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EXPERIMENTAL INVESTIGATION OF THE (n, γf)– REACTION IN RESONANCE NEUTRON-INDUCED FISSION OF U-235

The new experimental investigation of the (n,γf)-reaction, neutron-induced fission after preliminary emission of gamma-rays [1], have been done in neutron resonances of U-235 in the energy range from thermal to 300 eV. The measurements of fission gamma-ray and prompt neutron multiplicities as well as energy spectra of fission gamma-rays in separated neutron resonances were carried out at the neutron time-of-flight spectrometer GNEIS based on the SC-1000 proton synchrocyclotron used as a "spallation"neutron source [2]. Fission gamma-rays and neutrons were detected in coincidence with fission fragments registered by means of the fast parallel-plate ionization chamber which contained 1.8g of 90% enriched U-235. Two large NaI(Tl) scintillation detectors d150 x h100 mm^2 of size were used for registration of gamma-rays, while a couple of medium-sized d50 x h50 mm^2 stilbene scintillators were used for registration of prompt fission neutrons by applying a pulse-shape discrimination to separate gamma-rays and neutrons. The signals from all detectors were processed using 8-bit Acqiris DC-270 and 14-bit CAEN V1274 digitizers, which provided 1E6 time channels (2 –10 ns width) with a practically "zero"dead time.
The correlations observed between the fission gamma-ray as well as prompt neutron multiplicities and reciprocal fission widths in the isolated 3- and 4- resonances of U-235 have been analyzed to subtract the pre-fission widths. The values obtained from the experiment were compared with those calculated using various theoretical models adopted for description of the radiation strength function, shape of the fission barriers and transition states structure. Taking into account the data obtained from the analysis of measured pre-fission gamma-ray spectra, the conclusions about the nature of gamma transitions between the highly exited states in the compound nucleus U-236 were inferred.
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[1] O.A.Shcherbakov // Sov. J. Part. Nucl. 1990. V.21. P.177.
[2] O.A.Shcherbakov, A.S.Vorobyev, E.M.Ivanov // Phys. Part. Nucl. 2018. V.49. P.81.

Primary authors: SHCHERBAKOV, Oleg (B.P. Konstantinov Petersburg Nuclear Physics Institute of Natio); VOROBYEV, Alexander (NRC "Kurchatov institute"-PNPI); Mr GAGARSKI, Alexei (B.P. Konstantinov Petersburg Nuclear Physics Institute of National Research Centre "Kurchatov Institute", Gatchina, Russia); Dr VAISHNENE, Larisa (B.P. Konstantinov Petersburg Nuclear Physics Institute of National Research Centre "Kurchatov Institute", Gatchina, Russia)

Presenter: SHCHERBAKOV, Oleg (B.P. Konstantinov Petersburg Nuclear Physics Institute of Natio)

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