Proximity-Induced Spin-Orbit Interaction at Interface of Pb/MoSe2

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Abstract. Functional materials have entered our modern society by taking an ever-increasing pace in a wide range of technologies. They are defined as materials that possess particular functionalities on their particular electrical, optical or magnetic properties. Our daily life comprises technologies for communication, processing and displaying of information, computation and data storage, which would not work without functional materials.

To design new functional materials for our increasing daily demands, we must abandon standard models and move towards innovative compounds. These may be based on hybrid systems and heterostructures, invoking new physical mechanisms originating from proximity effects. Spin-orbit (SO) proximity effects, in particular, are finding increasing applications across the whole spectrum of condensed matter physics.

The present work focuses on the modulation of the SO interaction in 2H-MoSe2 which is induced by proximity effects at its interface with amorphous films of Pb, the high-Z element providing strong SO coupling. The key element of this research study is the formation of amorphous Pb overlayers rather than epitaxial crystalline ones, allowing us to overcome the ***k***-space wave-function mismatch at the interface.

With an advantage of the enhanced probing depth, the use of soft x-ray angle-resolved photoelectron spectroscopy (SX-ARPES) allows reaching the interface regions where the SO interaction is modulated. ***k***-space dependence of the proximity-induced SO interaction, as well as its dependence on the Pb-overlayer thickness will be presented. This fundamental knowledge will pave novel approaches towards realization of spintronic devices.