Contribution ID: **168** Type: **Talk (20 min + 5 min discussion)**

Field-Dependent Magnetic Ordering Dome and Quantum Spin Fluctuations in the Natural Mineral Henmilite

Monday 4 December 2023 16:15 (25 minutes)

Quantum materials have been playing a crucial role in the development of next-generation technologies and devices, including quantum computers. Such materials are usually prepared under laboratory conditions. However, some naturally occurring minerals have also been found to feature complex magnetic ground states, such as Henmilite [1] or Herbertsmithite [5,6]. They possess spin ½ Cu ions, which exhibit a magnetic ground state favouring the creation of quantum fluctuations, hinting at a possible quantum spin liquid state [1].
Henmilite is a bright blue-violet colour mineral, which has been suggested to consist of coupled two-leg ladders, where strong quantum fluctuations suppress (AF) magnetic order at low temperatures [1]. It is an extremely rare mineral only found in the Fuka mines of Japan [3]. In Henmilite, the B-T phase diagram has an unusual antiferromagnetic dome [2]. The nuclear crystal structure is complex and contains well-separated sheets of Cu(OH)4 square-planar plaquettes, separated by a network of Ca(OH)8 and B(OH)4 polyhedra. DFT (GGA+U) calculations found interlayer magnetic coupling less than 1% of the dominant intra-plane coupling, confirming the magnetic 2D nature of the material [1].

We will present our experimental results of the specific heat and magnetisation measurements on a single-crystal Henmilite.

References

[1] Hajime Yamamoto et al., PRM 5, 104405 (2021)
[2] Braithwaite et al., Mineralogical magazine 68.3 (2004): 527-539.
[3] Izumi Nakai et al., American Mineralogist 1986; 71 (9-10): 1234–1236.
[4] https://mambaproject.cz/alsa
[5] D. S. Inosov, Advances in Physics, 67:3, 149-252 (2018)
[6] R. S. W. Braithwaite et al., Mineralogical magazine 68.3 (2004): 527-539.

Author: Mr LABH, Ankit (Charles University)

Co-authors: Dr COLMAN, Ross Harvey (Charles University); JOCHUM, Johanna K.; Dr ČERMÁK, Petr (MGML, Charles University)

Presenter: Mr LABH, Ankit (Charles University)

Session Classification: Quantum Phenomena

Track Classification: Quantum Phenomena