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Meron crystals and skyrmion fractionalization in chiral magnets
AVADH SAXENA, SHI-ZENG LIN, CRISTIAN D. BATISTA, Los Alamos National Lab — The recent discovery of skyrmions in chiral magnets, e.g. MnSi, has triggered enormous interest due to their huge potential for spintronics. Unlike magnetic domain walls, skyrmions can be manipulated with very small electric currents, thus rendering them as prime candidates for novel information storage devices with much lower power consumption. Here we study the equilibrium phase diagram of ultrathin chiral magnets with an easy-plane anisotropy A. The triangular skyrmion lattice phase that is obtained for $A = 0$ evolves through different structural phase transitions upon increasing A, which are related to the compact packings of disks with two different radii. Meanwhile, the topological charge of a skyrmion decreases continuously and we call this process skyrmion fractionalization. For a strong easy-plane anisotropy, a meron-antimeron crystal is stabilized. Akin to the case of skyrmions, the resulting merons can be manipulated with external current, and they behave like particles. Meron charge can be measured in transport experiments or by direct imaging of meron motion. Our work demonstrates that symmetric magnetic anisotropy can be used as a knob for tuning the topological character of the emergent mesoscale particles as well as the nature of the crystal that they form.

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