MajuLab Seminar

Thursday, October 14, 2021
4:00 PM Singapore time / 10:00 AM French time
Online via Zoom, registration is required. Please register at:
https://nus-sg.zoom.us/meeting/register/tZIufu-sqjktE926HZLwdmDUPGsZgduU-qzI

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After a PhD in Condensed Matter Physics in the University of Valencia (SPAIN), he moved as a postdoc to the group of Prof. Grundmann, at the University of Leipzig (GERMANY), for the development of room-temperature operation nanolasers based on ZnO. In 2006 he was appointed permanent researcher at CNRS, where he has been working at CRHEA laboratory on the epitaxial growth of wide bandgap materials (ZnO and GaN) by molecular beam epitaxy and metalorganic vapour phase epitaxy, as well as on the characterization of optoelectronic devices. In CRHEA he has been the Head of the Nanotechnology team since 2008 and became CNRS Research Director in 2018.

Wide bandgap optoelectronics: from fundamental to applied physics

Given it is my first talk after my arrival to Singapore, I will spend some minutes giving a general overview of my research activities, pinpointing some results on the development of transparent electronics thanks to new materials [1], as well as on the development of UV-visible optoelectronics employing semipolar GaN [2] and GaN microstructures [3].

On the second part of the talk I will focus on two fundamental topics, both having applicative expectations: polariton lasers and topological photonics. First I will discuss our activity on microcavity exciton polaritons, which are mixed quasiparticles formed upon the strong-coupling of excitons in a semiconductor and confined photons. I will show that we have been able to achieve polariton lasing (and Bose-Einstein condensation) in vertical microcavities [4] as well as on waveguide geometries [5], at low and room-temperatures, and will illustrate the similarities and differences between polaritons in these two geometries [6]. Next, I will employ vertical optical microcavities operating in the weak-coupling regime to access

experimentally Hamiltonian singularities, so-called exceptional points, and will show how light properties are modified upon operating close to such singularities [7]. In the final part, I will implement the dynamic encircling of exceptional points within a metasurface and will illustrate how the phase associated to the encircling of the singularity can be exploited to provide new functionalities [8].

Finally, I will say some words on the work I plan to develop while in Singapore.

[1] P. John et al., Journal of Applied Physics 129, 095303(2021); P. John et al., Physical Review Materials 4, 054601 (2020)
[2] R. Mantach et al., Applied Physics Express 13, 115504 (2020)
[3] P. M. Coulon et al., Microsystems & Nanoengineering 5, 52 (2019); R. Dagher et al., Journal of Crystal Growth 526, 125235 (2019)
[4] O. Jamadi et al., Physical Review B 93, 11520 (2016) ; F. Li et al., Physical Review Letters 110, 196406 (2013)
[5] O. Jamadi et al., Light: Science & Applications 7, 82 (2018) ; C. Brimont et al., Physical Review Applied 14, 054060 (2020)
[6] O. Jamadi et al., Physical Review B 99, 085304 (2019)
[7] S. Richter et al., Physical Review Letters 123, 227401 (2019)
[8] Q. Song et al., Science 373, 1133 (2021)