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Reconciling superfluidity and deformation in the relativistic nuclear field theory

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The recent theoretical effort in reconciling superfluidity and deformation will be presented for the domain of the single-quasiparticle motion. Starting from a general many-body Hamiltonian confined by the two-body instantaneous bare interaction, the equation of motion for the fermionic propagator is obtained in the Dyson form. Before making any approximation, the interaction kernel is found to be decomposed into the static and dynamical (time-dependent) contributions, while the latter translates to the energy-dependent and the former maps to the energy-independent terms in the energy domain. The three-fermion correlation function being the heart of the dynamical part of the kernel is factorized into the two-fermion and one-fermion ones. With the relaxed particle number constraint, the normal propagator is coupled to the abnormal one via both the static and dynamical kernels, that is formalized by introducing the generalized quasiparticle propagator of the Gor'kov type. The dynamical kernel in the factorized form is associated with the quasiparticle-vibration coupling (QVC) with the vibrations unifying both the normal and pairing phonons. The QVC vertices are related to the variations of the Hamiltonian of the Bogoliubov quasiparticles, which can be obtained by the finite amplitude method. Calculations of single-particle characteristics for axially deformed nuclei will be presented and discussed.

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