Propagation and interaction of coherent structures in ferromagnetic systems

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Magnetic materials yield a rich variety of intriguing nonlinear wave phenomena. Recent theoretical and experimental developments have enabled the controlled manipulation of magnetic moments on the nanometer length scale, the magnetic exchange length, thereby generating further interest in the field of nanomagnetism, particularly as for future spin based information storage and processing technologies. Finally, the generation of coherent and localized magnetic structures (droplet solitons) has been recently experimentally observed, by using spin transfer torque underneath a nanocontact on a magnetic thin film with perpendicular magnetic anisotropy.

The existence, stability, and properties of propagating, (one-droplet) solitary waves in ferromagnetic systems have been inquired into and studied at various times since the first derivation of the corresponding governing equation, the Landau–Lifshitz (LL) equation. Although the LL equation for a one-dimensional uniaxial ferromagnetic system has been shown to be integrable by means of the inverse scattering transform, only the one-droplet solution has been studied extensively in the literature. The research illustrated in this poster is focused on the multi-droplet solutions of the one-dimensional LL equation for an easy-axis ferromagnetic system, in particular on the open problem of describing the propagation and interaction of N-droplets on the line. The solution to such a problem not only may lead to a better mathematical understanding of the LL equation, but may also provide a deeper physical insight into magnetic phenomena on the nanometer length scale.