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Valley Dynamics on H-Si(111) in Tilted Magnetic Fields ROBERT N. MCFARLAND, KEVIN ENG, BRUCE E. KANE, Laboratory for Physical Sciences, University of Maryland, College Park — Because of the predicted sixfold valley degeneracy of the Si(111) surface and the numerous mechanisms that can lift this degeneracy, 2D electron transport on this surface displays complex and interesting behavior. To explore this behavior, we have performed low temperature ($\sim$150 mK) tilted-field magneto-transport measurements ($0<B_{tot}<12$ T) on H-passivated Si(111) surfaces encapsulated in a vacuum cavity. We find a strong dependence of the longitudinal magneto-resistance on the in-plane B field. At low fields (<2 T) this manifests as an amplification of the Shubnikov-de Hass amplitudes without a significant effect on the phase or frequency. At high fields (>6 T, $\nu<6$) the valley degeneracy is lifted, and we observe energy gaps at ν=4 and ν=3 which are strongly affected by small in-plane fields. Since in neither case are the observed effects linear in total B field, the results are inconsistent with Zeeman-like effects. We present measurements of the activation energies for the gaps at ν=4 and 3 as a function of tilt angle. Finally, we consider possible mechanisms for this field-dependent splitting and propose future experiments that may shed further light on the matter.

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