# Time resolved ARPES study of intervalley scattering and long-lived hot electrons in layered InSe crystals

**Abstract :**

As a typical III-VI material, multilayer Indium selenite (InSe) has been attracted more and more attentions in very recent years because of the direct band gap, high optical absorption coefficient and charge carries mobility which is an ideal candidate for photovoltaic device and optoelectronics. However, the behind physical mechanism involved in photoexcited electron dynamics such as possible intervalley scattering process and thermalization of hot electrons are still not well understood.

In our previous study, we used time resolved ARPES (pump: 1.55 eV and 3.1 eV respectively, probe: 6.2 eV) to study the electron dynamics at the surface of bulk InSe single crystal. Hot electrons scattered from Γ valley can stay for a long time in M valley because of the significant difference of electronic density of state (DOS) between M valley and Γ valley. Furthermore, our findings provide a good estimation to electron dynamics in multilayer InSe ascribed to: the multilayer InSe has very similar electronic structure according to theory calculation and the photo-emitted electrons we acquired are from the topmost namometers of the surface. Thanks to this slow thermalization process and the high carrier mobility of hot electrons, one can further make novel efficient optoelectronics in the future.

However, our time resolved ARPES is limited to small momenta around Γ because of probe energy of 6.2 eV, it is essential to access large momenta and study the electron dynamics in the whole Brillouin zone using XUV for the probe in our next experiment.