

# New Phases in Thin Films of Topological Matter

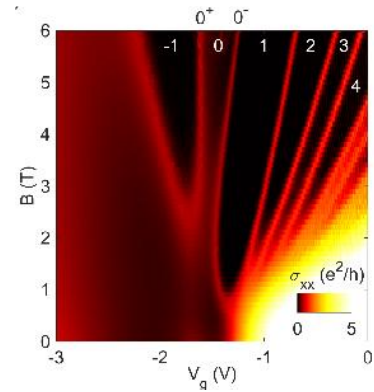
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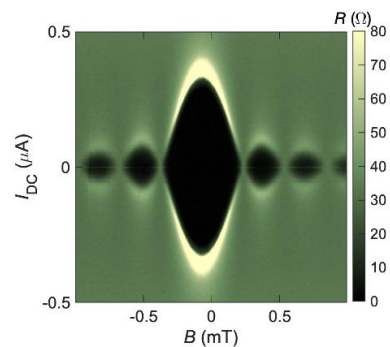
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Topological materials have attracted significant attention for applications in topological quantum computing. In this talk, we will discuss the synthesis of high-quality quantum wells of cadmium arsenide ( $\text{Cd}_3\text{As}_2$ ), which we grow by molecular beam epitaxy. Improvements in film quality and device fabrication provide evidence for a two-dimensional topological insulator state, which is characterized by subband inversion. We show that an in-plane Zeeman magnetic field induces a topological phase transition to a 2D Weyl semimetal phase, which shows a well-developed odd-integer quantum Hall effect under a small perpendicular magnetic field. We show that new types of insulators appear near the critical thickness. Using transport measurements, we identify these new insulators as hole and electron Wigner solids, respectively, which form spontaneously at zero magnetic field. Finally, we will discuss the characterization of several new types of superconductor/topological matter hybrid devices.

Figures



**Figure 1:** Typical Landau level spectrum of cadmium arsenide film in the 2D TI phase.



**Figure 2:** Superconducting interference pattern of a Josephson junction fabricated on a cadmium arsenide film.