Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Tunable, Adatom-induced surface conductance drop on InSb(110) SARA MUELLER, STEVEN TJUNG, JACOB REPICKY, ALEXANDER KEAST, EVAN LANG, KEVIN WERNER, ENAM CHOWDHURY, JAY GUPTA, The Ohio State University — Understanding atomic defects in III-V semiconductors is crucial for circuit miniaturization and innovation in nanotechnology. With its narrow bandgap and high carrier mobility, Indium Antimonide (InSb) is a desirable candidate for solotronics applications. Using scanning tunneling microscopy (STM) and spectroscopy (STS), we investigate an adatom defect on the InSb(110) surface. The defect presents in three charge states at different tunneling conditions: a bright protrusion in filled-state imaging which corresponds to a positive adatom charge, a deep crater in the neutral charge state, and a depression beyond a threshold condition indicating negative adatom charge. Remarkably, in the crater regime, the lateral size of the depleted area around the adatom extends to more than 50 nm and its apparent depth indicates a suppressed tunneling conductance by 100-fold. We attribute the dramatic change in conductance to filling a charge-transition state that is observed near the conduction band edge in STS. Furthermore, the depletion area can be reliably tuned by changing the local band-bending conditions using electric fields and optical illumination. These results demonstrate that a single adatom can significantly influence the surface conductivity over relatively large distances, which provides opportunities and challenges for future nanoscale electronics.

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Date submitted: 09 Nov 2016 Electronic form version 1.4