The Nuclear Thomas-Fermi Model*

W.D. Myers and W.J. Swiatecki

The statistical Thomas Fermi model is applied to a comprehensive survey of macroscopic nuclear properties. The adjustable parameters of the effective nucleon-nucleon interaction were fitted to shell-corrected masses of 1654 nuclei, to the diffuseness of the nuclear surface and to the measured depths of the optical model potential. With these parameters nuclear sizes are well reproduced, and only relatively minor deviations between measured and calculated fission barriers of 36 nuclei are found. The model determines the principal bulk and surface properties of nuclear matter and provides estimates for the more subtle, Droplet Model, properties. The predicted energy vs. density relation for neutron matter is in striking correspondence with the 1981 theoretical estimate of Friedman and Phandaripande [1]. Other extreme situations to which the model is applied are a study of Sn isotopes from ^{82}Sn to ^{170}Sn, and the rupture into a bubble configuration of a nucleus (constrained to spherical symmetry) which takes place when Z^2/A exceeds about 100.

*Condensed from Acta Physica Polonica B26 (1995) 111

[1] B. Friedman and V.R. Pandharipande, Nucl. Phys. **A361** (1981) 502

The Rotating Nuclear Thomas-Fermi Model*

W.D. Myers and W.J. Swiatecki

The Thomas Fermi model of Ref. [1] is generalized by the addition of a rotational energy. For heavy elements the calculated fission barriers of rotating nuclei agree with those of Ref. [2]. For lighter elements the barriers are lowered appreciably by the inclusion of the shape dependence of the congruence energy, but even then they exceed those of Ref. [2] by up to a few MeV. The shapes, density distributions, deformation energies and saddle-point properties of the superdeformed nuclei ^{152}Dy and ^{83}Sr are calculated.

*Condensed from Acta Physica Plonica B27 (1996) 99

[1] W.D. Myers and W.J. Swiatecki, Nucl. Phys. **A601** (1996) 141

[2] A. J. Sierk, Phys. Rev. **C33** (1986) 2039

The Nuclear Thomas-Fermi Model with Angular Momentum: Fission Barriers, Superdeformations, Moments of Inertia*

W.D. Myers and W.J. Swiatecki

When rotational energy is added to the Thomas-Fermi nuclear model of Ref. [1] a number of new predictions are possible. In this paper we present a survey of fission barriers, deformation energies, gamma-ray rotational cascades and moments of inertia. We also explore a hypothesis according to which the moment of inertia of a deformed nucleus can be estimated by subtracting from the rigid body value the moment of inertia of an inscribed sphere.

*Condensed from LBNL-39224

[1] W.D. Myers and W.J. Swiatecki, Nucl. Phys. **A601** (1996) 141