

Foreword

This book is the eighth in a series of Proceedings for the *Séminaire Poincaré*, which is directed towards a large audience of physicists and of mathematicians.

The goal of this seminar is to provide up to date information about general topics of great interest in physics. Both the theoretical and experimental aspects are covered, with some historical background. Inspired by the Bourbaki seminar in mathematics in its organization, hence nicknamed “Bourbaphy”, this Poincaré Seminar is held at the Institut Henri Poincaré in Paris, with contributions prepared in advance. Particular care is devoted to the pedagogical nature of the presentation so as to fulfill the goal of being readable by a large audience of scientists.

This new volume of the Poincaré Seminar series “The Spin” corresponds to the eleventh such Seminar, held on December 8, 2007. It describes how this once mysterious quantum reality called spin has become ubiquitous in modern physics from the most theoretical aspects down to the most practical applications of miniaturizing electronic and computer devices or helping medical diagnosis.

The first and more theoretical part of the book starts with a detailed presentation of the notion of spin by leading world expert Jürg Fröhlich. He reviews its historical development in quantum mechanics and its increasing relevance to quantum field theory and condensed matter. The next two papers discuss the exotic anyon particles. They carry a nontrivial fractional spin, hence lie in between the integer spin particles, the Bosons, and the half integer spin particles, the Fermions. The first paper by Nobel laureate Franck Wilczek gives an enticing introduction to this subject that he pioneered. The following paper by Stephane Ouvry gives a more in depth review of the corresponding mathematical formalism and its relevance in the context of the quantum Hall effect.

The second part of the book is more directly aimed at the presentation of the most advanced current experiments or applications of the notion of spin. Gerald Gabrielse reviews the extremely precise measurements of the fine structure constant and the electron magnetic moment that he and his group made by confining for months at a time a single electron in a Penning trap. This is followed by a presentation on spintronics by Nobel laureate Albert Fert and his collaborators Pierre Sénéor, Vincent Cros and Frédéric Petroff. Spintronics is the new branch of electronics in which the spin of the moving electrons is controlled and it has already lead to momentous developments in solid state physics, in particular by increasing spectacularly the capacity of magnetic memory storage devices. Finally Pierre-Jean Nacher explains the history and basic physics of magnetic resonance imaging and its application to medical diagnosis. He details the particular case of lung physiology and pathologies.

We hope that the continued publication of this series will serve the community of physicists and mathematicians at professional or graduate student level.

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Bertrand Duplantier
Jean-Michel Raimond
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Séminaire Poincaré XI

Le • Spin



Samedi
8 décembre 2007

J. FRÖHLICH : Spin and Quantum Statistics • 10h
F. WILCZEK : Spin in Physical, Internal & Hilbert Spaces • 11h
G. GABRIELSE : Probing the Electron • 14h
A. FERT : La Spintronique • 15h (*Prés. P. Seneor et V. Cros*)
P.-J. NACHER : Du Spin à l'IRM médicale • 16h

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The Spin

Poincaré Seminar 2007

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