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STATUS OF ^{239}Pu CROSS-SECTIONS EVALUATION
IN THE UNRESOLVED REGION

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METHODE OF EVALUATION.

The evaluation is performed by using the HAUSER-FESHBACH statistical code
FISINGA. Starting from the average parameters obtained from a statistical
analysis of the Reich-Moore resonance parameters of the energy range thermal
to 1 kev, a preliminary calculation gives the statistical parameters for the
best representation of the average experimental cross-sections in the energy
range 1 kev to 30 kev. A single set of S_0, S_1, average capture width for s
and p wave neutrons, fission barrier heights for the 0^+, 1^+,1^-, 2^- channels
is obtained, allowing a smooth representation of the cross-sections in the
energy range considered. The paramaters S_0, S_1 and the fission barrier
heights (mainly for the 1^+ fission channel) are then modified in order to
reproduce the local fluctuations of the experimental total and fission
cross-sections ; the corresponding channel widths are found in FISINGA output
and are introduced in the avaluated data file. Finally, the consistency of
the evaluation is checked by performing a NJOY-THEMIS calculation from the
evaluated data file.

PRELIMINARY RESULTS.

Preliminary calculations (1) were performed in the energy range 1 kev to
4 kev starting with the average parameters obtained in (2) ; for the fission,
one partially open 1^+ channel, one fully open 0^+ channel and one partially
open 0^+ channel were used. The effectif number, Nef, of 0^+ fission channels
was about 1.3. It was found that the fission cross-sections calculated by
FISINGA and those calculated by NJOY-THEMIS from an equivalent set of
parameters were not consistent in several energy points. The differences were
mainly due to the fact that NJOY-THEMIS did not calculate the width
fluctuation factor corrections for the 0^+ fission channels in the same way
than FISINGA ; only integer values are allowed for the AMUF parameter in
ENDF/B format. A Nef of 1.3 is not taken into account in the NJOY-THEMIS
calculations.

NEW RESULTS.

The recent statistical analysis (3) of the Reich-Moore multilevel resonance
parameters obtained in the energy range 0 ev to 1 kev (3) has shown that the
average 0^+ fission width is equal to about 2 800 mev, instead of 1 600 mev
obtained in early analysis (2) in the energy range 0 to 200 ev. This new
result is consistent with the one expected fully open 0^+ fission channel
(contributing to about 1 500 mev in the total fission width) and with 2 or
more not fully open fission channels (each contributing to several hundred
mev in the total fission width). The corresponding Nef is very close to the
integer 2. Starting from this new basis, which should allow consistent
calculation of the width fluctuation factors, much better agreement is
obtained between FISINGA and NJOY-THEMIS calculations. The calculated
cross-sections averaged over 1 kev intervals agree within 1% to 2%. Some
problems remain in the energy points were the fission cross-section is
particularly small, in relation with very small values of the 1^+ fission
channel width and with the $(n, \gamma f)$ component. The final set of average
parameters for the evaluated data file should be adjusted by using
NJOY-THEMIS calculations.

Table I and II give the current values of the fission and capture cross-sections calculated by NJOY-THEMIS in the energy range 1 kev to 4 kev.

REFERENCES.

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    Preliminary evaluation of ^{239}Pu cross-sections in thermal to 4 kev energy range for testing purpose ; available in ENDF/B-V format at NEA DB, SACLAY (1987).

2. H. DERRIEN,
    Thèse série A n° 1172, ORSAY (1979).

3. H. DERRIEN and G. de SAUSSURE,
    R-Matrix analysis of ^{239}Pu neutron cross-sections in the energy range 0 ev to 1000 ev (distributed at this meeting).

ENERGY(KEV)	FISSION(BARNS)		CAPTURE(BARNS)	
	A	B	C	D
1.025	7.007	7.064	4.123	4.108
1.075	4.614	4.615	5.481	5.494
1.125	7.225	7.294	4.392	4.377
1.175	4.860	4.910	3.721	3.691
1.225	3.972	4.010	3.148	3.117
1.275	5.334	5.332	6.111	6.023
1.325	7.543	7.575	3.002	2.907
1.375	6.892	6.919	2.887	2.880
1.425	3.673	3.673	4.202	4.196
1.475	4.326	4.362	3.291	3.262
1.525	2.797	2.756	3.080	3.093
1.575	2.184	2.188	4.128	4.105
1.625	4.616	4.616	4.285	4.283
1.675	3.440	3.444	3.996	3.982
1.725	2.922	2.954	4.318	4.347
1.775	3.785	3.785	3.755	3.755
1.825	6.068	5.987	4.553	4.500
1.875	4.165	4.198	3.092	3.063
1.925	2.207	2.210	3.591	3.562
1.975	1.844	1.850	4.330	4.296
2.050	1.910	1.911	3.551	3.520
2.150	3.149	3.151	3.700	3.674
2.250	2.621	2.619	3.242	3.213
2.350	3.456	3.457	3.692	3.665
2.450	4.269	4.270	2.856	2.831
2.550	2.647	2.646	3.171	3.134
2.650	3.159	3.161	3.746	3.710
2.750	4.200	4.180	2.392	2.373
2.850	4.147	4.126	2.455	2.434
2.950	3.333	3.333	4.004	3.961
3.050	3.034	3.020	2.404	2.371
3.150	4.943	4.908	2.269	2.254
3.250	3.959	3.932	2.626	2.599
3.350	1.717	1.721	2.561	2.509
3.450	2.208	2.210	2.918	2.862
3.550	2.197	2.196	2.300	2.252
3.650	2.396	2.394	3.242	3.180
3.750	3.117	3.072	1.988	1.963
3.850	3.580	3.534	2.448	2.420
3.950	2.965	2.943	2.712	2.666

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TABLE I

^{239}Pu Fission and capture cross-sections in
the energy range 1 kev to 4 kev

A and D   calculated from NJOY-THEMIS

B   calculated from selected experimental data

C   calculated from FISINGA

TABLE II

AVERAGE CROSS SECTIONS IN BARNS IN THE ENERGY INTERVAL 1 KEV-4 KEV

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  ENERGY
  RANGE KEV      A       B       C       D       E      D/A      F       G
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    1-2        4.487   4.474   4.274   3.957   3.974   0.882   0.834   0.927
    2-3        3.285   3.289   3.173   3.252   3.281   0.990   1.028   1.108
    3-4        2.993   3.015   2.918   2.508   2.547   0.838   0.820   0.895
*********************************************************************************
           A   FISSION CALCULATED FROM NJOY-THEMIS
           B   FISSION FROM SELECTED EXPERIMENTAL DATA
               RENORMALIZED ON ENDF/B-VI PROPOSED STANDARD
           C   FISSION FROM WESTON 1984
           D   CAPTURE CALCULATED FROM NJOY-THEMIS
           E   CAPTURE CALCULATED FROM FISINGA
         D/A   ALPHA CALCULATED FROM A AND D
           F   ALPHA AVERAGED FROM 11 EXPERIMENTAL DATA
           G   ALPHA FROM SOWERBY-KONSHIN 1971
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