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2D ferromagnetic nanostructures: A new class of metamaterials

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In recent years, the study of low-dimensional magnetic systems has become topical for its several technological applications but also for a complete understanding of the underlying physics of magnetic nanostructures. Very recently, for their challenging features, great attention has been given to the investigation of the static and dynamical properties of magnetic nanostructures with special regard to magnonic crystals, a class of periodic magnetic systems characterized by modulated properties. As shown by several theoretical approaches, the ferromagnetic materials composing periodic magnetic systems can be described as metamaterials since they exhibit effective properties. For instance, it is possible to define an effective magnetization and an effective permeability both in a lossless and in a lossy ferromagnetic medium, an effective wavelength and an effective wave vector for collective excitations and, under some conditions, an effective diamagnetic behavior of ferromagnetic periodic systems. Moreover, the band structure of different kinds of magnonic crystals can be determined. The aim of this talk is to give an overview of the recent results obtained on the study of metamaterial and effective properties of two-dimensional ferromagnetic nanostructures. Micromagnetic simulations and simple analytical calculations first applied to thin ferromagnetic films and then to different kinds of two-dimensional periodic magnetic systems allow extracting the above described metamaterial properties. Some possible applications based on the effective properties for tailoring new magnetic devices are suggested.

Biography

Roberto Zivieri is a Theoretical Condensed Matter Physicist. He got Master's degree in Medicine and Surgery and the Master's degree in Physics with honors and the PhD in Physics (grade excellent) from the University of Modena, Italy. He is author of about 200 scientific contributions including 70 articles in international and reputed journals. He has been serving as an Editorial Board of repute. He is Member by Invitation of the American Physical Society of the American Chemical Society and of the Italian Society of Mathematical Physics. He is winner of the APS Award "Outstanding Referees 2016".

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