SEMINAIRE DE LA MATIERE CONDENSEE

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Refrustration and Competing Orders in a Spin Ice Material

Mercredi 14 novembre 2014 à 14h30

Salle de conférence 15 – Bâtiment 563

Magnetic frustration caused by antagonistic spin-spin interactions is typically of geometric origin, as in antiferromagnetically coupled spins on a lattice of triangles or tetrahedra. Frustration can also arise from explicitly competing interactions, as in the $J1$-$J2$ model with antiferromagnetic next-nearest neighbour ($J2$) interactions on a square lattice. In real materials, however, the latter mechanism rarely leads to high frustration as it relies on a serendipitous fine-tuning of Nature. We report that dysprosium titanate ($Dy_2Ti_2O_7$), an archetypal spin ice compound, is precisely such a rare case. We find that exchange interactions compete with the dipolar interactions responsible for its main spin ice phenomenology, refrustrating the material, and positioning it at the boundary between two competing ordered states. This realization offers a new perspective into the physics of spin ices, and sheds light on the effects of minute random disorder and quantum fluctuations on their low-temperature properties.

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