Collaborative Research Centre 1415 "Chemistry of Synthetic Two-Dimensional Materials"

CRC Seminar Series

DATE: 22 October 2020
TIME: 3:00 PM – 5:00 PM
LOC: New Chemistry Building / Lecture Hall S89
Bergstraße 66, 01069 Dresden

GUEST SPEAKER:

Professor Paulina Plochocka-Maude
National Laboratory for Intense Magnetic Fields, France
Department of Experimental Physics, Faculty of Fundamental Problems of Technology, Wroclaw University of Science and Technology, Wroclaw, Poland

TITLE:

"Excitons and Phonons in 2D perovskites"

ABSTRACT:

High environmental stability and surprisingly high efficiency of solar cells based on 2D perovskites have renewed interest in these materials. These natural quantum wells consist of planes of metal-halide octahedra, separated by organic spacers. Remarkably the organic spacers play crucial role in optoelectronic properties of these compounds. The characteristic for ionic crystal coupling of excitonic species to lattice vibration became particularly important in case of soft perovskite lattice. The nontrivial mutual dependencies between lattice dynamics, organic spacers and electronic excitation manifest in a complex absorption and emission spectrum which detailed origin is subject of ongoing controversy. First, I will discuss electronic properties of 2D perovskites with different thicknesses of the octahedral layers and two types of organic spacer. I will demonstrate that the energy spacing of excitonic features depends on organic spacer but very weakly depends on octahedral layer thickness. This indicates the vibrionic progression scenario which is confirmed by high magnetic fields studies up to 67T. Finally, I will show that in 2D perovskites, the distortion imposed by the organic spacers governs the effective mass of the carriers. As a result, and unlike in any other semiconductor, the effective mass in 2D perovskites can be easily tailored.

PROFILE OF PROFESSOR PAULINA PLOCHOCKA-MAUDE:

P. Plochocka obtained her PhD cum-laude in 2004 at the University of Warsaw working on the dynamics of many-body interactions between carriers in doped semi-magnetic quantum wells (QW). During her first post doc at Weizmann Institute of science, she started working on the electronic properties of a high mobility 2D electron gas in the fractional and integer quantum Hall Effect regime. She continued this topic during second post doc in LNCMI Grenoble, where she was holding individual Marie Curie scholarship. At the same time, she enlarged her interest of 2D materials towards graphene and other layered materials as TMDCs or black phosphorus. In 2012 she obtained permanent position in LNCMI Toulouse, where she created the Quantum Electronics group, which investigates the electronic and optical properties of emerging materials under extreme conditions of high magnetic field and low temperatures. Examples include semiconducting layer materials such as transition metal dichalcogenides, GaAs/AlAs core shell nanowires and organic inorganic hybrid perovskites.