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Combined gate-tunable Josephson junctions and normal state transport in Bi_2Te_3 topological insulator thin films[1] PROSPER NGABONZIZA, MARTIN, P STEHNO, University of Twente , HIROAKI MYOREN, Saitama University, ALEXANDER BRINKMAN, University of Twente — In recent years, extensive efforts have been made to improve the coupling between topological insulators and s-wave superconductors in topological insulator Josephson devices (TIJDs). Despite significant progress, essential questions remain open such as the bulk contribution to the Josephson critical current or the existence (and number) of 4π-periodic bound states (Majoranas) in TIJDs. To address these issues, we fabricated Nb/Bi_2Te_3/Nb Josephson junctions alongside Hall bar devices on MBE-grown Bi_2Te_3 topological insulator thin films. Using the $SrTiO_3$ [111] substrate as a gate dielectric, we tuned the carrier density electrostatically and measured the Josephson supercurrent and the normal state transport properties of our thin film devices. We identify three gate voltage ranges with distinct behavior: A region of intermediate gate bias where the measured quantities change rapidly with the applied electric field, and two saturation regions for large bias of either polarity. We discuss carrier distribution and band alignment in the material as well as implications for the effective Josephson coupling in TIJDs.

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