REMARKS ABOUT THE URANIUM 233 EVALUATIONS

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The uranium 233 evaluation of JEF1 is similar to the one of ENDF/B4. This evaluation was used to compute a set of integral experiments. They are mainly buckling measurements obtained in critical facilities or exponential experiments, in which the importance of the thermal part of the neutron spectrum is predominent. Thus we can obtained with this integral experiments informations about the thermal neutron data of uranium 233. This work was performed with the tendency research method and the results were not satisfactory [1]. Strong modifications of the uranium 233 thermal data were needed in order to reproduce the results of the integral data. Changes are especialy required for ν - bar and the capture cross section.

A reevaluation of uranium 233 was recently released for ENDF/B6. This new file was processed with NJOY 89.62* and checked with the same set of integral experiments. The results of the thorium cycle experiments were added to the set of integral experiments used for the JEF2.0 major actinides testing [2]. Then the tendency research method was applied to the whole set of integral experiments (see table I). Only one least square computation is performed. With this procedure, the informations about the uranium 235 and moderator data which were obtained for the uranium and plutonium cycle are automatically taken into account for the uranium 233 and thorium cycle. The figure 1 displays the difference between the computed values, with APOLLO1, of keff and the experimental ones for the integral experiments relevant to the thorium cycle. The error bars correspond to the experimental uncertainties. They are important for the exponential experiments. The abscissa is representative of the spectrum hardness. The high values are the ones of the soft spectra. The proposed modifications of the uranium 233 thermal data are given in the last column of table II. They are compared with the initial values of JEF1 and ENDF/B6 and with the last recommendations. Contrary to the cases of uranium 235 and plutonium 239, the integral experiments seem to suggest strong modifications for uranium 233, specially for ν - bar and the radiative capture cross section in the same proportions as for ENDF/B4. Neither JEF1 nor ENDF/B6 are satisfactory to explain the experimental results. The ν - bar of JENDL3 is also too high and in addition this evaluation uses a single level Breit and Wigner formalism. It cannot be acceptable. Lets us also notice that the experimental results about the uranium 233 multiplying media are rather old and probably not accurate enough. Consequently it seems necessary to further investigate the problem of uranium 233 data for thermal neutron reactors.

REFERENCES

[1] H. TELLIER et al : Advances in Reactor Physics and shielding, Sun Valley, 781 (1980).

[2] H. TELLIER et al : Advances in Mathematics, Computations and Reactor Physics, Pittsburg, 4, 19.1.2 (1991).

Table I

INTEGRAL EXPERIMENTS

2	HOMOGENEOUS MEDIA	URANIUM
4	GRAPHITE LATTICES	
4	HEAVY WATER LATTICES	
23	LIGHT WATER LATTICES	
6	TIGHT PITCH LATTICES	
5	HOMOGENEOUS MEDIA	PLUTONIUM
6	HEAVY WATER EXPERIMENTS	
13	LIGHT WATER LATTICES	
3	TIGHT PITCH FACILITIES	
2	U233 HOMOGENEOUS MEDIA	THORIUM CYCLE
2	U235-TH LIGHT WATER LATTICES	
7	U233-TH LIGHT WATER EXPERIMENTS	
5	U233-TH HEAVY WATER EXPERIMENTS	

