance Microscope Objectives

Wolfgang Vollrath
KLA-Tencor, Germany

Leading edge high performance microscope objectives are optical systems at the very borderline of today's optical design and manufacturing capabilities. This holds on one hand for super-resolution microscope objectives in life science microscopy but even more so for DUV inspection and metrology objectives for the semiconductor industry. The presentation gives an introduction into the challenges in optical design and manufacturing of such semiconductor type objectives.

Room: Newton

TOM7 S06: Organic Bio Photonics

Session Chair: **Francesco Buatier de Mongeot**

Invited talk

17:10
Hybrid photoconverters from molecular dyes and photosynthetic microorganisms

Gianluca Maria Farinola[1,2], Alessandra Operamolla[1], Omar Hassan Omar[2], Rocco Roberto Tangorra[1], Francesco Milano[3], Roberta Ragni[1], Simona La Gatta[1], Angela Agostiano[1,3], Massimo Trotta[3]
[1]Dipartimento di Chimica Università degli Studi di Bari "Aldo Moro"; [2]CNR ICCOM - UOS Bari; [3]CNR IPCF - UOS Bari

Covalent functionalization of the Reaction Center (RC) photoenzyme from the photosynthetic bacterium Rhodobacter sphaeroides R26 with tailored dye molecules results in efficient bio-hybrid photoconverters. The nanohybrids can be incorporated into artificial membranes or anchored

Room: Pasteur

TOM9 S02: Advances in Scatterometry 1

Invited talk

17:10
Metrology with Synchrotron Radiation at PTB

Mathias Richter
Physikalisch-Technische Bundesanstalt, Germany

For more than 30 years, the Physikalisch-Technische Bundesanstalt (PTB) has applied synchrotron radiation. At the beginning, the former electron storage ring BESSY I in Berlin was used for radiometry in the spectral range from the UV to soft X-rays. At BESSY II, these activities were then extended to harder X-rays. PTB now operates four beamlines at BESSY II and seven at PTB’s own Metrology Light Source (MLS). This talk gives an overview of the different tasks, from radiometry and optics characterization to surface and materials science, performed in the spectral range from the

Room: Bunsen Hall

TOM 10 S04: Materials and Devices

Invited talk

17:10
Efficient and broadband blazing with artificial dielectrics

Philippe LALANNE
Institut d'Optique d'Aquitaine, France

We report on the manufacture of diffractive optical element with artificial dielectric materials, which remain efficient over almost one octave. This can be achieved by combining advanced optical design strategies and artificial dielectric materials that offer dispersion chromatism much stronger than those of conventional bulk materials.

Room: Small Club Room

light to WGM resonators and therefore this new method offers improved robustness for practical applications.

17:25
A novel deep-UV polymer for integrated photonics: from waveguides structures to cascade of multiple micro-resonators

Nolwenn Huby[1], Rigoberto Castro-Beltran[1], David Pluchon[1], Daphné Duval[1], Marion Specht[1], Hervé Lhermite[2], Bruno Bêche[1,3]
[1]Université de Rennes 1, IPR CNRS 6251, Rennes, 35042, France; [2]Université de Rennes 1, IETR CNRS 6164, Rennes, 35042, France; [3]Institut Universitaire de France, IUF-Paris, 75000, France

An overview of targeted current research on integrated photonics based on the new deep-UV210 organic material is given. We report on the interest of this new material and properties coupled to deep -ultraviolet (DUV) lithography processes towards the realization and optical characterization of sundry photonics structures. Such structures include sub-wavelength waveguides, pedestal and tapers waveguides until serial of optical micro-resonators (MRs) shaped as disk, ring, stadium and racetrack.

17:40
Tunable Waveguide Embedded Bragg Gratings in Lithium Niobate by Direct Femtosecond Laser Writing

Sebastian Kroesen, Wolfgang Horn, Jörg Imbrock, Cornelia Denz
University of Muenster, Germany

We demonstrate monolithic integration of tunable Bragg gratings in lithium niobate by femtosecond-laser direct writing. The core volume of a complex two-dimensional waveguide structure that supports both, ordinary and extraordinary modes is modulated with a period of Λ = 705 nm using the mul-

Room: Hans Grade

Invited talk

17:40
Optical design and evaluation of large-magnification and high-definition rigid endoscope

Dewen Cheng, Yongtian Wang
Beijing Institute of technology, China, People's Republic of

High definition and magnification rigid endoscope plays an important role in modern minimally invasive medical surgery and diagnosis. In this paper, we present the design and evaluation methods of a high definition rigid endoscope, specifically an arthroscope, with a large depth of field (DOF). An entrance pupil of 0.3 mm is achieved for the first time, to bring the theoretical resolution to 23.1 lps/mm in the object space at a working distance of 20 mm, with the wavelength of 0.532 um. The modulation transfer function (MTF) curves approach diffraction limit. Meanwhile, stray light caused by total internal reflection on the inner wall of the rod lenses and the objective lens is eliminated. The measured resolution in the object space at a 20 mm working distance is 22.3 lps/mm, and test results show that other performance characteristics also fulfill design requirements. The relay lenses are designed with only one type of the spacer and two types of lenses to greatly reduce the fabrication and assembly cost. The design method has important research and application values for lens systems used in modern minimally invasive medical surgery and industrial non-destructive testing area.

18:10
Miniaturized Ubiquitous Scanning Laser Ophthalmoscope

Helene Strese[1], Oliver Gubler[1], Francois Corthay[1], Serge Amoos[1], Frederic Truffer[1], Nuria Pazos Escuerdo[2], Francois Tieche[2], Julien Senn[2], Martial Geiser[1]

Room: Newton

on graphene layers.

17:40
Nonlinear Optical Bio-inspired Peptide Nanostructures

Amir Handelman
Tel Aviv University, Israel

In this work, we have studied SHG effect in bioorganic peptide nanostructures having different morphologies and symmetries, such as nanotubes, nanofibers, nanobelts and nanospheres. These peptide nanostructures were self-assembled in solvents of different origins from precursors with variable number of phenylalanine amino acid (F) units. Pronounced SHG response was detected in FFF-nanobelts, FF-nanotubes and FFF-nanospheres. Using two-photon optical microscopy, we found orientational molecular ordering in aligned peptide supramolecular structures by adapting a generic model that was earlier developed for diverse biological protein fibrils. We demonstrate frequency conversion from near infrared to visible green and blue light and a waveguiding effect.

17:55
Efficient Energy harvesting with nanostructured hybrid systems containing photosynthetic pigment-protein-complexes

Franz-Josef Schmitt[1], Evgeny Maksimov[2], Vladimir Paschenko[2], Thomas Friedrich[1], Gernot Renger[1], Hans Joachim Eichler[3]
[1]TU Berlin, Institute of Physical Chemistry, Berlin, Germany; [2]Lomonosov Moscow State University, Biophysics Department, Moscow, Russia; [3]TU Berlin, Institute of Optics and Atomic Physics, Berlin, Germany

Efficient coupling of electronic excitation energy into nanostructured semiconducting materials is suggested for hybrid systems containing photosynthetic light harvesting complexes that can be

Room: Pasteur

THz regime to hard X-rays.

17:40
Generation and field testing of roughness reference samples for industrial testing of surface roughness levels below 0.5 nm Sq

Oliver Faehnle[1], Eckhard Langenbach[1], Frank Frost[2], R Fechner[2], Axel Schindler[2], M Cumme[3], Heiko Biskup[4], Christine Wuensche[4], Rolf Rascher[4]
[1]FISBA OPTIK AG, Switzerland; [2]Leibniz Institute of Surface Modification (IOM), Germany; [3]Carl Zeiss Jena GmbH, Germany; [4]Deggendorf Institute of Technology, Germany

Applying reactive ion beam etching (RIBE) processes at the Leibniz Institute of Surface Modification (IOM), several reference samples to be used in industry for calibrating of roughness testing equipment have been generated with the smoothest sample featuring 0.1 nm rms Sq. Subsequently these reference samples have been measured cross-site applying atomic force microscopy (AFM), white light interferometry (WLI), Nomarski1 microscopy (NM) and scatterometry (iTIRM2) determining the appropriate range of measurable rms surface roughness for each industrial measuring device.

17:55
Fast methods for 3D light scattering simulations

Sven Burger, Jan Pomplun, Lin Zschiedrich, Mark Blome, Frank Schmidt
JCMwave GmbH, Germany

Methods for solving Maxwell's equations are integral part of optical metrology setups. Applications require to avoid poor geometry resolution, insufficient numerical accuracy and/or long computation times. We present a finite-element based Maxwell solver relying on unstructured 3D meshes and adaptive hp-refinement.

Room: Bunsen Hall

17:40
Loss-minimized resonant transmission/ reflection through/from undulated metal films on hard substrate by plasmon excitation

T. Tenev[2], I. Miloushev[2], R. Peyeva[2], S. Tonchev[1,2], O. Parriaux[1]
[1]Lab Hubert Curien CNRS University of Lyon, France; [2]Institute of Solid State Physics, Bulgarian Academy of Sciences,

Adequate hardbake of an undulated photosensitive polymer and the pre/post-deposition of nanometer-thick ZnS or MgF2 dielectric interfacial layers under/ on a thin metal film restore excellent propagation conditions for the long-range plasmon mode, reduces the resonant transmission excess loss to 10%, and reveals the plasmon resonant reflection phenomenon.

17:55
Elastomeric diffractive gratings: investigation of diffraction efficiency change during mechanical deformation

Benjamin Ryba, Erik Förster, Robert Brunner
University of Applied Sciences Jena, Germany

Summary

In this contribution the mechanical deformation of soft material (PDMS) blazed gratings is investigated using finite element analysis. The obtained topology provides as basis for a rigorous optical calculation. Effects on the diffraction efficiency of the grating caused by stretching the structure are discussed.

18:10
Glassy Carbon Molds for Precision Glass Molding of Diffractive Optical Elements

Karin Prater[1], Julia Dukwen[2], Toralf Scharf[1], Hans Peter Herzig[1], Andreas Hermerschmidt[3]
[1]École polytechnique fédérale de Lausanne

tiscan technique.

17:55
Dye excitation with the generated and guided second harmonic in LiNbO3 nanowires

Anton Sergeyev[1], Reinhard Geiss[1], Alexander S. Solntsev[2], Ernst-Bernhard Kley[1], Thomas Pertsch[1], Rachel Grange[1]
[1]Friedrich Schiller University, Abbe Center of Photonics, Institute of Applied Physics, Max Wien-Platz 1, Jena, 07743, Germany; [2]Australian National University, Nonlinear Physics Center, Research School of Physics and Engineering, Canberra, 0200, Australia

We demonstrate second-harmonic (SH) generation and guiding in lithium niobate (LiNbO3) nanowires (NWs) fabricated with a top-down method. We determine the guided SH power for the efficient excitation of fluorescent dyes to be 63±6 pW in a 400x600 nm2-cross-section NW. Calculations show that a NW with cross-section down to 40x60 nm2 can generate enough SH power to efficiently excite dyes. We also discuss how guided SH can be drastically increased through phase matching.

18:10
Injection molded coupling mirror array for integrated polymer multimode waveguides

Johannes Kremmel[1], Tobias Lamprecht[2]
[1]Interstate University of Applied Science NTB, Switzerland; [2]vario-optics ag, Mittelbissaustrasse 7, 9410 Heiden, Switzerland

The coupling of VCSELs and photodiodes to multimode waveguides, which are integrated into EOCBs, has been demonstrated using a mirror element, consisting of 16 single mirror surfaces. The device has been designed and optimized by ray-tracing simulations and was fabricated by injection moulding and subsequent metallisation. In a first characterisation step the

[1]HES-SO Vailais/Wallis, Switzerland; [2]HE Arc (BE-JU-NE)

We describe the design, the development and the realization of the core of a new miniaturized scanning laser ophthalmoscope (SLO), based on two micro-electro-mechanical system (MEMS) mirrors. The SLO unit, which is close to the subject's eye, has dimensions of 85mm x 43mm x 35mm. The aim of this project is to support the early detection of glaucoma.

18:25
Optical optimisation of Fabry-Pérot based spectral imaging systems

Matthias Strauch[1], Irina L. Livshits[2], Yifeng Shao[1], Florian Bociort[1], H. Paul Urbach[1]
[1]Delft University of Technology, The Netherlands; [2]National Research University of Information Technologies, Mechanics and Optics, Russia

Wide-angle spectral imaging systems using Fabry-Pérot interferometers face spectral resolution problems, which can only be corrected with high computational effort. A standard lens system is analysed and an alternative telecentric solution is proposed, that solves the issues optically without the use of intensive computation.

switched by temperature and continuously regenerated as self-assembled layers.

Invited talk

18:10
Light management with flexible organic photovoltaic devices

Olle Inganäs
Linköping University, Sweden

Present day organic photovoltaic devices comes with high internal quantum efficiency (≈90%) under short circuit condition, controlled by the interference of light in absorbing layers in the thin film limit (≈80-100 nm). It is therefore essential to make use of the photons by extending the effective path length of photons. We show how semitransparent solar cells in homo- or hetero-tandem constructions may enable better use of the incoming photon flux, while also offering the chance for transparency in building integrated devices, by using dielectric light scatterers, which return and redirect light, and which can be joined to, or in between, thin film organic solar cells.

We comment on application results in optical CD (critical dimension) metrology.

