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Continuous excitations of the triangular-lattice quantum spin liquid candidate $YbMgGaO_4$

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A quantum spin liquid (QSL) is an exotic state of matter in which electrons' spins are quantum entangled over long distances, but do not show magnetic order in the zero-temperature limit. The observation of QSL states is a central aim of experimental physics, because they host collective excitations that transcend our knowledge of quantum matter; however, examples in real materials are scarce. In this talk, I will report neutron-scattering experiments on $YbMgGaO_4$, a recently discovered QSL candidate in which Yb^{3+} ions with effective spin-1/2 occupy a triangular lattice. Our single-crystal measurements reveal a continuum of magnetic excitations – the essential experimental hallmark of a QSL – at very low temperature (0.06 K). The origin of this peculiar excitation spectrum is a crucial question, because isotropic nearest-neighbor interactions do not yield a QSL ground state on the triangular lattice. Using measurements in the field-polarized state, we identify antiferromagnetic next-nearest-neighbor interactions, spin-space anisotropies, and chemical disorder between the magnetic layers as key ingredients in $YbMgGaO_4$. *Reference:* J. A. M. Paddison, M. Daum, Z. L. Dun, G. Ehlers, Y. Liu, M. B. Stone, H. D. Zhou, and M. Mourigal, Nature Physics (In press, 2016). arXiv:1607.03231.