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Quantum point contacts for electrons on H-Si(111) surfaces using a Ga focused-ion beam for direct-write implant lithography LUKE D. ROBERTSON, B. E. KANE, Laboratory for Physical Sciences, University of Maryland — Quantum point contacts (QPCs) realized in materials with anisotropic electron mass, such as Si, may exhibit valley filter phenomena leading to extreme sensitivity to single donor occupancy, and thus are of interest to measurement schemes for donor-based quantum information processing. To this end, we have developed ambipolar devices on a H-Si(111):Si(100)/SiO_2 flip-chip assembly which utilize in-plane, degenerately doped n^+ (P) and p^+ (B) contacts to probe transport in a 2D electron system (2DES). In addition to providing electrostatic isolation of carriers, these p-type contacts can be used as lateral depletion gates to modulate the 2DES conductance, and if extended to the nanoscale can lead to 1D confinement and quantized conductance of the 2DES. In this talk, I will describe our efforts to use a Ga focused-ion beam for direct-write implant lithography to pattern QPCs and Ga nanowires on H-Si(111) surfaces. I will present low temperature (4.2K) conductance data collected on 30nm Ga nanowires to demonstrate their effectiveness as lateral depletion gates, and discuss on going measurements to confine and modulate the conductance of the 2DES using Ga QPCs.

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