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Memo CP-D/600

Date: 20 December 2009
To: Distribution
From: N. Otsuka
Subject: Ternary to binary light charged particle yield ratio
Reference: CP-N/44, 4C-4/114, CP-D/599

Ternary alpha and triton emission probabilities in neutron-induced and spontaneous fission have measured by C. Wagemans and their colleagues. In EXFOR, 5 articles [1-6] are considered as the sources of numerical data. They have denoted ternary (long-range) alpha and triton emission probabilities in fission by LRA/*B* and *t/B*, and they has been coded as

--- (-, F), BIN/TER, FY/RAT, A
--- (-, F), TER, FY/RAT, T

. However, Dr. O. Serot (CEA Cadarache) explains the definition of the probability as

“Counting rate of Ternary alphas particles (or tritons) emitted during fission, LRA (or *t*), divided by counting rate of all fission events (Binary + Ternary fissions, *B*)”

, even though *B* in their notation denotes “Binary fission”. Therefore their data should be coded with

--- (-, F) 2-HE-4, TER, FY
--- (-, F) 1-H-3, TER, FY

for LRA/*B* and *t/B*, respectively.

Because there is no other subentry coded with TER/BIN, FY/RAT the following update of dictionary is also proposed:

Dictionary 236 (Quantities)

TER/BIN, FY/RAT, T (Obsolete)
TER/BIN, FY/RAT, A (Obsolete)

Reference

- [1] P. D'Hondt *et al.*, Nucl. Phys. **A346** (1980) 461 (EXFOR 21705)
- [2] S. Pommee *et al.*, Nucl. Phys. **A587** (1995)1 (EXFOR 22308)
- [3] C. Wagemans *et al.*, Nucl. Phys. **A742**(2004)291 (EXFOR 22896)
- [4] O. Serot *et al.*, Proc. Int. Nat. Conf. Nucl. Data for Sci. and Technol. p857 (2004) (EXFOR 22900)
- [5] S. Vermote *et al.*, Nucl. Phys. **A806** (2008)1 (EXFOR 23026)
- [6] O. Serot *et al.*, Proc. Int. Nat. Conf. Nucl. Data for Sci. and Technol. P479 (2007) (EXFOR 23048)

List of data compiled with “TER/BIN,FY/RAT” in EXFOR

(10^{-3} and 10^{-4} should be multiplied to alpha and triton emission data, respectively).

- Bold font means we need additional correction.

- 22896: $^{257}\text{Fm}(\text{SF})$ data in Table 2 of [3] is missing and should be added.

- 22900: 007-018, 028-044 are not from experiments, but from empirical formula.

