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S E M I N A R
aus
Halbleiterphysik und Nanotechnologie

Di, 26.1.2016, 11:00 Uhr, Hörsaal für Physik

"Antiferromagnetic NiO nano-particles: general properties and magnetic behavior"

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It's rather well known that physical properties can strongly depend on particle size. Among all materials a special class is built by magnetic nano-particles. Because of the increase of surface to bulk ratio the spin alignment, spin ordering and spin dynamics can change dramatically resulting in completely different behavior. In magnetic nano-particles it is quite usual that a core-shell structure is established, where the surface spins are completely different oriented than the bulk. In the case of ferromagnetic particles the volume dependence of the anisotropy results in a new so called "superparamagnetic" behavior which can be observed as blocking effects in temperature and/or time dependent magnetization measurements. In antiferromagnets the situation is in some way more difficult as the ground-state's total magnetization is very small and standard magnetization measurements will not give enough information. Therefore, the combination with other, sometimes more unconventional methods, as 2-magnon Raman scattering, is required. On the other side, magnetic nano-particles are also very promising materials for high-tech applications ranging from storage devices to quantum computing. Therefore, fundamental physical understandings as well as possible applications satisfy the investigation of the behavior of nano-magnetic materials.

In this talk I will give a short survey how properties change with size and how the solid state picture breaks down. After a short introduction into 2-magnon scattering and how information can be obtained from such experiments in addition to SQUID-measurements experimental results on NiO-nano-particles of different sizes will be shown. NiO is a classical antiferromagnet crystallizing in the rock salt structure and exhibits a strong antiferromagnetic behavior due to its strong super-exchange. Nano-particles have been prepared by different methods (ball- milled, sol-gel, etc.) within a range of a view nm up to over 80nm. The obtained results are compared with the bulk material and are discussed with respect to models of magnetic nano-particles.