Neutron Star Properties in the Thomas-Fermi Model

K. Strobel, F. Weber, M. K. Weigel, and Ch. Schaab

The modern nucleon-nucleon interaction of Myers and Swiatecki, adjusted to the properties of finite nuclei, the parameters of the mass formula, and the behavior of the optical potential is used to calculate the properties of β–equilibrated neutron star matter, and to study the impact of this equation of state on the properties of (rapidly rotating) neutron stars and their cooling behavior. The results are in excellent agreement with the outcome of calculations performed for a broad collection of sophisticated nonrelativistic as well as relativistic models for the equation of state.

(to be published in: J. Modern Physics **E**, 1997
see also nucl-ph/9705043)

Neutron Star Properties with Relativistic Equations of State

H. Huber, F. Weber, M. K. Weigel, and Ch. Schaab

We study the properties of neutron stars adopting relativistic equations of state of neutron star matter, calculated in the framework of the relativistic Brueckner-Hartree-Fock approximation for electrically charge neutral neutron star matter in beta-equilibrium. For higher densities more baryons (hyperons etc.) are included by means of the relativistic Hartree- or Hartree-Fock approximation. The special features of the different approximations and compositions are discussed in detail. Besides standard neutron star porperties special emphasis is put on the limiting periods of neutron stars, for which the Kepler criterion and gravitation-reaction instabilities are considered. Furthermore the cooling behaviour of neutron stars is investigated. For comparison we give also the outcome for some nonrelativistic equations of state.

to be published in: J. Modern Physics **E**, see also nucl-th/9711025

Quark matter, Massive Stars, and Strange Planets

F. Weber, Ch. Schaab, M. K. Weigel, and N. K. Glendenning

This paper gives an overview of the properties of all possible equilibrium sequences of compact strange-matter stars with nulcear crusts, which range from strange stars to strange dwarfs. In contrast to their non-strange counterparts, – neutron stars and white dwarfs –, their properties are determined by two (rather than one) parameters, the central star density and the density at the base of the nuclear crust. This leads to stellar strange-matter configurations whose properties are much more complex than those of the conventional sequence. As an example, two generically different categories of stable strange dwarfs are found, which could be the observed white dwarfs. Furthermore we find very-low-mass strange stellar objects, with masses as small as those of Jupiter or even lighter planets. Such objects, if abundant enough in our Galaxy, should be seen by the presently performed gravitational microlensing searches. Further aspects studied in this paper concern the limiting rotational periods and the cooling behavior of neutron stars and their strange counterparts.

published in: Proc. of the International Conference on Nuclear Physics at the Turn of the Millennium, Wilderness, South Africa, World Scientific, Singapur, 1997, p. 322