Quantum Walks as charged general relativistic fermions

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The continuous limit of 1D quantum walks is revisited. A new limit procedure is introduced and the limit is determined for all walks. For a large family of walks, which includes the Hadamard walk, the continuous limit dynamics coincides formally with the transport of a relativistic spin 1/2 particle interacting with both a gravitational and an electric field. Numerical results are presented which show how a quantum walk on the line can be used to simulate a Dirac fermion crossing the horizon of a black hole.