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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 magetic 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.

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