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Superconducting Klein tunneling and AC Josephson effect in superconductor/topological insulator/superconductor junctions[1] EWELINA HANKIEWICZ, GRIGORY TKACHOV, Wuerzburg University — We consider superconductor(S)/surface state of topological insulator(TI)/superconductor junctions (S) where the S regime describes the surface state of the TI with the proximity with the s-wave superconductor. The novelty of such S/TI/S junctions originates from the electron spin helicity (locking of the mometum and the spin for a surface of TIs) which leads to both the s-wave singlet and the p-wave triplet pairing on the surface underneath the superconductor. Existence of these two superconducting channels lead to interesting features in transport through these junctions. In particular we show that superconducting Klein tunneling and topological Andreev bound state (ABS) (state of hybridized two Majorana fermions)) occur for the normal incidence where ABS is protected against backscattering. For transport channels different than for the normal incidence, the scattering from the junction barrier generates an energy gap in the spectrum supporting non-topological ABSs. Due to mixed order parameter, the AC Josephson effect is fractional showing higher odd harmonics. We conclude that favorable conditions for the observation of the topological ABS exist in narrow TI links with a small number of open channels close to one.

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