Induced supercurrent in the intrinsic magnetic topological insulator $MnBi_2Te_4$

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Topological superconductors hosting chiral Majorana zero modes are of great interest for both fundamental physics and potential quantum computing applications. The recent discovery of the intrinsic magnetic topological insulator $MnBi_2Te_4$ (MBT) [1,2] offers a new material platform that host chiral topological states. In this work, we investigate the transport properties of an MBT Josephson junction and explore their superconducting properties. MBT Josephson junction have been fabricated before, but no supercurrent was observed [3]. We do observe an onset of supercurrent and a clear Josephson coupling through RF measurements. The sensitive nature of superconducting interference, allows us to study the interference patterns in the superconducting junctions revealing interesting asymmetries, suggesting changes in the magnetic ordering of the MBT flakes under small applied magnetic fields. Although we observe a supercurrent, doping effects from the Nb leads hinder the manifestation of chiral Majorana edge modes. Our findings shed light on the interplay between superconductivity and topology in MBT flakes and provide insights into the challenges of inducing topological superconductivity in these systems.

References

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[3] Wen-Zheng Xu, Chun-Guang Chu, Zhen-Cun Pan, Jing-Jing Chen, An-Qi Wang, Zhen-Bing Tan, Peng-Fei Zhu, Xing-Guo Ye, Da-Peng Yu, and Zhi-Min Liao, Phys. Rev. B 105, 184515 – May 2022

Figures

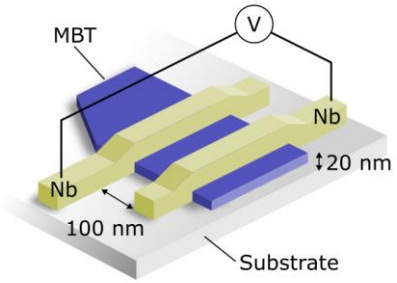

Figure 1: Schematic of the device

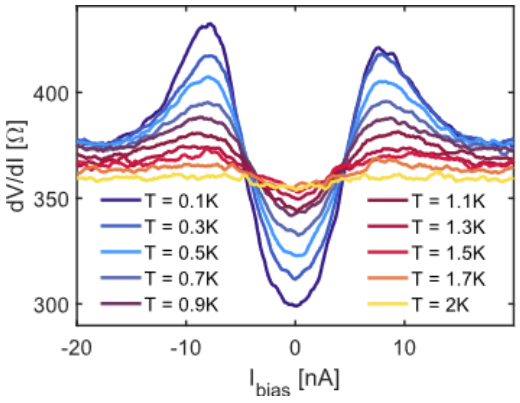

Figure 2: Differential resistance as function of bias current for different temperatures. An onset of supercurrent is observed.