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**C O N T E N T S**

*GENERAL PHYSICS*



*GENERAL PHYSICS- QUANTUM MECHANICS*



*MATHEMATICAL PHYSICS*



*MATHEMATICAL PHYSICS - QUANTUM FIELDS*



*CONDENSED MATTER*

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Large metallic clusters of heavy atoms are described within the quasi-classical theory, by means of a variational approach to the linearized Thomas-Fermi model. Effective inter-atomic potentials are derived and equilibrium spatial structures are given; these structures are universal for homo-atomic metallic clusters, in the sense that they are independent of the chemical nature of the atoms. The binding energies, interatomic distances, and the vibration spectra are computed as functions of the effective number of "valence" electrons; this effective valence is estimated from the atomic screening. Magic numbers are obtained, corresponding to close spatial packings; these geometric magic numbers are also universal for homo-atomic metallic clusters, in the sense that they do not depend on the atomic species. The quadrupole-deformed potential for the electrons in a metallic cluster is also derived. The extension of the theory to including ionic or covalent bonds is discussed.

*NUCLEAR PHYSICS*



Experimental results on ternary fission of $^{252}$Cf suggest the existence of a short-lived quasi-molecular state. We present a three-center phenomenological model able to explain such a state by producing a new minimum in the deformation energy at a separation distance very close to the touching point. The shape parametrization chosen by us allows to describe the essential geometry of the system in terms of one independent coordinate: the distance between the heavy fragment centers. The shell correction (also treated phenomenologically) only produces quantitative effects; qualitatively it is not essential for the new minimum. Half-lives of some quasi-molecular states which could be formed in $^{10}$Be accompanied fission of $^{236}$U, $^{236}$Pu, $^{246}$Cm, $^{252}$Cf, $^{252,256}$Fm, $^{256,260}$No, and $^{262}$Rf are roughly estimated.



A model is used to determine the fission products of $^{238}$U. The deformation energy of the decaying system is obtained within the microscopic-macroscopic model using a two-center nuclear shape parametrization. This model takes into account the excitation energy of the target nucleus and the evaporation of prompt neutrons. The isotopic yields of the induced fission are obtained for all mass partitions.