

Isotopes in Condensed Matter

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Preface

This book describes the manifestations of the isotope effect in all branches of physics: nuclear, atomic and molecular as well as condensed matter and its applications in *human health* and *medicine*, *geochronology*, industry, research in academic and applied fields. This book is intended both as a tutorial and as a reference. It is a concise introduction to isotopetronics, developing the basic elements of this new branch of nanoscience. The problem of the enigma mass in microphysics is briefly discussed.

The science of the nuclear, atoms and simple molecules and the science of matter from microstructures to larger scales, are well established. A remaining, extremely important, size—related challenge is at the atomic scale—roughly the dimensional scales between 1 and 10 molecular sizes—where the fundamental properties of materials are determined and can be engineered. This field of science—isotopetronics—is a broad and interdisciplinary field of emerging research and development. Isotopetronics technology is concerned with materials, structures and systems whose components, as in nanoscience, exhibit novel and significantly modified physical, chemical and biological properties due to their small sizes. A principal goal of isotopetronics technology is to control and exploit these properties in structures and devices at atomic and molecular levels. To realise this goal, it is essential to learn how to fabricate and use these devices efficiently. Practical implementations of isotopetronics science and technology have great importance, and they depend critically on training people in these fields. Thus, modern education needs to address the rapidly evolving facets of isotopetronics science and applications. With the purpose of contributing to education in the *isotopetronics* as a new branch of *nanoscience* I present this book providing a unifying framework for the basic ideas needed to understand recent developments underlying isotopetronics science and technology, as applied to nanoelectronics and quantum information. Quantum information is a field which at present is undergoing intensive development and, owing to the novelty of the concepts involved, it seems to me it should be as interest to a broad range of scientists beyond those actually working in the field. I have tried to present a simple and

systematic treatment of the isotopetronics, such that the reader might understand the material presented without the need for consulting other books.

With numerous illustrations, this book will be of great interest to undergraduate and graduate students taking courses in mesoscopic physics or nanoelectronics as well as quantum information, and academic and industrial researches working in this field.

The references I cite are those with which I am most familiar and which have helped us understand the subject as presented here. While there has been no attempt to give credit to each contributor, I have tried to cite the original papers, which brought new and important results (methods) to the isotope effect applications in all branches of microphysics.

Tallinn

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