appropriate questions of the model one can then estimate, more or less reliably, various properties of the macroscopic nuclear fluid. What model to use? The Hartree-Fock model, quite successful for finite nuclei, is not what you really need. You cannot carry out a microscopic Hartree-Fock calculation for 10^{57} nucleons in a neutron star anyway, and even if you could, the microscopic shell effects that the calculation would produce would be that much wasted effort. What one needs is a theory like a self-consistent Hartree-Fock theory, but *without* shell effects.

The Thomas-Fermi model is just that. It is a self-consistent theory like Hartree-Fock, but averaged over shells. It was introduced into atomic physics by L.H. Thomas as early as November 1926 (published in January, 1927, [3]) and, independently, by E. Fermi a year later [4]. It is a beautiful statistical theory based on one simple fact: the Pauli exclusion principle forces a degenerate gas of fermions to populate phase space with two particles per volume h^3 of this space. Thus, for any given potential well $U(\bar{r})$, the atomic or nuclear particle density can be written down at once as proportional to the 3/2 power of the potential depth measured with respect to the Fermi level, i.e., with respect to the energy of the fastest particle. (The local phase space is proportional to the cube of the Fermi momentum P and the Fermi energy is proportional to the square of P, hence the 3/2 power.) If the resulting density is then used to generate the potential $U(\bar{r})$ by way of an appropriate law of interaction (Coulomb in the atomic case, an effective short-range force in the nuclear case), and if the potential and density are subsequently iterated to self-consistency, as in a Hartree-Fock scheme, one obtains the Thomas-Fermi approximation to the density distribution, binding energy and any other property of the system. As the title of Fermi's paper proclaims in broken English: "Un metodo statistico per la determinazione di alcune proprietà dell' atomo."

Figure 1 shows, as an example, a comparison of the Thomas-Fermi and the Hartree electronic densities for the Hg atom [5], and Fermi's calculation of the number of atomic p-electrons as a function of the atomic number Z [4]. As you can see, the Thomas-Fermi