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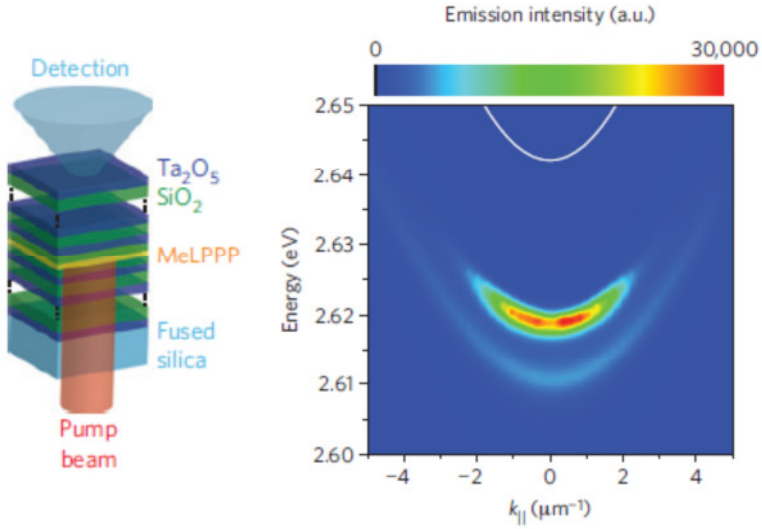
School of Physics and Astronomy
Quantum Physics and Quantum Engineering Group

PhD thesis

Bose-Einstein condensation of organic polaritons at room temperature

Light-matter interaction is a field of tremendous interest. In the strong coupling regime between a layer of active material hosting bound electron-hole-pairs (called 'excitons') and a microcavity, new quasi-particles emerge called polaritons. These polaritons have fascinating properties. Due to their ultra-light effective mass and their bosonic nature, they can undergo Bose-Einstein condensation at elevated temperatures. In contrast to polaritons in the in-organic semiconductor GaAs, organic solids can have excitons binding energies of up to a few hundred meV. This makes them ideally suited for the observation of room-temperature polariton lasing and Bose-Einstein-Condensation [1,2].



(a) Schematic layout of an organic polariton sample and (b) energy-momentum dispersion revealing polariton condensation (according to [2]).

This project is about the investigation of organic polaritons and their condensation properties. In the first part of the project, the focus will be on the fabrication of coupled organic-cavity structures in collaboration with the Organic Semiconductor Centre. You will design, realise and characterise organic polariton samples that serve you for spectroscopic investigations like angularly resolved imaging as well as temporal and spatial correlation measurements. This will enable you to observe Bose-Einstein-Condensation of organic polaritons at room-temperature.

[1] S Kéna-Cohen & S R Forrest, Nat. Phot. **4**, 371 (2010)
[2] J D Plumhof *et al.*, Nat. Mat., DOI: 10.1038/NMAT3825 (2013)

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