PRODUCTION OF SUPERHEAVIES AND EXOTIC NUCLEI

G.G. Adamian, Joint Institute for Nuclear Research, Dubna, Russia

The calculations performed with the modified two-center shell model reveal quite strong shell effects at Z=120-126 and N=184 as in the self-consistent mean-field treatments. If our prediction of the structure of heaviest nuclei is correct, than one can expect the production of evaporation residues Z=120 in the reactions ^{50}Ti+^{249}Cf and ^{54}Cr+^{248}Cm with the cross sections 23 and 10 fb, respectively. The Z=120 nuclei with N=175-179 are expected to have Q_α about 12.1-11.2 MeV and lifetimes 1.7 ms-0.16 s in accordance with our predictions. The experimental measurement of Q_α for at least one isotope of Z=120 would help us to set proper shell gaps in the region of superheavies.

We discuss the possibilities of production of new isotopes of transfermium nuclei in the complete fusion-evaporation reactions with emission of neutrons and charged particles. Our results in evaporation channels of various reactions agree with the available experimental data within a factor of 2-4. In spite of the high Coulomb barrier, the emission of charged particles seems to compete with the neutron evaporation in some cases. Especially after emission of α-particle, the daughter nuclei have higher fission barriers, and the survival probability becomes larger in many systems. The proton emission is less probable. For systems forming an identical compound nucleus, we have analyzed the effective capture cross section and fusion probability.

The production of hassium isotopes $^{266–271}$Hs in various reactions ^{22}Ne+^{249}Cf, ^{25,26}Mg+^{248}Cm, ^{30}Si+^{244}Pu, ^{34,36}S+^{238}U, ^{40}Ar+^{232}Th, and ^{48}Ca+^{226}Ra was studied. The experimental excitation functions of the isotopes Hs are well described and predictions were made for future experiments.