Magnetically doped topological materials tuned by electron irradiation\(^1\) ZHIYI CHEN, HAIMING DENG, SHIHUA ZHAO, INNA KORZHOVSKA, City College of New York, MARCIN KONCZYKOWSKI, Ecole Polytechnique, LIA KRUSIN-ELBAUM, City College of New York — We have recently demonstrated that irradiation of topological materials, such as Bi\(_2\)Te\(_3\) and Ca:Bi\(_2\)Se\(_3\), with high energy (2.5 MeV) electron beams can sweep Fermi level \(E_F\) across the bulk gap to charge neutrality point (CNP) \(^1\). Here we show that such irradiation technique applied to magnetically doped topological insulators (TIs) can be used to tune anomalous Hall effect (AHE). We performed irradiation experiments on a series of Mn-doped Bi\(_2\)Te\(_3\) crystals, \((\text{Bi}_1-x\text{Mn}_x)_2\text{Te}_3\), using both \(p\)- and \(n\)-type starting materials. All materials, displayed magnetic hysteresis loops consistent with ferromagnetic order present. However, in transport the two conductivity types were found to be surprisingly different. While the \(p\)-type crystals did convert to \(n\)-type across CNP, no trace of AHE was detected. In contrast, \(n\)-type materials showed pronounced hysteretic anomalous Hall resistance, consistent with magnetization. In the latter case, charge density has decreased and the zero-field Hall signal increased after irradiation. We will discuss how AHE in irradiated magnetically doped TIs can be fine tuned by electrostatic gating in the vicinity of CNP. \(^1\)L. Zhao \textit{et al}, \textit{Nat. Comm.} \textbf{7}, 10957 (2016)

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