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Probing material properties with neutrons under pressure

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Quantum magnets are physical realisations of many-body quantum systems which may host interesting phenomena such as entangled states or spin-nematic states and quantum phase transitions. There exists a number of experimental knobs for controlling the state of such system: Temperature, magnetic field, chemical doping and pressure. Of all these, the latter is the cleanest way of manipulating exchange paths in a system and therefore offers the possibility to dramatically manipulate the ground state. Inelastic neutron scattering is one of the most powerful tools to probe the finger print of non-ordered quantum entangled states: The spin dynamics. Therefore, in combination, pressure and inelastic neutron scattering are a super tool in experimental quantum magnetism. Using the archetypic quantum magnet, SrCu2(BO3)2, we present a number of high-pressure inelastic neutron scattering studies. SrCu2(BO3)2 is the realisation [1] of what is known as the Shastry-Sutherland lattice [2] consisting of a network of spin dimers with exchange interaction J inside the dimer and J' between the dimers. For low ratios of J'/J, a product of dimer singlets is the ground state. Upon increasing J'/J, a singlet plaquette phase is encountered and finally an ordered antiferromagnetic state is established [3]. The phase diagram of SrCu2(BO3)2 resembles the predicted one remarkably well with phase transitions around 1.8 GPa and 3.0 GPa to enter the plaquette and antiferromagnetic phases respectively [4]. We performed inelastic neutron scattering experiments with high pressures to investigate the nature of the predicted phases and in this way contribute with a piece in the puzzle for understanding many-body quantum physics.

[1] Kageyama et al., Phys. Rev. Lett. 82, 3168-3171 (1999)

[2] B. S. Shastry and B. Sutherland, Physica 108B, 1069-1070 (1981)

[3] P. Corboz and F. Mila, Phys. Rev. B 87, 115144 (2013)

[4] M. E. Zayed et al., Nature Physics 13, 962-966 (2017)

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