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# "Half-moon"excitations in the magneto-elastic spin liquid Tb2Ti2O7

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Geometrical magnetic frustration is a central concept in condensed matter physics. In this field, rare earth pyrochlore magnets R2Ti2O7 (R is a rare earth) play a prominent role, as they form model systems showing a rich variety of ground states, depending on the balance between dipolar, exchange interactions and crystal field [1]. The Terbium compound Tb2Ti2O7 remains a cooperative paramagnet, or a "quantum spin ice" , with strongly correlated moments still fluctuating at 50 mK [2]. Recent time of flight neutron and triple-axis neutron scattering experiments have recently shed light in this puzzle, revealing a complex "magneto-elastic"ground state [3,4] characterized by a local constraint resulting in "pinch points"[5], analogous to the ice rule in spin ices, and supporting a low energy (bosonic) excitation [4]. Under applied field, a complex antiferromagnetic structure sets in, while the low energy excitations transform into a spin wave like mode whose dynamical structure factor is highly anisotropic, showing "half-moons"in reciprocal space [6]. This peculiar form indeed casts light on the underlying "ice rule"of Tb2Ti2O7.

[1] J Gardner, M. Gingras and J. Greedan, Reviews of modern Physics, Vol 82 (2010)
[2] J. Gardner et al PRL 82, 1012, (1999)
[3] S. Guitteny et al PRL 111, 087201 (2013)
[4] T. Fennell et al., PRL 112, 017203 (2014);
[5] T. Fennell et al, PRL 109, 017201 (2012) and (2013)
[6] S. Petit et al, in preparation

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