Abstract Submitted
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Wormhole effect in a strong topological insulator M. FRANZ, G. ROSENBERG, H.-M. GUO, University of British Columbia — When the surface of a strong topological insulator (STI) is coated by a ferromagnetic film the surface state acquires a gap and becomes a quantum Hall liquid with the Hall conductance $(n + 1/2)e^2/h$, n integer. Applying the Laughlin flux-insertion argument to such a surface implies the existence of quasiparticles with fractional charge $\pm e/2$. This result however contradicts the microscopic theory of the surface state, given by a simple massive Dirac Hamiltonian with odd number of fermion species, which only has excitations with integral charge. The paradox is resolved by noticing that an infinitesimally thin flux tube employed in the Laughlin argument is not innocuous inside a STI; we show that when the flux is equal to $hc/2e$ the flux tube carries topologically protected one-dimensional gapless modes that form a conducting 'wormhole' through the STI bulk. The wormhole allows the excess charge to escape to the other side of the STI and, in the end, no fractional charge is accumulated at the surface.

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