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Proximity-induced Superconductivity in Topological Insulator/Superconductor Heterostructures¹

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The exploration of superconductivity in helical Dirac fermions is strongly motivated by scenarios for realizing exotic quantum states in condensed matter. Examples include Majorana modes [1] and supersymmetry [2]. Motivated by such proposals, we are pursuing the development of epitaxially grown heterostructures wherein we attempt to induce superconductivity in the surface states of a three dimensional topological insulator thin film when interfaced with both conventional [3] and unconventional [4] superconductors. This talk will provide an overview of the materials synthesis challenges in this context and discuss the picture of induced superconductivity (or lack thereof) that emerges from angle-resolved photoemission spectroscopy [3,4], point contact Andreev reflection spectroscopy [5] and tunneling spectroscopy.

Work done in collaboration with A. Richardella, S.-Y. Xu, M. Z. Hasan, M. Gilbert, F.-C. Chou, G. Gu, W.-Q. Dai and Qi Li.

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2. T. Grover, D. N. Sheng, A. Vishwanath, *Science* **344**, 280 (2014).
3. S.-Y. Xu *et al.*, *Nature Physics* **10**, 943 (2014).
4. S.-Y. Xu *et al.*, *Phys. Rev. B* **90**, 085128 (2014).
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