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Anomalous Resistance Fluctuations in a Macroscopic 2DEG on a H-Si(111) Surface ROBERT N. MCFARLAND, KEVIN ENG, BRUCE E. KANE, Laboratory for Physical Sciences, University of MD, College Park — We report the experimental observation of large ($\sigma(R)/\langle R\rangle$ $\sim$15%) resistance fluctuations as a function of electron density for a high mobility 2DES induced on a free H-passivated Si(111) surface in the strongly 'metallic' regime. The observed fluctuations are reproducible and two orders of magnitude larger than the time-dependent noise. As the contact spacing ($\sim$1mm) is four orders of magnitude larger than the mean free path length ($\sim$100 nm), an explanation in terms of universal conductance fluctuations seems implausible. Because the dielectric is vacuum, the dominant scattering centers are located right at the surface. As discussed in [1], this 2DES has 6 unequally occupied valleys, which leads to an anisotropic longitudinal resistance. Interestingly, we note a strong anti-correlation between the fluctuations observed for orthogonal current directions. Furthermore, the fluctuations appear largely insensitive to small magnetic fields ($|B| < 2T$). We present a systematic experimental characterization of this phenomenon, including temperature dependence (0.15 to 14K), I-V characteristics, and the response to perpendicular and parallel magnetic fields up to 12 T. [1] See talk "Experimental observation of six valleys and an anisotropic IQHE on H-Si(111) surfaces" K. Eng *et. al.*

Robert N. McFarland
Laboratory for Physical Sciences, University of MD, College Park

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