Quantum Transport and Spectroscopy of 2D Perovskite/Graphene Interfaces

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Understanding the quantum transport properties of 2D perovskite heterostructures is key to interpreting their electronic performance and promoting optoelectronic devices. Here we show that clear Shubnikov-de Hass oscillation appears in the heterostructure of monocrystalline 2D perovskites and graphene, thanks to the clean interface. We find an efficient charge transfer between perovskite nanosheets and graphene, facilitating the separation of electrons and holes at the interface. The relation between the charge transfer efficiency and microscopic interface structures is quantitatively described. We reveal the evidence of photo-assisted transport from the photo-response of magnetoresistance, which happens between Landau levels of two graphene layers mediated by hot carriers in the perovskite layer, overcoming the barrier from the organic layers in the Ruddlesden-Popper perovskite phase. Our results provide a picture to understand the transport behavior of 2D perovskite/graphene heterostructure and a reference for the controlled design of interfaces in perovskite optoelectronic devices.

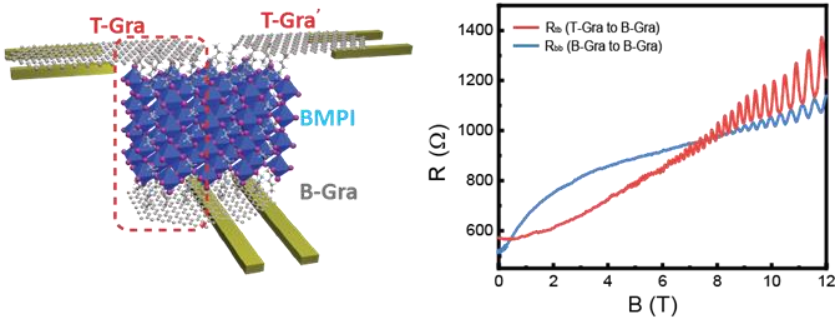

Figure. Schematic illustration of the graphene/ perovskite/ graphene device, in which clear SdH oscillations appear showing the intrinsic physical properties of the efficient charge transfer at the interface and photo-related transport processes through hot carriers in perovskite.