Influence of Cranking Inertia on Binary Nuclear Processes

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The sub-barrier fusion reactions, though they occur with a lower cross section, have the advantage of a final state closer to the ground state. Consequently one hopes for a longer lifetime of the nucleus. Superheavy nuclei are stable only due to the shell and pairing corrections. The macroscopic energy produces no barrier. We calculated here the pairing corrections within a specialized binary model, the deformed two center shell model. The pairing corrections have been obtained by solving the BCS system, in order to obtain the Fermi level for paired nucleons and the energy gap which appears when protons and neutrons are under pairing interaction.

Compared to the shell correction, the pairing energy is in antiphase and smaller. When we have paired nucleons, they have an occupation and non-occupation probability different from 1. These probabilities depend on the energy gap and the new Fermi level. These quantities determine the inertia tensor, which is necessary in the dynamics of the process via the action integral.

The binary character appears in the use of the deformed two center Hamiltonian . The deformation parameters are: the ratios of the semiaxes, the small semiaxis of the projectile and the distance between centers.

The total penetrability is calculated within the WKB approximation and the final transmission factor for the sub-barrier cross-section is obtained. Calculations have been performed for superheavy nuclei. We obtained for example the most favorable reaction ^{160}Yb+^{132}Sn $\rightarrow$ ^{292}120 (highest penetrability).