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μSR studies of the metal-organic-framework kagome quantum spin liquid Cu3(HOTP)2

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The metal-organic-framework (MOF) compound Cu3(HOTP)2 is a small-gap semiconductor containing a kagome lattice of antiferromagnetically coupled S = 1/2 CuII spins with exchange coupling J~2 K. The J calculated using DFT+U matches experiment and structural modelling shows frustrated layer stacking without long-range order. Muon spin relaxation confirms no magnetic ordering down to 50 mK and sees spin fluctuations diffusing on a 2D lattice, consistent with a quantum spin liquid (QSL) ground state. Reduction of the diffusion rate on cooling from the paramagnetic region to the low temperature QSL region is assigned to the effects of quantum entanglement. Combined analysis of the spin diffusion, magnetic susceptibility and specific heat in the QSL region suggests proximity to a quantum critical point and a large density of low energy spinless electronic excitations. A Z2-linear Dirac model for the spin excitations of the QSL is found to provide the best match with experiment.

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