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Novel insight into Tb2Ti2O7 Flavor modes and mixed dipolar-quadrupolar phases

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Tb2Ti2O7 has remained an enigma in condensed matter physics, and more specifically in the field of frustrated magnetism, for about two decades [1]. This material evades long-range order down to temperature as low as 20 mK and its ground state exhibits puzzling diffuse magnetic scattering [2,3]. Its low energy spin dynamics includes, on the one hand, an exciton located at about ⌧= 1.5 meV, which shows a significant dispersion [4]; on the other hand, Tb2Ti2O7 also hosts an exotic low energy collective mode (≈ 0.3 meV), which is believed to be a hybrid dipolar-quadrupolar mode [5,6].

Using polarized inelastic neutron scattering measurements, I will present a review of the characteristics of this low-energy mode, its dispersion, the evolution of its spectral weight in the Brillouin zone and its temperature dependence. I will then describe RPA simulations, based on a Hamiltonian, which includes both dipolar and quadrupolar couplings [7], yielding spin dynamics which compare quite well with those data. The best set of couplings suggest that Tb2Ti2O7 is one of the very rare examples of quantum spin ice, yet very close to several ordered phases, especially a planar antiferromagnetic dipolar phase and a purely quadrupolar one [8,9].

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