

*Bilayered crystal of magnetic monopoles and multiferroicity in spin ice*

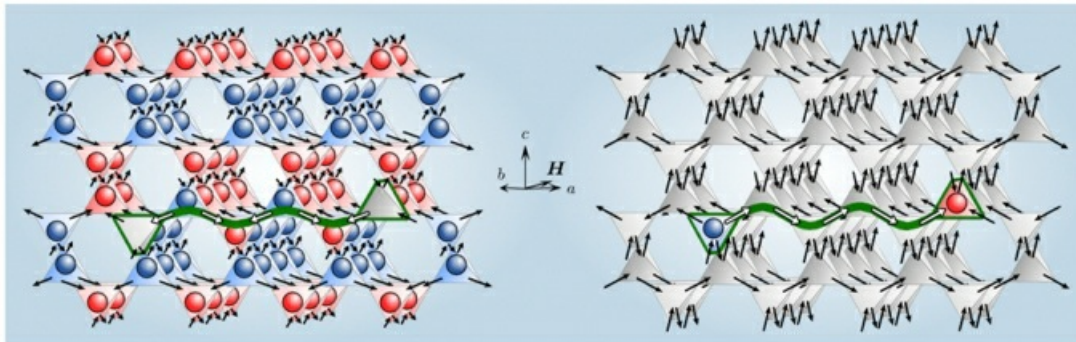
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In geometrically frustrated pyrochlore magnets, the magnetic interactions cannot be simultaneously satisfied, leading to short-range magnetic orders called spin ices or spin liquids. Spin ice support an extensively degenerate ground state and ensure the local conservation of magnetic fluxes. Such flux conservation can be described as Coulomb spin liquid by analogy with Maxwell's electromagnetism where excitations take the form of emergent magnetic monopole. It was found that under a field spin liquid Tb<sub>2</sub>Ti<sub>2</sub>O<sub>7</sub> orders as a three dimensional arrangement of magnetic monopole and antimonopole double layers [1]. Recent theory shows that magnetoelectric coupling in pyrochlores is able to lift the degeneracy and to manipulate topological excitations [2]. As a result the electric dipolar interactions can be responsible for the emergence of the double-layer structure of monopoles.

[1] Sazonov et al. Phys. Rev. (2012), B 85, 214420

[2] L. D. C. Jaubert and R. Moessner. (2015), Phys. Rev B 91, 214422



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