Subentry	SF1	SF2-3	SF4-SF9 (proposed)	Data
21705 (Data source [1])				
21705.013	92-U-235	N,F	2-HE-4,TER,FY,,MXW	1.696+-0.027
22308 (Data source [2])				
22308.002	92-U-235	N,F	2-HE-4,TER,FY	(60 points)
22896 (Data source [3])				
22896.008	1 90-TH-229	N,F	2-HE-4,TER,FY,,MXW	2.05+-0.09
22896.008	2 90-TH-229	N,F	2-HE-4,TER,FY,,MXW	2.17+-0.10
22896.009	1 91-PA-231	N,F	2-HE-4,TER,FY,,MXW	1.67+-0.11
22896.009	2 91-PA-231	N,F	2-HE-4,TER,FY,,MXW	1.77+-0.12
22896.010	1 92-U-233	N,F	2-HE-4,TER,FY,,MXW	1.99+-0.07
22896.010	2 92-U-233	N,F	2-HE-4,TER,FY,,MXW	2.11+-0.07
22896.011	1 92-U-235	N,F	2-HE-4,TER,FY,,MXW	1.60+-0.05
22896.011	2 92-U-235	N,F	2-HE-4,TER,FY,,MXW	1.70+-0.05
22896.012	1 93-NP-237	N,F	2-HE-4,TER,FY,,MXW	1.94+-0.17
22896.012	2 93-NP-237	N,F	2-HE-4,TER,FY,,MXW	2.06+-0.18
22896.013	1 94-PU-239	N,F	2-HE-4,TER,FY,,MXW	2.07+-0.08
22896.013	2 94-PU-239	N,F	2-HE-4,TER,FY,,MXW	2.19+-0.09
22896.014	1 94-PU-241	N,F	2-HE-4,TER,FY,,MXW	1.75+-0.06
22896.014	2 94-PU-241	N,F	2-HE-4,TER,FY,,MXW	1.86+-0.07
22896.015	1 95-AM-241	N,F	2-HE-4,TER,FY,,MXW	2.24+-0.09
22896.015	2 95-AM-241	N,F	2-HE-4,TER,FY,,MXW	2.37+-0.09
22896.016	1 95-AM-243	N,F	2-HE-4,TER,FY,,MXW	1.72+-0.10
22896.016	2 95-AM-243	N,F	2-HE-4,TER,FY,,MXW	1.82+-0.10
22896.017	1 96-CM-245	N,F	2-HE-4,TER,FY,,MXW	2.15+-0.15
22896.017	2 96-CM-245	N,F	2-HE-4,TER,FY,,MXW	2.28+-0.16
22896.018	1 96-CM-247	N,F	2-HE-4,TER,FY,,MXW	1.85+-0.10
22896.018	2 96-CM-247	N,F	2-HE-4,TER,FY,,MXW	1.96+-0.11
22896.019	1 94-PU-238	0,F	2-HE-4,TER,FY	2.76+-0.13
22896.019	2 94-PU-238	0,F	2-HE-4,TER,FY	2.93+-0.14
22896.020	1 94-PU-240	0,F	2-HE-4,TER,FY	2.51+-0.14
22896.020	2 94-PU-240	0,F	2-HE-4,TER,FY	2.66+-0.15
22896.021	1 94-PU-242	0,F	2-HE-4,TER,FY	2.17+-0.07
22896.021	2 94-PU-242	0,F	2-HE-4,TER,FY	2.30+-0.08
22896.022	1 94-PU-244	0,F	2-HE-4,TER,FY	1.71+-0.09
22896.022	2 94-PU-244	0,F	2-HE-4,TER,FY	1.81+-0.10
22896.023	1 96-CM-242	0,F	2-HE-4,TER,FY	3.34+-0.26
22896.023	2 96-CM-242	0,F	2-HE-4,TER,FY	3.54+-0.28
22896.024	1 96-CM-244	0,F	2-HE-4,TER,FY	2.73+-0.20
22896.024	2 96-CM-244	0,F	2-HE-4,TER,FY	2.89+-0.21
22896.025	1 96-CM-246	0,F	2-HE-4,TER,FY	2.49+-0.12
22896.025	2 96-CM-246	0,F	2-HE-4,TER,FY	2.64+-0.13
22896.026	1 96-CM-248	0,F	2-HE-4,TER,FY	2.30+-0.10
22896.026	2 96-CM-248	0,F	2-HE-4,TER,FY	2.44+-0.11

22896.027	1	98-CF-250	0,F	2-HE-4,TER,FY	3.65+-0.28
22896.027	2	98-CF-250	0,F	2-HE-4,TER,FY	3.87+-0.30
22896.028	1	98-CF-252	0,F	2-HE-4,TER,FY	3.06+-0.11
22896.028	2	98-CF-252	0,F	2-HE-4,TER,FY	3.24+-0.12
22896.029	1	100-FM-256	0,F	2-HE-4,TER,FY	4.24+-0.59
22896.029	2	100-FM-256	0,F	2-HE-4,TER,FY	4.49+-0.63

22900 (Data source [4])

