Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Unconventional Vortex States in Nanoscale Superconductors Due to Shape-Induced Resonances in the Inhomogeneous Cooper-pair Condensate LING-FENG ZHANG, LUCIAN COVACI, MILORAD MILOSEVIC, GOLIBJON BERDIYOROV, FRANCOIS PEETERS, University of Antwerp — Vortex matter in mesoscopic superconductors is known to be strongly affected by the geometry of the sample. Here we show that in nanoscale superconductors with coherence length comparable to the Fermi wavelength the shape resonances of the order parameter results in an additional contribution to the quantum topological confinement leading to unconventional vortex configurations. Our Bogoliubov de Gennes calculations in a square geometry reveal a plethora of asymmetric, giant multivortex, and vortex antivortex structures, stable over a wide range of parameters and which are very different from those predicted by the Ginzburg Landau theory. By modifying the size of the system and the Fermi energy we show that ground states with different symmetries can be obtained. By increasing the temperature we observe first-order transitions from multivortex to giant vortex states. These unconventional states are relevant for high Tc nanograins, confined Bose Einstein condensates, and graphene flakes with proximity induced superconductivity.

Ling-Feng Zhang
University of Antwerp

Date submitted: 09 Nov 2012 Electronic form version 1.4