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Progress Report from Bulgaria

Submitted by N. Janeva
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Preparation of a 26-Group Library for Neutron Transport Calculations

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L26P3534 - a 26-group library for the computation of neutron transport in shielding media was prepared.

The L26P3534 library (ENDL 26-group up-to P3 library prepared by SUPERTOG for 34 materials) is produced from the evaluated Nuclear Data File ENDL-2 by means of our version of the SUPERTOG-3 code.

SUPERTOG computes the average scattering cross-sections for given energy group structure as well as the P_u-matrices of elastic, inelastic and (n,2n)-scattering.

The use of SUPERTOG-3 for converting the evaluated data of ENDL into multigroup contents displays at least two peculiarities:

- the cross-section smooth and resonance parts are combined in ENDL-2; therefore, the SUPERTOG routines for resonance processing are skipped;

- the elastic-scattering anisotropy data in ENDL-2 have the form of tabulated values of the probability-density function which depends on the scattering angle and on the incident energy. The standard version of SUPERTOG-3, however, is able to compute the P_u-matrices of elastic scattering if this function is represented by its expansion coefficients in a Legendre polynomial series. In our modified version of the same program these coefficients are computed from the tabulated values in a preparatory routine within a single SUPERTOG run.

The algorithm of Legendre's polynomial expansion in our modification of SUPERTOG-3 was published as an IAEA report INDC (BUL)-6/GV, February 1982.

A communication containing some observations on the performance of this algorithm and the format specifications of the L26P3534 library was also submitted to the Nuclear Data Section of the Agency for publication.

The L26P3534 library was sent to Oak Ridge National Laboratory at a request to place it in the Data Library Collection of the Radiation Shielding Information Centre.

L26P3534 is being used for Monte Carlo calculations of neutron transport in shielding media.

ANALYSIS OF IRON NEUTRON EXPERIMENTAL DATA IN THE RESONANCE REGION

N. Kuyumdzhieva, N. Yaneva

The experimental data about T-transmission of resonance neutrons through thick samples contain the valuable information on the neutron cross section σ_n resonance structure. The minima of resonance interference cannot be determined very well in measurements with thin samples. This is in accordance with the opinion about the possibility to determine the precise value of average cross sections and parameters of resonance structure by simultaneous analysis of experimental data on neutron partial cross sections and transmission of neutrons through samples of various thicknesses.

The method previously developed and the programme[1] for analysis of neutron cross sections and transmission data are used for reproducing the dependence of neutron transmission on the sample thickness for ^{56}Fe. The comparison of calculated T and σ_n value with the experimental data permits to evaluate some of the average resonance parameters.

The method is based on simulation of neutron cross sections and functions of them, constructing the random matrix K related with matrix S by

$$S = (1+ik)\cdot(1-ik)^{-1} \qquad \text{where}$$

$$k = \frac{\bar{\Gamma}_n}{\bar{D}} \sum_{\lambda=1}^{n} \frac{\beta_{\lambda n}^2}{(E_0-E)^2 + Z_\lambda + \frac{\bar{\Gamma}_\gamma}{4}} \qquad \text{and}$$

$\bar{\Gamma}_n$, $\bar{\Gamma}_\gamma$, $\bar{D}$ are average resonance parameters (average partial widths and level spacing). $\beta_{\lambda n}$ are random numbers with normal distribution (0,1) and Z_λ - are random numbers obeying Wigner's law.

1. N. Kuyumdjieva, N. Yaneva, Nuclear Constants, 3(42) 1981.

ABSOLUTE MEASUREMENTS OF NEUTRON CROSS SECTIONS IN THE REGION OF ENERGY $E_n < 0.3$ eV BY THE METHOD OF γ-RAY MULTIPLICITY SPECTROMETRY

(a joint work with the Institute of Kurchatov-Moscow)

An absolute measurement of "alpha"-value for ^{235}U is in progress on the horizontal neutron beam of the experimental reactor in Sofia. The mechanical selection of neutrons and time of flight method are used for measurement of the thermal neutron energy. The big multisectional detector of gamma-ray capture named "Romashka" - 12 NaJ crystals with total volume of scintillator greater than 17 l, constructed in the group of Dr. Myradjan from the Institute of Kurchatov, is used for measuring the distribution of gamma rays multiplicity. This method allows to separate the capture and fission events. The fission events are distinguished also by two solid state detectors situated in the centre of "Romashka" on both sides of the ^{235}U sample. Special care is taken for collimation of neutron beam and reduction of background.

The experimental data are registered "on line" with CAMAC system based on mini computer. The preliminary results demonstrated the possibility of the method for precise measurements of "alpha" value in the thermal point.