Dynamics of Correlated Systems with Nonequilibrium Green's Functions

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Theory of non-equilibrium Green's function (NGF) provides a practical framework for studying quantum many-body systems out of equilibrium. Extending the previous mean field approach developed for nuclear systems in one dimension with NGF, we introduce isospin degrees of freedom to the Green's functions and incorporate short-range two-body interactions in the second-order self-consistent approximation to correlations, which represents the scattering of momentum orbitals in the Born approximation. We discuss the preparation of a finite nuclear system and examine the impact of correlations on the ground state. We also excite a finite symmetric nuclear system to oscillate in an isovector dipole mode and explore the dissipation effects in the oscillation. Finally, we demonstrate how to boost a slab to a constant and stable motion in a box, based on Galilean covariance of the theory. The studies in this paper lay the ground for the future exploration of collisions of correlated nuclear systems in one dimension.