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Experimental Studies of Berry Phase Effects and Collective Excitations in Skyrmion Materials

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The emergence, stability and decay of skyrmions in chiral magnets and the associated emergent electrodynamics are reviewed. The non-zero topological winding, which corresponds to precisely one quantum of emergent magnetic flux, mediates an extremely efficient coupling between the conduction electrons and the magnetic properties. This emergent flux leads to a topological Hall signal, spin transfer torques at ultra-low current densities and emergent electric fields. Additionally skyrmions are characterised by an exceptional stability, which cannot be simply suppressed under large hydrostatic pressures or doping. In fact, measurements of the Hall effect suggest the survival of non-trivial topological winding akin that of the skyrmion lattice in a non-Fermi liquid regime at high pressures, where neutrons scattering suggests the absence of long-range magnetic order. The topological unwinding of skyrmions, which involves emergent magnetic monopoles, may be at the heart of the loss of long-range order.