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Anisotropic exchange in ytterbium spinels JEFFREY RAU, MICHEL GINGRAS, University of Waterloo — Recently, the possibility that competing strongly anisotropic exchange interactions may stabilize a range of unusual phenomena has attracted much interest. Examples include spin-orbit Mott insulators which may realize variants of Kitaevs honeycomb model and quantum rare-earth pyrochlores which host order-by-disorder physics, strong multi-phase competition, and could potentially harbour a quantum spin ice ground state. In this talk, we consider exchange interactions in ytterbium pyrochlore spinels. These compounds have the same edge-sharing octahedra found in the Kitaev materials, but with the atomic physics and frustrated lattice of the rare-earth pyrochlores. We argue that the exchange in these compounds can be understood within the simple charging approximation. We then validate this framework on the well-characterized breathing pyrochlore $Ba_3Yb_2Zn_5O_{11}$, finding good agreement with the experimentally determined parameters. Turning to the Yb-based spinels, we find that the landscape of exchange parameters contains only two clear limits: a Heisenberg antiferromagnet and a ferromagnetic Kitaev exchange interaction. We further discuss the effect of relaxing the assumption of a perfect 90 degree bond angle and comment on applications to known Yb-based spinels.

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