Abstract Submitted
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Resolving the band structure of topological insulators and point-contact spectroscopy analysis PAVEL SHIBAYEV, Princeton Univ, HASAN GROUP TEAM[1] — This study concerns a comprehensive quantitative analysis of topological insulators (TIs) [1], a new quantum state of matter, namely Bi_2Se_3. The first stage is observing the proximity-induced superconductivity effect [2] via point-contact spectroscopy (PCS). Differential conductance of the superconducting $NbSe_2$ crystal was measured at approximately 4 K, cooled with liquid helium. Through the analysis of I-V characteristics, it was possible to observe an expected behavior of differential conductance for voltages higher than 1 mV, and the ongoing work is to observe this effect at lower voltage. Subsequently, this method will be used to induce superconductivity in Bi_2Se_3 by combining it with $NbSe_2$. The second stage is a first-principles calculation of band structure of the TI crystal based on the density functional theory, DFT, performed on Bi_2Se_3 using the ABINIT program [3]. The third stage is resolving the band structure of the crystal via angle-resolved photoemission spectroscopy (ARPES) at a synchrotron facility and comparing with the above calculation. It is expected to be completed in February 2014.

[1] M. Z. Hasan et. al. Rev. Mod. Phys. 82, 3045 (2010).
[2] Zareapour, Parisa et. al. Nature Communications 3 (2012).
[3] Gonze, X. et al. Comput. Mater. Sci. 25, 478-492 (2002).

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