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Evaluation of the Cross-Section for the Capture  
of fast Neutrons by Gold-197

V.N. Vinogradov, V.N. Manokhin, V.P. Platonov,  
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EVALUATION OF THE CROSS-SECTION FOR THE CAPTURE  
OF FAST NEUTRONS BY GOLD-197

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ABSTRACT

The evaluation of the cross-section for the radiative capture of neutrons with energies in the range 0.01-3.5 MeV by  $^{197}\text{Au}$  is described. The evaluated curve is obtained on the basis of selected data sets by means of fractional-rational expressions.

Gold is often used in carrying out in-pile measurements of the distribution of capture events through the core and reflector of fast reactors. Moreover, it is used as a monitor in measurements of the cross-sections for capture by other isotopes.

The publication in recent times of the results of many experiments involving the measurement of  $\sigma_{n,\gamma}^{197}\text{Au}$  calls for a critical examination of the averaged curve for fast neutron capture by gold.

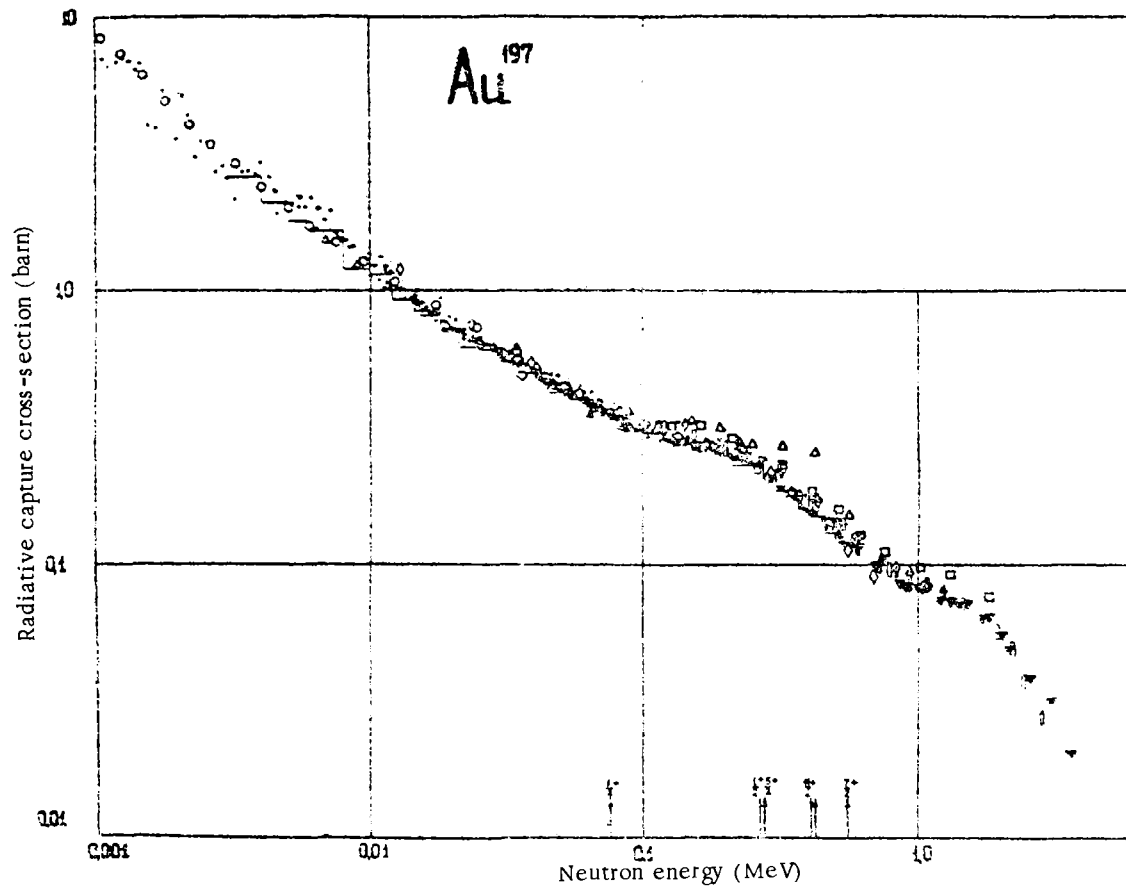
On the basis of an analysis of the experimental results, we selected 15 works containing data used in constructing the averaged curve for fast neutron capture by gold. Use was made of only those activation measurements where  $\sigma_f^{235}\text{U}$  served as a standard or absolute measurements had been performed. The data of Barry [4], presented by way of illustration in Fig. 1, were not used in the evaluation owing to doubts on our part about the correctness with which the backgrounds had been taken into account. The data of Czirr [1] for  $E = 412$  and  $319$  keV were not used either. The data used were normalized uniformly and are presented for purposes of comparison in Fig. 1. As can be seen from Fig. 1, use was made mainly of data from work done since 1965 - i.e. during the past ten years. The results published in Ref. [14] are not presented in Fig. 1, although the data were taken into account.

