

Séminaire

Mercredi 28 juin 2017- 11 heures
Salle 44 (Pierre Grivet) - C2N site Orsay-

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Spectral signatures of photonic molecules and whispering gallery mode graphene sensors

This talk has two parts. In the first part, we take an inspiration from analogy between quantum mechanics and the classical electrodynamics since the dielectric microspheres with coupled whispering gallery modes (WGMs) can be viewed as an example of photonic molecules. We built such molecules by using microspheres with sorted positions of WGM peaks and show that the spectra of supermodes of such molecules have certain features which can be used for identification of their symmetry, number of constituting atoms and topology [1]. We show that these properties can be viewed as “spectral signatures” of various molecules. Excellent agreement was found between measured and calculated spectral signatures.

In the second part, we study coupling of WGMs with graphene flakes deposited on a sidewall surface of high-Q cylindrical resonators. This work was developed in close collaboration with the groups of Anatole Lupu and Maria Tchernycheva at IEF. Our experimental approach is based on manipulation with the position of WGM orbit excited in a fiber using a side-coupled tapered microfiber. We observed an interesting polarization TE/TM conversion effect in the WGM spectra detected through the microfiber. We believe that this effect represents a novel sensor modality for sensing nanoobjects which has some advantages over conventional modalities based on spectral shift, damping or splitting of the WGM peaks.

[1] Y. Li et al., Whispering Gallery Mode Hybridization in Photonics Molecules, *Laser & Phot. Rev.* 11, 1600278 (2017).

Vasily N. Astratov is a professor in the Department of Physics and Optical Science at the University of North Carolina-Charlotte since 2002. In 1986, he received his Ph.D. degree from the A.F. Ioffe Physical-Technical Institute in Russia. In the mid-90s, he pioneered studies of synthetic opals as novel self-assembled photonic crystals for visible light in his group at the Ioffe Institute. In 1997-2001, he was a postdoctoral scholar at the University of Sheffield. His current research is devoted to microspherical photonics including optical nanoscopy, resonant light forces, photonic nanojets, and whispering gallery mode coupling effects. He was a topical editor for the journal *Optics Express* in 2005-2011 and a technical committee member for major international conferences including CLEO, IEEE Photonics, Photonics West, ICTON and OECC/ACOFT. In 2016-17, he organized workshops and special sessions on label-free super-resolution at IEEE Photonics, PQE and ICTON conferences. He is a recipient of a number of awards including International Visitor Awards in Spain (2015), France (2011), UK (2006), and Award of the Exchange Program adopted between Royal Society and Russian Academy of Sciences in 1996. He authored and co-authored about 150 publications and 14 patents which were cited about 5000 times.