18:10
Reconstruction of nanostructured surfaces with X-ray scattering

Victor Soltwisch[1], Jan Wernecke[1], Jürgen Probst[2], Max Schoengen[2], Sven Burger[3], Michael Krumrey[2], Frank Scholze[2]
[1]Physikalisch-Technische Bundesanstalt, Germany; [2]Helmholtz-Center-Berlin; [3]JCMwave GmbH

The interest in nanostructured surfaces increased strongly in the last decade. Feature sizes down to several nm challenge the existing metrology toolsets. X-ray scattering is a fast and non-destructive method with a high sensitivity capable of sub-nm resolution. PTB developed X-ray reflectometry and scattering methods over a broad spectral range from the EUV to hard X-rays at several beamlines in the PTB laboratory at the synchrotron radiation facility BESSY II. The radiometric characterization of the measurements stations allows to obtain absolute scatter and diffraction respectively reflection efficiencies. The geometrical parameters like deflection angles and distances as well as photon energies are also measured traceable to the SI-system of Units, with the goal of obtaining traceable parameters for the nano-structure dimensional parameters.

18:25
Expanded beam spectroscopic ellipsometry for big area on-line monitoring

Fried, Miklos (1); Major, Csaba (1); Juhasz, Gyorgy (1); Petrik, Peter (1); Horvath, Zoltan (2)
1: MTA TTK MFA, Hunga-

EPFL, Switzerland; [2]Fraunhofer Institute for Production Technology (IPT), Germany; [3]HOLO-EYE Photonics AG, Germany

We study the suitability of glassy carbon as a mold material for high precision compression glass molding at low and high glass-transition temperatures. We developed structuring techniques for glassy carbon that can be used to realize feature sizes below 1 micron. The processes are based on Reactive ion etching with hard masks. The technique leads to excellent surface quality with roughness below 3nm, an high wall verticality of ~80° for etch depth of 690nm. Such glassy carbon molds were successfully applied to the glass K-Bal 42 at a molding temperature of 550°C and to fused silica at 1360°C.

18:25
Electrically controllable diffractive optical elements based on photocurable polymer-LC composites

Oksana Sakhno[1], Yuri Gritsai[2], Regina Rosenhauer[2], Joachim Stumpe[1]
[1]Fraunhofer Institute for Apllied Polymer Research, Potsda-Golm, Germany; [2]Institute for Thin Film Technology and Microsensoric, Teltow, Germany

We perform high efficient electrically switchable/tunable diffraction elements based on LC droplets-free transmission gratings formed in the photocurable LC containing organic composite materials. Specific morphology of the gratings makes them attractive for numerous applications in optics and photonics.

Room: Small Club Room

shape of the mirror surfaces and the roughness were characterized. The element was successfully integrated into the waveguide layers by standard pick and place technology. In a second step the device was studied in a proof-of-principle application. The resulting coupling losses were about 1.5 dB.

18:25
Tunable integrated Near-Infrared laser for gas spectroscopy

Andreas Hänsel[1], Sylwester Latkowski[2], Nandini Bhattacharya[1], E.A.J.M. {Erwin} Bente[2], H. Paul Urbach[1]
[1]TU Delft, Netherlands, The; [2]TU Eindhoven, Netherlands, The

A tunable near-infrared single-mode laser design for the 2 µm range is presented. An intracavity filtering based on asymmetric Mach-Zehnder interferometers is used for wavelength selection. Multiple cavity and filter configurations have been designed to compare their performances. Photonic integrated circuit test chips, operating at 1.55 µm wavelength, have been fabricated within the CO-BRA multiproject wafer runs.

Notes:

Room: Pasteur

ry; 2: MTA Wigner, Hungary

Non-destructive analyzing tools are needed at all stages of thin film process-development, especially photovoltaic (PV) development, and on production lines. In the case of thin films, layer thicknesses, micro-structure, composition, layer optical properties, and their uniformity are important parameters. An important focus is to express the dielectric functions of each component material in terms of a handful of wavelength independent parameters whose variation can cover all process variants of that material. With the resulting database, spectroscopic ellipsometry coupled with multilayer analysis can be developed for on-line point-by-point mapping and on-line line-by-line imaging.

Date: Friday, 19/Sep/2014

8:20- 9:05

Bunsen Hall

Plenary TOM6: Iain A. Neil

Development of Motion Picture Camera Zoom Lenses

Iain Alexander Neil
ScotOptix, Switzerland

A chronology of Academy Award® winning zoom lens optical designs are described in terms of technical innovation and artistic impact on cinematography. In addition, trends in cine zoom lens development are discussed with reference to optical design examples taken from US Patents and published papers as well as optical technology. Also, future advances in zoom lenses through utilization of potential technology are considered and some recent zoom lens products are used to illustrate how diverse motion picture zoom lenses are becoming.

9:15- 10:45

Room: Hans Grade	Room: Pasteur	Room: Newton	Room: Bunsen Hall	Room: Small Club room

TOM3 S12: Optical System Design and Tolerancing

Session Chair: **Yongtian Wang**
Session Chair: **Yasuhiro Ohmura**

Invited talk

9:15
Wavefront control technology using spatial light modulator in bio and medical imaging

Takashi Inoue
Hamamatsu Photonics K. K., Japan

Wavefront control technology using spatial light modulators is useful in bio and medical imaging. With the technology, we can introduce additional flexible functions into imaging systems, such as aberration correction, multifocal beam generation for simultaneous multipoint detection, and super-resolution. In the presentation, I will introduce a phase modulation type of SLM we developed as an example of SLM for wavefront control and some experimental results obtained with wavefront control technology about microscopy and adaptive opticss retinal imaging.

Invited talk

9:45
Spectrum-sensitive OCT microscope using visible LEDs

Toshiaki Iwai
Optical Society of Japan (OSJ), Japan

A new optical coherence tomography system has been developed on the basis of the Linnik-type Michelson interferometer with visible light emitting diodes (LEDs) with the

TOM6 S01: Optics for Cinematography and Video

Invited talk

9:15
Double Vision: Cine Lens Quality

Ian Marshall
BAE Systems, United Kingdom

Cine lenses are used to produce movies, TV productions and adverts. Producers are trying to emotionally engage viewers with the content, whereas the imaging quality of the lens obstructs or enhances this engagement. In particular, the aesthetics of a lens are not fully understood from a scientific standpoint. There is 'double vision': the users want more than lens designers fully understand. This paper takes data from two lenses tests conducted by users and a sample still image taken from the web to illustrate some of the underlying lens design theory.

9:45
An introduction to the state-of-the-art CMOS Image Sensor

Satoshi Aoyama[1], Shoji Kawahito[1,2]
[1]Brookman Technology, Inc., Japan; [2]Shizuoka University, Japan

An image sensor, located in the front end of an image pick-up, plays the large role and has big influence in the system. Especially, the CMOS image sensor becomes a key device not only in consumer applications, but in non-consumer area. The technological

TOM7 S07: Photovoltaics 2

Session Chair: **Gianluca Maria Farinola**

Invited talk

9:15
Massive scale production and installation of flexible printed solar cells

Fredrik Krebs
Technical University of Denmark, Denmark

Printed solar cells can be prepared on a large scale (kilometers) on relatively small equipment using little material. The performance and lifetime are lower and shorter than many conventional PV technology but manufacturing speed, manufacturing cost, energy pay back time and installation speed can by far exceed known energy technologies with a significant potential for further improvement through architecture development and process intensification.

9:45
Post-deposition activation of latent hydrogen-bonding: A new paradigm for enhancing the performances of bulk heterojunction solar cells

Francesco Bruni[1], Mauro Sassi[1], Marcello Campione[1], Umberto Giovanella[2], Riccardo Ruffo[1], Silvia Luzzati[2], Francesco Meinardi[1], Luca Beverina[1], Sergio Brovelli[1]
[1]University of Milano Bicocca, Italy; [2]Consiglio Nazionale delle Ricerche - Istituto per lo Studio delle Macromolecole, Italy

TOM 10 S05: Beams and propagation

Session Chair: **Haifeng Wang**
Session Chair: **Pedro ANDRES**

Invited talk

9:15
Customised laser modes by dynamic and geometric phase control

Andrew Forbes
CSIR, South Africa

It is well known that customized modes from lasers may be created by phase-only optics. Traditionally diffractive optical elements have been used to control the dynamic phase. We will review this field and then outline how a combination of these optics together with inhomogeneous polarization optics may also be inserted into a laser cavity to modify both the dynamic and geometric phase of the light, leading to control of the handedness of the laser modes. Finally we will show how traditional approaches may be replaced with an intra-cavity spatial light modulator to form a digital laser for on-demand laser modes.

9:45
Optical rogue waves in laser speckle

Luc Froehly, Thomas Godin, Luca Furfaro, Pierre-Ambroise Lacourt, François Courvoisier, John Dudley
Institut FEMTO-ST, France

We report the observation of optical rogue events in a free-space linear system through the propagation

TOM11 S01: Dissemination of EU projects

Session Chair: **Paul Urbach**

9:15
EMRP Joint Research Project Scatterometry

Bernd Bodermann
Physikalisch-Technische Bundesanstalt, Germany

Supported by the European Commission and EURAMET, a consortium of 11 participants from national metrology institutes, universities and companies has worked on a joint research project with the aim of overcoming current challenges in optical scatterometry for traceable linewidth metrology. Both experimental and modelling methods have been enhanced and different methods have been compared with each other and with specially adapted atomic force microscopy (AFM) and scanning electron microscopy (SEM) measurement systems in measurement comparisons. Novel methods for sophisticated data analysis have been developed and investigated to reach significant reductions of the measurement uncertainties in critical dimension (CD) metrology. Finally a wafer based reference standard material for calibration of scatterometers has been developed and tested.

Room: Hans Grade | Room: Pasteur | Room: Newton | Room: Bunsen Hall | Notes:

central wavelengths of 444.6 nm (B), 522.6 nm (G), and 637.3 nm (R). The potential of spectroscopic performance was experimentally confirmed by observing RGB OCT-images of the femur of a cricket, a RGB-cellophane phantom, and dyed goat hairs. The spectral transmittance of RGB cellophanes and reflectance of the dyed hairs were quantitatively estimated from the OCT images and, as a result, agreed well with the given values.

Invited talk

10:15
Photomask challenges of EUV technology

Massimiliano Pindo
Toppan Photomasks, France

The development of EUV technology is considered as a major step to bring EUV lithography in production mode and keep the semiconductor industry on track with the Moore's law. EUV lithography requires reflective optics: this fundamental change in the physics behind the wafer exposure process induces important technological challenges to both the exposure tool, providing the illumination at 14nm wavelength, and the mask featuring the chip design. In particular, the need of reflective masks represents a major change vs. traditional mask making techniques based on transmitting substrates. The main challenges for mask imaging performance will be discussed, together with the most recent results coming from the collaboration between Toppan, AMTC and ASML.

10:45
Recording of Fiber Bragg Gratings Using Interferometer Scheme

Andrey Kulikov, Galina Romanova, Anna Voznesenskaya
St.Petersburg National Research University of Information Technologies, Mechanics and Optics, Russian Federation

Interferometer schemes for recording of fiber Bragg development of CMOS image sensor is dramatic, and the performance of the device is improving every day by taking in various analog and digital circuit technologies. In this talk, the high-spec CMOS image sensor for the specialized applications, for examples: 8K, high speed, high sensitivity, and range image sensors are presented.

10:15
HDR-Measurement of the straylight point spread function

Julian Achatzi[1], Gregor Fischer[1], Volker Zimmer[2], Dietrich Paulus[3], Gerhard Bonnet[4]
[1]Cologne University of Applied Sciences, Germany; [2]Leica Camera AG, Wetzlar, Germany; [3]University Koblenz Landau, Germany; [4]SPHERON-VR AG, Waldfischbach-Burgalben, Germany

Stray light is the part of an image that is formed by misdirected light. I.e. an ideal optic would map a point of the scene onto a point of the image. With real optics however, some parts of the light gets misdirected.
It is of interest, to measure and quantify these effects. Our work aims at measuring the stray light point spread function (stray light PSF) of a system which is composed of a lens and an imaging sensor. In this work we present a new way of measuring the straylight-psf, using HDR-technologies.

Small conjugated molecules (SM) are rapidly gaining momentum as a valid alternative to semiconducting polymers for the production of solution-processed bulk heterojunction (BHJ) solar cells, as they allow to overcome current limitations imposed by the intrinsic polydispersity of long conjugated chains and low batch-to-batch reproducibility. The major issue with SM-BHJ solar cells is the low carrier mobility due to the scarce control on the phase segregation process and consequent lack of preferential percolative pathways for free carriers to the extraction electrodes. Here we demonstrate a new paradigm for fine tuning the phase segregation in SM-BHJs based on the post-deposition exploitation of latent hydrogen bonding in binary blends of functionalized electron-donor moieties mixed with PCBM.

10:00
Hyperbranched 1-D Nanostructure for Solid -State Dye Sensitized Solar Cells

Luca Passoni[1,2], Pablo Docampo[3], Agnese Abrusci[3], Javier Marti-Rujas[1], Giorgio Divitini[4], Caterina Ducati[4], Maddalena Binda[1], Simone Guarnera[1], Hanry James Snaith[3], Annamaria Petrozza[1], Fabio Di Fonzo[1]
[1]Italian Institute of Technology, Center for Nano Science and Technology - Milan, Italy; [2]Dipartimento di Fisica – Politecnico di Milano, Piazza Leonardo Da Vinci 32, 20133 Milano, Italy; [3]University of Oxford, Clarendon Laboratory, Parks Road, Oxford, OX1 3PU, United Kingdom; [4]Department of Materials Science & Metallurgy, University of Cambridge, Pembroke Street, CB2 3QZ Cambridge, UK

In this work we demonstrate hyperbranched nanostructures, grown by Pulsed Laser Deposition, comprised of one dimensional anatase single crystals assembled in arrays of high aspect ratio hierarchical mesostructures. The and interaction of light speckles, initially generated using a spatial light modulator with appropriate phase mask. We observe that granularity is an essential element for their existence but, unlike previous studies, that spatial inhomogeneity, although enhancing the rare events probability may not be a strict and necessary requirement for their observation. Experimental results are confirmed using numerical simulations.

