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The Euroschool on Exotic Beams, Vol. IV

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Preface

We are pleased to present the continuation of the series Lecture Notes in Physics emerging from the Euroschool on Exotic Beams. This school, initiated in Leuven (Belgium) in 1993, has been running every year (with one exception in 1999). Based on lectures given at the Euroschool, the Lecture Notes provide an introduction for graduate students and young researchers to novel and exciting fields of physics with radioactive ion beams and their applications. The fourth volume in this series covers selected material presented in Euroschool lectures between 2007 and 2011.

Since the late 80s, the field of radioactive ion beams has been rapidly developing and substantially expanding. While many of its roots were founded in Europe, and also leadership of the field was for many years concentrated in Europe, there are meanwhile intense efforts worldwide to build and exploit dedicated second-generation radioactive beam facilities. The exciting physics of radioactive ions is mainly linked to the study of nuclear structure under extreme conditions of isospin, mass, spin and temperature. Radioactive ion beam science addresses problems in nuclear astrophysics, solid-state physics and fundamental interactions. Furthermore, important applications and spin-offs also originate from this basic research. The development of new production, acceleration and ion manipulation techniques and the construction of new detectors is also an important part of this science. A major aim is the development of a unified picture of the atomic nucleus, to understand the structure and dynamics of nuclei and to provide reliable predictions of nuclear structure properties within the "Terra Incognita", the regions in the nuclear chart which cannot be explored with present experimental techniques.

As with previous volumes, the present Lecture Notes do not comprise a complete overview of the field, but represent sample topics of theory and experiment. Since the appearance of the latest volume in 2009, and already before, many new subjects were covered in the lectures, and some of them are presented here. The topics have been selected by the editors to exhibit recent advances in the field and to complement previous Lecture Notes. None of them has been covered in previous volumes, all represent an active field of current research, and all authors are well known experts in their domains and are highly respected scientists. Their contributions to this book are not meant to be review-type articles rather they provide a modern introduction to a specific subject in a didactic way, given by practitioners at the forefront of scientific research. This approach has proved to be successful and the Euroschool Lecture Notes are popular among both students and scientists. The content of volumes I, II and III of this series is available on the Euroschool website http://www.euroschoolonexoticbeams.be. We hope that the present volume will be no less successful than the previous editions.

The Euroschool concept began as a European initiative. From the start the intention was to gather original questions, methods and results from the field of radioactive beams and exotic nuclei, and to bring them to the attention of students and young researchers working in this domain both within Europe and overseas. The school has, at all times, been open for European and international participants. Since 2001 the Euroschool has traveled to various locations and countries throughout Europe. Events took place in Finland (2001, 2011), France (2002, 2007), Spain (2003, 2010), United Kingdom (2004), Germany (2005), Italy (2006), Poland (2008), Belgium (2009), Greece (2012), and most recently in Russia (2013). The evident success of the Euroschool on Exotic Beams originates to a large extent from the excellence of the lecturers invited to share their knowledge with the students and the pleasant, informal atmosphere which generates a valuable forum for discussions. Despite some organizational changes which occurred during this time, the scope, format, spirit, and popularity among young participants has been maintained. It is our pleasure—and debt—to thank the sponsors for their support, which makes the Euroschool events possible:

- Demokritos—National Center for Scientific Research, Athens (Greece)
- ECT*, European Centre for Theoretical Studies in Nuclear Physics and Related Areas, Trento (Italy)
- GANIL—Grand Accelerateur National d'Ions Lourds, Caen (France)
- Gobierno de España—Ministerio de Economia y Competitividad—FNUC Network and CPAN Ingenio 2010, Madrid (Spain)
- GSI—Helmholtz Centre for Heavy Ion Research, Darmstadt (Germany)
- HIC-4-FAIR—Helmholtz International Center for FAIR, Darmstadt (Germany)
- IFIC-CSIC—Instituto de Fisica Corpuscular, Consejo Superior de Investigaciones Cientificas, Madrid (Spain)
- INFN—Instituto Nazionale di Fisica Nucleare (Italy)
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- University of Warsaw (Poland)
- USC—University of Santiago de Compostela (Spain)

Finally, we would like to thank all who have contributed to this volume. First of all to the authors who have given excellent lectures for the Euroschool students, and who have invested time and effort in preparing the contributions to this book in a comprehensive and pedagogical way. Secondly, we thank our colleagues on the Board of Directors of the Euroschool, who supported the development of this volume with interest and for their valuable ideas. Last, but not least, it is our pleasure to thank Dr. Chris Caron and his colleagues at Springer Verlag for the encouragement and continuous support in a fruitful collaboration.

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