Dependence of total kinetic energy of fission fragments as function of excitation energy and neutron excess for U and Pu isotopes

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Abstract:
Total kinetic energy (TKE) of fission fragments consists of about 80 % of energy released by nuclear fission. Therefore, understanding of the behavior of TKE is crucial in designing nuclear energy systems as well as understanding local heat source in r-process nucleosynthesis where fission recycling plays an important role. We have investigated fragment mass and TKE correlation as functions of excitation energy and neutron excess for a series of U and Pu isotopes in terms of a 4D Langevin dynamical model developed at Tokyo Tech. We found that decrease of TKE as a function of the excitation energy of fissioning nucleus could be understood by considering the change of shape of the heavy fragments from spherical to prolate deformation, which makes distance between the center-of-mass of the 2 nascent fragments longer, then the Coulomb repulsion of 2 fragments to decrease [1]. Then, we have done similar systematic calculations of mass-TKE correlation ranging from proton drip to neutron drip line of U and Pu. We found that the TKE trend deviates from the 1/A^{1/3} law as indicated by Viola and Unik systematics. The reason of such a deviation was again accounted for by change of the fragment deformation.