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[604] Emergent quantum coherence in random magnets allows to probe slow quantum dynamics

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Local excitations in magnetic materials are usually highly incoherent, since they dephase quickly due to mutual interactions. However, there are interesting exceptions to this common lore.

Our study of the random rare-earth magnet $\text{LiY}_{1-x}\text{Tb}_x\text{F}_4$ reveals that a combination of hyperfine interactions, external magnetic fields and disorder allows certain excitations on pairs of Tb sites to retain coherence for remarkably long times, as dominant decoherence channels are suppressed. The remaining decoherence then probes the slow dynamics in the neighborhood of these degrees of freedom, which thus act as quantum sensors. This is particularly interesting as a means to probe the nearly many-body localized dynamics of strongly disordered dipolar magnets.

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