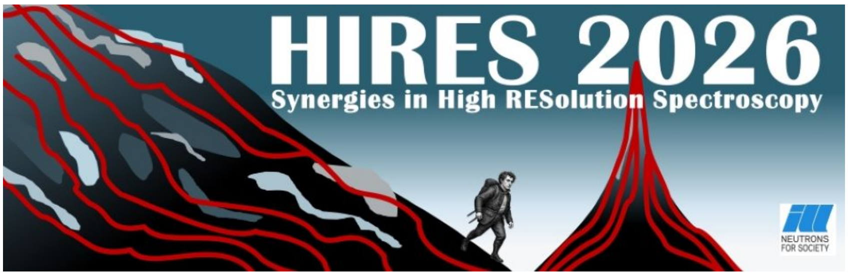


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# Enhanced dynamics in disordered non-Kramers spin ice Ho2(Ti1−x-Hfx)2O7

The Ho2Ti2O7 compound is a frustrated magnet that does not stabilize an ordered ground state down to the lowest reachable temperature, but instead, enters a correlated but disordered phase called spin ice below about 2K. The excitations out of the spin ice state, described as emergent magnetic monopoles, exhibit extremely slow dynamics at low temperature.

In spin ices such as Ho2Ti2O7, where the magnetic element is a non-Kramers ion (integer J), the crystal electric field (CEF) ground state is a non-protected doublet. It has been proposed that in that case, quantum fluctuations induced by non-magnetic disorder can push the system toward a Quantum Spin Liquid phase (QSL). This phase is characterized, inter alia, by much faster dynamics.

To investigate this potential new QSL phase we have introduced non-magnetic disorder in Ho2Ti2O7, through a controlled substitution of Ti4+ ions by Hf4+ ions, with substitution rates from 0 to 40%. X-ray and neutron diffraction measurements confirm that the crystal structure and the spin ice correlations are preserved up to at least 30% of substitution but a broadening of the crystal electric field levels is observed in inelastic neutron scattering measurements, as expected in the presence of local disorder.

To probe the dynamics, we have performed AC susceptibility and neutron spin echo (NSE) experiments down to 50 mK, which allows us to explore more than ten decades of time. These measurements reveal that the dynamics in the substituted compounds is accelerated by several orders of magnitude in the spin ice regime and up to 30 K, where quantum tunneling effects are relevant. This strongly suggests that disorder enables quantum fluctuations in the system and opens the way to the stabilization of a QSL phase at lower temperature.

## Session

Hard Condensed Matter

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