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Spinon walk in quantum spin ice YUAN WAN, JUAN CARRASQUILLA, ROGER MELKO, Perimeter Institute for Theoretical Physics — Quantum spin ice is a novel family of spin ice magnets that possess substantial quantum fluctuations. The fractional excitations are spinons, which are quantum analog of the monopoles in classical spin ice. The spinon propagates in quantum spin ice via quantum tunnelling. As opposed to a conventional quantum particle, the spinon moves in a background of disordered spins. The orientation of background spins controls the spinon motion, whereas the spinon motion in turn alters the spin background. One may naturally ask what a suitable framework for understanding the dynamics of spinon is in quantum spin ice, and furthermore, whether the spinon propagation is coherent. In this talk, we address these issues by investigating a minimal model that captures the essential features of single spinon dynamics in quantum spin ice. We demonstrate that the spinon motion can be thought of as a quantum walk with entropy-induced memory. Our numerical simulation shows that the simple quasi-particle behaviour emerges out of the intricate interplay between the spinon and the background spins .

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