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EXPERIMENTAL STUDY OF INTERACTION MECHANISMS IN THE REACTIONS WITH HEAVY IONS

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The reaction mechanisms have been investigated intensively in many reactions with heavy ions. Several processes can take place at the interaction of two colliding nuclei. The main of them are fusion-fission, quasifission, fast fission, the formation of the evaporation residue, deep inelastic collisions and, finally, quasielastic and elastic scattering.

A big set of the experimental data obtained in very different nuclear reactions were measured with use of double-arm Time-Of-Flight spectrometer CORSET [1], which allows to measure binary processes with high accuracy. The experiments were carried out in FLNR JINR at U-400 and U-400M accelerators, and in other European and American scientific centers as well. The investigated compound nuclei formed in the reactions last from neutron-deficient ^{178}Pt up to superheavy nucleus with Z=122. Many of the reactions were measured in wide energy range, below and well above the Coulomb barrier. The contribution of different processes in the mass-energy distributions of the reaction products is mainly defined by the entrance channel characteristics, such like mass asymmetry of the reaction partners, Coulomb factor (Z_1Z_2), angular momentum and excitation energy of the compound system, etc. It was shown that in some case it is possible to distinguish different mechanisms and extract their corresponding mass-energy distributions. Moreover, the applied experimental methods give the possibility to deduce the cross-section values of different processes. The detailed and complex analysis of mass and energy distributions of the fusion-fission fragments indicates that not only spherical proton and neutron shells influence on the behavior of mass and energy distributions, but deformed proton shells either. In quasifission process which conquers with fusion-fission the influence of shell effects was also observed.

Possible ways of the set-up development will be also discussed in the presentation. The proposed upgrade of the spectrometer would significantly enlarge the facilities for experimental investigations of the reaction mechanisms observed in reactions with different entrance channel properties, and allow investigations of the structure both reaction products and evaporation residues.

[1] E. M. Kozulin et al., Instrum. Exp. Tech. 51, 44 (2008).

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