10:00
Polarization modulation of complex light fields

Christina Alpmann, Eileen Otte, Christian Schlickriede, Cornelia Denz
University of Muenster, Germany

Tailored light fields with complex polarization states are of growing interest in theory as well as in experimental investigations. These so called vector beams provide transversely spatially distributed states of polarization in combination with amplitude- and phase-structured modes. We show the modulation and analysis of different higher order vector beams.

10:15
Unstable cavity lasers - from kaleidoscopes to snowflakes

James M. Christian[1], Ioannis Begleris[1], Graham S. McDonald[1], Jungang Huang[2]
[1]University of Salford, United Kingdom; [2]University of Glamorgan, United Kingdom

The snowflake laser is proposed - a new class of unstable resonator whose feedback mirror has the shape of the von Koch snowflake. Theoretical analysis is undertaken with two-dimensional virtual source theory, and predictions of novel mode patterns, eigenvalue spectra, and convergence phenomena are presented.

Room: Hans Grade

gratings (FBG) with variable index modulation period are observed

Room: Newton

proposed growth mechanism relies on a two-step process: self-assembly from the gas phase of amorphous TiO2 clusters in a forest of tree-shaped hierarchical mesostructures with high aspect ratio; oriented crystallization of the branches upon thermal treatment. Structural and morphological characteristics can be optimized to achieve both high specific surface area for optimal dye uptake and broadband light scattering thanks to the microscopic feature size.

Invited talk

10:15
Structural properties of molecular thin films for organic electronic applications

Roland Resel
Graz University of Technology, Austria

The optical as well as the electronic properties of molecular semiconductors are highly anisotropic. Therefore, defined orientation of molecules are required to obtain optimized performance in organic electronic devices. Additionally, the molecular packing, the domain size and the structural properties of the interface are important parameters. This contribution discusses the morphology as well as the crystallographic properties of molecular crystals and of polymers within thin films. The aim is to understand the importance of specific structural features for device performance as well as to understand the evolution of defined thin film morphologies and crystallographic order as a function of the substrate type.

Room: Bunsen Hall

10:30
Diffraction of fractal optical fields by simple apertures

James M. Christian, Maria Mylova, Graham S. McDonald
University of Salford, United Kingdom

We propose and investigate, for the first time to our knowledge, an entirely new regime in wave physics - the diffraction of fractal waves from simple apertures. A selection of new analyses and physical predictions will be given for experimental geometries when the illuminating field has structure on multiple spatial scale-lengths.

10:45- 11:15 Coffee Break

11:15- 13:15

Bunsen Hall

Session: Grand Challenges in Optics

Session Chair: **Paul Urbach**
Session Chair: **Hans Peter Herzig**

The mechanical properties of light
Tobias Kippenberg, Ecole Polytechnique Fédérale de Lausanne (EPFL), Germany

Attosecond Nanophotonics
Matthias F. Kling, Ludwig-Maximilians-Universität München, Germany

Negative optical forces
Aristide Dogariu, The University of Central Florida, USA

Challenges and Opportunities for Photonics
Markus Weber, Carl Zeiss AG, Germany
Photonics is one of the key enabling technologies of the 21st century. This view is now shared by political stakeholders, the importance of photonics being reflected by the significant portion of current and future public funding being injected into this field.
In this context, 2015 has been announced as the International Year of Light – which evidences the bright role of photonics in our modern society.

Friday, 19 September

13:15 - 14:05 Lunch Break

14:05– 14:50 Bunsen Hall

Plenary TOM9: H. Philip Stahl

Rules for Optical Testing

H. Philip Stahl
NASA Marshall Space Flight Center, United States of America

Optical testing is the discipline of quantifying the performance parameters of an optical component or system using any appropriate metrology tool. Based on 30 years of testing experience, I have defined seven guiding principles: Fully Understand the Task; Develop an Error Budget; Continuous Metrology Coverage; Know where you are; 'Test like you fly'; Independent Cross-Checks; and Understand All Anomalies. These rules have been derived from my own failures and successes. And, these rules have been applied with great success to the in-process optical testing and final specification compliance testing of the JWST OTE mirrors.

15:00 - 16:30

Arsenal Cinema	Room: Newton	Room: Pasteur	Room: Bunsen Hall	Room: Small Club room

TOM6 S02: Optics for Cinematography and Video

Invited talk

15:00
4K and HFR: The Trouble with Sharpness

Christian Iseli
Zurich University of the Arts, Switzerland

The current discussion on the technical improvement of cinema and television is dominated by ultra high resolution and high frame rate. The aesthetics of the new hyper-real images have become a challenge for the filmmakers as cinema doesn't necessarily unfold its narrative force by showing everything clearly and precisely.
In its artistic research the Institute for the Preforming Arts and Film focuses on the aesthetic consequences of technical innovation in a narrative context. The presentation will include footage from a short film which was produced in a complete 4K-workflow.

15:30
PHOTO-REALISTIC SYNTHESIS OF CINEMATIC LENS BOKEH

Thomas Hach[1], Artur Pappenheim[2], Johannes Steurer[3]
[1]ARRI, Germany; [2]HdM Suttgart, Germany; [3]ARRI, Germany

This paper presents a novel approach of rendering synthetic depth-of-field for cinematic purposes. While computer graphics methods are not applicable for real footage, the latter don't provide the necessa-

TOM7 S08: Photovoltaics 3

Session Chair: Jerome Cornil

15:00

Invited talk

Jordi Martorell, Institut de Ciènces Fotòniques, Spain

15:30
Photo-electrochemical sensor for dissolved oxygen sensor, based on a APFO-3:PCBM/ palladium oxide hybrid electrode

Sebastiano Bellani[1], Maria Rosa Antognazza[1], Fabio Di Fonzo[1], Ali Ghadirzadeh[1], Laura Meda[2], Alberto Savoini[2]
[1]Istituto Italiano di Tecnologia; [2]Istituto Eni Donegani

This study reports photoelectrochemical activity towards the reduction of dissolved oxygen in aqueous solutions exploiting novel hybrid organic-inorganic systems, based on the coupling of a photoactive conjugated polymer (APFO-3:PCBM) with nanostructured palladium oxide (PdO) as semiconductor photocathodes, realizing a photoelectrochemical amperometric oxygen sensors. Suitable selection of electrochemical parameters resulted in an optimal condition under which linear calibration plots were derived, with a sensitivity of -5.87(μA/cm^2)/ ppm, making the possible use of the sensor in various fields of research.

TOM9 S03: Advances in Scatterometry 2

15:00
Solving inverse problems in scatterometry for grating reconstruction in semiconductor metrology

Nitish Kumar[1], Peter Petrik[1,2], Luca Cissoto[1], Sarathi Roy[1], Silvania F Pereira[1], H Paul Urbach[1]
[1]Delft University of Technology, Netherlands, The; [2]Institute for Technical Physics and Materials Science, Hungarian Academy of Sciences, Hungary

Coherent Fourier scatterometry (CFS) is an emerging tool for semiconductor metrology. Here, reconstruction of grating parameters are shown with CFS. Experimental implementation of interferometric CFS (ICFS) and its role in solving inverse problems in grating reconstruction is discussed. High sensitivity to change in grating parameters can be achieved by ICFS.

15:15
Bayesian approach to uncertainty estimations in scatterometry

Sebastian Heidenreich
Physikalisch-Technische Bundesanstalt, Germany

Scatterometry is an indirect optical method to characterize photomask geometry parameters from scattered light intensities. In this contribution, we present a stochastic collocation based surrogate model that enables the Bayesian approach to solve the statistical inverse problem of scatterometry.

TOM 10 S06: Modelling Stategies for Diffractive Devices and Materials

Session Chair: **Toyohiko Yatagai**
Session Chair: **Benfeng Bai**

Invited talk

15:00
Design and fabrication of the diffractive optical elements on curved surface by interference

Juan Liu, Yongtian Wang
Beijing Institute of Technology, China, People's Republic of

A review of the design and fabrication of Diffractive Optical Elements (DOEs) on curved surface is presented firstly. Then two methods: iteration algorithms and the analytical formula, are presented for the design DOEs with arbitrary complex phase profile on curved surface, and the fabrication is performed on the curved surface with two-step exposure technique by interference. Both a binary pattern and a gray pattern are designed and reconstructed numerically on the curved surfaces with big curvatures in large areas, while a binary and nonperiodic pattern is produced experimentally on a lens surface. The simulations together with the experiment demonstrate the validity of the method.

TOM11 S02: Dissemination of EU projects

Session Chair: **Seppo Honkanen**

Invited talk

15:00
Adoption of the Foundry Model to Photonics: The Integrated EU Project PARADIGM

Ronald Broeke[1], Norbert Grote[2], Twan Korthorst[3], Katarzyna Lawniczuk[4]
[1]Fraunhofer HHI, Germany; [2]Bright Photonics B.V.; [3]PhoeniX B.V.; [4]Technical University Eindhoven

We present the objectives and results achieved in the EU funded FP-7 Integrated Project PARADIGM (duration: 10/2010-5/2015). The project aims to develop the eco-system for the implementation of InP based photonic integrated circuits (PIC) by adopting a foundry model, as successfully established in Si electronics since many years. The project activities encompass the following topics that will be presented in different sub-talks:
- InP based platform technology development
- Development of photonic design environment
- Development of components libraries
- Compilation of a comprehensive Design Manual
- Development of PIC standards for electrical and optical connections
- Development of adapted generic packages

ry depth information. This problem is overcome using a monocular RGB+Z camera yielding pixelwise matching color and distance information. Furthermore, we aim for realistic bokeh and hence conducted an in-depth measurement of the point-spread-function of a high-quality master prime lens. Deploying linear shift-invariant properties of the overall signal processing chain leads to a photo-realistic rendering of synthetic Bokeh and depth-of-field.

16:00
The lens of the future from the cinematographers perspective. Results of an inquiry.

Peter C. Slansky
Hochschule für Fernsehen und Film München, Germany

What kind of lenses do cinematographers need in the future, with 4K/8K and UHD?

In summer 2014 the center of advanced studies of filmtechnology of the university of television and film Munich made an inquiry among cinematographers in Germany, Swizerland and Austria about their needs and wishes for lenses in the future. The results of the inquiry are presented and specified for different formats in the cinema and television, studio production and field production, fictional and nonfictional, large sensor cameras and small sensor cameras.

15:45
Solvent vapor sensing by hybrid polymer-ZnO 1D photonic crystals

Paola Lova[1,2], Giovanni Manfredi[2], Antonio Comite[2], Luca Boarino[3], Michele Laus[4], Maddalena Patrini[5], Franco Marabelli[5], Cesare Soci[2], Davide Comoretto[1]
[1]Nanyang Technological University, Singapore; [2]Università degli Studi di Genova, Genova, Italy; [3]Università del Piemonte Orientale, Alessandria, Italy; [4]Istituto Nazionale di Ricerca Metrologica (INRIM), Torino, Italy; [5]Università degli Studi di Pavia, Pavia, Italy

Thanks to low cost and ease of processing, polymers are widely considered for the fabrication of photonic crystal (PhC). However, the low dielectric contrast among mutually processable polymers remains a technological challenge.

16:00
Development of Perovskite and Dye Sensitized Photovoltaic Modules on Plastic Substrates

Francesco Di Giacomo[1], Valerio Zardetto[2], Fabio Matteocci[1], Stefano Razza[1], Andrea Reale[1], Aldo Di Carlo[1], Diana Garcia-Alonso[2], Wytze Keuning[2], Wilhelmus M. M. Kessels[2], Mariadriana Creatore[2], Alessandra D'Epifanio[3], Silvia Licoccia[3], Thomas Meredith Brown[1]
[1]Centre for Hybrid and Organic Solar Energy, University of Rome - Tor Vergata, Italy; [2]Department of Applied Physics, Eindhoven University of Technology, The Netherlands; [3]Department of Chemical Science and Technologies, University of Rome - Tor Vergata, Italy

We report the development and formulations of materials and processes for the fabrication of flexible plastic CH3NH3PbI3-xClx perovskite cells (efficiency of 8.4%) and first module (efficiency of 3.1%) based on a UV-

15:30
Fourier ellipsometry - phase retrieval in Fourier scatterometry using polarization modulation

Peter Petrik[1,2], Nitish Kumar[2], Miklos Fried[1], Balint Fodor[1,3], Gyorgy Juhasz[1], Silvania F. Pereira[2], Paul H. Urbach[2]
[1]MTA TTK MFA, Hungary; [2]Delft University of Technology, P. O. Box 5046, 2600GA Delft, The Netherlands; [3]Faculty of Science, University of Pecs, 7624 Pecs, Ifjusag utja 6, Hungary

An extension of Fourier scatterometry will be presented that aims at increasing the sensitivity by measuring the phase difference between the reflections plarized parallel and perpendicular to the plane of incidence. The ellipsometric approach requires no additional hardware elements compared with conventional Fourier scatterometry. Furthermore, incoherent illumination is also sufficient, which enables spectroscopy using standard low-cost light sources.

