

PHYSICS COLLOQUIUM

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UNCONVENTIONAL SUPERCONDUCTIVITY IN TOPOLOGICAL INSULATORS AND RASHBA 2DEGS

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A topological insulator in the proximity to an s-wave superconductor is the perfect material to detect signatures of Majorana fermions. S-wave superconductor on the top of the surface states of 3D TI generates s-wave and p-wave pairing mixture in the surface state due to the spin-momentum locking [1,2]. We predict that in the Josephson junction setup, namely superconductor (S) /surface state of topological insulator/superconductor (S), existence of this p-wave component leads to novel features in transport like superconducting Klein tunneling i.e. the perfect transmission of hybridized Majorana states for normal incidence, the non-sinusoidal current phase relation [2] and unusual phase-dependent thermal conductance [3]. Further, we propose the experimental setups to observe signatures of Majorana fermions in the ac Josephson effect on TI hybrid structures [4] and in phase controlled Josephson junctions based on Rashba 2DEGs [5,6].

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