

Nuclear Data Measurements in Russia

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Measurements at IPPE (Obninsk)

i) A preparation of the lead slowing-down spectrometer (LSDS) at INR RAS (Troitsk) to the measurements of the fission cross-sections for highly radioactive minor actinides (MA) was continued in cooperation with the IPPE experimental group. The LSDS consist of the high purity lead (99.9999%) with the total mass of 10^5 kg assembled from blocks with the mass about 1 t, the surface of which was specially cleaned to decrease an amount of oxides. Such a cleaning allow to achieve the energy resolution close to the theoretical limit ~ 27 - 28% . As the neutron source the spallation reaction on a lead sample irradiated by 208 MeV proton beam of the INR linear accelerator is used. The IPPE group supplies the MA fissile sample, the corresponding detectors and the processing codes. Two sessions of measurements were carried out during 2005 to test the whole equipment and to estimate the spectrometer characteristics. The first measurements with the samples of U-236, -238, Am-241 and Am-242m were performed in 2006 and their preliminary results for Am-242m are shown in the Fig. 1.

The measurements will be continued in this year to estimate better the background conditions, to improve the event statistics and to use other samples including curium ones. A high price of target preparation for curium isotopes limits possible measurements rather strongly and an international support of this activity is very desirable. Such measurements should essentially reduce uncertainties of experimental data on the fission cross sections of minor actinides, transmutation of which relates nowadays to one of the most topical task.

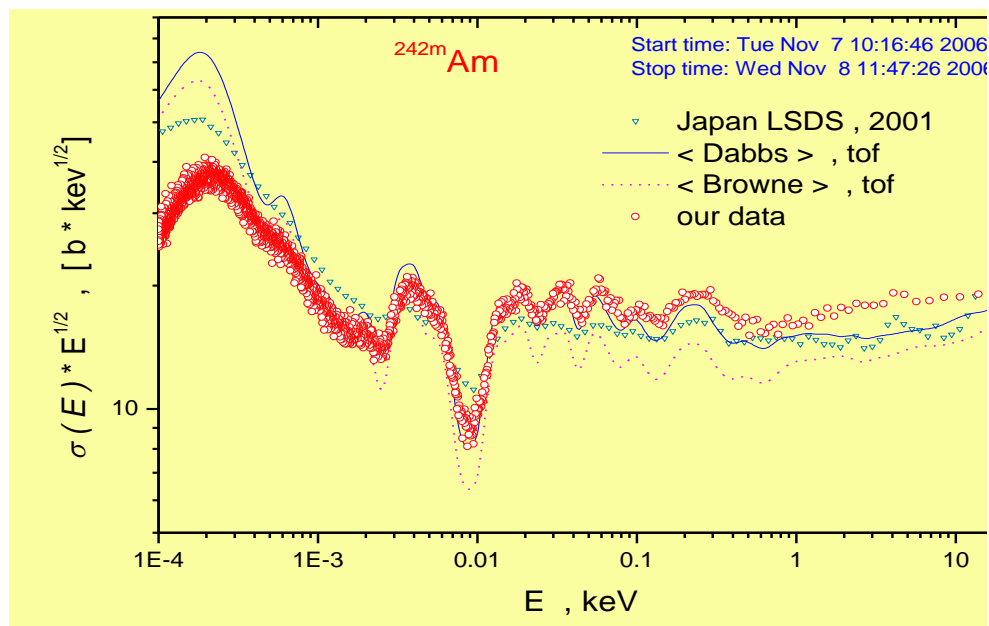
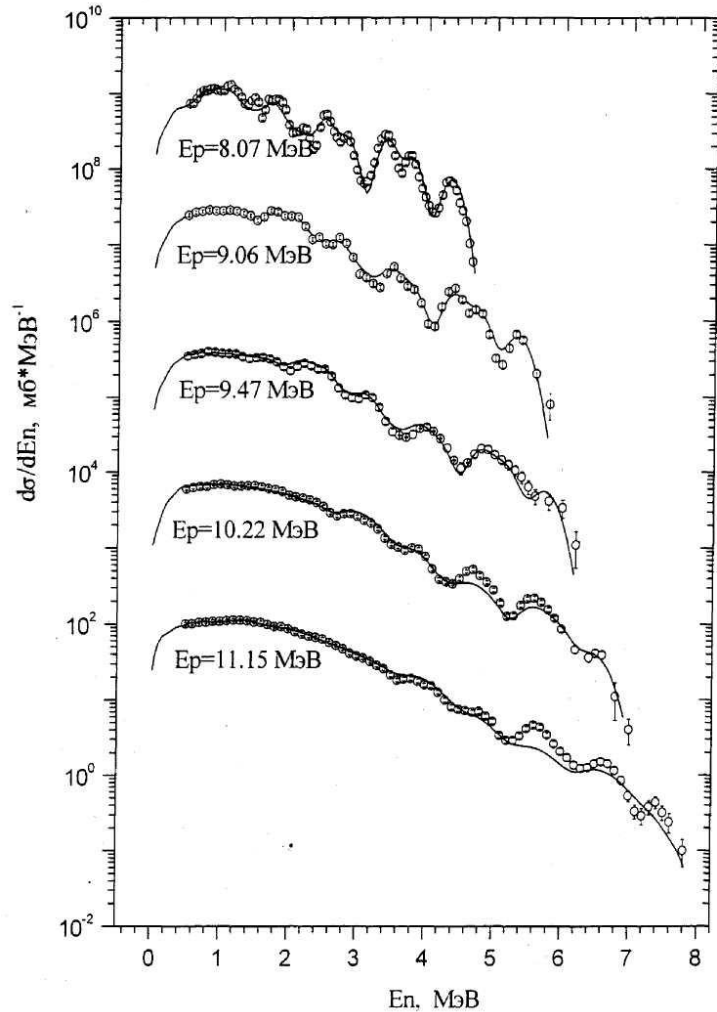


