

Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Experimental observation of six valleys and an anisotropic integer quantum Hall effect on H-Si(111) surfaces KEVIN ENG, ROBERT N. MCFARLAND, BRUCE E. KANE, University of Maryland — We have recently developed a new high mobility 2DES on a clean and atomically flat hydrogen-passivated Si(111) surface, where electrons are gated through an encapsulated vacuum dielectric. Our devices have exhibited peak scattering times, $\tau \sim 5$ ps, which exceed even the best Si(100) MOSFETs. We will discuss magneto-transport measurements made as a function of tilted magnetic fields in such a 2DES. The Si(111) surface is unique in that it has been calculated to have six valleys of equal energy in its ground state. Measurements at $T=150$ mK and $n_s = 6.5 \times 10^{11} \text{cm}^{-2}$ show clear signatures of the integer quantum Hall effect where contrary to predictions filling factors less than 6 are observed (i.e. $\nu=6, 5, 4, 3,$ and 2). In addition, we have observed anisotropy in R_{xx} with respect to the crystal orientation in a magnetic field range of $0 \leq B \leq 12$ T, which is also unexpected for an equally occupied six-fold degenerate system. As a result, an application of a non-interacting model whereby two valleys have a greater population than the remaining four has general agreement with the Landau level crossings at specific tilt orientations and with the anisotropy of R_{xx} at low fields. At high fields, the presence of $\nu=3, 4$ and 5 indicates that individual valleys are splitting but what is more interesting is the anisotropy of R_{xx} at $\nu=3$ & 4 toward in-plane magnetic fields.

Kevin Eng

Date submitted: 02 Dec 2006

Electronic form version 1.4