Symmetry regimes for circular photocurrents in monolayer $MoSe_2$

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The circular photogalvanic ad photon drag effects (CPGE and CPDE, respectively) are very attractive mechanisms for optically generating charge and spin transport in two-dimensional transition metal dichalcogenides (TMDCs). They allow to produce directed spin-polarized current of controllable direction and intensity by illumination with circularly polarized light, even without applying any electric bias (circular photocurrents, CPC). In this work, we study for the first time the spectral and electrical response of CPC in a monolayer TMDC. By illuminating an h-BN encapsulated monolayer $MoSe_2$ phototransistor at an oblique incidence angle with respect to the crystal surface, we generate a helicity-dependent DC photovoltage. Its dependence on the drain-source and gate voltages reveals the presence of two different CPC regimes, each becoming dominant at different applied voltages and showing different symmetry upon change of the illumination angle.

Figures

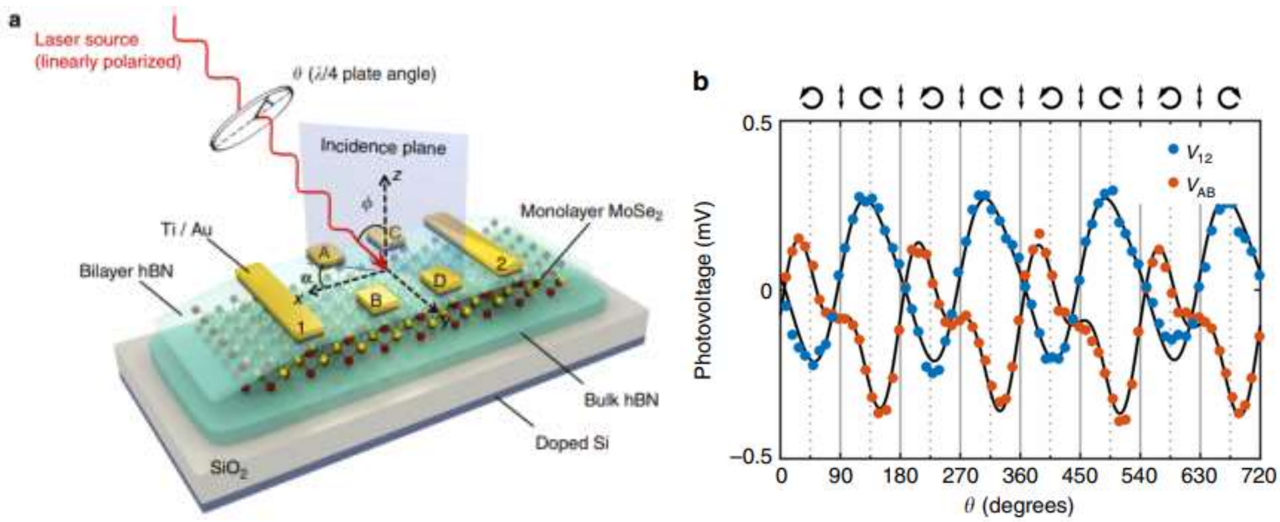

Figure. (a) Schematic experimental setup for measuring the CPGE. (b) Helicity-dependent photovoltage as a function of the quarter-waveplate angle.