Department of Physics
Condensed Matter Physics
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UNIVERSITY OF OXFORD

CONDENSED MATTER SEMINAR

Thursday 24 May at 2.15pm

"Tunable potential landscapes for polariton condensates"

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Microcavity exciton-polaritons (MPs) are quasi-particles resulting from the strong coupling between photons in a microcavity (MC) and excitons confined in a quantum well (QW) embedded in it. The hybrid matter/light character yields polaritons a low effective mass and, therefore, de-Broglie wavelengths reaching several µm. In addition, polaritons are bosons and undergo a transition to a Bose-Einstein-like state (a condensate) with extended temporal and spatial coherence at temperatures of a few K. [1]
The long spatial and temporal coherence enables the control of MP condensates using confinement potentials with µm-dimensions.
In this talk, I review recent results on tunable potentials and lattices for MP condensates created via the modulation by a surface acoustic waves (SAWs). The periodic modulation of an (Al,Ga)As MC by a SAW with µm wavelength creates a moving lattice, which is able to confine mini MP condensates at the lattice sites.[2] The tenability of the lattice potential makes it possible to control the interaction between the mini condensates and, in this, induce coupled ondensates with different spatial phases.[3,4] Tunable lattices with arbitrary shapes can be realized by combining SAWs with static MPtraps defined during the MC growth.Tunable MP lattices are solid - state analogues to optical lattices of cold atoms. [2, 4]. They can hold MP phases of different symmetries and solitonic behavior, [4] thus providing a test-bed for the investigation of many -body interactions in non-equilibriummany-bodyphases.
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[1] J. Kasprzak et al., Nature 443, 409 (2006).
[2] E. A. Cerda-Méndez et al., Phys. Rev. Lett. 105, 116402 (2010).
[3] J.Buller et al., Phys. Rev. B94, 125432 (2016).
[4] E. A. Cerda-Méndez et al., Phys. Rev. Lett. 111, 146401 (2013).

Host: Dr Alexy Karenowska

Audrey Wood Seminar Room, Clarendon Laboratory