

The Signature of Neutron Fluences of the Artificial Pulse Nucleosynthesis

Wednesday 3 July 2024 16:25 (20 minutes)

An extreme high intensive neutron pulses ensure the conditions for pulse nucleosynthesis realized in nature (at neutron concentration $>10E+19\text{ cm}^{-3}$): at different mechanism of supernova explosions, in very massive stars, at merging and destroying of neutron stars). In the artificial condition the nucleosynthesis can occur in the close zone of nuclear/thermonuclear explosions where the neutron fluxes reach the units of $10E+24\text{ cm}^{-2}$ during the short pulse $\sim 10E-6\text{ s}$ (prompt rapid process). The purpose of executed experiments on nucleosynthesis were production of transuranic elements by multiple $(n,?)$ -captures in the irradiated target (manufactured from the ^{238}U or more heavy/mixture isotopes as ^{232}Th , ^{237}Np , ^{238}U , ^{242}Pu and ^{243}Am). The first time the creation of isotopes with neutron excess up to mass $A = 255$ was obtained and discovered in the Mike experiment [1]. During the Plowshare scientific program and some next USA nuclear tests (as Anacostia, Kennebec, Par, Barbel, Tweed, Cyclamen, Kankakee, Vulcan and Hutch) the transuranium isotopes up to $A=257$ was registered [2-4].

Basing on the proposed ABM-model it was simulated the transuranium isotope yields for five large scale pulse experiments (Mike, Anacostia, Barbel, Par and Vulcan) for creation of uranium isotopes up to $A=257$. The model target irradiated by sequential $(n,?)$ -neutron captures is the mixture of ^{238}U (main isotope) with admixture of the ^{239}Pu injected into the plasma ball [5,6]. The model includes the elements of the dynamics with temperature decrease down to $\sim 2\text{ keV}$ and expansion of the matter with linear velocity $\sim 190\text{ km/s}$. The obtained results indicated on the roughly linear dependence of the isotope Y-yield relations from the neutron fluence [7]. It were considered the next pairs of neighboring isotopes with atomic masses $A=245$ and 244 , $A=246$ and 245 , $A=247$ and 246 . The relation $246/245$ (i.e., yields with masses $A=246$ and 245) depending on the fluences is the most strong demonstrator of the linear dependence. The analysis of transuranic isotope yields and them relation can be sensitive signature of the fluences realized in artificial nucleosynthesis.

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Section

Experimental and theoretical studies of nuclear reactions

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Session Classification: Neutrino physics and nuclear astrophysics