Symplectic Symmetry Approach to Clustering in Atomic Nuclei: The Case of ^{20}Ne

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Symplectic symmetry approach to clustering (SSAC) with the essential group structure $Sp(6,R)_R \otimes Sp(6,R)_C \otimes O(A-2) \subset Sp(6(A-1),R)$ is applied to the microscopic description of the lowest $K^\pi = 0_1^+$, $K^\pi = 0_1^-$, and $K^\pi = 0_2^+$ rotational bands in the classical two-cluster α + ^{16}O $\rightarrow$ ^{20}Ne nuclear system. The latter consist of two scalar $SU(3)$ clusters, so in this particular case the more complete cluster dynamics within the SSAC is reduced to a pure intercluster dynamics of the R-subsystem only. A good description for the excitation energies of the these three bands, as well as for the experimentally known $B(E2)$ transition probabilities between the states of the ground band without the use of an effective charge, is obtained. For this purpose a simple vertical-mixing term of algebraic nature is added to the dynamical symmetry Hamiltonian, which mixes different irreducible representations from the so-called stretched $SU(3)$ states associated with the relative-motion cluster excitations.