Laboratoire des Solides Irradiés, UMR 7642

Séminaire

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Post Doc

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10h

Study of two-photon photoemission in photovoltaic semiconductors: Perovskite and indium selenide

The first part: The grain structure of heterogeneous $CH_3NH_3PbI_3$ plays a major role in the conversion efficiency of solar cells based on hybrid perovskites. Nonetheless, the dynamics of electrons at the surface of crystallites facets is still poorly understood. In this work, we measure the topmost layers of $CH_3NH_3PbI_3$ by making use of two-photon photoemission (2PPE) spectroscopy. Our method monitors the electronic distribution of photoexcited electrons, explicitly discriminating electronic thermalization from slower dynamical processes. The reported results establish the initial energy relaxation time of hot carriers, suggest the proximity of a photoinduced phase transition, sets a limit on the surface induced recombination and outline the effects of internal electric fields in proximity of the perovskite-vacuum interface. Controlling such fields in heterogeneous films may boost the macroscopic efficiency of solar cells to the theoretical limit.

The second part: Bulk and multilayer Indium selenide (InSe) has been attracted more and more attentions in very recent years because of the ideal direct band gap (~1.3 eV) and high optical absorption which is suitable for photovoltaic device and optoelectronics such as photo-detectors. Here, we found the ultrafast scattering dynamics of hot electrons in the Γ valley of conduction band of InSe by using time resolved 2PPE, and analyzed the photoexcited electrons distributions and dynamical relaxations of hot carries at the surface of InSe.