

Unconventional orderings in pyrochlore ruthenates

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Pyrochlore oxides of formula $R_2M_2O_7$, made of two interpenetrated pyrochlore lattices, are a rich playground in frustrated magnetism to stabilize unconventional magnetic phases, among which classical and quantum spin ice states or dipolar-octupolar phases [1-3]. When the M site is occupied by a magnetic atom such as iridium, it was shown that new magnetic states called fragmented states can emerge [4-6]. These states are characterized by the coexistence of a spin liquid phase and an ordered phase, carried by a single degree of freedom, which manifests by the presence of both magnetic Bragg peaks and diffuse scattering in neutron scattering patterns.

In this talk, I will focus on the case where the M site is occupied by another magnetic atom, ruthenium. The ruthenium sublattice orders in the 100 K range in an easy plane antiferromagnetic structure, very different from the so-called "all in - all out" state stabilized by the iridium ion. I will show how this ordering affects the magnetic rare earth properties in the cases where $R=Ho$, Dy , Nd . It includes the discovery of a ferromagnetic fragmented state [7], and of unconventional dipolar-octupolar couplings.

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