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The influence of proximity induced ferromagnetism, superconductivity and Fermi-velocity on evolution of Berry phase in Bi_2Se_3 topological insulator PARIJAT SENGUPTA, University of Wisconsin-Madison — Bi_2Se_3 is a well-known 3D-topological insulators (TI) with a non-trivial Berry phase of (2n+1) π attributed to the topology of the band structure. The Berry phase shows non-topological deviations from (2n+1) π in presence of a perturbation that destroys time reversal symmetry and gives rise to a quantum system with massive Dirac fermions and finite band gap. Such a band gap opening is achieved on account of the exchange field of a ferromagnet or the intrinsic energy gap of a superconductor that influences the topological insulator surface states by virtue of the proximity effect. The Berry phase of such gapped systems with massive Dirac fermions is considered. Additionally, it is shown that the Berry phase for such a system also depends on the Fermi-velocity of the surface states which can be tuned as a function of the TI film thickness. The role of higher order warping terms in the surface state Hamiltonian which influences deviations to the Berry phase is evaluated. Finally, a connection between Berry phase and circular dichroism is examined through explicit calculation of the optical matrix elements.

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