Negative Longitudinal Magnetoresistance and Angle Dependent Transport Near the Quantum Limit in Cd_3As_2 Films

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The field angle dependence of magnetoresistance (MR) in topological semimetals can contain information about mobility anisotropy and topological transport [1-4]. Here, we report on angle dependent magnetotransport in (001)-oriented Cd_3As_2 thin films with ultralow carrier densities (~2-5 · 10^{16} cm^{-3}) near their quantum limit. With increasing field magnitude, we identify a striking crossover in the $H \parallel I$ transport from negative longitudinal MR to a huge positive longitudinal MR with magnitude comparable to the transverse MR (Figure 1). Using systematic transport measurements and theoretical modeling of the transport with an 8 x 8 $k \cdot p$ model, we identify a unique quantum-limit contribution governed by Fermi surface anisotropy. We discuss these results within the context of previously undescribed field-angle dependent quantum limit transport in other semimetals.

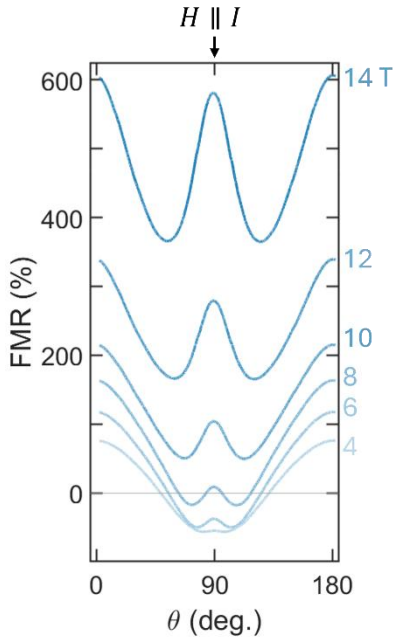

Figure 1: 2 K, fractional MR ($FMR = \rho_{xx} - \rho_0/\rho_0 * 100\%$) for an (001) Cd_3As_2 film exhibiting the crossover from negative to positive longitudinal MR with increasing field magnitude.

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