Topological and Correlated Insulators in Thin Films of Cadmium Arsenide

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Bulk cadmium arsenide (Cd_3As_2) hosts topologically non-trivial bands in its electronic structure. In thin films, it can be engineered to a variety of new topological phases. In this talk, we will discuss the synthesis of high-quality quantum wells of Cd_3As_2, which we grow by molecular beam epitaxy. Using Landau level spectroscopy, we show that films transition to a two-dimensional topological insulator phase at quantum well thicknesses around 20 nm. We also discuss the characterization of the edge states of the topological insulator. At lower thicknesses, the topological gap closes and reopens as a trivial gap. We show that another type of insulator appears near this critical thickness. These insulators exhibit unique transport characteristics, such as a strongly non-linear current-voltage behavior and voltage fluctuations indicative of stick-slip motion. We discuss the interplay of topology, electron correlations, and spin-orbit coupling that gives rise to these novel insulating states.