Exploring a New Family of *S* = ½ Kagomé Antiferromagnets

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Materials constructed from kagomé layers of antiferromagnetically coupled *S* = ½ moments are highly prized as they offer a unique opportunity to explore the elusive quantum spin liquid state (QSL).[1] Recently, the Cu^{2+}-based mineral known as Zn-doped barlowite, $ZnCu_3(OH)_6FBr$, has shown promise as a new realisation of the QSL state.[2] Despite this interest, the crystal and magnetic structures of the parent material barlowite, $Cu_4(OH)_6FBr$, are poorly understood with several conflicting reports in the literature.[3-5] In this seminar, I will introduce these developments in the field of highly frustrated magnetism before presenting our comprehensive neutron diffraction studies of barlowite. In doing so, I will discuss the intriguing structural phase transition we observe in this material at T = 250 K, and clarify the nature of the magnetic ground state below T_N = 15 K.[6] I will also discuss our efforts to control the nature of the structural phase transition within a new family compounds through exchange of the halide ions in barlowite. In addition, I will show that we can tune the magnetic ground state of barlowite from antiferromagnetic order to quantum disorder upon Zn-doping though muon spectroscopy measurements supported by density-functional theory.[7]

[1] Broholm *et al.*, *Science* **367**, 263 (2020).

[2] Han, Singleton, Schlueter, *Phys. Rev. Lett.* **113**, 227203 (2014).

[3] Feng *et al.*, *Phys. Rev. B* **98**, 155127 (2018).

[4] Pasco *et al.*, *Phys. Rev. Mater.* **2**, 0444061 (2018).

[5] Smaha *et al.*, *J. Solid State Chem.* **268**, 123-129 (2018).

[6] Tustain *et al.*, *Phys. Rev. Mater.* **2**, 111405(R) (2018).

[7] Tustain *et al.*, *npj Quantum Materials* **5**, 74 (2020).