Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

**Andreev bound states in superconductor ferromagnet hybrids** SHI-HSIN LIN, Univ. of Notre Dame, MILORAD MILOSEVIC, FRANCOIS PEETERS, Universiteit Antwerpen , BOLDIZSAR JANKO, Univ. of Notre Dame, UNIV. OF NOTRE DAME TEAM, UNIVERSITEIT ANTWERPEN TEAM — We investigate the electronic structure of a superconductor in proximity of nanoscale ferromagnets (SC/FM hybrids) and find that a wide variety of superconducting order parameter landscape can be achieved by varying the parameters and the magnetic state of the nanomagnets. In particular, we propose an energy-angular momentum dispersion $\varepsilon(l)$ with the energy minimum at $l \neq 0$ in systems with superconductivity suppressed in a ring. This resembles to Landau's energy-momentum dispersion $\varepsilon(k)$ for the roton in superfluid, a dispersion that also exhibits a local minimum at $k \neq 0$. We show how such structures will emerge in specific examples SC/FM hybrids and investigate these systems via Ginzburg-Landau and Bogoliubov-de Gennes calculations. Our results show that the low-lying bound states correspond to a non-zero angular momentum. In the presence of injected current, our system becomes analogous to an inverted pendulum, which could be driven towards equilibrium with an AC magnetic field.

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Date submitted: 20 Nov 2009 Electronic form version 1.4