Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Phase diagram and vortex dynamics in superconducting spherical nanoshells JACQUES TEMPERE, TFVS, Universiteit Antwerpen, VLADIMIR GLADILIN, INPAC, Katholieke Universiteit Leuven, ISAAC SILVERA, Lyman Laboratory of Physics, Harvard University, JOZEF DEVREESE, TFVS, Universiteit Antwerpen, VICTOR MOSHCHALKOV, INPAC, Katholieke Universiteit Leuven — Curving a superconducting film into a spherical shell changes its vortex-related properties drastically due to topological constraints. The interplay between the Lorentz force due to an applied field and the vortex superflow will force vortices away from the equator (leaving an equatorial "Meissner band") and towards the poles, where they may coalesce to form giant or ring-like vortices. Using the time-dependent Ginzburg-Landau equations adapted for the spherical geometry, we derive the phase diagram and identify where, as a function of the applied magnetic field, the shell thickness and the shell radius, different vortex phases occur. We also examine the dynamics of the decay of giant and ring-like vortices into a vortex lattice, when the magnetic field is adapted so that a phase boundary is crossed. Moreover, we show that the vortex dynamics are insensitive to moderate imperfections in the shell: effects due to topological constraints can overcome the pinning potential due to imperfections. This robustness, together with the tunability of the phase diagram through a limited set of controllable parameters, makes superconducting nanoshells uniquely suited for the study of vortex states.

Jacques Tempere
TFVS, Universiteit Antwerpen

Date submitted: 12 Dec 2007 Electronic form version 1.4