SKYRMIONIC MATTER - A NEW TYPE OF MAGNETIC ORDER

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In non-centrosymmetric magnets the chiral Dzyaloshinskii-Moriya (DM) exchange stabilizes tubular Skyrmions, i.e. smooth, topological, and static spin textures. Chiral Skyrmionic states may exist in many magnetic systems due to the DM-couplings as leading spin-orbit effect, if allowed by crystal symmetry or induced by broken inversion symmetry at surfaces. Skyrmionic textures are determined by the stability of localized solitonic cores and their geometrical incompatibility frustrating homogeneous space-filling. Results from phenomenological continuum theory of chiral magnets show that these spin-textures form extended states. Present understanding of the Skyrmionic magnetic states is described with a view on recent experimental observations in chiral cubic helimagnets. The multidimensional solitonic nature of the Skyrmion strings underlies unusual magnetic in such systems. The isolated Skyrmion excitations may undergo confinement near the magnetic ordering transition. In the ordered state these molecular units condense into mesophases that may appear as liquid-like or regular arrays. The existence of the particle-like Skyrmions and their variable arrangements explains the notion of 'Skyrmionic matter' that underlies exotic properties and unusually rich magnetic phase diagrams of non-centrosymmetric magnets.