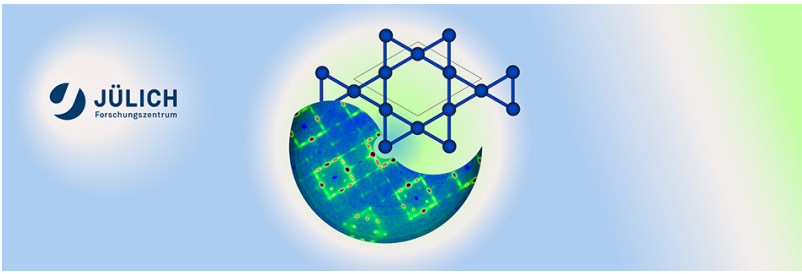

Beitrag ID: **65** Typ: **Talk**

Spin-liquid dynamics over multiple resolutions and dynamic ranges measured via time-of-flight neutron spectroscopy

Mittwoch, 8. Oktober 2025 09:45 (15 Minuten)

The measurement of the magnetic dynamical properties of strongly correlated frustrated spin-liquids presents a significant challenge for neutron scattering instrumentation. Spin-liquids can commonly present spin-fluctuations over a massive dynamical range, strongly correlated in Q-space. In addition, quantum spin-liquid candidate materials have low moments (spin-1/2 or 1) and therefore require high flux instrumentation to perform successful measurements.

Recently, Ramirez and co-workers [1,2] have pointed out the importance of the spin-glass transition in many quantum-spin-liquid materials, which counterintuitively, seems to be strongest in the limit of disorder-free samples. This underlines the importance of measuring spin-liquid materials with a wide energy range to cover the, often, high energy quantum spin-dynamics at low temperatures, and also to measure with high energy resolution to look for possible spin-freezing.

The quantum spin-liquid candidate material, ZnV_2O_4, contains just such a freezing transition in a sample which we have confirmed to be free of substitutional or occupational disorder and also free of lattice strain. We have used time-of-flight spectroscopy at both ISIS (MERLIN and LET) and the ILL (Panther) to examine the magnetic dynamical properties of ZnV_2O_4 with resolutions down to 30 μeV and dynamic ranges up to 50 meV at $|Q| \sim 1.5$ Å^{-1}. ZnV_2O_4 exhibits complex, and highly correlated spin-dynamics over all energy scales measured, with a residual spin-dynamical spectral width of ~7 meV at the lowest temperatures - therefore due to quantum (non-thermally activated) fluctuations. The spin-glass freezing temperature is associated with only a fraction of the full magnetic spectral weight and is easily distinguished from temperature independent high-energy fluctuations. Our work highlights the importance of using a suite of instruments with various characteristics in order to get the full picture of the magnetic dynamics.

1. Syzranov and Ramirez, Nat. Comms. (2022) 13:2993
2. Syzranov, Phys. Rev. B 106 L140202 (2022)

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