$$E_n(\rho_n) = 16.464\Phi^2 - 13.635\Phi^3 + 5.391\Phi^5 \text{ MeV} \quad . \tag{22}$$

Figure 16 compares this prediction with the theoretical estimate of [1]. The similarity of the two curves is quite remarkable. The physical ingredients in the two methods are quite different, and they both represent bold extrapolations from measured properties of nuclear interactions and bindings to the extreme conditions prevailing in neutron matter. (It is essential to stress that, in contrast to our paper of 1990 [20], the parameters of our present Thomas-Fermi model were *not* constrained to agree with the results of [1]. They were fitted to ground-state masses and to the surface diffuseness, and the extrapolation to neutron matter agrees then with [1] without any readjustments.)

16. A nuclear bubble

It has been known for a long time [29, 30] that a sufficiently highly charged idealized nucleus, if constrained to spherical symmetry, would eventually rupture into a bubble configuration. In the simplest liquid drop model, a bubble configuration first appears when the fissility parameter x exceeds the value 2.0216 [29]. [Implying that, very roughly, $(Z^2/A)/50$ exceeds 2.0216. Stability against fission is lost at $x = 1$, i.e., when $Z^2/A \approx 50$]. The energy of the bubble configuration falls below that of the unruptured sphere when $x > 2.212$ [29]. As an illustration of this phenomenon we carried out a series of Thomas-Fermi calculations, starting with $N = 600$, $Z = 400$, and reducing the mass number A down from 1000, while keeping $(N-Z)/A$ at the fixed value of 0.2. In this way we located approximately the point where the Thomas-Fermi solution would switch from an unruptured nucleus to a bubble configuration with increasing Z^2/A. Figure 17 shows the last solid nucleus for $N = 372$, $Z = 248$ ($Z^2/A = 99.2$) and the first bubble configuration for $N = 378$, $Z = 252$ ($Z^2/A = 100.8$).

Summary and conclusions

We applied the statistical method, introduced for atomic electrons by Thomas and by Fermi, to a comprehensive description of nuclear properties. We did this by generalizing the