

Abstract Submitted
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Time-Reversal-Invariant Z_4 Fractional Josephson Effect FAN ZHANG, University of Texas, Dallas, CHARLES KANE, University of Pennsylvania — We study the Josephson junction mediated by the quantum spin Hall edge states and show that electron-electron interactions lead to a dissipationless fractional Josephson effect in the presence of time-reversal symmetry. Surprisingly, the periodicity is 8π , corresponding to a Josephson frequency $eV/2\hbar$. We estimate the magnitude of interaction-induced many-body level splitting responsible for this effect and argue that it can be measured by using tunneling spectroscopy. For strong interactions we show that the Josephson effect is associated with the weak tunneling of charge $e/2$ quasiparticles between the superconductors. Our theory describes a fourfold ground state degeneracy that is similar to that of coupled “fractional” Majorana modes but is protected by time-reversal symmetry. [Reference: PRL 113, 036401 (2014).]

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