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# Hyperfine Interactions of Radioactive Nuclei

Edited by J. Christiansen

With Contributions by

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With 172 Figures

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# Preface

This volume deals with the interaction between moments of excited or radioactive nuclei and electromagnetic fields. The experimental techniques developed for the observation of this hyperfine interaction are governed by the lifetime of the nuclear states in question. The dynamics of the interaction are reflected by the time dependence of the spatial distribution of the radioactive decay radiation. Basically, the experiments yield information on the energy shifts and/or splittings of the nuclear levels. These quantities are determined essentially by the product of the nuclear moment and the electromagnetic field acting at the site of the nucleus. Due to the strong decrease in the fields with distance, the measurements probe these fields within a highly localized region centered around the radioactive nuclei.

Detailed experimental methods with numerous ramifications were developed in the early sixties. In the period which followed, the main emphasis was on excitation of short-lived nuclear states by means of pulsed particle accelerators, implantation of radioactive nuclei, and production of polarized  $\beta$ -unstable nuclei by nuclear reactions with polarized neutrons or particles. The seventies were a period of fruitful applications directed to extensive studies of the moments of excited nuclear states on the one hand, and local internal fields on the other, resulting in far-reaching information on atomic and solid-state properties.

The organization of this *Topics* volume follows these main lines of research. Following the introduction, which summarizes some methodological and historical aspects, the second chapter discusses aspects of nuclear physics which are correlated with the measurements of magnetic dipole and electric quadrupole moments of excited nuclear states. The next chapter reviews the results of experiments on the electron shells of free atoms or ions. The three final chapters present current research on solid-state problems: lattice defects (Chap.4), electric field gradients in metals and alloys (Chap.5), and the applications of nuclear magnetic resonance experiments to  $\beta$ -unstable polarized nuclei (Chap.6).

The editor is grateful to the authors for their active cooperation, and to Dr. H. Lotsch for his encouragement and patience during the delayed maturing of this volume.

Erlangen, March 1983

*Jens Christiansen*

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