Abstract Submitted
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Gapped Dirac surface states in In doped topological insulator Bi_2Se_3[1] WEIDA WU, QUANTONG SHEN, XUEYUN WANG, SANG-WOOK CHEONG, Rutgers Center for Emergent Materials & Department of Physics and Astronomy, Rutgers University, Piscataway, NJ, 08854 — Topological insulators host helical Dirac surface states which linearly disperse through bulk band gap. The unusual helical surface states are protected by time reversal symmetry, and therefore believed to be robust against disorders that do not break time reversal symmetry. It has been debated whether massive Dirac surface states (i.e. a gap at the Dirac point) are experimentally observed in doped topological insulators [1-3]. Herein, we report the observation of a spectroscopic gap of topological surface states in $Bi_{2-x}In_xSe_3$ using low temperature scanning tunneling microscopy and spectroscopy (LT-STM/STS). The tunneling spectroscopic maps suggest that the interactions between In dopants effectively change the topological class of local band structure, resulting in a nanoscale mixture of topologically trivial and nontrivial states. This electronic inhomogeneity poses a nanoscale spatial confinement to the Dirac surface states so that the long wavelength surface states near the Dirac point are suppressed, i.e. a gap is opened at the Dirac point.

[1] Sato et al, Nat. Phys., 7, 840, (2011).
[2] Xu, et al., arXiv:1206.0278v1 (2012).
[3] Souma et al, PRL, 109, 186804 (2012).

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