Lecture Notes in Physics 838

Theory of Nuclear Fission

A Textbook

Bearbeitet von
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Preface

In his book "Theories of Nuclear Fission" of 1964, L. Wilets summarized the state of understanding nuclear fission at that time. Since then the field has considerably expanded owing to the vast increase in the amount and quality of experimental data, in particular those obtained in heavy-ion fusion-fission reactions or made possible by the development of mass separators and high-flux neutron sources. Motivated in many cases by the new data and greatly aided by the phenomenal increase in computing power over the past decades, considerable progress has also been made in our theoretical understanding of nuclear fission. Notably the construction of the potential energy surface profited from Strutinsky's shell correction and the introduction of energy-density functionals, which made realistic calculations possible in both, the Hartree-Fock and the Hartree-Bogolyubov frame. The progress has been less convincing for inertial and especially friction coefficients, needed to model fission dynamics. A variety of models have been proposed for the friction tensor with widely differing results.

Our aim in this book is to give an account of the development of the theory of fission in recent years. In order to keep the size of the book within reasonable bounds, we focus on low and medium energy fission. Thus we shall not discuss the decay of highly excited nuclei as in spallation and multifragmentation reactions or processes involving antiprotons or hyperons. Heavy-ion fusion reactions will be treated only marginally.

The reader is expected to be familiar with the basic elements of theoretical physics. We will frequently make reference to the first 6 volumes of the "Course of Theoretical Physics" by Landau and Lifshitz and to the textbook "The Nuclear Many-Body Problem" by P. Ring and P. Schuck for more detailed derivations and discussions of results. To represent multidimensional dynamics in the collective coordinates we will use tensor notation in Chap. 5. The reader may consult A. Lichnerowicz's "Elements of Tensor Calculus" for some elementary results from tensor analysis.

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