15:45
Fabrication of a high quality scatterometry reference standard

Max Schoengen[1], Jürgen Probst[1], Frank Scholze[2], Bernd Löchel[1]
[1]Helmholtz Zentrum Berlin, Germany; [2]Physikalisch Technische Bundesanstalt, Germany

To establish scatterometry as traceable and absolute metrological method for dimensional measurements, a reference standard was developed and fabricated by electron beam lithography. The reference standard allows measurement comparisons between scatterometry and scanning probe microscopes of nanostructures down to 25 nm.

15:30
Studying the reflection and transmission properties of the oriental hornet's brown cuticle using visible sunlight spectrum

Hamed Ahmadpanahi[1], Omar El Gawhary[2], Paul Urbach[1]
[1]TUDelft, Netherlands, The; [2]Dutch Metrology Institute (VSL), Delft, Netherlands

We study the optical properties of a Bio-Nano grating-like structure on the oriental hornet's brown cuticle. The structure is modeled in COMSOL to numerically calculate the reflection and transmission efficiencies. The calculation has been done for TE and TM polarizations for different incident angles over the spectrum of 400 nm to 900 nm with Solar Spectral Irradiance (Air Mass 1.5). The results then were compared to the transmission and reflection coefficients for flat surface structure with the same refractive index. The result show that for normal incident the difference between reflected irradiance from the grating and flat surface is 50% less than a flat surface.

15:45
Modeling of gratings with irregularities and roughness

Joerg Bischoff
Osires Optical Engineering, Germany

An efficient method is presented for the diffraction and scattering modeling of gratings that possess irregularities or roughness. It is based on the combination of a modal method with near field stitching. Both surface irregularities as well as line edge roughness are considered. Simulations are compared with experimental results.

16:00
Matrix formalism for the design of guided-mode resonance filters

Christelle Tuambilangana[1,2], Fabrice Pardo[1],

Invited talk

16:00
Large-area Nanophotonic Chemical Sensors – FP7-PHOTOSENS project

Pentti Karioja
VTT, Finland

Utilization of nanophotonic sensors is hindered by the lack of low-cost and highly reproducibility fabrication methods. To demonstrate a multi-parameter large-area sensor platform for environmental and pharmaceutical sensing, we developed materials and processes for mass-manufacturable, nanostructured, large-area multi-parameter sensors applying Photonic Crystal (PC) and enhanced Surface Enhanced Raman Scattering (SERS) methodologies. Scientific work included development of the nanophotonic sensor structure, nanoimprint materials for large-area, high-throughput fabrication, functionalized molecularly imprinted polymers (MIP) and mass-manufacturing methods including R2R nanoimprint processes for nanotexturing of large-area plastic films. Three sensing platforms were demonstrated: Roll-to-roll printed SERS, Photonic Crystal sensor and Roll-to-roll printed waveguide sensor.

Notes:

Room: Newton	Room: Pasteur	Room: Bunsen Hall

irradiated TiO2 scaffold and ALD compact layer, and also a fully plastic W-series interconnected dye solar cell module utilizing UV processing for both the TiO2 and the platinization of the counterelectrode.

16:15
"Green" 2D Hybrid Perovskites for Perovskite -Based Solar Cells

Daniele Cortecchia[1], Herlina Arianita Dewi[2], Dharani Sabba[2], Tom Baikie[2], Cesare Soci[3], Nripan Mathews[2]
[1]Interdisciplinary Graduate School, Energy Research Institute at NTU (ERI@N), Nanyang Technological University, Singapore 639798; [2]Energy Research Institute @ NTU (ERI@N), Research Technoplaza, Nanyang Technological University, Nanyang Drive, Singapore 637553; [3]Division of Physics and Applied Physics, Nanyang Technological University, Singapore 637371

Organolead-halide-perovskite solar cells containing absorber materials with general formula (CH3NH3)PbX3 have emerged in the last year as a major breakthrough in the photovoltaic research field. However, the main drawback of this perovskite sensitizer is its high lead content, which is toxic, polluting and bio-accumulates in the ecosystem. Therefore, it is highly desirable to find a suitable replacement to the lead. Bi-dimensional perovskites with general formula (CH3NH3)2MX4 containing transition metals are interesting green alternatives to the lead based perovskite. Here we report on the synthesis, characterisation and optical properties of 2D perovskites and their novel integration in to solar cell devices.

Invited talk

16:00
Ptychography: Lensless microscopy and metrology with quantitate phase imaging

John Marius Rodenburg
University of Sheffield, United Kingdom

Ptychography is a high-resolution lensless imaging method that works over all wavelength scales. Because it does not need a lens, its main field of application is in X-ray and electron imaging, where lenses of high numerical aperture are not available. The method is analogous to holography in that it deduces an estimate of both the amplitude and the phase of a wavefield, but it does not require a reference wave. This talk will give an overview of recent advances in ptychography, especially in relation to the sensitivity of the phase image it supplies.

Riad Haïdar[2], Jean-Luc Pelouard[1]
[1]Laboratoire de Photonique et de Nanostructures-CNRS, France; [2]ONERA-The French Aerospace Lab, France

Metal-dielectric periodic nanostructures are designed to operate as infrared spectral filters based on guided-mode resonances. We present an original matrix formalism that describes in a close form the resonance mechanism. It is used to control the optical response features (transmission maximum, resonance wavelength, angular tolerance).

16:15
Perfect blazing for echelle gratings in Littrow mount

Bernd H. Kleemann
Carl Zeiss AG, Germany

Perfect blazing for echelle gratings in Littrow mount really exists, even simultaneously in TE and TM polarization. Then no directed stray light from other diffraction orders occurs. In the ideal case of infinite conductivity, 100% efficiency is diffracted into the Littrow order. A small loss occurs for low conducting metal gratings. Requirements are a unique diffraction order, a square apex angle and surprisingly, a blaze angle which is 4...8 degrees larger than the Littrow angle. The effect is based on and can be explained by a four-wave interference of conterpropagating waves in a retroreflector setting.

16:30– 16:45 Coffee Break

16:45 - 18:15

Arsenal Cinema

TOM6 S03: Optics for Cinematography and Video

Invited talk

16:45
Lens - Pixel - Look. Camera Optics beyond 4K and UHD

Peter C. Slansky
Hochschule für Fernsehen und Film München, Germany

With the substitution of 35mm Film by digital single sensor cameras the parameters for optical design of lenses for cinematography have changed - and will change further with 4K/UHD and beyond. Directors of photography have to face the fact, that the substitution of the film emulsion eliminates an important mean of look creation. Digital cameras now often seem to produce "too perfect" images that look somehow sterile. For directors of photography a very important aim is to create a specific "look" for a cinematographic image or a whole film - an aim as important as technical quality parameters like MTF, color rendition, flare light behavior and so on. By this, the importance of the different photographic characteristics of different lenses has become more important - and will become even more important. Now it is time to try to bridge the information and communication gap between lens designers and lens manufacturers on one side and directors of photography and rental companies on the other side.

17:15
Detection and correction of lens distortion in stereoscopic cinematography

Thomas Schneider, Nikolaus Hottong
Hochschule Furtwangen University (HFU), Germany

Improper matching of stereoscopic images may

Room: Newton

TOM7 S09: Organic electronics

Session Chair: **Jordi Martorell**

16:45
Fully efficient Yb-to-Er resonance energy transfer in solution-processable molecular materials

Francesco Quochi[1], Flavia Artizzu[2], Raquel Fonseca Correia[2], Luciano Marchiò[3], Cristiana Figus[1], Mauro Aresti[1], Michele Saba[1], Angela Serpe[2], Maria Laura Mercuri[2], Paola Deplano[2], Andrea Mura[1], Giovanni Bongiovanni[1]
[1]Università di Cagliari, Dipartimento di Fisica, Monserrato, 09042, Italy; [2]Università di Cagliari, Dipartimento di Scienze Chimiche e Geologiche, Monserrato, 09042, Italy; [3]Università di Parma, Dipartimento di Chimica, Parma, 43100, Italy

We demonstrated Yb-to-Er resonance-energy transfer with nearly unitary efficiency in mixed Yb−Er trinuclear quinolinolato compounds. Such complexes represent a suitable strategy for achieving effective erbium sensitization in solution processable molecular materials.

17:00
Fabrication and Scale-up of High Performance Low Band-gap Polymer Solar Cells by Spray-Coating in Air

Nicholas William Scarratt[1], Tao Wang[1], Jonathan Griffin[1], Andrew Brook[1], James Kingsley[2], Hunan Yi[1], Ahmed Iraqi[1], David Lidzey[1]
[1]The University of Sheffield, United Kingdom; [2]Ossila Ltd, United Kingdom

In this work we present ultrasonic spray coating, a solution processable deposition technique which is compatible large scale processing. A PCE of 5.17% was achieved from a spray coated PCDTBT:PC70BM active

Room: Pasteur

TOM9 S04: Surface Topography and Interferometry

16:45
High-resolution dynamic 3D-shape measurement

Invited talk

Gunther Notni
Fraunhofer Institute IOF Jena, Germany

3-D measurement of objects has become an important challenge in industrial quality control, human-machine interaction and medicine. Often not only high accuracy and precision are demanded, but also high speed giving the possibility to measure dynamic objects or processes. This contribution gives an overview over high-speed active 3-D shape measurement techniques, highlights new methods for high-speed pattern projection techniques and shows several applications. To overcome the speed-limit a multi-channel architecture is presented which is able to project patterns with high brightness and depth of focus with frame rates up to the 100 kHz range giving the possibility to capture more than 300 3D-frames/s

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17:15
Phase retrieval from carrier frequency interferograms: a new averaging algorithm

Johannes Schwider
University Erlangen-Nürnberg, Germany

Phase extraction from single carrier frequency interferograms is immune against vibrations provided the integration time is short enough. Phase errors can be reduced through averaging of independent results. In order to exclude phase dependent errors it is useful to systematically ramp the reference phase while gathering the intensities of a set of M interferograms. The averaging of phases extracted from single interferograms will be free

Room: Bunsen Hall

TOM 10 S07: Emerging Applications

Session Chair: **Juan Liu**
Session Chair: **Pierre Chavel**

16:45
Full view-angle 3-D display with computer-generated holograms based on a rigorous diffraction theory

Invited talk

Toyohiko Yatagai
Utsunomiya University, Japan

A rigorous equation describes the relation between the diffracted wavefront of a 3-D object and its 3-D Fourier spectrum. An exact solution of the diffraction integral is given by the Green function. Based on this principle, CGHs with full view-angle are synthesized and reconstructed using simulated experiments.

17:15
Optical effects in asymmetric metal gratings

Fabian Luetolf[1,2], Martin Stalder[1], Olivier J.F. Martin[2]
[1]CSEM SA, Switzerland; [2]EPFL

Structures changing the visible color upon rotation or flipping are fabricated by oblique deposition of aluminium on dielectric gratings. The available color palette is presented and insight into the underlying physical principle is provided.

17:30
Design and fabrication of a diffractive optical element for optical identification

Vishal Gandhi, Joni Orava, Hemmo Tuovinen, Toni Saastamoinen, Janne Laukkanen, Seppo Honkanen, Markku Hauta-Kasari
Institute of Photonics, University of Eastern Finland, Finland

We present the design and

Room: Small Club room

TOM11 S03: Dissemination of EU projects

Session Chair: **Paul Urbach**

Invited talk

16:45
Control the flow of light and manipulate its polarization state on polymer-based photonic integration platform – FP7-PANTHER project

Ziyang Zhang
Fraunhofer HHI, Germany

PANTHER will combine electro-optic with passive polymers and will develop a novel photonic integration platform with unprecedented potential for high-speed modulation and optical functionality on-chip. It will also rely on the combination of polymers with InP gain chips and photodiode arrays, and on the use of the InP-DHBT platform for driving circuits based on 3-bit power-DACs and high-speed TIA arrays. Using 3D integration techniques, PANTHER will integrate these components in compact system-in-package transceivers capable of operation at rates up to 64 Gbaud with formats up to DP-64-QAM and flexibility in the generation and handling of multiple optical flows on-chip.

Invited talk

17:15
LightSWORDS: a non axial-symmetric Lens that mIGHT be a Satisfactory Way Of Reducing age Degradation of Sight

Andrzej Kolodziejczyk[1], Maciej Sypek[2], Adam Czerwiński[2], Krzysztof Grabowiecki[3], Samuele Ambrosetti[4]
[1]Faculty of Physics, Warsaw University of Technology, Poland; [2]SKA Polska sp.z.o.o., Poland; [3]CIMmes Projekt sp.z.o.o.; [4]D'Appolonia S.p.A.

LightSWORDS is a European FP7 project funded under “Research for the benefit of SMEs”; the project is developing high-

result in eye strain and visual fatigue for the audience. Optical devices are employed at the acquisition stage and at the end of the 3D work-flow chain. If these lens systems display geometric distortion, mismatches between left- and right-eye views may result, requiring great efforts in 3D-postproduction. We present a method for the detection and correction of camera lens distortion from a single image of a checkerboard target. We have tested the robustness of the detection algorithm against Gaussian noise and various contrast ranges. Finally we have maesured the quality of image correction.

17:35
Wave-optical optimization of autostereoscopic displays for automotive use

Christoph Ewen[1], Markus Kreuzer[1], Cornelia Denz[2]
[1]Daimler AG, Germany; [2]Westfälische Wilhelms-Universität Münster, Germany

We present a wave-optical model to simulate an autostereoscopic display system (ASD) based on a dynamic barrier mask. Phase-shifting and amplitude-changing elements are applied to optimize not only the static optical performance but critical luminance variations during dynamic mask adaptation.

