Chez Pierre

Presents ...

Monday, November 19, 2012
12:00pm
MIT Room 4-331

Xiaodong Xu
University of Washington

"Optical Probing Novel 2D Electronic Systems"

Two dimensional (2D) electronic systems serve as a fundamental platform for condensed matter physics. The recent discoveries of new classes of 2D materials, such as graphene, transition metal dichalcogenides, and topological insulators, have provided opportunities to investigate new physics and device applications. In the first part of my talk, I will cover our resent optical investigation of atomically thin transition metal dichalcogenides with electrical control. We show that this mono or bilayer semiconductor not only behave as remarkable excitonic systems in the truly 2D limit, but also provide an ideal system for optical generation and electrical control of valley degrees of freedom, which is a manifestation of control of Berry phase effects in Bloch bands. In the second part of may talk, I will show the experimental demonstration of chiral edge photocurrent in nano beams with strong spin-orbit coupling, which resembles the spin Hall effect in GaAs system. We attribute the observation to the chiral nature of the surface spin states generated by the Rashba spin-orbit coupling effect.

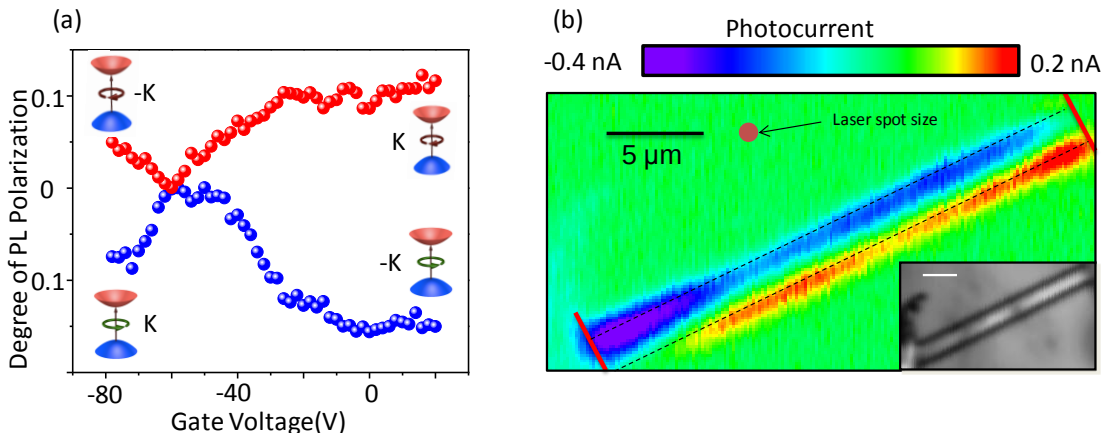

Figure: (a) Electrically tuning the optical dichroism of a bilayer MoS_2 field effect transistor This is direct evidence of switching on/off and continuously tuning the valley magnetic moments via reversible electrical control. (b) Photocurrent image of a Bi_2Se nanobeam which shows the spatially separated photocurrent of opposite sign localized along the 20 μm sample edges. Black dotted line: sample edge. Red line: metal contact. Inset: reflection image of the device.