**MA 12: FS: Single Nanomagnets**

**Topical Talk** MA 12.1 Tue 10:45 H22

**Exploring the frontiers in cluster magnetism from a theorist’s perspective**
— **Gustavo Pastor** — Institut für Theoretische Physik, Universität Kassel, Germany

In past years a remarkable progress has been achieved in the experimental synthesis and characterization of magnetic clusters, which renders increasingly rigorous comparisons between realistic (experimental) and idealized (theoretical) nanostructures possible. These investigations concern in particular magnetic phenomena that are specific to single clusters. The purpose of this talk is to discuss some of the current theoretical challenges in the theory of cluster magnetism.

The specific subjects to be explored are strong electron correlation effects, finite-temperature spin fluctuations and magnetic anisotropy energy (MAE). The problem of local moment formation and Kondo effect of transition-metal impurities in finite NiCuN and CoCuN metal clusters is investigated. First, principles calculations show that the Ni or Co impurities preserve their magnetic degree of freedom and are therefore good candidates for developing interesting many-body phenomena. The temperature dependence of the magnetic properties of FeN clusters (N ≤ 24) are determined in the framework of a functional-integral itinerant-electron theory. A remarkable dependence of the average magnetic moment per atom ∆ N(T) on size and structure is observed. CoRh alloy nanoparticles show non-trivial correlations between chemical and magnetic order that lead to a non-monotonous dependence of the MAE as a function of composition, yielding a perspective of tailoring the MAE of nanoalloys.

**Topical Talk** MA 12.2 Tue 11:15 H22

**Magnetic chirality in the electron microscope: Progress and Applications**
— **Peter Schattschneider** — Inst. F. Festkörperphysik und Univ. Serviceeinrichtung für Elektronenmikroskopie, Technische Universität Wien, A-1040 Vienna, Austria

In this talk, I will discuss recent developments in the field of magnetic chirality studies using electron microscopy. Chiral transitions in materials can give rise to distinctive asymmetries in energy spectroscopic diffraction (ESD) and imaging, thus opening a road to mapping electron spins of individual atomic columns under HR-TEM conditions.

**Topical Talk** MA 12.3 Tue 11:45 H22

**Stochastic resonance of a nanomagnet excited by spin transfer torque**
— **Ilya Krivorotov** — Department of Physics & Astronomy, University of California, Irvine, California 92617, USA

Spin transfer torque from spin-polarized electrical current can excite large-amplitude magnetization dynamics in metallic ferromagnets of nanoscale dimensions. Since magnetic anisotropy energies of nanomagnets are comparable to the thermal energy scale, temperature can have a profound effect on the dynamics of a nanomagnet driven by spin transfer torque. We observe unusual types of microwave-frequency nonlinear magnetization dynamics co-excited by alternating spin transfer torque and thermal fluctuations in NiFe/Cu/Co spin valves of nanoscale dimensions. In these dynamics, temperature amplifies the amplitude of GHz-range precession of magnetization and enables excitation of highly nonlinear dynamical states of magnetization by weak alternating spin transfer torque. We explain these thermally activated dynamics in terms of non-adiabatic stochastic resonance of magnetization driven by spin transfer torque.

**Topical Talk** MA 12.4 Tue 12:15 H22

**Exploring single nanomagnets with photoelectron microscopy**
— **Florian Kronast** — Helmholtz-Zentrum Berlin GmbH, Albert-Einstein-Str. 15, D-12489 Berlin, Germany

Nanostructures exhibit new and interesting magnetic properties that can not be derived from bulk properties. E.g. their effective magnetization and the Curie temperature may differ dramatically from bulk values due to finite size effects. Magnetic nanoparticles with core-shell structures are likely to show different magnetic order at the surface and in the core. In ensembles of nanoparticles inter-particle interactions strongly influence their individual magnetic properties. To resolve these nanoscale effects on the appropriate length scale we investigate individual nanomagnets by means of microspectroscopy. Using photoelectron microscopy with synchrotron light excitation we can access their chemical composition, magnetic moment and orientation with 30nm lateral resolution. A built-in magnetic yoke and temperature control allows us to measure magnetic responses of individual nanoparticles to an external magnetic field of up to ± 50mT as a function of temperature. To correlate magnetic properties of individual nanomagnets with their size, chemical composition, structure, and local coordination we combine our microspectroscopy data with detailed structural information obtained by high resolution electron microscopy. Measurements on Fe nanoparticles with a cubic shape and a side length 18nm [1] demonstrate how strongly their magnetic properties vary with their local coordination and oxidation state. [1] A. Shavel et al., Adv. Funct. Mat. 17 (2007) 3870.