Nuclear slabs in terms of Green's functions: Collective oscillations with short-range correlations

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Nonequilibrium Green's functions (NGF) seem ideally suited for describing central nuclear reactions, but their use poses serious computational challenges. The attraction of NGF is in the opportunity to include on par the effects of short-range correlations, or collisions between nucleons, and the mean-field effects, in a consistent quantal framework. The computational challenge is in the double-space and double-time integrations within the approach. To progress with the application of NGF to the reactions, we start with nuclear systems modeled in one dimension and seek to develop approximations that may be carried over to two and three dimensions. We first switch on correlations adiabatically in infinite uniform systems at different densities and develop a combination of correlations and mean field that can yield systems saturated at normal density corresponding to the centers of nuclei. Upon constructing finite nuclear slabs, again through adiabatic switching, we study collective oscillations for these slabs, where neutrons move against protons, as common in highly excited nuclei. We compare the progress of oscillations between the situations with mean field only and mean field combined with short-range correlations. Finally, upon preparing two cold nuclear slabs, we slam them against each other, again without and with short-range correlations.