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Superconducting Proximity Effect in Topological Metal KYUNGMIN LEE, ABOLHASSAN VAEZI, Cornell University, MARK H. FISCHER, Weizmann Institute of Science, EUN-AH KIM, Cornell University — Much interest in the superconducting proximity effect in 3D topological insulators (TI) has been driven by the potential to induce exotic pairing states at the interface surface. However most candidate materials for 3D TI's are in fact bulk metals, due to the presence of bulk conduction states at the Fermi level. Nevertheless, such systems can have well-defined surface states exhibiting robust spin-momentum locking when the doping level is low enough. For such topological metals (TM), superconducting proximity effect can be qualitatively different from that in TI's. By studying a model topological metal-superconductor (TM-SC) heterostructure within Bogoliubov-de Gennes formalism, we show that the pairing amplitude is not confined to the interface as it is in topological insulator-superconductor (TI-SC) heterostructure and rather it reaches the naked surface. Furthermore, we predict vortex bound state spectra to contain a Majorana zero mode localized at the naked surface, separated from the bulk vortex bound state spectra by a finite gap in such a TM-SC heterostructure. Such naked-surface-bound Majorana modes are amenable to experimental observation and manipulation and hence present experimental advantage of TM-SC structure over TI-SC structure.

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