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Integer quantum Hall effect and valley splitting on a H-Si(111) surface KEVIN ENG, ROBERT N. MCFARLAND, BRUCE E. KANE, Laboratory for Physical Sciences, University of Maryland at College Park — We have recently developed a high mobility two-dimensional electron system, where an electric field is applied through an encapsulated vacuum cavity and induces electrons on a clean and atomically flat hydrogen-passivated Si surface. Low temperature magneto-transport measurements (0<B<12T) made on such an inversion layer has led us to the first observation of the integer quantum Hall effect on a Si(111) surface. With a mobility of ∼10,000 cm^2/Vs at T=150 mK and n_s=6.75 x 10^{11} cm^{-2}, we observed filling factors ν=6, 4, 3, and 2. This is particularly interesting, because Si(111) is expected to have a six-fold valley degeneracy. Activation energy measurements within filling factors 6 and 2 coupled with analysis of Shubnikov-de Haas oscillations suggests that the six-fold valley degeneracy is broken asymmetrically into 2-fold and 4-fold at B=0. In addition, the observation of ν=3 indicates that individual valleys are splitting at higher fields. We will discuss these results along with the possible origins of the breaking of the six-fold valley degeneracy at B=0.

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