17:55
Optical System Enables New Solutions for Live Broadcast

Marco Hanft
Carl Zeiss AG, Germany

Based on the latest advancements in high-speed computing, image processing and optical technologies, new concepts for broadcasting have been developed. It is possible to identify billboards in sport scenes and replace their contents. This paper shows the implications of an application of the optics and important details of the solution.

layer, comparable to a spin cast reference of 5.23% PCE. This process was then scaled up to cover an area of 9cm2, containing 36 individual pixels. A 100% pixel yield and an average of 4.3% PCE were achieved over 36 pixels, with a standard deviation of 0.2%. A vanadium oxide hole transport layer was then sequentially deposited with the photoactive layer, creating a device without any spin casting stages.

17:15
Nanoparticle agglomeration in Therminol VP-1 after being produced by Pulsed Laser Ablation in Liquids in two steps

Rafael Omar Torres Mendieta[1], Rosa Mondragón[1], Pedro Andrés Bou[2], Jesús Lancis Sáez[1]
[1]Universitat Jaume I., Spain; [2]Universitat de Valencia

We present the experimental characterization of gold nanoparticles agglomeration in Therminol VP-1, when the particles are created by Pulsed Laser Ablation in Liquids. In particular we analyzed the agglomeration dynamics by Dynamic Light Scattering finding that this nanofluid is stable for 3 days.

17:30
Experimental and Theoretical studies in an hybrid CsSenanocrystal-organic interface: trap states and role of the ligands

Tersilla Virgili[1], Inmaculada Suarez-Lopez[1], Marta M. Mroz[1], Barbara Vercelli[2], Giuliano Angella[2], Gianni Zotti[2], Juan Cabanillas-Gonzalez[3], Daniel Granados[3], Larry Luer[3], Arrigo Calzolari[4], Alice Ruini[4], Alessandra Catellani[4], Francesco Tassone[5]
[1]IFN-CNR, Politecnico di Milano,Milan, Italy; [2]IENI-CNR, Via Cozzi 53, Milan, Italy; [3]Instituto Madrileño de Estudios Avanzados,

of time-dependent reference phase errors. However, calibration is mandatory since phase contributions arising from different path differences due to strong tilt of the wave fronts passing the imaging optics would cause incorrect wave aberrations or surface deviations.

17:30
Point diffraction interferometry to measure local curvatures and caustics of noisy wavefronts

Santiago Vallmitjana[1], Isaac Ricart[1], Salvador Bosch[1], Ana Gargallo[2], Eva Acosta[2]
[1]University of Barcelona, Spain; [2]University of Santiago de Compostela, Spain

A method for measuring local curvatures of optical phase in a plane with a point diffraction interferometer (PDI) is proposed. Formulas based in the analysis of the interferogram and in the local optical path differences are shown. An application to noisy wavefronts as those produced by fish eye lenses is shown.

17:45
Model-based deflectometric measurement of transparent objects

Marc Fischer, Marcus Petz, Rainer Tutsch
Technische Universität Braunschweig, Germany

In this contribution a model-based deflectometric approach is presented that allows the simultaneous geometric measurement of the front and rear surface of refractive objects in transmission. The principles of the measurement and evaluation are discussed and measurement results for an aspheric ophthalmic lens blank are given.

fabrication of a diffractive optical element (DOE) and its application for optical identification purposes. In a test environment, two binary reflective diffraction gratings are used. The diffraction orders of the two gratings are used as a binary code for the optical identification.

17:45
Micro-Optical Freeform Elements for Imaging

Daniel Infante Gómez, Hans Peter Herzig
EPFL, Switzerland

Thin optical elements that produce good quality images and that are operational with different light sources are studied in this work. The influence of design parameters such as sampling, scaling and smoothing of their surfaces is evaluated.

18:00
Non-polarizing Organic-Inorganic Nano-photonic Device Components

Muhammad Rizwan Saleem[1,2], Rizwan Ali[1], Mohammad Bilal Khan[2], Seppo Honkanen[1], Jari Turunen[1]
[1]University of Eastern Finland, Institute of Photonics, P.O. Box 111, FI-80101, Joensuu, Finland; [2]National University of Sciences and Technology (NUST), Center for Energy Sources (CES), Sector H-12, Islamabad, Pakistan

A diffraction grating is an alternatively periodic modulation of refractive indices between two dissimilar materials. A typical diffraction grating in a dielectric material is considered as a Guided Mode Resonance Filter (GMRF). The polarization state of outgoing light is unknown in optical communications which need polarizer via coupling elements. The design and fabrication of nonpolarizing GMRFs is worth emphasizing to control light polarization.In this work we report on the design, fabrication and characterization of two types of simple structured onedimensional (1D) GMRFs with non-polarizing resonance properties, which are designed to work around a wavelength of 50 nm under normal incidence.

quality low cost manufacturing technologies for a new type of asymmetric plastic lens to be applied in the correction of human vision.

We have developed a non axial symmetric lens with continuously changing optical power that may prove a valid aid in mitigating the effect of aging on sight. Preliminary laboratory tests confirm that the LightSWORDS lens is able to extend ability of optical system to focus with sufficient sharpness at focal lengths from 0.3 m to infinity.

Room: Newton

(IMDEA-Nanociencia), Madrid, Spain; [4]Istituto Nanoscienze CNR-NANO Centro S3, Modena, Italy; [5]Center for Nanoscience and Technology@Polimi, IIT, 20133 Milan, Italy

We time-resolved the excited states dynamics of hybrid multi-layered structures composed of alternated CdSe NCs and poly(p-styrenesulphonic acid) obtained by LBL. We found evidence of the long-lived charged surface states in the LBL film.Density functional calculations also indicate that these states are localized close to the nanoparticle surface

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17:45
The Influence of Residual Palladium Catalyst on the Performance and Stability of Organic Photovoltaic Devices

Christopher Bracher[1], Nicholas W. Scarratt[1], Robert Masters[1], Hunan Yi[1], Andrew J. Pearson[2], Ahmed Iraqi[1], David G. Lidzey[1]

[1]University of Sheffield, United Kingdom; [2]University of Cambridge, United Kingdom

We study the effects of palladium content mixed with PCDTBT; palladium is used as a catalyst in the polymerisation process of PCDTBT, during which it forms nanoparticles that bind to conjugated polymers. A series of solar cell devices were fabricated using PCDTBT:PC70BM, with palladium concentrations up to 0.26 wt%. The power conversion efficiency of these devices were measured over 140 hours giving insight into the operation stability of such solar cells. Optical microscopy, laser beam induced current mapping, scanning electron microscopy and space charge limited current techniques are used to further characterise the solar cell blend thin films.

18:00
Ultrafast study of polymer/ nanocrystal interface towards efficient hybrid solar cells

Carlo Giansante[1,2], Rosanna Mastria[2], Giovanni Lerario[1], Luca Moretti[3], Ilka Kriegel[3], Francesco Scotognella[3], Aurora Rizzo[1,2], Guglielmo Lanzani[4], Giuseppe Gigli[1,2,5]

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Room: Pasteur

18:00
A Novel Approach to Eyeglass Metrology

Carsten Glasenapp

Carl Zeiss AG, Germany

A novel approach to measure the topography of progressive eyeglasses is presented here. First, the demand of such a technology is drafted. Then, the detailed functionality and the solution to reach the needed specification for full integration in-line metrology tool is discussed.

Notes:

Room: Newton

CNST-IIT@PoliMi, 20133 Milano, Italy; [5]Dipartimento di Matematica e Fisica 'E. De Giorgi', Università del Salento, 73100 Lecce, Italy

We have investigated, by means of ultrafast transient absorption, the photophysical processes occurring in different polymer/nanocrystal heterojunction, in order to understand the behaviour of the photogenerated species in such blends. These results are interesting for the fabrication of efficient hybrid solar cells.

Poster Presentations

Room: Newton

Please Note: No Poster Session for TOM 2 and TOM 8

TOM 1 poster session — Wednesday, 17 September 12:45-14:45

A novel approach to obtain hollow core antiresonant fiber polarizers for 3 - 4 µm spectral region

Chuncan Wang[1,2], Morten Bache[1], Meihui Wang[2]
[1]echnical University of Denmark, Department of Photonics Engineering, DK-2800, Kgs. Lyngby, Denmark; [2]Beijing Jiaotong University, Institute of Lightwave Technology, Beijing 100044, China; xzwangchuncan@126.com

We propose a fiber polarizer consisting of a hollow core antiresonant fiber (HCARF) and a silica substrate with gold film coating. The numerical results show that the polarization dependent loss (PDL) is larger than 20 dB for the fiber length of 0.11 m at the wavelength of 3 - 4 µm.

ALD-tuned nanobeam cavity on titanium dioxide-on-insulator platform operating in the visible

Arijit Bera, Markus Häyrinen, Matthieu Roussey, Markku Kuittinen, Seppo Honkanen
University of Eastern Finland, Finland; arijit.bera@uef.fi

We experimentally demonstrate a photonic crystal nanobeam cavity, operating in the visible, fabricated on titanium dioxide platform. The atomic layer deposition provides an additional tunability of the hole radii for the aimed size. This work shows the feasibility of a new platform for the future applications in integrated quantum optics and bio-sensing.

Influence of coating materials and cladding-to-core ratio on the transmittance of optical multimode fibres

Yazmin Padilla Michel[1], Mohamad Zoheidi[2], Patrick Steglich[1], Sigurd Schrader[1]
[1]Technische Hochschule Wildau [FH], Germany; [2]OBERON GmbH Fiber Technologies, Germany; padilla-michel@th-wildau.de

In the last fifty years, the industry has centred its attention in the step index multimode fibres (MMFs), because they are easier to handle and couple/feed than single mode fibres. MMFs have allowed technical developments in a wide range of industrial and scientific areas such as medicine, chemistry and astrophysics. In this poster we present the results of spectral characterization of multimode optical fibres (MMFs) as a function of the bending radius depending on: 1) Cladding-to-core ratio, 2) Coating thickness, and 3) coating materials.

Strain induced refractive index changes in buried waveguides.

Marco A. G. Porcel[1], Marcel Hoekman[2], Matthijn Dekkers[3], Remco Stoffer[4], Ronald Dekker[5], Arne Leinse[2], Peter van der Slot[1], Klaus-Jochen Boller[1]
[1]University of Twente, Netherlands, The; [2]Lionix BV, Netherlands, The; [3]Solmates, Netherlands, The; [4]Phoenix BV, Netherlands, The; [5]Xiophotonics, Netherlands, The; m.a.garciaporcel@utwente.nl

Using strain induced index changes is of high interest for modulating light in low-loss Si3Ni4 waveguide circuits. Such index changes might be introduced via surface acoustic waves (SAWs) providing modulation at MHz frequencies.

Using numerical analysis we show that SAWs can be launched, using a thin piezoelectric film on top of the buried waveguide, that modify the refractive index of the propagating mode. The analysis shows that a phase shift of pi/2 can be achieved in less than 10cm propagation. This is sufficient to achieve full modulation in a balanced Mach-Zehnder interferometer. Initial experiments are underway.

Spatiotemporal vector solitons in nonlinear optical systems with $\chi(3)$ susceptibility

James T Ashley[1], James M. Christian[1], Graham S. McDonald[1], Pedro Chamorro-Posada[2]
[1]University of Salford, United Kingdom; [2]Universidad de Valladolid, Spain; j.christian@salford.ac.uk

A new model is proposed for describing coupled optical waves propagating in a system with linear dispersion (both group-velocity and spatial contributions) and third-order nonlinear susceptibility. The modulational instability problem is solved in full, and its predictions are related to the analysis of new exact analytical vector soliton families.

Slot waveguide based ring resonators for visible and near infrared wavelengths

Matthieu Roussey, Markus Häyrinen, Markku Kuittinen, Seppo Honkanen
University of Eastern Finland, Finland; matthieu.roussey@uef.fi

We demonstrate the first slotted micro-ring resonator in titanium dioxide working at visible wavelengths. This device, with a very small size, was fabricated using atomic layer deposition, which enabled the tuning of the geometrical parameters of the structure.

Second harmonic generation in swift-heavy ion irradiation lithium niobate waveguides. Looking for tunability and efficiency.

Mariano Jubera[1], Mercedes Carrascosa[1], Ángel García-Cabañes[1], Jose Olivares[2]
[1]uam, Spain; [2]CSIC, Spain;
m.carrascosa@uam.es

In this work we address this task reporting second harmonic generation (SHG) experiments from 1.064 nm to 532 nm in two configurations: i) birrefringent ordinary-extraordinary (o-e) with non-critical phase matching and ii) an extraordinary-extraordinary (e-e) using quasi-phase matching. The first configuration allows phase matching for a wide range of wavelengths by thermal tuning, whereas the second process allows achieving maximum conversion efficiency. The possibility of using these two approaches for frequency conversion makes SHI waveguides suitable for a wide range of nonlinear applications.

Polymeric waveguide display and its application

Suntak Park, Seung Koo Park, Bong Je Park, Sungryul Yun, Sae Kwang Nam, Ki-Uk Kyung
Electronics and Telecommunications Research Institute, Korea, Republic of (South Korea); spark@etri.re.kr

We have proposed and demonstrated polymeric optical waveguide based displays which consist of light sources, optical waveguides, and scatters. We have fabricated the waveguide displays like a thin film showing numbers and letters. The developed displays have high flexibility and transparency.

