Department of Physics
Condensed Matter Physics
Clarendon Laboratory, Parks Road, Oxford OX1 3PU

UNIVERSITY OF OXFORD

CONDENSED MATTER SEMINAR

Wednesday 22nd of March at 2.15pm

"Excitons in emerging materials: single layer transition metal dichalcogenides and hybrid perovskites"

Dr Paulina Plochocka,
Laboratoire National des Champs Magnetiques Intenses, Toulouse, France

The talk will focus on the electronic properties of the excitons in new emerging materials as atomically thin transition metals dichalcogenides and solid-state perovskite investigated by magneto optics.
Reducing dimensionality of the dichalcogens from 3D to 2D leads to new interesting optical properties e.g. opening a direct gap in the visible range. I will discuss the optical properties of excitons in mono and tri – layer transitions metal dichalcogenides (TMDC). I will demonstrate a novel approach to neutralize the intrinsic defects of CVD-grown TMDCs. We investigate the optical properties of trilayer stacks composed of external CVD-grown MoS2 flakes as capping layers and an internal CVD-grown MoSe2 flake which has a smaller band gap. Remarkably, this fabrication approach completely suppresses the localized exciton emission in MoSe2. Furthermore, the investigation of the charge transfer between the MoS2/MoSe2 layers allows us to demonstrate a novel way to introduce the valley polarization in MoSe2. Furthermore, I will discuss the impact of the bright and the dark excitonic states on valley polarization. The measurements of the valley polarization of MoSe2 obtained for resonant excitation as close as 10 meV suggest that inter valley scattering is dominated by exchange interaction rather than by phonons.
In the second part of the talk I will discuss the results of the measurement of the Exciton Binding Energy and effective masses for Charge carriers in Organic-Inorganic or fully inorganic Tri-halide Perovskites. I will show that for all the family of these materials, binding energy of the exciton is smaller or comparable with the thermal energy at 300K, explaining the excellent performance of the devices. Finally, I will demonstrate that morphology has negligible influence on the electronic properties of organic inorganic hybrid perovskite.

Host: Prof Robin Nicholas

Robert Hooke Building Meeting Room, Clarendon Laboratory