Symmetry Reduction in a Quantum Kagomé Antiferromagnet

A. Zorko[1], M.Herak[2], M. Gomilšek[1], J. van Tol[3], M. Velásquez[4], P. Khuntia[5], F. Bert[5], and P. Mendels[5]

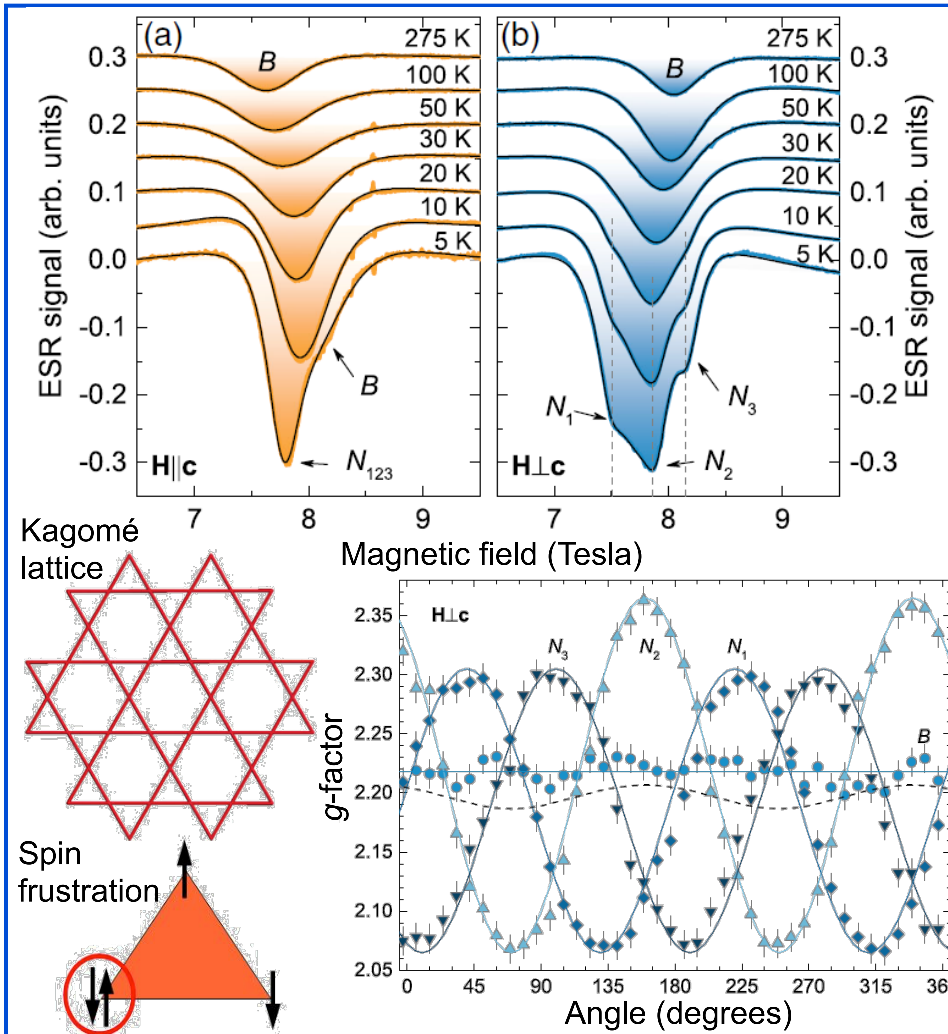
1. Jožef Stefan Institute Slovenia; 2. Institute of Physics, Croatia; 3. National High Magnetic Field Laboratory, Florida State University; 4. CNRS Bordeaux, France; 5. CNRS Paris-Saclay, France

Funding Grants: G.S. Boebinger (NSF DMR-1157490); Zorko (SRA* BI-HR/14-15-003, BI-FR/15-16-PROTEUS-004, P1-0125); Gomilšek (CSF§ UIP-2014-09-9775); Mendels (ANR†-12-BS04-0021)

A quantum spin liquid state occurs in a system of interacting quantum spins that remains magnetically disordered down to very low temperatures. Predicted in 1973 by Phil Anderson, quantum spin liquids were not realized experimentally until this century, and they remain rare. The quantum antiferromagnet herbertsmithite ($ZnCu_3(OH)_6Cl_2$) has a kagomé lattice structure in which the Cu spins reside on the vertices of corner sharing triangles. This arrangement of spins is called "frustrated" because it is impossible to satisfy an up/down/up/down pattern of spins for nearest-neighbor spins on this triangle-based lattice. *This frustration of spin order gives rise to the closest realization to date of a quantum spin liquid ground state.*

By employing complementary torque magnetometry and high-field electron spin resonance (ESR) on single crystals of herbertsmithite, novel insights are obtained into the different contributions to its magnetism. At low temperatures, two distinct types of magnetic defect with different couplings to the kagomé spins are found. *The magnetic-field response of both defects provide evidence for a global symmetry reduction of the kagomé lattice in herbertsmithite at low temperatures.*

This surprising finding contradicts the threefold symmetry of the ideal kagomé lattice, *suggesting the presence of a global structural distortion that may require a revised interpretation of the spin-liquid ground state in herbertsmithite.*



Facilities: EMR, 12.5 T heterodyne.

Citation: Zorko, A.; Herak, M.; Gomilšek, M.; van Tol, J.; Velázquez, M.; Khuntia, P.; Bert, F. and Mendels, P., *Symmetry Reduction in the Quantum Kagome Antiferromagnet Herbertsmithite,* **Phys. Rev. Lett.**, **118**, 017202 (2017).

*Slovenian Science Foundation, §Croatian Science Foundation, †Agence Nationale de la Recherche