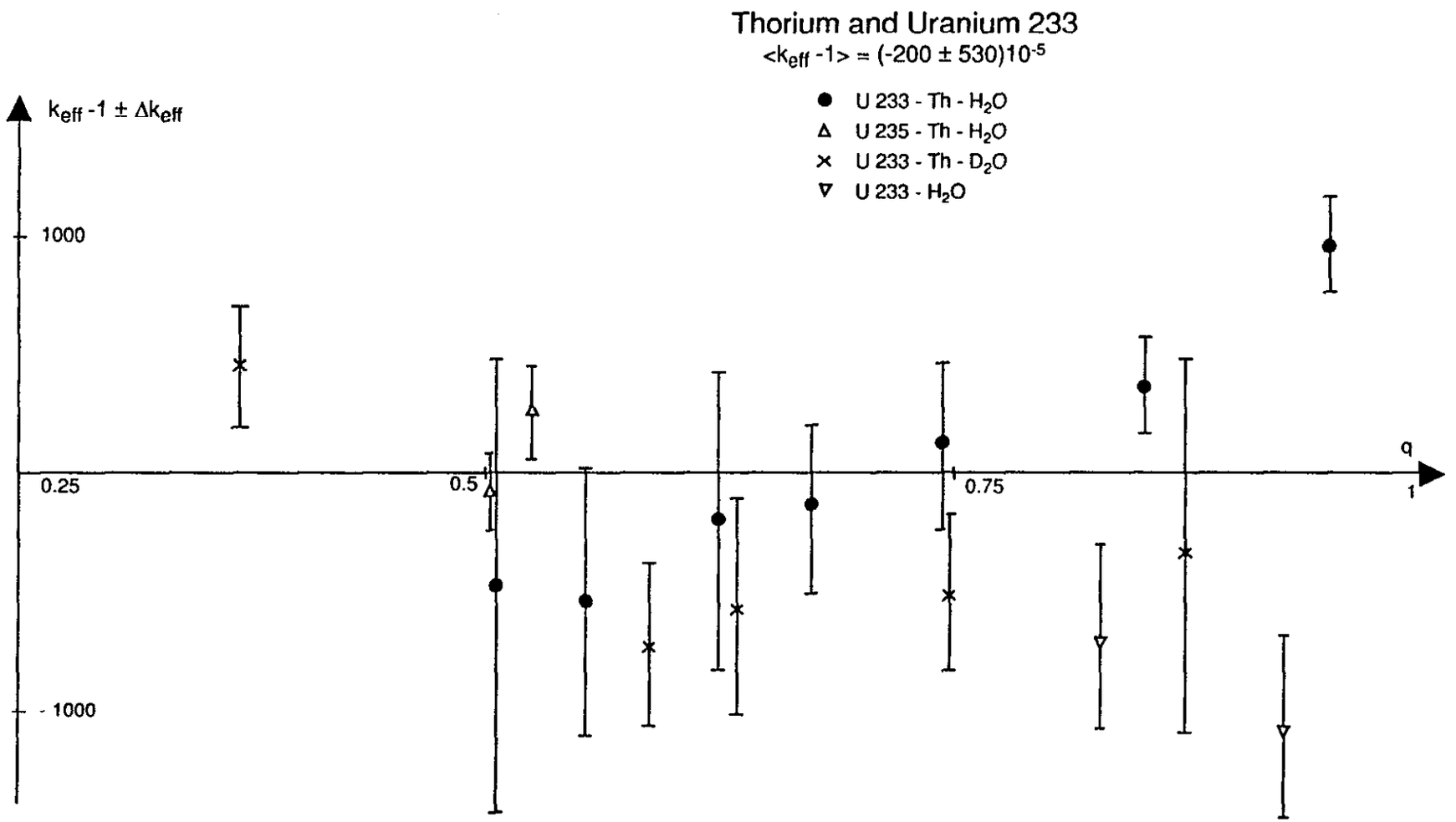
Table II

Actinide Thermal Data

		ENDF/B5	JEF2.0	Divadeenam	Axton	Tendency Research
U235	ν	2.4367	2.437	2.425 ± 0.003	2.426 ± 0.005	2.435 ± 0.004
	σ_f	583.6	582.5	582.6 ± 1.1	585.1 ± 1.6	582.3 ± 1.1
	σ_c	98.4	98.8	98.3 ± 0.8	96.1 ± 1.7	98.0 ± 2.0
Pu239	ν	2.8914	2.877	2.877 ± 0.006	2.879 ± 0.006	2.873 ± 0.007
	σ_f	741.7	747.2	748.1 ± 2.0	748.5 ± 2.6	745.8 ± 2.0
	σ_c	270.2	270.2	269.3 ± 2.2	270.4 ± 3.2	269.8 ± 3.9
U233	ν	2.495*	2.498+	2.493 ± 0.004	2.486 ± 0.006	2.483 ± 0.004
	σ_f	528.4*	525.1+	529.1 ± 1.2	533.3 ± 2.4	526.9 ± 1.1
	σ_c	45.8*	45.9+	45.5 ± 0.7	42.0 ± 1.7	49.2 ± 1.7

* ENDF/B6

\+ JEF1


Thorium and Uranium 233
<k_eff -1> = (-200 ± 530)10^-5
U 233 - Th - H2O
U 235 - Th - H2O
U 233 - Th - D2O
U 233 - H2O
k_eff -1 ± Δk_eff
1000
- 1000
0.25
0.5
0.75
1
q