ΠΑΝΕΠΙΣΤΗΜΙΟ ΚΡΗΤΗΣ

ΤΜΗΜΑ ΦΥΣΙΚΗΣ

ΓΕΝΙΚΟ ΣΕΜΙΝΑΡΙΟ ΤΜΗΜΑΤΟΣ ΦΥΣΙΚΗΣ

PHYSICS COLLOQUIUM

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17:00-18:00

3rd Floor Seminar Room

"*Nonlinear excitations in discrete model metamaterials*"

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Abstract

The term *'metamaterial'* usually refers to periodic arrangements of artificially structured elements designed to achieve advantageous and/or unusual electromagnetic properties. The interest in metamaterials originates from their great potential for novel applications in antennas, microwave devices, super-resolution imaging, cloaking devices, etc. The last decade, there have been many efforts to increase their performance and bring their operation frequency towards the optical. One of the issues concerns real-time tunability, that could be achieved through nonlinearity. Nonlinear metamaterials can be constructed by several ways, and it has been observed that they are dynamically tunable with the variation of an external field.

The nonlinearity, along with the discreteness, inherent in all metamaterial structures, make possible the localization of energy and the formation of nonlinear excitations in the form of solitons and discrete breathers. We demonstrate numerically the existence and stability of such excitations in various model magnetic metamaterials comprised of nonlinear split-ring resonators. Moreover, we demonstrate that dissipative breathers, resulting from a delicate balance of input power and intrinsic losses, change locally the magnetic response of those systems from diamagnetic to paramagnetic and vice versa. Also we propose a new type of nonlinear metamaterial resulting from the replacement of the split-ring resonator with its superconducting analogue, the rf SQUID, whose intrinsic nonlinearity is due to the Josephson effect.

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