Molecule fluorescence coupled to dielectric waveguides: towards integrated single photon sources

Pietro Ernesto Lombardi[1], Sahrish Rizvi[1], Giacomo Mazzamuto[1], Costanza Toninelli[1,2], Gunter Kewes[3], Max Schongen[4], Oliver Neitzke[3], R.-S. Schönfeld[3], A. W. Schell[3], J. Probst[3], Janik Wolters[3], Oliver Benson[3]
[1]LENS-Università degli Studi di Firenze, Italy; [2]INO-CNR, Istituto Nazionale di Ottica, Largo Fermi 6, 50125 Firenze, Italy; [3]Institut für Physik, Humboldt-Universität, Newtonstrasse 15, 12489 Berlin, Germany; [4]Helmholtz Zentrum zu Berlin, Albert-Einstein-Strasse 15, 12489 Berlin, Germany;
lombardi@lens.unifi.it

We are working on a new kind of solid state single photon source based on organic molecule emitters efficiently coupled to dielectric waveguides. The system under investigation is based on Dibenzoterrylene fluorescent molecules hosted in anthracene crystals, eposited on Si3N4 waveguides. Here we present a first evidence of molecule excitation through light coupled into a waveguide.

Near-field enhancement in large-area Si-photonic crystals

Carlo Barth
Helmholtz-Zentrum Berlin für Materialien und Energie, Germany; carlo.barth@helmholtz-berlin.de

We report on recent results in large-area photonic crystals based on Si which show field enhancements of up to 550. Using nanoimprint-lithography, such nanohole arrays can be fabricated fast and inexpensively - reaching dimensions of 5 x 5 cm² - and are thus interesting for many fields such as spectral conversion and biosensing.

Analysis of deformation of the working surface of the mirror depending on the type of lightweight design

Michael YU. Neutov, Nadezhda D. Tolstoba, Polina A. Abdula
ITMO University, Russian Federation; nadinet@mail.ru

At the present time, developers of space telescopes seek to increase the aperture defined, primarily, by diameter of primary mirror. An important issue in this case, determining not only the cost but also the possibility of creating of a telescope becomes mass reduction of the primary mirror, while maintaining a high quality form of its surface. One solution to this problem is to create rigid passive mirrors, which do not require control over the shape of its surface. It is, of course, lightweighted mirrors.
In this paper modeling and comparative study of the basic structures to facilitate mirrors was made, taking into account the use of materials that meet the requirements for the creation of large mirrors.

Set-up Modeling for Recording of Fiber Optic Bragg Gratings

Andrey Kulikov, Galina Romanova, Anna Voznesenskaya
St.Petersburg National Research University of Information Technologies, Mechanics and Optics, Russian Federation; voznesenskaya@mail.ifmo.ru

Interferometric scheme for recording of Bragg diffractive structures in optical fibers using Talbot interferometer is considered and analyzed

Research on the column channel gain non-uniformity of simulate detector

Honglie Xu, Qian Chen, Chunhua Yang
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xhl1192008@hotmail.com

In the ideal case, each column of the infrared detector should have the same gain, assumed that the response to the blackbody radiation of the same temperature are equal for each pixel. In practice, due to the defects of the production process and the material components of the focal plane array, the response of each pixel is not identical, meanwhile the channel gain of each column is not the same. In this paper, we mainly did the research on the column channel gain non-uniformity, deduced the model of the polynomial curve simulate detector with column channel gain non-uniformity1-4), and did the precision analysis of the fitting curve，where a hypothesis testing method is used to verify whether the polynomial model is fit for the column gain of actual detector in global. Finally, we achieve a good simulation to the gain non-uniformity of each column.

DEVELOPMENT OF SOLAR RADIATION SIMULATORS FOR THERMAL VACUUM TESTS

Marina Letunovskaya, Irina Livshits, Anton Filatov
ITMO University, Russian Federation; mletunovskaya@gmail.com

Article provides an overview of solar radiation simulators (SRS) based on the principle of summation of light streams from an array of gas discharge lamps. Current trends of stands for the ground experimental testing of spacecraft using solar radiation simulators are analyzed as well

Analysis of influence of the central screening at the entrance pupil on the optical systems modulation transfer function

Kseniia Ezhova, Victor Zverev
University ITMO, Russian Federation; katty2@mail.ru

The influence of the central screening pupil coefficient on image quality system are considered. Dependence of the residual wavefront aberration coefficient from the central screening are showed

Investigation On Ground To Train FSO Based Communication

Hamsa Gamal Abdelazim Ahmed, Nour El Din El Madany El Madany, Ahmed Abd Aziz Shalaby Shalaby
Arab Academy for Science Technology and Maritime Trabsport, Egypt; massygamal@gmail.com

Abstract— There is a need for a promising seamless communication for ground to train communication. In this paper we present an valuation of free space optical (FSO) link for ground to train high-speed optical transmission. We enhanced the performance of the system by selecting the optimum modulation technique, wavelength light source and photodetector to improve the quality of service for the passengers. The proposed FSO link for ground to train high speed optical transmission showed a better performance than other existing systems. The use of such proposed parameters lead to cost reduction as the number of transceivers and base stations are reduced.

Simulation of good white LED light

Sebastian Linke, René Hegel, Oliver Esser, Adrian Mahlkow
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Good quality light is measured with respect to Planckian black-body distributions. One indicator of light quality is the colour rendering index (Ra). Single phosphorous converted white LEDs, with Ra values of typical 85, show rather poor similarities with a Planckian spectral power distribution. To receive a more Planckian spectrum characteristic the use of a sum-spectrum of different colour-LEDs would be beneficial. The advantage of a multiple LED solution is the easy adjustment of the colour coordinate and the correlated colour temperature, the Planckian spectral energy distribution and a more natural colour rendering compared to single phosphorus converted white LEDs.

Optical schemes of spectrographs with a diffractive optical element in a converging beam

Eduard R. Muslimov, Nadezhda K. Pavlycheva
Kazan National Research Technical University, Russian Federation; eduard.r.muslimov@gmail.com

Optical schemes of spectrographs based on transmission concave holographic gratings working in converging beams are considered. It's shown that combination of such element with a spherical wedge allows to create a spectrograph with correction of astigmatism and a variable-dispersion spectrograph.

Imaging of tumorous human brain tissues with multiphoton microscopy

Gael Latour[1], Aurélie William[1], Charles-Henri Andrieu[1], Bertrand Devaux[2], Frédéric Pain[1], Pascale Varlet[2]
[1]Universite Paris Sud, Laboratoire Imagerie et Modélisation en Neurobiologie et Cancérologie, Orsay, France; [2]Centre hospitalier Sainte Anne, Université Paris Descartes, Paris, France; gael.latour@u-psud.fr

To diagnosis human tumorous brain tissue, histological and immunohistochemical analyses remain the gold standard. However, the different preparation steps of the tissue are time-consuming and the analysis of the tissue is generally several days after the surgery. The use of optical technique without any preparation (slicing, staining…) that can give subcellular images appears as a promising alternative. We compared multiphoton imaging to histology in order to determine what type of structures and organizations can be characterized with this novel approach. Fresh tissues were collected immediately after resection in the hospital and were imaged within five hours. The aim was to observe intrinsic signals without any contrast agents. After imaging, the tissue was fixed in formaldehyde and was processed to obtain the histological section for comparison.

Images from the same tissues were similar. The 3D characterization of tumor cells and extracellular organization could be a precious additional tool to histology.

Calculation of dielectrophoretic potential generated under illumination patterns on x- and z-cut LiNbO3; application to photovoltaic particle trapping

Cándido Arregui[1], J.Bruno Ramiro[1], Angel Alcazar[1], Angel Méndez[1], Juan Francisco Muñoz[1], Mercedes Carrascosa[2]
[1]Universidad Politécnica de Madrid, Spain; [2]Universidad Autónoma de Madrid, Spain; a.alcazar@upm.es

The dielectrophoretic potential generated near the surface of a z-cut LiNbO3 by photovoltaic charge transport has been calculated for first time. The procedure and results are compared with the ones corresponding to x-cut. Diferences in the position, sharpness and time evolution are reported, and their implication on particle trapping are discussed.

Competition of sub-bandgap absorption mechanisms in commercial GaAs photodiodes

Benjamin VEST[1], Julien JAECK[1], Riad HAÏDAR[1,2], Emmanuel ROSENCHER[1,2]
[1]ONERA - The French Aerospace Lab, France; [2]Ecole Polytechnique, Département de Physique; benjamin.vest@onera.fr

We investigate the response of a commercial p-i-n GaAs photodiode to sub-bandgap energy. We describe the competition between single-photon absorption mechanisms and two-photon absorption at 1.55µm, meaning well below the gallium arsenide bandgap (875nm).

Design and synthesis of zero–zero-birefringence polymer using N-phenylmaleimide

Shotaro Beppu[1,2], Shihei Iwasaki[1,2], Houran Shafiee[1,2], Akihiro Tagaya[1,2], Yasuhiro Koike[1,2]
[1]Keio University, Japan; [2]Keio Photonics Research Institute, Japan; shotaro-b@z2.keio.jp

Zero–zero-birefringence polymers which exhibit no orientational birefringence and no photoelastic birefringence would be suitable candidates for the components of optical devices. In order to develop zero–zero-birefringence polymers, we investigated two types of birefringence of poly(N-phenylmaleimide) (PPhMI) and showed that PPhMI exhibits positive orientational and photoelastic birefringence. Based on the results, we proposed the copolymerization system consisting of methyl methacrylate (MMA), N-methylmaleimide (MeMI), and PhMI and calculated the optimal composition for compensating both types of birefringence. When the copolymer compositions were optimized, zero–zero-birefringence polymers were obtained. We also evaluated transparency, and heat resistance of the copolymer.

Ellipsometric revelation of the effective light polarization in 3-dimensional photonic crystals

Oleksandr Zhuromskyy, Sergei G. Romanov, Ulf Peschel
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Effective polarization of eigenmodes and critical angle of diffraction of light in 3-dimensional opal photonic crystals have been investigated by means of spectroscopic ellipsometry of linear and circular polarized light.

High efficiency photonic hierarchical nanostructures self-assembled from the gas phase

Luca Passoni[1,2], Lugino Criante[1], Francesco Fumagalli[1], Francesco Scotognella[1,2], Guglielmo Lanzani[1,2], Fabio Di Fonzo[1]
[1]Italian Institute of Technology, Italy; [2]Politecnico di Milano, Dip. Fisica, Italy; luca.passoni@iit.it

The increasing awareness of industries in the commercial opportunities given by nanotechnology is driving the research and development of novel material designs with cutting edge functionalities. Nature, with several billion year of R&D, has often been taken as example to derive smart solution to engineering problems. In the field of optics the natural world molds the flow of light with wide variety of nanometer scale modulations of materials properties, like porosity and morphology (e.g. cuticle of the beetles, butterfly wings or mother of pearls). Being able to mimic these strategies with added high-tech functionalities would open up a broad array of applications. Existing fabrication techniques of porous photonic architectures severely limit their exploitation. Here we report on photonic hierarchical nanostructures obtained by self-assembly from the gas-phase at low temperature. Periodic refractive index modulation is achieved by stacking layers with different nano-architectures. Fine control over material density and porosity allows the fabrication of high efficiency (R(λ) > 85%) single material photonic crystal with tuneable Bragg-diffraction peak. The fabrication of high efficiency broad band dielectric mirrors (R≈1 over the whole visible spectrum) on glass and flexible substrates, opto-fluidic switches and matrix of photonic crystal pixels with feature size < 10 micron is demonstrated. Porous photonic crystals fabricated with conductive, semiconductor and insulating materials are shown to withstand temperature (>500°C) common in silicon platform. This new technique is demonstrated to be a promising route for filtering, optical-sensing, electro-optical modulation, light harvesting energy devices and photocatalysis applications.

Low loss hybrid plasmonic slow light waveguide

Wenfu Zhang, Lingxuan Zhang, Wei Zhao
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Slow-light in plasmonic waveguide promotes stronger light–matter interaction and offers additional control over light in sub-wavelength structures. Periodical metal-dielectric-metal (M-D-M) structures have been proposed to realize plasmonic slow-light guiding, however, suffer from high power loss. A hybrid plasmonic structure is introduced to achieve low-loss slow-light guiding in sub-wavelength scale. Theoretical calculating results show that the proposed structure has tenfold transmission length comparing with the M-D-M structure at the same slow down factor. It has potential applications in optical signal processing in future ultra-compact integrated circuit.

Use of gold nanorings for field enhancement

Anni Partanen[1], Markus Erola[2], Hanna Lajunen[1], Sari Suvanto[2], Tuula Pakkanen[2], Markku Kuittinen[1]
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In this work gold nanorings were studied. The electric field was calculated with Fourier modal method in the visible spectrum to study the enhancement of electric field in the gold nanoring layer.

Tunable 1x3 Photonic Crystal Beam Splitter Based on Self-Collimation

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A 1x3 photonic crystal beam splitter based on self-collimation phenomenon is demonstrated for a proper width of the L-shaped air gap. By modulating voltage, the beam splitter can be operated in a large bandwidth or switched on and off.

The Van Cittert-Zernike theorem for Plasmon fields

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We describe the local and global structure of the electromagnetic field in free space by analyzing its partial coherence features. The analysis can be transferred to plasmon fields obtaining a matrix representation whose components correspond with the generalized Van Cittert-Zernike theorem.

Single interfaces and coupled-waveguide arrays: off-axis nonparaxial analyses

Emily A. McCoy[1], James M. Christian[1], Graham S. McDonald[1], Julio Sánchez-Curto[2], Pedro Chamorro-Posada[2]
[1]University of Salford, United Kingdom; [2]Universidad de Valladolid, Spain;
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We report on our most recent results concerning arbitrary-angle spatial soliton refraction at the interface between dissimilar dielectrics, each of which comprises both third-order and fifth-order nonlinear susceptibilities. Attention is also paid to the oblique injection of spatial solitons into optical structures with a periodically-patterned refractive index.

