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High-mobility hydrogen-terminated Si(111) transistors for measurement of six-fold valley degenerate two-dimensional electron systems in fractional quantum Hall regime BINHUI HU, MOHAMAD MEQDAD YAZDANPANAH, BRUCE E. KANE, Univ of Maryland-College Park — The quality of hydrogen-terminated Si(111) (H-Si(111)) transistors has improved significantly. Peak electron mobility of 325,000 cm^2/Vs was achieved at 90 mK, and the fractional quantum Hall effect (FQHE) at $1 < \nu < 2$was studied extensively [1]. We have further improved the device by solving gate leakage and contact problems with an updated design, in which a Si piece with thermal oxide acts as a gate through a vacuum cavity, and PN junctions are used to define a hexagonal two-dimensional (2D) region on a H-Si(111) piece. The device operates as an ambipolar transistor, in which a 2D electron system (2DES) and a 2D hole system can be induced at the same H-Si(111) surface. Peak electron mobility of more than 200,000 cm^2/Vs is routinely achieved at 300 mK. The Si(111) surface has a six-fold valley degeneracy. The hexagonal device is designed to investigate the symmetry of the 2DES. Preliminary data show that the transport anisotropy at $\nu < 6$ can be explained by the valley occupancy. The details of the valley occupancy can be caused by several mechanisms, such as miscut, magnetic field, pseudospin quantum Hall ferromagnetism (QHFM), and nematic valley polarization phases [2]. The FQHE is investigated in magnetic fields up to 35T, and the properties of composite fermions will be discussed. [1] T.M. Kott, B.H. Hu, S.H. Brown, B.E. Kane, Phys. Rev. B 89, 041107(R) (2014) [2] D. A. Abanin, S. A. Parameswaran, S. A. Kivelson, and S. L. Sondhi. Phys. Rev. B, 82, 035428 (2010)

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