SFB 631

Festkörperbasierte Quanteninformationsverarbeitung

TECHNISCHE UNIVERSITÄT MÜNCHEN

Seminar Announcement

Location Festkörperkolloquium, Hörsaal III, Physik-Department, Garching

Time Donnerstag, den 11. November 2004, 17.15 h

Speaker Prof. Dr. Victor V. Moshchalkov
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Title Vortex Matter in Nanostructured Superconductors

Abstract Flux confinement phenomena have been studied in individual superconducting nanoplaquettes, their clusters and huge arrays (films with nanoengineered periodic pinning arrays (PPA)). In individual nanoplaquettes of the different form (loops, discs, triangles and squares) the superconducting critical temperature $T_c(H)$ was measured resistively and also calculated from the linearized Ginzburg-Landau equations. Novel symmetry consistent vortex patterns have been identified for triangles and squares. To keep the imposed symmetry, vortex-antivortex pairs can be spontaneously formed, for example, in an equilateral triangle with two flux quanta applied, antivortex is formed in the centre and the three vortices sit in the three corners, thus complying with the symmetry (see also Nature 408, 833 (2000); PRL 86, 1323 (2001)). Stability of the vortex-antivortex molecules in type-I equilateral mesoscopic triangles has been demon-strated (PRL 90, 147003 (2003)). In films with the PPA (lattices of antidots or magnetic dots) pronounced peaks at integer and rational fields have been revealed in dc- and ac-magnetisation and transport measurements. The peaks are attributed to certain stable vortex configurations. These configurations have been directly visualised by using scanning Hall probe microscopy (PRL 90, 237001 (2003)). The combination of the local probe techniques with the bulk probes has made it possible to identify correctly all relevant vortex patterns (multiquanta and composite vortex lattices, interpenetrating sublattices of strongly and weakly pinned vortices, etc) respon-sible for the strong enhancement of the critical current. In Pb films with a periodic array of mag-netic dots with perpendicular magnetic anisotropy field-induced superconductivity has been ob-served. This effect can be induced in any superconducting film combined with a nanoengi-neered dipole field compensator (PRL 90, 197006 (2003), PRL 92, 177904 (2004). Finally, do-main wall superconductivity in superconductor/ferromagnet hybrids will be also discussed (Na-ture Materials, October 3, 2004).

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