Harvard Quantum Optics Center

ITAMP
Institute for Theoretical Atomic Molecular and Optical Physics

Joint Quantum Sciences Seminar

Wednesday, March 8, 4:00 pm

Jefferson 250

Prof. Ortwin Hess

Imperial College London

"Controlled Single-Molecule Strong Coupling and Stopped-Light Lasing in Nanoplasmonic Cavities"

Recent progress in nanophotonics and metamaterials physics is now allowing us to 'look inside the wavelength' and exploit active nano-plasmonics and metamaterials as a new route to quantum many-body optics on the nanoscale [1,2]. At the same time, lasers have become smaller and smaller, reaching with the demonstration of plasmonic nanolasing, scales much smaller than the wavelength of the light they emit [3,4].

Here we discuss recent progress in the study of quantum emitters and quantum gain in nanoplasmonic systems and deliberate on approaches. We combine classical and quantum many-body theory and simulation to describe and model the spatio-temporal dynamics of the optical near field and plasmon polaritons coupled with quantum emitters in nano- plasmonic cavities. We reveal the mechanisms that have allowed us to experimentally reach the strong-coupling regime at room temperature and in ambient conditions [5]. Moreover, it will be demonstrated that applying the nanoplasmonic stopped-light lasing principle to surface- plasmon polaritons (SPP) facilitates trapped/condensed non-equilibrium surface-plasmon polaritons at stopped-light singularities, providing an entry point to SPP-condensation.

[1] O. Hess *et al. Nature Materials* **11**, 573 (2012). [2] O. Hess *et al.*, *Science* **339**, 654 (2013).
[3] T. Pickering, et al., *Nature Communications* **5**, 4971 (2014). [4]S. Wuestner, T. Pickering, J. M. Hamm, A. F. Page, A. Pusch and O. Hess, *Faraday Discuss.* **178**, 307 (2015). [5] R. Chikkaraddy, B. de Nijs, F. Benz, S. J. Barrow, O. A. Sherman, E. Rosta, A. Demetriadou, P. Fox, O. Hess and J.J. Baumberg, *Nature* **535**, 127(2016).

10 minute presentation by Hannes Pichler will begin at 4:00 PM
Guest Presentation will begin at 4:30 PM
Refreshments will be provided