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Quantum spin liquid in the Ising triangular-lattice antiferromagnet NdTa7O19

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Spin liquids–strongly correlated, yet disordered magnetic ground states–are extremely attractive from fundamental as well as application point of view [1,2]. While their realizations are scarce and not yet completely understood, they are praised as a platform for quantum computers. A classical spin liquid is predicted for the Ising antiferromagnetic triangular model, while additional non-commuting exchange terms should induce its quantum version.
Here we present our discovery of quantum spin liquid in the triangular-lattice antiferromagnet $NdTa_7O_{19}$ [3]. Our refinement of magnetic susceptibility, magnetization, inelastic neutron scattering and electron paramagnetic resonance spectra reveals an Ising-type Kramers doublet ground state of Nd^{3+} ions. The Curie-Weiss temperature imply exchange interaction of ~0.5 K, yet no magnetic reflections were found down to 40 mK. However, polarized neutron diffraction at 50 mK reveals diffuse magnetic scattering corroborating Ising correlations between the nearest neighbours. Finally, dynamical nature of the ground state down to 66 mK is confirmed by muons spin relaxation.
Our study [3] shows the key role of strong spin-orbit coupling in stabilizing spin liquids resulting from magnetic anisotropy and highlights rare-earth (RE) heptatantalates $RETa_7O_{19}$ as a novel framework for realization of these states.

[1] Y. Tokura *et al.* Nat. Phys. 13, 1056 (2017)
[2] D. Basov *et al.* Nat. Mater. 16, 1077 (2017)
[3] T. Arh *et al.* Nat. Mater. 21, 416 (2022)

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