

Fractional Charges and Triply Degenerate States of Fermion Zero Modes on the Domain Wall of the Quantum Dot

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Recent relationship between condensed matter physics such as topological insulators and elementary particle physics is remarkable. The effective topological field in field-theoretical formula captures their topological effects, including the quantization of the Hall conductance, the fractional charge, and statistics of quasiparticles. Kanazawa has indicated the importance of the hole-induced domain-wall in magnetoresistance in diluted magnetic semiconductors [1,2]. In addition, Kanazawa and coworkers [3,4] have proposed that there might be emergent quasiparticles with fractional electronic charge such as dyon on the domain wall between topological insulators and spin ice compounds through the Witten effect [5] and interaction between the Dirac fermions and excited magnetic monopoles. Recently Kanazawa and Maeda [6] have discussed quark-like fermions of triply degenerate states of fermion zero mode on the quantum dot. In this study, we have discussed the anomalous excitations such as fractional charges on the quantum dot, extending the theoretical formula [7,8].

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