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MEASUREMENT OF THE NEUTRON-INDUCED FISSION CROSS SECTION OF ^{244}Pu
RELATIVE TO ^{235}U FROM 0.2 TO 30 MeV

J. W. Behrens
R. S. Newbury
J. C. Browne
G. W. Carlson

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MEASUREMENT OF THE NEUTRON-INDUCED FISSION CROSS SECTION OF

^{244}Pu RELATIVE TO ^{235}U FROM 0.2 TO 30 MEV

ABSTRACT

Continuing our fission cross-section ratio studies at Lawrence Livermore Laboratory, we have determined preliminary results for the $^{244}\text{Pu}/^{235}\text{U}$ fission cross-section ratio from 0.2 to 30 MeV. Using the threshold method, we obtained the value 0.980 ± 0.021 for the average cross-section ratio in the interval from 1.75 to 4.00 MeV.

PRELIMINARY RESULTS

We measured the fission cross section of ^{244}Pu relative to that of ^{235}U using ionization fission chambers at Lawrence Livermore Laboratory's 100-MeV electron linear accelerator. The time-of-flight technique was used to measure the cross-section ratio as a function of neutron energy over the energy range from 0.001 to 30 MeV. Using the threshold method¹⁻³, we obtained the value 0.980 ± 0.021 for the average cross-section ratio in the interval from 1.75 to 4.00 MeV.

To reduce the effect of spontaneous fission background from the ^{244}Pu sample, we conducted the measurement at the 15.7-m time-of-flight station.

Figure 1 shows and Table 1 lists our preliminary data for the $^{244}\text{Pu}/^{235}\text{U}$ ratio from 0.2 to 30 MeV.

The Cross Section Evaluation Working Group (CSEWG), which is responsible for the upcoming ENDF/B-V evaluations, requested this brief report. We plan a more complete and formal presentation of this measurement.

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Fig. 1. Ratio of the ^{244}Pu to ^{235}U fission cross sections in the energy range from 0.2 to 30 MeV. Statistical error bars, representing one standard deviation, are included.

Table 1. Fission cross-section ratio of ^{244}Pu to ^{235}U

Neutron energy (MeV)	Ratio	Statistical uncertainty ^a (%)	Neutron energy (MeV)	Ratio	Statistical uncertainty ^a (%)
0.1996	0.0105	±8.7	0.5775	0.1703	1.8
0.2213	0.0109	8.0	0.5901	0.1918	1.6
0.2400	0.0094	11.7	0.6031	0.2352	1.5
0.2538	0.0164	7.0	0.6165	0.2440	1.5
0.2689	0.0134	8.3	0.6304	0.2700	1.4
0.2853	0.0176	6.4	0.6447	0.3175	1.3
0.3033	0.0210	5.0	0.6596	0.3416	1.2
0.3179	0.0251	5.9	0.6749	0.3754	1.1
0.3282	0.0292	4.9	0.6908	0.3935	1.0
0.3391	0.0273	5.0	0.7073	0.4579	1.0
0.3505	0.0283	5.5	0.7243	0.4789	1.0
0.3625	0.0345	4.6	0.7420	0.5607	0.9
0.3751	0.0399	3.8	0.7604	0.5688	0.9
0.3884	0.0460	3.4	0.7794	0.6466	0.8
0.4024	0.0496	3.1	0.7992	0.7059	0.8
0.4172	0.0574	2.9	0.8197	0.7201	0.8
0.4328	0.0589	2.8	0.8410	0.8149	0.7
0.4451	0.0710	3.4	0.8631	0.8392	0.7
0.4535	0.0735	3.1	0.8862	0.9015	0.6
0.4623	0.0901	2.7	0.9102	0.9582	0.6
0.4713	0.0868	2.7	0.9352	1.005	0.6
0.4805	0.0894	2.6	0.9612	1.023	0.6
0.4900	0.0955	2.4	0.9883	1.064	0.6
0.4998	0.1068	2.2	1.017	1.094	0.6
0.5099	0.1040	2.2	1.046	1.083	0.6
0.5204	0.1201	2.3	1.077	1.095	0.5
0.5311	0.1255	2.2	1.109	1.113	0.6
0.5422	0.1586	1.9	1.143	1.131	0.6
0.5536	0.1621	1.8	1.178	1.130	0.6
0.5654	0.1607	1.8	1.215	1.131	0.6

Table 1 (continued)

Neutron energy (MeV)	Ratio	Statistical uncertainty ^a (%)	Neutron energy (MeV)	Ratio	Statistical uncertainty ^a (%)
1.254	1.129	0.6	3.422	0.9911	1.0
1.294	1.108	0.6	3.608	0.9952	1.0
1.337	1.108	0.6	3.809	0.9616	1.0
1.381	1.116	0.6	4.028	0.9473	1.0
1.428	1.090	0.6	4.267	0.9420	1.0
1.477	1.078	0.6	4.527	0.9235	1.0
1.529	1.064	0.6	4.813	0.9360	1.0
1.584	1.047	0.6	5.044	0.9724	1.3
1.642	1.025	0.6	5.208	0.9846	1.3
1.703	1.027	0.6	5.381	1.1011	1.3
1.767	1.033	0.6	5.562	1.048	1.3
1.836	1.014	0.6	5.752	1.154	1.2
1.908	1.012	0.7	5.952	1.165	1.2
1.984	0.9972	0.7	6.163	1.160	1.1
2.066	0.9724	0.7	6.385	1.155	1.1
2.152	0.9579	0.7	6.620	1.116	1.0
2.244	0.9759	0.8	6.868	1.058	1.0
2.342	0.9685	0.8	7.130	1.016	1.0
2.446	0.9542	0.8	7.407	0.9859	1.0
2.558	0.9670	0.8	7.701	0.9455	1.1
2.677	0.9629	0.9	8.013	0.9599	1.1
2.805	0.9619	0.9	8.345	0.9229	1.1
2.943	0.9949	0.9	8.697	0.9193	1.2
3.091	0.9951	0.9	9.073	0.9141	1.2
3.250	0.9949	1.0	9.473	0.9319	1.3

Table 1 (continued)

Neutron energy (MeV)	Ratio	Statistical uncertainty ^a (%)	Neutron energy (MeV)	Ratio	Statistical uncertainty ^a (%)
9.901	0.9053	1.4	16.43	0.8250	2.2
10.36	0.8785	1.5	17.43	0.8363	2.3
10.85	0.8927	1.6	18.51	0.8380	2.5
11.37	0.8838	1.6	19.71	0.8626	2.6
11.94	0.8557	1.7	21.02	0.8672	2.8
12.55	0.8552	1.8	22.47	0.8777	2.9
13.21	0.8425	1.8	24.08	0.7822	3.2
13.92	0.8707	1.9	25.87	0.7848	3.3
14.69	0.8162	2.0	27.87	0.8690	3.5
15.52	0.8057	2.1	30.12	0.8670	3.8

^aThis indicates a counting error expressed as one standard deviation. Total errors may be estimated by combining the normalization error of 2.1% and the estimated overall systematic error of 1% with the counting errors in the table.

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