ΠΑΝΕΠΙΣΤΗΜΙΟ ΚΡΗΤΗΣ
ΤΜΗΜΑ ΦΥΣΙΚΗΣ

CRETE CENTER FOR QUANTUM COMPLEXITY AND NANOTECHNOLOGY

ΓΕΝΙΚΟ ΣΕΜΙΝΑΡΙΟ ΤΜΗΜΑΤΟΣ ΦΥΣΙΚΗΣ

PHYSICS COLLOQUIUM

Thursday, 14 November 2013

17:00 -18:00

3rd Floor Seminar Room

"Magnetic vortex-antivortex dipoles in spin-transfer oscillators "

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Abstract

The injection of a dc spin-polarised current through a magnetic element can induce magnetisation oscillations and thus turn a nanoelement into a spin-transfer-torque oscillator. Magnetic elements with sizes of tens of nanometers can be fabricated, so this property can be exploited for the design of, possibly, the smallest available frequency generators. We present magnetic configurations in the form of a vortex-antivortex dipole which can be generated due to electrical current. Its dynamics is analyzed using the Landau-Lifshitz equation including a spin-torque term. We observe numerically a steady-state rotational motion and show that this dynamics is due to the interaction between the vortices, while an external in-plane magnetic field can tune the frequency of rotation. The rotational motion (and the ensuing magnetization oscillation) is linked to the nonzero skyrmion number of the dipole, while the spin-torque acts to stabilize the motion. An analytical relation gives a guide for the frequency of rotation and an asymptotic analysis describes interesting features of the magnetic configuration.