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**Compensation of intrinsic charge carriers in topological insulators using high energy electron beams**[1] LUKAS ZHAO, HAIMING DENG, JEFF SECOR, CCNY, MARCIN KONCZYKOWSKI, Ecole Polytechnique, ANDRZEJ HRUBAN, Institute of Electronic Materials Technology, LIA KRUSIN-ELBAUM, CCNY — One of the main challenges in probing charge transport of the topological Dirac surface states is a non-vanishing conductivity of the bulk. With the techniques employed thus far, reaching the charge neutrality point (CNP) has proved difficult. Here we demonstrate that we can reach CNP by compensating intrinsically $p$-type topological insulators (TIs) by irradiation with high energy (2.5 MeV) electrons, and increase bulk resistivity by orders of magnitude. Irradiations, performed at liquid hydrogen, create Frenkel (vacancy-interstitial) pairs in the bulk, with donor-type vacancies that remain stable up to room temperature. The conversion of conductivity type (from $p$- to $n$-type) in $Bi_2Te_3$ and $Sb_2Te_3$ occurs at the resistivity maximum obtained for the beam fluence $\phi \cong 30 - 35\ mC/cm^2$. The 2D character of longitudinal conductance $\sigma_{xx}$ near CNP is indicated by the appearance of weak anti-localization (WAL) cusp that scales with $H_\perp = Hcos\theta$. The coherence length extracted from the fits to 2D Hikami-Larkin-Nagaoka theory of WAL is $\sim 210$ nm, comparable to that obtained in thin MBE films.

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