

# NANOSCIENCE AND TECHNOLOGY

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# NANO SCIENCE AND TECHNOLOGY

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Alberto P. Guimarães

# Principles of Nanomagnetism

With 117 Figures

 Springer

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For Juliana, Felipe, Luisa and Paulo

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## Preface

The field of Nanomagnetism is a young branch of the study of magnetic phenomena, phenomena that have been a source of amazement and stimulus for speculation for more than 3,000 years [1].

Nanomagnetism, despite being a young area, has already affected every sphere of human activity, through its fundamental contribution to make the computer an ubiquitous instrument for communication, control of industrial processes, medical diagnosis, scientific investigation, or leisure. The studies of particulate and thin film magnetic media and other related questions led to improvements that have multiplied, in five decades, the amount of data that can be encoded into a unitary area by some 50 million times.

The 2007 Nobel Prize in Physics, awarded to Albert Fert and Peter Grünberg, is an important recognition of the extraordinary achievements of the research in Nanomagnetism. The unfolding revolution brought about by Spintronics is intimately connected, and enhances the relevance of these developments.

Nanomagnetism already encompasses a very wide range of remarkable properties and phenomena, as illustrated in the case of thin films, for example, by the volumes of the series on *Ultrathin Magnetic Structures* [2].

In the present book I have attempted to organize, out of the myriads of publications, those results that might be more revealing of the principles that every student, material scientist, or physicist have to be familiar with. The fast pace of evolution of Nanomagnetism adds to the difficulty of this project, but this fascinating subject turns this into a very pleasant and stimulating challenge to be taken up.

I have also made an effort to facilitate the conversion of the expressions that describe the magnetic properties of nanoobjects from CGS to SI units, and viceversa, since the question of units is a recurrent obstacle in the path of the student of Magnetism.

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For comments and corrections related to this volume see [www.cbpf.br/nanomagnetism](http://www.cbpf.br/nanomagnetism).

Rio de Janeiro, June 2009

*Alberto P. Guimarães*

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