CMP Seminar

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Dirac fermions in $Pb_{1-x}Sn_xSe$ superlattices

Topological crystalline insulators (TCIs) in the Pb1-xSnxSe class are exemplary topological systems. Their surface and bulk band structure consists of symmetric electron-hole bands with a widely tunable energy gap and nearly isotropic Fermi surface. TCIs grown by molecular beam epitaxy exhibit high mobilities (>1m^2/Vs) and low carrier densities ($10^{17}cm^{-3}$) allowing the observation of Landau levels at fields as low as 2T and up to temperatures close to 200K. This unprecedented material quality has allowed us to perform a systematic mapping of the topological phase diagram of Pb1-xSnxSe bulk epilayers and quantum wells using the Landau levels of the system. In this seminar, I will discuss our experimental measurement and tuning of the hybridization gap on that TCI surface-states over a range exceeding 50meV in $Pb_{1-x}Sn_xSe$ superlattices. This result has led to two consequential horizons: (1) the realization of a valley degenerate quantum Hall effect in TCIs quantum wells (2) the ability to engineer new types of Dirac fermions in TCI superlattices. I will conclude by showing preliminary work on the latter, paving the way towards emergent phenomena resulting from the collective behavior of topological surface states.

Monday, September 9th, 2019 at 4:10 p.m.
Room 1400 BPS Bldg.
Host: Norman Birge