Leaky nanoresonator modes: their nature, computation & applications

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Abstract

Because they enhance and localize fields, nanoresonators are key elements for controlling light in modern optics. This control is ultimately limited by our capability to combine several nanoresonances, enable energy transfers between them, and understand how every individual mode precisely interfere to create new resonant states that overlap in space and energy. Starting from the actual leaky nature or resonator modes, we will review the basics: their definition, how we may compute them, normalize them, how much we excite them with some driving fields. Then we will move to physics: mode volume, weak and strong coupling, cavity perturbation theory, Fano lineshapes. See Laser Photonics Rev. 2018, **12**, 1700113 https://onlinelibrary.wiley.com/doi/full/10.1002/lpor.201700113 for details.

Dr. **Philippe Lalanne** is a CNRS scientist, expert in subwavelength-scale electrodynamics, with a particular emphasize on computational electrodynamics and modal methods. His work has provided deep insight into the physical mechanisms involved in key nanoscale optical phenomena and devices, e.g., light confinement in photonic-crystal cavities and the extraordinary optical transmission. He has designed and demonstrated novel nanostructures with record or completely novel performance in their time, e.g., diffractive artificial dielectrics known as metasurfaces nowadays, slow light injectors, directional plasmon launchers, and non-classical light source devices.

He is presently heading the group “light in complex nanostructures” at the Institut d’Optique in Bordeaux. He is also deputy-director of GDR ondes that gathers the French community on electromagnetic waves (~300 researchers and 20 industrial companies). He has co-authored about 180 publications in peer-reviewed journals. He is a recipient of the Bronze medal of CNRS, the prix Fabry de Gramont of the French Optical Society. He is a fellow of the IOP, OSA and SPIE.