Engineered Nonlinear Excitations in Magnetic Nanostructures

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The active control of nonlinear dynamical systems — nonlinear excitations engineering — is a fastly developing area of condensed matter physics. Superstructures of well–controlled, laterally defined magnetic elements: so–called magnetic wires and dots (*i.e.* elements with one– and two– restricted dimensions, respectively) have acquired a significant place in physics as well as in technology. In these systems the topological excitations (domain walls and vortices) determine the static and dynamic properties. The aim of this talk is to demonstrate that vortex dynamics in magnetic nanodots may be effectively controlled by applying alternative magnetic fields and spin-polarized electrical currents.

Two main items are planned to discuss: (i) The control of the vortex state of a magnetic nanoparticle, *i.e.* vortex polarity by ac magnetic fields and spin-polarized currents is studied. It is shown that the mechanism of core magnetization switching is quite general. It includes a creation of an intermediate vortex-vortex-antivortex state with subsequent annihilation of the original vortex and new-born antivortex. A simple analytical picture of such phenomena is proposed. (ii) The chirality switching in a magnetic nanodisk by applying a field pulse is also discussed. Using numerical spin-lattice simulations it is demonstrated that chirality can be controllably switched by a field pulse, which intensity is above some critical value.