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Dynamics of two-cluster systems in phase space

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We present a phase-space representation of quantum state vectors for two-cluster systems which is valid both for finite hbar and when hbar goes to zero. The Bargmann-Segal transformation was used to map wave functions of two-cluster systems in the coordinate space into the Fock-Bargmann space. The density distribution in the phase space was compared with those in the coordinate and momentum representations. Density distributions in the Fock–Bargmann space were constructed for bound and resonance states of 6,7Li and 7,8Be, provided that all these nuclei are treated within a microscopic two-cluster model. The microscopic model is based on the resonating-group method and uses a full set of oscillator functions to expand a wave function of relative motion of interacting clusters. The dominant two-cluster partition of each nucleus was taken into consideration. The input parameters of the model and nucleon-nucleon potential were selected to optimize description of the internal structure of clusters and to reproduce position of the ground state with respect to the two-cluster threshold. We considered a wide range of excitation energies of compound systems, but special attention was devoted to the bound and resonance states. Bound states and narrow resonance states realize themselves in a very compact area of the phase space. We establish the quantitative boundaries of this region for the nuclei under consideration. Phase portraits of the high-energy excited states peak along the line which coincides with a classical trajectory.

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