A SIMULTANEOUS CENTER-OF-MASS CORRECTION OF NUCLEON DENSITY AND MOMENTUM DISTRIBUTIONS IN NUCLEI

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S u m m a r y

The approach exposed in the recent paper [1] has been applied in studying the center-of-mass (CM) motion effects on the nucleon density and momentum distributions in nuclei. We use and develop a formalism based upon the Cartesian or boson representation, in which the coordinate and momentum operators are expressed through the creation and annihilation operators for oscillator quanta in three different space directions. We are focused upon effects due to the center-of-mass and short-range nucleon correlations embedded in translationally invariant ground-state wavefunctions. The latter are constructed in the so-called fixed center-of-mass approximation, starting with a Slater determinant wave function modified by some correlator e.g., after Jastrow or Villars. It is shown how one can simplify the evaluation of the corresponding expectation values that determine the distributions. The analytic expressions derived here involve the own Tassie–Barker factors for each distribution. As an illustration, numerical calculations have been carried out for a nucleus ^{4}He with the Slater determinant to describe the nucleon $(1s)^4$ configuration composed of single-particle orbitals which differ from harmonic oscillator ones at small distances. Such orbitals simulate a somewhat short-range repulsion between nucleons. Special attention is paid to a simultaneous shrinking of the CM corrected density and momentum distributions as compared with the purely $(1s)^4$ shell nontranslationally invariant ones.