Treatise on Heavy-Ion Science

EDITED BY D. ALLAN BROMLEY

Volume 4
Extreme Nuclear States

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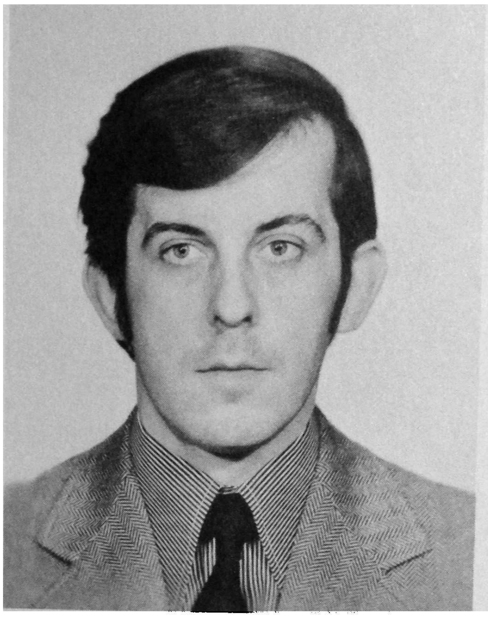

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Heavy Ions and Nuclear Fission

YURI TS. OGANESSIAN AND YURI A. LAZAREV

To Academician G. N. Flerov on the occasion of his seventieth birthday.

1. Introduction

The discovery of neutron-induced fission of uranium nuclei in the experiments performed by Hahn and Strassmann (Ha 39, Me 39) has signified an observation of nuclear transmutations of a radically new type—the processes of large-scale rearrangement of finite amounts of nuclear matter. As a matter of fact, the fission is a result of an irreversible deformation, that grows in time, in the course of which an original, nearly spherical heavy nucleus undergoes drastic changes in its topology and is transformed into two fragments of comparable, yet generally unequal, mass. The time evolution of a fissioning system is accompanied by multiple redistribution of available energy between various degrees of freedom, and culminates in the release of a vast amount of energy in the form of kinetic energy of the fission fragments and energy (mass) of accompanying radiation, i.e., prompt neutrons and γ rays. To initiate such radical rearrangement, an extremely weak external perturbation proved to suffice—the capture of a slow neutron causing only tiny changes in the total number of nucleons as well as in the total energy of the original nucleus.

The discovery of spontaneous fission of uranium in the experiments performed by Flerov and Petrzhak (Fl 40a, b, Pe 40) has demonstrated that

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