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Progress Report to The International Nuclear Data Committee

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Bulgaria

May 1981

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Nuclear Data Activity
in the Faculty of Physics (University of Sofia)

N. Nenov, E. Dobreva, D. Kolev, M. Yovchev

1. Determination of the ^{132}I, ^{133}I and ^{134}I independent yields in the ^{238}U fission induced by neutrons from the experimental reactor in Sofia. The separation of iodine is made radiochemically. Ge(Li) detector is used for the activity measurement.

2. Determination of the I and Te independent yields in the ^{232}Th fission induced by α -particles with energy 30.5 MeV. The measurements were performed on the heavy-ions accelerator (U-200 in the JINR, Dubna). The separation of I and Te is made radiochemically. Ge(Li) detector techniques were used.

3. Measurements of $(n, 2n)$, (n, p) and (n, α) with 14 MeV neutrons using activation techniques.

ANALYSIS OF NEUTRON CROSS SECTION AND TRANSMISSION FUNCTIONS FOR FISSIONABLE NUCLEI IN THE UNRESOLVED RESONANCES ENERGY REGION

M. Koyumdjieva, N. Janeva

Following the theoretical proposal [1], the program was prepared for simulation the average neutron cross sections and transmission functions for fissionable nuclei in the unresolved resonances energy region by the Monte Carlo method.

Techniques of casual matrices were used for calculation of the S-matrix in the case of a few channels taking into account the interference between resonance levels. The gamma-channels contribution is calculated following the approximation of Riech-Moore.

The program is used for analysis of experimental data for neutron induced fission cross section, total neutron cross section and transmission functions of ^{235}U and ^{239}Pu measured on the time of flight spectrometer on the IBR reactor in the JINR (Dubna) [2]. The full set of experimental data gives the possibility of determining the average resonance parameters in the energy range 2-20000 eV.

The neutron capture cross section of ^{238}U is calculated for analysis of data obtained on the large liquid scintillation detector,

1. A.A. Lukyanov. The neutron cross section structure, M. Atomizdat 1978.
2. Vankov, A.A., Grigoriev, Yu.V. et al., Sov. Atomic Energy 48 (6) 1980.

Correlation measurements of angular and mass distributions of fragments from ^{238}U fission induced by 1.6 MeV neutrons

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The double pulsed ionization chamber with grids[1,2] allows registration of three pulses - the pulses on the collecting electrodes are proportional to the kinetic energy, the amplitude of the pulse on the high voltage electrode is connected with the value of the total kinetic energy and the angle between the direction of the fragments and the electrical field on the chamber . Using such a chamber as a detector, the apparatus was prepared for a correlation measurement of the angular and mass distribution of the fragment from ^{238}U fission induced by 1.6 MeV neutrons. The electronic equipment contains mini-computer IZOT-310.

The measurements are performed on the electrostatic accelerator in the "I.V.Kurchatov" Institute (Moscow, USSR). The fission target (6 cm diameter), prepared by the method of vacuum evaporation of UF_4, contained about 50 mg/cm^2 ^{238}U on 15 mg/cm^2 collodium film covered by 15 mg/cm^2 gold. Experimental information about 500000 fission events is obtained. The data processing is not finished yet.

1. Kashukeev, N.T., M. Drajev, N. Kalinkova et al., Izv.Phys. I, XXIV 1973 (1959).
2. E. Antonova et al. Bul.Nucl.Energy 11, 1980.

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* "I.V. Kurchatov", Institute, Moscow, USSR.

Determination of the correlation between burn-up and the accumulation of plutonium and fission products

Zh. Zhelev, I. Penev, I. Marinov

The accumulation of some long-lived fission products as ^{134}Cs, ^{137}Cs, ^{95}Nb is strongly dependent on the burn-up of the primary reactor fuel and may be used as an indication for the ^{239}Pu production. The determination of such a correlation is very important for the PWR-440 because of the fuel cycle high price. The ratio $^{134}Cs/^{137}Cs$ was measured for determining its dependence on the burn-up of ^{235}U and the plutonium accumulation. To avoid the destructive analysis of fuel elements, the mini-tablets were irradiated in the six channels of the PWR-440. After irradiation, the fission products gamma-spectra were measured. The plutonium quantity was determined by the intensity of its KX-rays. It is shown that the accuracy of the plutonium determination may reach 5%. The $^{235}U/^{238}U$ ratio will be determined with great accuracy by mass-separation analysis of some mini-tablets, too. Mass separation data will be used in the further determination of $^{235}U/U^{238}$ ratio and the plutonium accumulation by the use of fission products gamma-spectra.

Streamer spectrometer for investigation of rare reactions induced by neutrons

T.M. Troshev, A.I. Trifonov, M.N. Michailov, V.I. Christov, I.V. Falomkin, Yu.A. Shcherbakov

The streamer spectrometer was built using a streamer chamber[*]. The spectrometer will be situated on the horizontal channel of the experimental thermal reactor (2000 W) in Sofia with the aim of investigating the rare reactions induced by neutrons. The streamer chamber with dimensions 30x20x10 cm^3 is to be filled with argon or hydrogen and situated in the magnetic field of 0.075T intensity. Such an apparatus permits the realization of a vast program of experiments, where simultaneously with registration of the position of interaction with neutrons, it is possible to detect the reactions with particle emission, to evaluate the ionization and to measure the space correlations. The streamer chamber can work in high intensity neutron beams and, therefore, it can effectively registrate processes with small cross-sections. By this streamer spectrometer the tracks will be detected and photographed of the electron-positron pairs, obtained by conversion during the thermal neutron capture by argon and hydrogen nuclei. In such a case, the streamer spectrometer offers good possibilities for measuring the position of pair creation as well as angular and energy parameters due to the fact that the working gas in the chamber is in the same time the gas target.

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[*] Prepr. JINR Dubna 13-80-627 1980, T.M. Troshev, A.I. Trifonov, M.N. Michailov, V.I. Christov, I.V. Falomkin, Yu.A. Shcherbakov.