MATHEMATICAL MODELLING OF DINUCLEAR SYSTEMS AT LOW ENERGY NUCLEAR REACTIONS

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The problem of constructing a quantum-mechanical description of neutron and collective degrees of freedom of dinuclear systems at the first stage of the near-barrier fusion of heavy ions is investigated. A new method for numerically solving the Schroödinger equation for an arbitrary axially symmetric field with allowance for spin–orbit interaction is proposed. This method is not plagued by restrictions on the distance between approaching nuclei or on the elongation of fused nuclei or nuclei undergoing separation. The method is illustrated by applying it to determining neutron two-center (molecular) states in systems of light and heavy nuclei. The experimentally observed properties of the barrier distribution extracted from the energy dependence of the cross section for nuclear fusion are explained on the basis of an analysis of neutron states and excited vibrational and rotational states of a dinuclear system [1]. Numerical and computer realizations of coupled channel method from [2] was used.

References

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2. *Samarin V.V., Zagrebaev V.I.* Channel coupling analysis of initial reaction stage in synthesis of super-heavy nuclei. // Nuclear Physics A Vol. 734, 2004, E9–E12