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Supersolidity in a quantum degenerate dipolar spinor gas

M. VENGALATTORE, Cornell University

I will describe studies on the magnetic and superfluid order of quantum degenerate $F = 1$ ^{87}Rb spinor gases. In these magnetic quantum fluids, we observe the spontaneous emergence of a self-organized phase exhibiting a crystalline ordering of magnetic domains. We ascribe this spatial organization to the competition between the short-range ferromagnetic interaction and the long-range magnetic dipolar interaction. Further, via Bragg spectroscopy of this dipolar quantum fluid, we confirm the presence of long-range phase coherence (characteristic of a superfluid) co-existing with the crystalline magnetic order. Together, these results provide strong experimental evidence for the realization of the supersolid phase of matter.