Photonics of cyanine dye molecules in the presence of plasmonic Ag nanoparticles

Anton Starovoytov, Nikita Toropov
ITMO University, Russian Federation; anton.starovoytov@gmail.com

Hybrid nanostructures based on organic dyes placed in the near field of metal nanoparticles are promising technique for spaser. In our work we investigated layers of fluorescence cyanine molecules in the presence of plasmonic silver particles.
Sample was prepared in two stages. Nanogranular silver film was obtained by vacuum deposition, then the layer of cyanine dye was spin-coated over the film. The resulting hybrid film had been studied using the spectrophotometer SF-56, the laser scanning confocal microscope LSM 710, and the spectrofluorophotometer RF-5301PC.

Optically induced two-dimensional aperiodic Vogel spirals

Falko Diebel, Patrick Rose, Martin Boguslawski, Cornelia Denz
Westfälische Wilhelms-Universität Münster, Germany; falko.diebel@uni-muenster.de

We present an experimental technique to realize two-dimensional aperiodic photonic lattices. Our approach utilizes multiplexing of well-localized zero-order nondiffracting Bessel beams for optical induction. As a comprehensive example we demonstrate the fabrication of a two-dimensional aperiodic golden angle Vogel spiral.

On the spatial range of dielectrophoretic forces induced by the bulk photovoltaic effect on micro- and nanoparticles

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An experimental study of the spatial range of dielectrophoretic forces used to ma-nipulate particles with the so called PV tweezers is developed and compared with theory. The results corroborate theoretical predictions that indicate a spatial range about 20 times smaller than the periodicities of light pattern illumination.

Minimizing the effect of near-distance dielectric sensitivity on retrieving average aspect ratio of gold nanorod by optical extinction spectroscopy: in the case of CTAB adsorption

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Minimizing the effect of near-distance dielectric sensitivity on retrieving average aspect ratio of gold nanorod by optical extinction spectroscopy: in the case of CTAB adsorption
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The optical extinction spectroscopy method (OES) has been developed for allowing fast statistically measuring the average aspect ratio (AR) under static approximation. We further analyze the effects of gold dielectric function and near distance dielectric sensitivity on the determination of AR in OES method.

Numerical method to study metamaterial composites in higher dimension

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Metamaterial photonic crystals (MPC) composed of dispersive left-handed materials and right-handed medium were investigated numerically[1-3]. Extended plane-wave expansion (EPWE) method is developed, which is a suitable technique to analyze the electromagnetic properties of any dispersive metamaterial composites numerically. The application of the EPWE method to three-dimensional (3D) MPC has been also discussed.

Optical Design for Combining, Homogenizing and Shaping Beams from Multiple Lasers using a Waveguide for 3D Display

Hadi Baghsiahi[1], Sally Day[1], Phil Surman[2], David Selviah[1]
[1]University College London, United Kingdom; [2]Nanyang Technology University of Singapore

Optical waveguides are considered and investigated for laser beam combining and colour homogenization in laser based display systems. The simulation and experimental results using an optical waveguides in the light engine of an auto-stereoscopic 3D display based on RGB laser projection are presented. In this paper the system of a glass free 3D laser display system is explained and the results for beam shaping, colour homogenising and speckle reduction using optical waveguide is in the light engine is presented.

The Luminescence Quantum Efficiency of a Strong-Coupled Organic Microcavity

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Strong-coupling has been achieved in a series of microcavities containing a Bromine substituted boron-dipyrromethene molecular dye (BODIPY-Br). Photoluminescence (PL) spectroscopy following non-resonant photo-excitation has been used to map the polariton population distribution and fluorescence quantum yield (QY) as a function of exciton-photon detuning.

Polariton Induced Enhanced Emission from an Organic Dye under Strong Coupling Regime

Armando Genco[1,3], Dario Ballarini[2], Milena De Giorgi[2], Salvatore Gambino[2,3], Giovanni Lerario[2,3], Marco Mazzeo[1,2], Gianluca Accorsi[2], Carlo Giansante[2,3], Silvia Colella[2], Stefania D'agostino[3], Paolo Cazzato[2], Daniele Sanvitto[2], Giuseppe Gigli[1,2]
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Exciton-polaritons in semiconductors are quasi-particles which have recentlyshown the capability to undergo phase transition into a coherent hybrid state of light and matter. The observation of such quasi-particles in organic microcavities has attracted increasing attention for their characteristic of reaching condensation at room temperature. In this work we demonstrate that the emission dynamics are modified in the strong coupling regime due to the formation of new eigenstates of the system, allowing the circumvention of non-radiative decay channels and leading to a significant enhancement of the photoluminescence intensity as compared to the bare dye.

Room Temperature Bloch Surface Wave Polaritons

Maddalena Patrini[1], Stefano Pirotta[1], Marco Liscidini[1], Matteo Galli[1], Giacomo Dacarro[1], Giancarlo Canazza[2], Giorgio Guizzetti[1], Davide Comoretto[2], Daniele Bajoni[3]
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We demonstrate strong coupling between Bloch surface waves in a Ta_2O_5/SiO_2 multilayer and J-aggregate excitons. The mode dispersion curves are investigated by means of attenuated total reflection and photoluminescence experiments. The measured Rabi splitting is 290 meV, in agreement to our theoretical model.

Amplified spontaneous emission in conjugated polyrotaxanes under quasi-CW excitation

Marta M. Mroz[1,5], Giuseppe Sforazzini[2], Yongchun Zhong[3], Kam Sing Wong[3], Harry L. Anderson[2], Guglielmo Lanzani[4], Juan Cabanillas-Gonzalez[5]
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A combined spectroscopy study and amplified spontaneous emission (ASE) characterization of a rotaxinated conjugated polymer is presented. We show that optical amplification over a bandwidth of more than 30 nm and ASE under quasi-cw laser pumping can be achieved in supramoleculary encapsulated polymer film.

Luminescent micro/nano-structures by functionalization of nanostructured biosilica from Thalassiosira weissflogii diatom

Danilo Vona[1], Stefania R. Cicco[2], Roberta Ragni[1], Vita Pinto[1], Gianluca M. Farinola[1]
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Functionalization of nanostructured biosilica from diatoms microalgae by in vivo and/or in vitro methods produces luminescent micro/nano-structures and multifunctional hybrid materials for applications in photonics and biology.

Field Assisted Modulation of Optical Properties in F8BT

Luca Moretti[1], Luigino Criante[2], Guglielmo Lanzani[2], Giulio Cerullo[1], Francesco Scotognella[1]
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We present a spectroscopic study on a novel blend of F8BT and 5CB. By applying an external electric field the optical behaviour of the active material is actively changed, resulting in a modulation of the stimulated emission. Such field-induced stimulated emission modulation could be very interesting for lasing and information and communication technology.

Improved detection of explosives with polyfluorene fluorescence sensors by control of β-phase

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We report an enhancement of the sensitivity to the explosives vapours of polyfluorene fluorescence sensors due to the content of the beta phase in the sensing film. We show how the fabrication conditions can be optimised to maximise sensitivity.

Solution Processing of Organic Photovoltaic Devices Using Non-Halogenated Solvents

Jonathan Griffin[1], Andrew J Pearson[1], Nicholas W Scarratt[1], Hunan Yi[2], Ahmed Iraqi[2], Alastair R Buckley[1], David G Lidzey[1]
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The solution based fabrication of organic photovoltaic devices (OPVs) using non-halogenated solvents is a necessary step towards commercialisation. In this work we present a non-halogenated solvent blend based on a mixture of carbon disulfide and acetone. This solvent blend was then used to deposit a donor-acceptor polymer – fullerene thin-film that was then used as the active layer of bulk-heterojunction OPV. For the benchmark polymer:fullerene system PCDTBT:PC70BM, a power conversion efficiency (PCE) over 6.7% was achieved; a relative increase of 20% in comparison to reference cells cast from chlorobenzene. Improvements in device efficiency are attributed to an increase in electron and hole conductivity resulting from enhanced fullerene crystallisation; a property that leads to enhanced device efficiency through improved charge extraction.

All-polymer microcavities

Serena Gazzo, Giovanni Manfredi, Robert Knarr, Francesco Campanella, Rosasilvia Raggio, Marina Alloisio, Davide Comoretto
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We report on the growth, optical properties and photonic applications of all-polymer one-dimensional photonic crystals. When such free-standing and flexible structures (both Distributed Bragg Reflectors or microcavities) are doped with photoactive materials (fluorescent and photochromic polymers, J-aggregates, plasmonic nanostructures) and used to prepare laser, optical modulators and sensors.

Organic Flexible Photonic Structures for Amplified Light Emission

Maddalena Patrini[1], Lucia Fornasari[1], Francesco Floris[1], Giancarlo Canazza[2], Giorgio Guizzetti[1], Davide Comoretto[2], Franco Marabelli[1]
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We demonstrate photoluminescence excitation enhancement in all-polymer flexible 1D photonic crystal structures capped with a fluorescent organic ultrathin film. The effect is due to optical matching conditions between the excitation beam and the Bloch surface wave mode supported by the photonic structure.

Neutron Radiation Tolerance of Organic Field-Effect Transistors

Giuseppe Maria Paternò[1], Valentina Robbiano[1], Victoria Garcia-Sakai[2], Franco Cacialli[1]
[1]London Centre for Nanotechnology, Department of Physics and Astronomy, University College London, Gower Street, London WC1E 6BT, UK; [2]ISIS Pulsed Neutron and Muon Source, Science and Technology Facilities Council, Rutherford Appleton Laboratory, Harwell Science and Innovation Campus, Didcot OX11 0QX, UK; g.paterno.11@ucl.ac.uk
We report a study of the effect of fast neutron irradiation on organic field-effect transistors, in order to mimic the effect of the cosmic rays on this class of devices. We monitored the changes in field-effect mobility of two conjugated polymers namely poly (3-hexylthiophene)[P3HT] and poly(2,5-bis(3-hexadecylthiophen-2-yl)thieno[3,2 b] thiophene)[PBTTT] before and after fast neutron irradiation.

Exciton Diffusion Length of P3HT Determined by GaAs Quencher

Jun Yin, Manoj Kumar, Lin Ma, Raavi Sai Santosh Kumar, Gagik G. Gurzadyan, Cesare Soci

Division of Physics and Applied Physics, School of Physical and Mathematical Sciences, Nanyang Technological University, 21 Nanyang Link, Singapore 637371; jyin002@e.ntu.edu.sg

In hybrid polymer/inorganic solar cells, photogenerated excitons (strongly bound electron-hole pairs) diffuse to the hybrid heterointerfaces and dissociate into free carriers. This is one of most important photophysical processes affecting device performance. According to our previous studies, III-V semicondutor GaAs (111B) is an ideal exciton quencher and electron acceptor. Here we make use of P3HT/GaAs heterostructures to determine fundamental parameters of P3HT low bandgap polymer, such as the exciton diffusion length. The exciton quenching dynamics and the yield of charge pair generation in P3HT was studied in thin films with different thickness by time-resolved photoluminescence measurements.

Photonic crystals containing poly (phenylene-oxide)

Paola Rizzo

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1D polymer photonic crystals, based on of poly(phenylene-oxide)(PPO), both in amorphous and clathrate crystalline phases, have been prepared. The high uptake of guest molecules into void cavities of PPO should assure a variation of the film refractive index and hence a change in the optical response of the photonic crystal.

Morphological and optical characterization of CuO

Daniele CORTECCHIA[1], Diana Gisell Figueroa del Valle[2], Ilka KRIEGEL[2], Tingchao HE[3], Jun YIN[3], Majid PANAHANDEH-FARD[3], Manoj KUMAR[3], Handong SUN[3], Francesco SCOTOGNELLA[2], Cesare SOCI[3]

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Among the metal oxide semiconductors copper oxide (CuO) is an interesting material for the production of photoelectrochemical (PEC) and solar cells. We determine morphology and composition of the CuO films by SEM, AFM and XRD and study their optical and transport properties by UV-Vis, photoluminescence, and photocurrent spectroscopy.

Study on the transient absorption of CuO/ZnO thin film heterojunction

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Due to its stability and to its wide absorption spectrum in the visible copper oxide (CuO) can be considered to be used in the production of low cost solar cells. In the literature, CuO/ZnO heterojunction devices are reported, but they suffer from extremely low efficiency. We proposed the study the CuO/ZnO heterojunction by femtosecond transient absorption, in order to comprehend the photophysical processes occurring in the junction.

Nanometric layer thickness detection via spatial mode projection

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The search for new optical methods to measure thickness in the range of a few hundred picometers is a topic of great interest. This is driven not only by the stringent requirements of nanofabrication but also to complement and/or substitute some well-established techniques. In this work, we put forward a novel way to analyze layer thickness by measuring the shape of the light reflected from the sample under investigation. The key point of our approach is to project the reflected light onto a convenient ensemble of spatial modes (spatial mode projection) which are determined by some a priori available information about the sample.

Predictable Quantum Efficient Detector

Meelis-Mait Sildoja[1], Timo Dönsberg[1,2], Farshid Manoocheri[1,2], Mikko Merimaa[2], Erkki Ikonen[1,2]

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We present the design and measurement results of a Predictable Quantum Efficient Detector (PQED), suggested to be capable of measuring optical power with an uncertainty down to 1 ppm. The detector is based on custom-made induced junction photodiodes operated at either low or room temperature using a reverse bias mode. A constructed test PQED was compared with a cryogenic radiometer at the temperatures of 78 K and 300 K with reverse bias of -5 V. Our preliminary results show that the quantum efficiency of the PQED both at room temperature and low temperature is unity with uncertainty of 100 ppm.

