

Shell effects in fission, quasi-fission and in multi-nucleon transfer reactions

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Results of the study of mass-energy distributions of binary fragments for a wide range of nuclei with $Z=82-122$ produced in reactions of ions located between ^{22}Ne and ^{136}Xe at energies close and below the Coulomb barrier are presented. Velocity vectors of binary reaction products were measured using the two-arm time-of-flight spectrometer CORSET. The extraction of the masses and Total Kinetic Energy (TKE) of the binary reaction products is based upon the analyses of the two-body velocity diagram.

The role of the shell effects, the influence of the entrance channel asymmetry and the deformations of colliding nuclei on the mechanism of the fusion-fission and the competitive process of quasi-fission are discussed. The observed peculiarities of the mass and energy distributions of reaction fragments are determined by the shell structure of the formed fragments.

Special attention will be paid on the symmetric fragment features in order to clarify the origin of these fragments (fission or quasifission). The influence of shell effects on the fragment yield in quasifission and multi-nucleon transfer reactions will be considered.

It is noted that the major part of the asymmetric quasifission fragments peaks around the region of the $Z=82$ and $N=126$ (double magic lead) and ($Z=28$ and $N=50$) shells, and the maximum of the yield of the quasifission component is a mixing between all these shells. Hence, shell effects are everywhere present and determine the basic characteristics of fragment mass distributions.