Plotting of the curve on the basis of experimental data was performed by means of fractional-rational expressions, as was done by us in evaluating the  $^{238}\text{U}$  capture cross-section [16], the totality of the experimental data of the different authors being regarded as a

single statistical assembly. The energy range was broken down into four intervals: 1.5-20.5 keV; 17.5-74 keV; 68-223 keV; 0.19-3.5 MeV. The results of fractional-rational approximation in the overlapping neutron energy intervals were matched within 1% divergence limits. The mean square deviation of the averaged data from the initial experimental data was 6.5% for the interval 1.5-20.5 keV, 4.2% for the interval 17.5-74 keV, 5.2% for the interval 68-223 keV and 6.5% for the interval 0.19-3.5 MeV.

The evaluated data on  $\sigma_{n,\gamma}^{197}\text{Au}$  presented here should be regarded as the results of one evaluation variant and the errors as estimates of the error in the averaged data when there is no correlation between the data of different authors or within the data of each author.

In Fig. 2, the results of our estimate are compared with an estimate of the gold capture cross-section from ENDF-B/IV [17]. The estimates give similar results, especially below 200 keV.



- \* Yurlov, time-of-flight, 1975
- Davletshin, act. abs. meas., 1975
- Chelnokov, Pb cube, 1975
- △ Czirr, time-of-flight, 1973
- ▼ Poenitz, time-of-flight, 1974
- Fricke, time-of-flight, 1971
- v Le Rigoleur, time-of-flight, 1973
- Barry, activation, 1964
- Poenitz, activation, 1961
- ⊠ Poenitz, time-of-flight, 1968
- \*/ Harris, activation, 1965
- \*/ Nagle, activation, 1965
- \*/ (illegible), time-of-flight, 1969
- \*/ Macklin, time-of-flight, 1974
- \*/ Grench, activation, 1966

\*/ Signs illegible.

Fig. 1. Experimental data from publications used in evaluating the cross-section for the capture of fast neutrons by a  $^{197}\text{Au}$  nucleus.

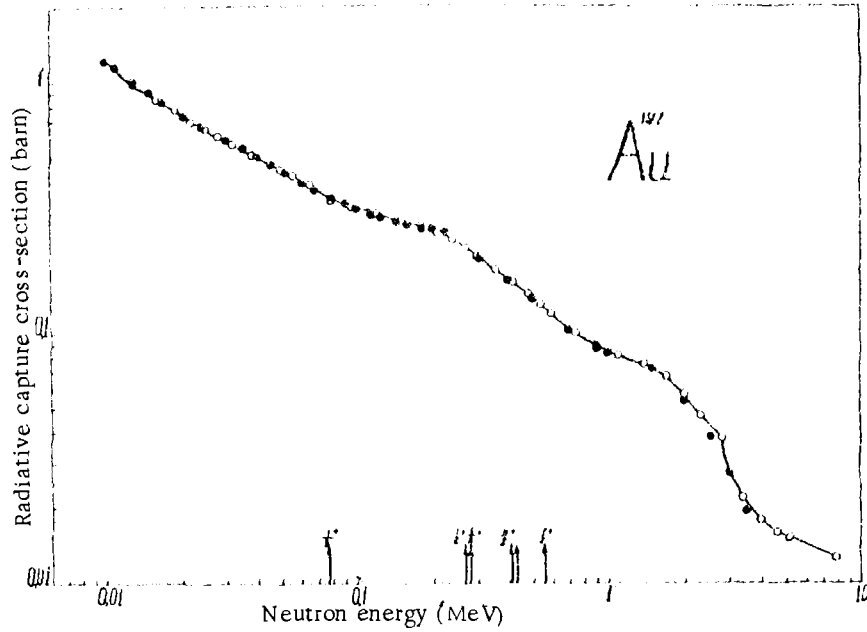


Fig. 2. Comparison of the average  $\sigma_{n,\gamma}(E)$  curve for  $^{197}\text{Au}$  with the estimate from ENDS-B/IV [17].

- ⊙ data of present work
- data from ENDF-B/IV



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