Analysis of fusion-fission and quasi-fission processes in reactions using ^{238}U target nucleus

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We analyzed experimental data obtained for the mass distribution of fission fragments in the reactions ^{36}S+^{238}U and ^{30}Si+^{238}U at several incident energies, which were performed by the JAEA experimental group [1,2]. The analysis of the mass distribution of fission fragments is a powerful tool for understanding the mechanism of the reaction in the heavy- and superheavy-mass regions.

Our FLNR theoretical group has recently developed a calculation model that can treat all reaction processes in heavy- and superheavy-mass regions, the so called "unified model", which has been applied to several types of reactions [3]. We take into account the time evolution from the diabatic potential to the adiabatic potential [4]. We connect the diabatic potential and adiabatic potential with a weight function on the relaxation time. We then perform a trajectory calculation on the time-dependent unified potential energy surface using the Langevin equation.

Using the dynamical model, we precisely investigate the incident energy dependence of mass distribution of fission fragments. This study is the first attempt to treat such experimental data systematically. We also consider the fine structures in the mass distribution of fission fragments caused by the shell structure at low incident energy. In the reaction ^{30}Si+^{238}U, there are two peaks at approximately A=90 and 178 at a low incident energy, which do not correspond to nuclei with a closed shell. Using our model, we analyze the data obtained from this reaction in an attempt to understand the origin of these peaks [5]. The fusion cross sections are also estimated.

References

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