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Gating a two dimensional electron gas in silicon using a metallic single electron transistor LUYAN SUN, Laboratory for Physical Science, University of Maryland, K.R. BROWN, National Institute of Standards and Technology, Boulder, Co, B.E. KANE, Laboratory for Physical Sciences, University of Maryland — A wealth of physical phenomena has been observed in two dimensional electron systems such as the silicon metal-oxide-semiconductor field effect transistor (MOSFET). Due to impurities and interface states, a silicon MOSFET channel is usually imperfect. A single electron transistor (SET) close to the channel could provide a useful probe of these imperfections and of the channel behavior. We have incorporated an Al/AlO_x/Al SET as the top gate of a conventional MOSFET. The SET is fabricated with standard electron-beam lithography and double-angle thermal evaporation. A thermally grown SiO_2 barrier layer about 20 nm thick isolates the SET from the lightly p-doped MOSFET channel beneath. The drain and source of the MOSFET are heavily n-doped and conduct at cryogenic temperatures. A nearby surface metal gate is used to modulate the width of the channel right beneath the SET island. Near the pinch off regime we expect to see a correlation between fluctuations in the current through the SET and fluctuations in the current of the MOSFET channel. We will present preliminary data from these devices.

Luyan Sun
Laboratory for Physical Sciences, University of Maryland

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