Fig. 1. Preliminary results of the LSDS measurements of the neutron-induced fission cross-sections for Am-242m in comparison with previous data

ii) The leakage neutron spectra from the thick sphere ($d=400$ mm, $t=140$ mm) of the Li/Pb alloy were measured for the $^{252}\text{Cf}(sf)$ neutron source. The time resolution of the neutron time-of-flight spectrometer was about 2,5 ns, the neutron registration threshold was close to 70 keV and the gamma-ray suppression factor was about 10. The obtained data together with the previous data for the lead spheres are processing now to compare with the available evaluations of neutron spectra for Li and Pb isotopes.

iii) Neutron emission spectra of the (p,n) reactions on Pb-208 and Bi-209 were measured during the last years on the IPPE time-of-flight spectrometer. The protons were produced by the tandem-accelerator at the energies from 7 to 11 MeV. The results of the measurements for lead are shown in Fig. 2. The spectra were used to estimate the level density of residual nuclei. The energy dependence of the obtained level densities contradict to the Gilbert-Cameron systematics and agree rather well with the predictions of the generalized superfluid model.

Fig. 2. Neutron spectra from the $^{208}\text{Pb}(p,n)$ reaction for different energies of incident protons. The data for each curve starting from the lowest one are increased on the factor 100, respectively.



Measurements at the Radium Institute (Saint-Petersburg)

Activation measurements are performed by A.Filatenkov's group for the $^{26}\text{Mg}(n,a)$, $^{57}\text{Fe}(n,p)$, $^{74}\text{Ge}(n,p)$, and $^{80}\text{Se}(n,p)$ reactions at the neutron energies about 14 MeV. The data obtained are under processing now.

Measurements at the ITEP (Moscow)

The yields of spallation and multi-fragmentation reaction products from the highly enriched ^{56}Fe target irradiated by protons were measured on the ITEP U-10 accelerator for the proton energies from 300 MeV to 2.6 GeV. Such data are important for the analysis of radiation damages and residual activities of structural materials used in the ADS target. Residual nuclei were identified by the gamma-spectroscopy method and the cumulative and independent of all residual with the half-life time from 6.5 min to 312 days were estimated. The measure yields were compared with the similar data obtained at the GSI (Darmstadt) by the inverse kinematics method and with different versions of the intranuclear model codes. This work is supported by the Project ISTC-3266 and its first results are contributed to the ND-2007 Meeting.