Expanded beam spectroscopic ellipsometry for big area on-line monitoring

Miklos Fried[1], Csaba Major[1], Gyorgy Juhasz[1], Peter Petrik[1], Zoltan Horvath[2]

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Non-destructive analyzing tools are needed at all stages of thin film process-development, especially photovoltaic (PV) development, and on production lines. In the case of thin films, layer thicknesses, microstructure, composition, layer optical properties, and their uniformity are important parameters. An important focus is to express the dielectric functions of each component material in terms of a handful of wavelength independent parameters whose variation can cover all process variants of that material. With the resulting database, spectroscopic ellipsometry coupled with multilayer analysis can be developed for on-line point-by-point mapping and on-line line-by-line imaging.

On machine contamination control of polishing processes

Oliver Faehnle[1], Frank Zygalsky[1], Eckhard Langenbach[1], Franco Weimer[2], Michael Kahl[2], Andreas Ettemeyer[2]
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Light scattering from within a sample at a surface under test enables in situ, on machine, monitoring of surface roughness levels during polishing. Surface roughness levels of 0.6 nm rms have been detected. In addition, its capability to function as in process contamination control of industrial polishing processes has been demonstrated.

Thermal diffusivity measured with a single nanoparticle

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The transport of heat is of high technological importance and intrinsically difficult to control due to its diffusive nature. Recently, numerous schemes have been proposed and implemented that manipulate the flow thermal energy. But there is currently a lack of techniques that probe thermal transport properties on small length scales and inside a medium. We use a single nanoparticle that dissipates its optical excitation as heat to study thermal transport on small length scales. We show that a single nanoparticle combined with optical control is well suited to measure thermal diffusivities in liquids and solids.

Calibration-free self-absorption model for measuring nitric oxide concentration in a pulsed corona discharge

Yanjun Du, Zhimin Peng, Yanjun Ding
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The effect of self-absorption on emission intensity distributions can be used for species concentration measurements. A calculation model is developed based on the Beer-Lambert law to quantify this effect. A calibration-free measurement method is then proposed by establishing the relationship between gas concentration and absorption strength. The effect of collision parameters and rotational temperature on the method is also discussed. The proposed method is verified by investigating the nitric oxide emission bands (A2∑+→X2∏) generated by a pulsed corona discharge The satisfactory agreement between the predicted and theoretical values indicates the precision and accuracy of the model.

Two-wavelength method for measurement of relative optical phase shifts

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The optical phase shift in reflection or transmission is of great interest in characterizing a material or multilayer stack but cannot generally be measured directly using a macroscopic apparatus. Using two optical frequencies from a SHG laser, the relative phase phi_2 - 2*phi_1 is directly measured interferometrically using heterodyne detection. The technique can be employed as a function of incidence angle complementary to standard ellipsometry, but also works at normal incidence. The same setup can simultaneously track small nonuniformities in the surface height interferometrically, making it attractive as a process-control scanner for surface monitoring of 3 reflection parameters plus surface relief.

Characterisation of a balanced, double-sided, heterodyne interferometer for picometer-level dimensional stability metrology

Arthur Siewert van de Nes
VSL Dutch Metrology Insitute, Netherlands, The; AvandeNes@vsl.nl
The full characterisation and a selection of measurements of drift at the picometer range using a balanced, double-sided, heterodyne interferometer operating in air is presented. The achieved performance ranges from less than 15 pm at a timescale of minutes to less than 100 pm over several hours.

Spatial and Temporal Resolutions Pixel level Performance Analysis of the Onboard Remote Sensing Electro-Optical Systems for Nadir and Oblique Photography

Hany Mohammed El-sheikh, Yuri Yakushenkov Grigorievich
Moscow State University of Geodesy and Cartography, Russian Federation; yakush@miigaik.ru
The determination of the spatial and temporal resolutions of the onboard remote sensing electro-optical system is offered for a variety of scene viewing modes. The resolutions may be compared with the design parameters of the modern electro-optical systems (EOS) as well as the EOS user's requirements.

Mid-IR laser system based on difference frequency mixing for precision spectroscopy measurement of the hyperfine splitting of the muounic-hydrogen

Lyubomir Stoychev[1,2], Miltcho Danailov[3], Alexander Demidovich[3], Ivaylo Nikolov[3], Paolo Cinquegrana[3], Paolo Sigalotti[3], Dimitar Bakalov[4], Roberta Ramponi[5], Komlan Gadedjisso-Tossou[1,2], Andrea Vacchi[1]
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Laser system emitting infrared radiation in the spectral range 6.78 μm based on direct difference frequency generation in LiInS2 nonlinear crystal using single-mode Nd:YAG laser and tunable Cr:forsterite laser is developed for the measuring of the hyperfine splitting of the muonic-hydrogen.

Using Spherical Geodesic Waveguide (SGW) for sub-wavelength displacement sensing

Hamed Ahmadpanahi[1], Dejan Grabovičkić[2], Juan Carlos González[2], Pablo Benítez[2], Juan Carlos Miñano[2]
[1]TUDelft, Netherlands, The; [2]CEDINT, Universidad Politecnica de Madrid, Madrid, Spain; S.H.Ahmadpanahi@tudelft.nl
The Spherical Geodesic Waveguide (SGW) consist of two concentric spherical surfaces which is filled with silicon (refractive index 3.48).We use two silicon probes as a source and detector. When the SGW is excited using a very specific wavelength (notch wavelength) the system can detect a very tiny displacement. We implement this system in COMSOL and measure the sensitivity of the system to lateral displacement. The notch wavelength falls approximately around 1.624μm (in vacuum). Our results show that for SGW with no dispersion and no losses our receiver can sense a displacement as small as 8 nm using a wavelength of 1.624μm (in vacuum).

Future Instrumentation Trends in SE with integrated metrology (IMT).

Frederic FERRIEU
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IMT technology provides a better SE system fiability and introduces new capabilities when using new models and real time parallel computing. Different perspective can then be seen considering how to build an instrument incorporating all of this as being a global compound for a microscope. The trend is to deliver more than which is normally achieved with conventional SE systems.

Measurement of Power Loss on Core Materials by Holografic Interferometry

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Bülent Ecevit University, Turkey; ufuksan@beun.edu.tr
Power loss occurred on core materials due to magnetic force effect was measured by holographic interferometry method with using Fourier Transform Algorithm. Power loss was measured firstly by optical metrology in this study.

TOM 10 poster session — Wednesday, 17 September 12:45-14:45

Controlled multi-beam white-light generation in fused silica with a spatial light modulator

Rocío Borreo-Varillas[1,2], Jorge Perez-Vizcaino[1], Omel Mendoza-Yero[1], Gladys Mínguez-Vega[1], Javier R. Vázquez de Aldana[2], Jesus Lancis[1]
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We report on deterministic femtosecond multi-filamentation in fused silica by encoding a diffractive microlens array into a spatial light modulator. Controlled multi-filamentation patterns and tunable spectra are achieved for an input inhomogeneous irradiance distribution.

Characterization of diffractive optical elements using scatterometric data

Toni Saastamoinen[1], Hannu Husu[2], Janne Laukkanen[1], Samuli Siitonen[3], Antti Lassila[2], Jari Turunen[1]
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In this work we have determined the structural parameters of diffractive optical elements using diffraction efficiency data measured by scatterometer. The parameters are compared to the corresponding parameters obtained by SEM and AFM measurements.

Modelling ultra-short image sequence recording by digital holography

Haofeng Hu[1], Zhonghong Ma[2], Yong Yang[2], Hongchen Zhai[2], Pierre Chavel[3]
[1]Tianjin University, College of Precision Instrument and Optoelectronics Engineering, Tianjin, 300072, China; [2]Nankai University, Institute of Modern Optics, Tianjin, 300071, China; [3]Laboratoire Charles Fabry, Institut d'Optique, CNRS, Univ Paris Sud, F 91127 Palaiseau; pierre.chavel@institutoptique.fr
Angular spatial multiplexing combined with delay lines allows recording digital hologram sequences from a single femtosecond pulse. We investigate limiting factors that arise from setup complexity and image sensor characteristics and conclude that “video” sequences consisting of tens of frames are within reach.

Proximity correction of arbitrary diffractive structures for direct laser writing using deconvolution

Jan Beneke[1,2], Christof Pruss[1,2], Frederik Schaal[1,2], Wolfgang Osten[1,2]
[1]Institut für Technische Optik, Universität Stuttgart, Pfaffenwaldring 9, 70569 Stuttgart; [2]Stuttgart Research Center of Photonic Engineering (SCoPE), Pfaffenwaldring 9, 70569 Stuttgart; beneke@ito.uni-stuttgart.de
A new optimization technique for diffractive structures, fabricated using maskless laser direct writing grayscale lithography, is introduced. This study proposes an universally applicable deconvolution based algorithm, that allows to improve the diffraction efficiency of arbitrary grayscale structures by more than 5%.

Beam shaping with cross-zoned diffractive optical elements

Michael A. Golub
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Capabilities of beam shaping with diffractive optics are substantially improved by a concept of crossed zones. We generalized the map transformation design of beam shapers by additional set of diffractive zone borders orthogonal to phase isolines. Computer simulation results confirm flexibility of the proposed approach.

Interference of laser beams with different OAMs

Maxime Favier[1], Sergei Popov[2]
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Spatial modulation of laser beam phase with a helix profile allows creating the intensity pattern with a dark spot in the center of beam cross-section. Such waves known as vortex beams, or beams carrying orbital angular momentum (OAM), have a sharp intensity gradient in the central part and find different applications, e.g., manipulating small particles (optical tweezers), free-space communication, and others. The spatial phase pitch along the beam axis defines the order of OAM. OAM beams are generated by the use of phase retardation plates implementing continuous azimuthal phase modulation where the number of integer 2pi rotations corresponds to the order of OAM. Making two beams carrying different OAMs to interfere with each other, it is possible to shift a zero-intensity area away from the beam center.

Comparison of different methods for characterization of diffractive optical elements

Hannu Husu[1], Poul Erik Hansen[2], Toni Saastamoinen[3], Janne Laukkanen[3], Juuso T Korhonen[4], Janne Ruokolainen[4], Samuli Siitonen[5], Jari Turunen[3], Antti Lassila[1]
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The operation of diffractive optical elements in real applications is really sensitive to their nanoscale structure. Measuring accurately such structures sets remarkable challenges for the measurement technologies. In this Paper several different methods for obtaining the structure parameters are compared.

F2-Laser Microfabrication of Diffractive Phase Elements

Michael Pfeifer, Falko Jahn, Alexander Kratsch, Bernhard Steiger, Steffen Weißmantel
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Fluorine laser microfabrication provides an effective alternative to lithography techniques for direct structuring of diffractive phase elements. These elements are used as beam shapers for the wide wavelength range from 248 to 1100 nm. An improvement of the diffraction image quality of the DPEs is possible by CO2 laser smoothing.

Novel approach to improving period measurement of gratings with multiple diffraction orders

Hiroyuki Ichikawa, Tomohiro Toda
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Determining the period of a grating generating multiple diffraction orders from the data of diffraction angle measurement is not actually an easy task mainly because of positioning error. We propose a novel technique, i.e. numerically adjusting specimen position, to solve the problem.

Randomness effects on the diffraction by ripples on metal surfaces generated by short laser pulses

Dengfeng Kuang[1,2], Mathieu Hebert[1], Maxime Mallet[1], Jean-Paul Hugonin[3], Mondher Besbes[3], Benjamin Dusser[4], Sébastien Landon[4], Pierre Chavel[1,3]
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Ripples created by short, intense laser irradiation of metallic surfaces are an interesting laser-matter interaction effect. In addition, their diffraction offers colors that are similar to those of diffraction gratings, but ripples are quasi-periodic rather than periodic. We develop a model to investigate the effect of disorder on the observed diffracted spectra.

Transverse linear momentum in optical beams with orbital angular momentum

Job Mendoza-Hernández[1], Maximino Luis Arroyo Carrasco[1], Marcela Maribel Méndez Otero[1], Marcelo David Iturbe Castillo[2], Sabino Chávez-Cerda[2]
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We investigate the relation between radial position and tangential energy circulation in beams with rotating wave front when they are partially obstructed. We show that high order Bessel and parabolic beams present the same relation as that of a particle in a central force.

Polarisation properties of planar cylinder arrays

Hiroyuki Ichikawa
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Optical properties of one-dimensional planar cylinder arrays have been investigated in detail, in particular assuming applications to biosensing such as optical coherence tomography.

Intracavity tilted volume grating: spatial and spectral filtering

Lamis Al Sheikh[1,3], Florian F.L. Bentivegna[1,3], Yann G. Boucher[2,3]
[1]CNRS, UMR 6285 Lab-STICC-MOM-MF, Brest, France; [2]CNRS, UMR 6082 FOTON-Systèmes Photoniques, Lannion, France; [3]École Nationale d'Ingénieurs de Brest (ÉNIB), Brest, France; fb@enib.fr
The spectral and angular responses of a slanted, thick holographic grating inserted in a resonant cavity are investigated within the frame of the coupled-mode theory.

Topological evolution of the optical focusing regions

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We describe the structure topological of the Optical field in the neighborhood of focusing regions. The study is performed by analyzing the Dupin indicatrix which allows to characterized the nature of the phase function. Experimental results are shown.

Notes:

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