**Skyrmions, Merons and Monopoles: Topological Excitations in Chiral Magnets**

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Stable topological excitations such as domain walls and vortices are ubiquitous in condensed matter as well as high energy physics and are responsible for many emergent phenomena. In 2009 a new mesoscopic spin texture called skyrmion was discovered experimentally in certain conducting and insulating magnets. It is now believed to exist in Bose-Einstein condensates, 2D electron gases, superconductors, nematic liquid crystals among many other systems. This topological excitation was originally proposed by Tony Skyrme in 1958 in a nonlinear field theory of baryons. In the temperature-magnetic field phase diagram of chiral magnets, skyrmions form a triangular lattice in the low temperature and intermediate magnetic field region (in thin films). In metallic magnets, skyrmions can be driven by a spin polarized current while in insulating magnets by magnons. The threshold current density to depin skyrmions is 4 to 5 orders of magnitudes weaker than that for magnetic domain walls. The low depinning current makes skyrmions extremely promising for applications in spintronics. I will first attempt to summarize the experiments and present an overview on skyrmions. Then I will demonstrate how increasing the easy-plane anisotropy results in a transition from a triangular lattice of skyrmions to a square lattice and eventually to merons. The latter are essentially half-skyrmions, with half the topological charge and have been experimentally observed. Finally, I will show that under current driving skyrmion tubes can split or merge at certain points leading to the formation of magnetic monopoles and anti-monopoles connected by a Dirac string.

**Brief bio:** Avadh Saxena is Group Leader of the Condensed Matter and Complex Systems group (T-4) at Los Alamos National Lab, New Mexico, USA, where he has been since 1990. He is also an affiliate of the Center for Nonlinear Studies at Los Alamos. His main research interests include phase transitions, optical, electronic, vibrational, transport and magnetic properties of functional materials, device physics, soft condensed matter, geometry, topology and nonlinear phenomena. He is an Affiliate Professor at the Royal Institute of Technology (KTH), Stockholm, Sweden and holds adjunct professor positions at the University of Barcelona, Spain, Virginia Tech and the University of Arizona, Tucson. He is Scientific Advisor to National Institute for Materials Science (NIMS), Tsukuba, Japan. He is a Fellow of Los Alamos National Lab, a Fellow of the American Physical Society (APS), and a member of the Sigma Xi Scientific Research Society and APS. Contact him at: avadh@lanl.gov