HFB theory for nuclei near the drip-lines: continuum coupling *

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Near the neutron or proton drip lines, large pairing correlations are expected which can no longer be described by a small residual interaction. Furthermore, the outermost nucleons are weakly bound (which implies a large spatial extent), and they are strongly coupled to the particle continuum. These features represent major challenges for the mean field theories.

We solve the Hartree-Fock-Bogoliubov equations for deformed, axially symmetric even-even nuclei on a two-dimensional lattice. High accuracy is achieved by representing the operators and wavefunctions in terms of Basis-Splines; a combination of the Galerkin and collocation method is utilized [1]. This work represents a natural extension of the 1-D calculations for spherical nuclei by Dobaczewski et al. [2]. Test results for ^{22}Ne using a Skyrme mean field and a constant pairing Hamiltonian are shown in Fig. 1. The HFB lattice Hamiltonian has been directly diagonalized using LAPACK yielding a quasiparticle energy spectrum up to $E_n = 2000$ MeV. In calculating observables, we cut off this spectrum at an equivalent s.p. energy of about 60 MeV. These first results are a successful test of our numerical algorithm to perform pairing calculations in two dimensions for nuclei near the drip lines. Calculations with realistic pairing interactions (density-dependent delta-forces) are now underway.

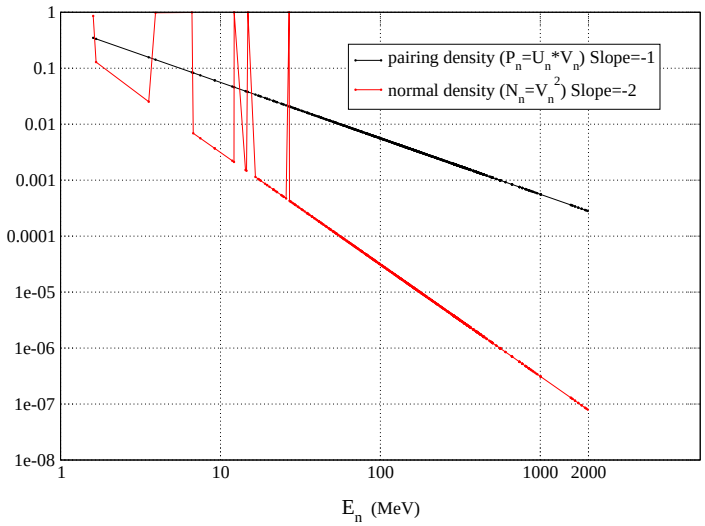

FIG. 1. Quasiparticle energy spectrum of normal and paring densities.

[1] V.E. Oberacker and A.S. Umar, in "Perspectives in Nuclear Physics", World Scientific Publ. Co. (1999), p. 255-266; nucl-th/9905010.
[2] J. Dobaczewski, W. Nazarewicz, T.R. Werner, J.F. Berger, C.R. Chinn, and J. Dechargé, *Phys. Rev.* **C53** (1996) 2809.

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