Skyrmions and stability of degree ± 1 harmonic maps from the plane to the two-dimensional sphere

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Skyrmions are topologically nontrivial patterns in the magnetization of extremely thin ferromagnets. Typically thought of as stabilized by the so-called Dzyaloshinskii-Moriya interaction (DMI), or antisymmetric exchange interaction, arising in such materials, they are of great interest in the physics community due to possible applications in memory devices. In this talk, I will characterize skyrmions as local minimizers of a two-dimensional limit of the full micromagnetic energy, augmented by DMI and retaining the nonlocal character of the stray field energy. In the regime of dominating Dirichlet energy, I will provide rigorous predictions for their size and "wall angles". The main tool is a quantitative stability result for harmonic maps of degree ± 1 from the plane to the two-dimensional sphere, relating the energy excess of any competitor to the homogeneous H^1-distance to the closest harmonic map. This is joint work with Cyrill Muratov and Anne Bernand-Mantel.