Dimensional Reduction in Quantum Dipolar Antiferromagnets
HENRIK RONNOW, PETER BABKEVICH, MINKI JEONG, Laboratory for Quantum Magnetism, Institute of Physics, EPFL, Switzerland, YOSUKE MATSUMOTO, Institute for Solid State Physics, University of Tokyo, Kashiwa, Chiba 277-8581, Japan, IVAN KOVACEVIC, Laboratory for Quantum Magnetism, Institute of Physics, EPFL, Switzerland — LiYbF$_4$ and LiErF$_4$ represent rare examples of materials where dipolar interactions dominate. Combining neutron scattering, specific heat and magnetic susceptibility data for LiErF$_4$ and LiYbF$_4$, we demonstrate that dipolar interactions can lead to antiferromagnetic order. We establish the critical properties at respectively the thermal phase transition and the quantum phase transition as function of transverse magnetic field, and discover a surprising dimensional reduction. Despite dipolar interactions being three-dimensional and long-range in nature, the critical exponents place these materials in the 2D $XY/h_4$ universality class. The effective dimensional reduction may be a consequence of the intrinsic frustrated nature of the dipolar interaction, which calls for theoretical efforts to elucidate the observation.

Henrik Ronnow
Laboratory for Quantum Magnetism, Institute of Physics, EPFL

Date submitted: 11 Nov 2016

Electronic form version 1.4