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Effects of heat current in magnetic nanostructures

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This work is aimed at investigating the interplay between spin dynamics and heat current in magnetic systems. We looked e.g. at Co/Cu granular films and conducted local ferromagnetic resonance (FMR) measurements at 4.4 GHz. The samples were in the famous Spin Seebeck geometry [1] and subjected to a temperature gradient of the order of 20K/cm. We studied also electrically detected FMR of electrodeposited Co/Cu/Co asymmetric spin valves positioned at the middle of Cu nanowires, when subjected to a strong heat current in order to extend the quasi-static study of switching field versus heat current [2]. This work is supported by the Polish-Swiss Research Program NANOSPIN under the grant number PSRP-05/2010.

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Collective phenomena in magnetic nanoarchitectures

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Due to progress in a high-resolution methods the research of a nanostructured materials such as the magnetic force microscopy, the scanning tunneling microscope and high-performance supercomputing techniques, the nanoscale structures are currently the object of intensive fundamental and applied research. Nanoarchitectures are interesting from the application point of view because they could be used for production elements of random access memory, and magneto-electronic devices. From a fundamental point of view the interest to nanoarchitectures is determined by the complexity of the theory of strong-correlated state. The number of interacting particles in such nanoarchitectures is usually greater than the number of particles, for which ones are possible to obtain exact solutions. Open questions on today in this array: the trajectory in the phase space, choice of microstates at magnetization reversal of an array of nanoparticles and the magnetization reversal mechanisms, the transition from individual behavior of isolated magnetic nanoparticles to the collective behavior of nanosystems and role which one played the magnetostatic interaction in this transition.
The aim of this work to identify patterns of magnetization of the square array of 10x10 nanoparticles with desired geometric characteristics of nano-elements [1]. It is interesting to study the hysteresis properties in connection with trajectory in phase space, takes into account the distribution of magnetization in each of the nanoparticle array, taking into account the influence of dipole-dipole (magnetostatic) interaction between the particles and the field of anisotropy required for magnetization reversal in nanoparticles in the internal field interaction and the external magnetic field.

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Spin inelastic electron transport through magnetic nanostructures

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Recent experimental advances in scanning tunneling microscopy make the measurement of the conductance spectra of isolated and magnetically coupled atoms on nonmagnetic substrates possible. Notably, these spectra are characterized by a competition between the Kondo effect [1] and spin-flip inelastic electron [2] tunneling. In particular they include Kondo resonances and a logarithmic enhancement of the conductance at voltages corresponding to magnetic excitations, two features that cannot be captured by second order perturbation theory in the electron-spin coupling. We have now derived a third order analytic expression for the electron-spin self-energy, which can be readily used in combination with the non-equilibrium Green's function scheme for electron transport at finite bias. We demonstrate that our method is capable of a semi-quantitative description of the competition between Kondo resonances and spin-flip inelastic electron tunneling at a computational cost significantly lower than that of other approaches. The examples of Co and Fe on CuN will be discussed in detail. Our current work is focused on explaining the theoretical origin of the conductance asymmetry that is present in all of the experimentally determined spectra for Mn, Fe and Co [3]. We propose that the real part of the calculated self-energy is an odd function of bias, which results in a conductance asymmetry highly dependent on the magnitude of the onsite energy. This effect is explained for both spin and non spin polarized STM probes and to cases when the spin-system is driven out of equilibrium.

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Influence of pore diameter on competing anisotropies in FePd antidot arrays

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Large-scale area nanometric antidots are easily fabricated by metallic thin film deposition on nanoporous alumina templates top-surface. For a magnetic film, the pores modify its local magnetic behaviour, in comparison with a plain thin film, due to their shape anisotropy. In contrast with perfectly regular antidots fabricated by lithography, the alumina templates are isotropic on a large scale. In this work, we characterised (through major hysteresis curves, first-order reversal curves (FORC) and remanence measurements) the pores diameter influence (0, 35 and 70 nm) of polycrystalline 50 nm thick FePd thin film antidots. Unlike one could expect due to their structure, they present an in-plane anisotropic behaviour [1]. The anisotropy arises from large and parallel undulations (50 μm wide, 500 nm