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February 2, 1972
WARD-1690

Mr. Harold N. Miller, Director
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U. S. Atomic Energy Commission
Chicago Operations Office
9800 South Cass Avenue
Argonne, Illinois 60439

MASTER

Dear Mr. Miller:

SUBJECT: AT(11-1)-3045, Task 4B, Review of Technical Paper

Enclosed is a copy of a technical paper entitled "Improved ²³⁸U
Resonance Parameter Evaluation for ENDF/B Version III" by C. Durston.
This paper was prepared for presentation at the Annual Meeting of the
American Nuclear Society to be held June 18-22, 1972 in Las Vegas, Nevada.

Your approval for presentation and publication is requested.

By copy of this letter, Mr. R. A. Anderson is requested to review and
approve this paper from a patent standpoint.

Very truly yours,

WESTINGHOUSE ELECTRIC CORPORATION

Edward Mullan
Contract Administrator

TAK/rmd

Enclosure

CC: R. A. Anderson - AEC/Patents

See Attached List

Improved ²³⁸U Resonance Parameter Evaluation for ENDF/B Version III *Colin Durston

Heretofore evaluations have involved weighted means with little emphasis on systematic differences between measurements. An attempt is made here to reduce systematic differences before calculating means. The method used is a form of regression analysis where one of the measurements is taken as a standard and the others plotted against it. Rohr^[1] was taken as the standard and the four measurements Asghar,^[2] Carraro,^[3] Rahn^[4] and Garg^[5] were plotted against this standard. A least squares fit of the form $y = mx$ was applied, y being the value of (Γ_n/E) from one of the four measurements and x being the standard (Γ_n/E) . Ideally these four lines would lie on top of each other with a slope of 45° . Any deviation from 45° shows a systematic difference and the scatter of points around the line is a measure of the consistency of the experiment. Rohr was chosen as the standard since the experiment showed the most consistency with the other experiments.

Each measurement was scaled by normalizing the least squares fit to the 45° reference curve. Table 1 shows the results for and associated statistics obtained by this procedure using Rohr as the reference. Scale factors are given in Table 2.

This procedure significantly improved the agreement between the scaled values. However, this analysis only gives a relative scaling not the ultimate one. It is noted that there is excellent agreement between the mean and Carraro.

Above 1 keV there were three experiments available, and a list of scale factors relative to Rahn are given in Table 2. These values indicate that there is a large measure of disagreement above 1 keV.

Parameters evaluated with this technique give multiple scattering and self shielding corrections to ORNL data which are consistent to 1/2%.^[6]

A similar approach was tried for radiative capture widths without much success.

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Table 1. Normalized Neutron Widths for ^{238}U

Energy	Rohr [1]	Asghar [2]	Carraro [3]	Rahn [4]	Garg [5]	Γ_γ	Mean Γ_α	Mean Γ_n	Variance σ^2	St.Dev. σ
66.0	24.8		25.2	25.5		23.0	3.10	25.2	0.123	+ 0.40
102.6	72.6	71.9	69.1	66.5		26.1	6.91	70.0	7.81	+ 2.8
116.9	28.3	28.3	27.1	33.7		24.3	2.72	29.4	8.73	+ 3.0
189.6	168.8		168.1	171.3		24.7	12.30	169.4	2.83	+ 1.7
208.6	49.0		52.7	56.5		22.4	3.65	52.7	14.06	+ 3.3
237.3	26.1	30.6	28.0	31.8	28.4	24.5	1.88	29.0	5.04	+ 2.2
273.6	25.6	25.4	25.8	26.4	25.8	23.1	1.56	25.8	0.14	+ 0.4
290.8	16.1	17.1	14.9	15.5	15.8	23.1	0.93	15.9	0.66	+ 0.8
347.8	81.7		83.2	81.1	79.0	23.5	4.36	81.3	3.03	+ 1.7
397.6	6.4	6.1	6.3	5.5	6.2	25.2	0.306	6.1	0.125	+ 0.4
410.2	19.9	22.1	20.5	17.3	19.7	22.6	0.98	19.9	3.00	+ 1.7
434.1	10.1	9.6	9.5	8.0	8.5	26.5	0.437	9.1	0.743	+ 0.9
518.3	48.9	47.9	48.3	44.7	44.7	24.4	2.06	46.9	4.16	+ 2.0
535.2	43.0		45.0	41.0	40.6	24.7	1.83	42.4	4.11	+ 2.0
580.0	42.5	46.0	43.9	37.4	39.6	26.1	1.74	41.9	11.677	+ 3.4
595.0	85.2	87.5	83.9	77.5	83.8	23.1	3.43	83.6	13.777	+ 3.7
619.8	30.0	31.2	32.3	25.5	29.1	24.6	1.19	29.6	6.768	+ 2.6
661.1	123.2	128.3	131.3	125.8	118.7	26.0	4.88	125.5	23.273	+ 4.8
693.0	42.3	38.8	43.6	38.3	35.1	24.1	1.51	39.7	11.468	+ 3.4
708.0	22.3	21.6	22.1	15.5	19.1	28.5	0.755	20.1	8.313	+ 2.9
821.8	57.0	61.3	64.9	56.5	60.3	26.0	2.09	60.0	11.76	+ 3.4
851.4	55.6		62.7	50.1	56.9	30.9	1.93	56.3	26.75	+ 5.2
856.3	78.4		85.8	73.8	82.6	23.6	2.74	80.2	27.10	+ 5.2
905.4	49.3		55.9	44.7	46.3	26.8	1.63	49.1	24.993	+ 4.9
937.2	129.5		136.6	131.2	132.4	23.6	4.325	132.4	9.163	+ 3.0
958.9	180.5		195.2	185.0	181.6	22.7	5.99	185.6	44.84	+ 6.7
991.9	341.2		375.0	355.4	355.5	30.7	11.33	356.8	192.75	+13.9
1054.8	99.7		92.0	81.1	76.7	24.2	2.69	87.4	108.9	+10.4

NOTICE

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Table 2. Scale Factors for Normalization of ^{238}U Resonances

<u>ΔE - keV</u>	<u>Rohr</u>	<u>Asghar</u>	<u>Garg</u>	<u>Rahn</u>	<u>Carraro</u>
0.0 - 1.0	1.0*	.816	0.974	1.097	1.005
1.0 - 1.5	-	-	0.893	1.0*	0.98
1.5 - 2.0	-	-	0.838	1.0*	1.008
2.0 - 2.5	-	-	0.665	1.0*	1.033
2.5 - 3.0	-	-	0.799	1.0*	1.185
3.0 - 3.5	-	-	0.740	1.0*	1.375
3.5 - 4.0	-	-	0.769	1.0*	1.323

The above numbers are the slopes of a least squares straight line passing through the origin and fitting a plot of (Γ_n/E) versus (Γ_p/E) Reference. Deviations in the scale factor from unity are a measure of systematic differences between experiments.

*Reference values

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