Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Surface Termination of Cleaved Bi_2Se_3 Investigated by Low Energy Ion Scattering XIAOXIAO HE, ZHIYONG WANG, JING SHI, JORY YARMOFF, Department of Physics and Astronomy, University of California, Riverside — The 3D Topological Insulator, Bismuth Selenide (Bi_2Se_3), is investigated with low energy ion scattering (LEIS). Se vacancies are believed to be responsible for the metallic behavior in transport, and LEIS is uniquely sensitive to the outermost atomic layer composition. Bi_2Se_3 is comprised of Se-Bi-Se-Bi-Se quintuple layers (QLs). Since the van der Waals bonds between QLs is weaker than the covalent bonds within each QL, it has been assumed that it is Se-terminated when cleaved. This assumption has been used in previous surface studies, such as STM or ARPES, which do not provide the composition of the surface atoms. 3 keV Na^+ ions were scattered from single crystal Bi_2Se_3 cleaved in ultra-high vacuum. At room temperature, the spectra indicate a surface terminated with Bi, rather than Se, although some Se is still present. The samples display a sharp 1x1 LEED pattern, indicative of an ordered material. We conclude that Bi_2Se_3 cleaves between the QLs, but that the surface Se quickly desorbs, likely as Se_2 or Se_4. To test this, the Se:Bi ratio was monitored by LEIS after a sample was cleaved at liquid nitrogen temperature. It was found that the ratio starts out high, but decreases over the course of hours until it reaches the same value as that of a room temperature cleave.

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Date submitted: 11 Nov 2011 Electronic form version 1.4