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Fully gapped topological surface states in Bi_2Se_3 films induced by a *d*-wave high-temperature superconductor HAO DING, ERYIN WANG[1], Department of Physics, Tsinghua University, ALEXEI V. FEDOROV, Advanced Light Source, WEI YAO, ZHI LI, YAN-FENG LV, KUN ZHAO, LI-GUO ZHANG, Department of Physics, Tsinghua University, ZHIJUN XU, JOHN SCHNEELOCH, RUIDAN ZHONG, Brookhaven National Laboratory, SHUAI-HUA JI, Department of Physics, Tsinghua University, LILI WANG, KE HE, XUCUN MA, Institute of Physics, Chinese Academy of Sciences, GENDA GU, Brookhaven National Laboratory, HONG YAO, Institute of Advanced Study, Tsinghua University, QI-KUN XUE, XI CHEN, SHUYUN ZHOU, Department of Physics, Tsinghua University
— The interplay of superconductivity and topological surface states which are protected by time-reversal symmetry provides a platform for exploring new quantum phenomena, such as Majorana zero modes that may find application in fault-tolerant quantum computation. Here, by growing high-quality topological insulator Bi_2Se_3 films on a *d*-wave superconductor $Bi_2Sr_2CaCu_2O_{8+\delta}$ (Bi2212) using molecular beam epitaxy, we are able to induce high-temperature superconductivity on the surface states of Bi_2Se_3 films with a large pairing gap up to 15 meV. Interestingly, distinct from the *d*-wave pairing of Bi2212, the proximity-induced gap on the surface states is nearly isotropic and consistent with predominant *s*-wave pairing as revealed by angle-resolved photoemission spectroscopy. Our work could provide a critical step towards the realization of the long sought Majorana zero modes.

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