22900.002		96-CM-246	0,F	1-H-3,TER,FY	1.72+-0.24
22900.003		96-CM-248	0,F	1-H-3,TER,FY	1.79+-0.07
22900.004		98-CF-250	0,F	1-H-3,TER,FY	2.70+-0.50
22900.005		98-CF-252	0,F	1-H-3,TER,FY	2.43+-0.17
22900.006		100-FM-256	0,F	1-H-3,TER,FY	3.90+-0.50
22900.007		94-PU-238	0,F	Delete?	1.37+-0.08
22900.008		94-PU-240	0,F	Delete?	1.34+-0.08
22900.009		94-PU-242	0,F	Delete?	1.31+-0.08
22900.010		94-PU-244	0,F	Delete?	1.29+-0.08
22900.011		96-CM-242	0,F	Delete?	1.92+-0.12
22900.012		96-CM-244	0,F	Delete ?	1.86+-0.11
22900.013		96-CM-246	0,F	Delete ?	1.8+-0.11
22900.014		96-CM-248	0,F	Delete ?	1.74+-0.10
22900.015		98-CF-250	0,F	Delete ?	2.60+-0.16
22900.016		98-CF-252	0,F	Delete ?	2.54+-0.15
22900.017		100-FM-256	0,F	Delete ?	3.36+-0.20
22900.018		100-FM-257	0,F	Delete ?	3.33+-0.20
22900.019		90-TH-229	N,F	1-H-3,TER,FY,,MXW	0.85+-0.15
22900.020		92-U-233	N,F	1-H-3,TER,FY,,MXW	1.14+-0.05
22900.021		92-U-235	N,F	1-H-3,TER,FY,,MXW	1.08+-0.04
22900.022		94-PU-239	N,F	1-H-3,TER,FY,,MXW	1.42+-0.07
22900.023		94-PU-241	N,F	1-H-3,TER,FY,,MXW	1.41+-0.06
22900.024		95-AM-241	N,F	1-H-3,TER,FY,,MXW	1.65+-0.10
22900.025		96-CM-245	N,F	1-H-3,TER,FY,,MXW	1.85+-0.10
22900.026		96-CM-247	N,F	1-H-3,TER,FY,,MXW	1.84+-0.11
22900.027		98-CF-251	N,F	1-H-3,TER,FY,,MXW	2.35+-0.40
22900.028		90-TH-229	N,F	Delete ?	0.78+-0.07
22900.029		91-PA-231	N,F	Delete ?	0.93+-0.08
22900.030		92-U-233	N,F	Delete ?	1.12+-0.10
22900.031		92-U-235	N,F	Delete ?	1.09+-0.10
22900.032		93-NP-237	N,F	Delete ?	1.25+-0.11
22900.033		93-NP-238	N,F	Delete ?	1.25+-0.11
22900.034		94-PU-238	N,F	Delete ?	1.44+-0.13
22900.035		94-PU-239	N,F	Delete ?	1.44+-0.13
22900.036		94-PU-241	N,F	Delete ?	1.41+-0.13
22900.037		95-AM-241	N,F	Delete ?	1.60+-0.14
22900.038		95-AM-242-M	N,F	Delete ?	1.60+-0.14
22900.039		95-AM-243	N,F	Delete ?	1.57+-0.14
22900.040		96-CM-243	N,F	Delete ?	1.96+-0.18
22900.041		96-CM-244	N,F	Delete ?	1.91+-0.17
22900.042		96-CM-245	N,F	Delete ?	1.89+-0.17
22900.043		96-CM-247	N,F	Delete ?	1.83+-0.16
22900.044		98-CF-251	N,F	Delete ?	2.63+-0.24

22900.045	93-NP-238	N,F	2-HE-4,TER,FY,,MXW	1.86+-0.19
22900.046	94-PU-238	N,F	2-HE-4,TER,FY,,MXW	2.42+-0.24
22900.047	95-AM-242-M	N,F	2-HE-4,TER,FY,,MXW	2.10+-0.21
22900.048	96-CM-243	N,F	2-HE-4,TER,FY,,MXW	2.58+-0.26
22900.049	96-CM-244	N,F	2-HE-4,TER,FY,,MXW	2.42+-0.24
22900.050	98-CF-251	N,F	2-HE-4,TER,FY,,MXW	2.88+-0.14

23026 (Data source [5])

23026.013	1	96-CM-243	N,F	2-HE-4,TER,FY,,SPA	2.43+-0.08
23026.013	2	96-CM-243	N,F	1-H-3,TER,FY,SPA	1.96+-0.25
23026.014	1	96-CM-245	N,F	2-HE-4,TER,FY,,SPA	2.15+-0.12
23026.014	2	96-CM-245	N,F	1-H-3,TER,FY,SPA	1.85+-0.21
23026.015	1	96-CM-247	N,F	2-HE-4,TER,FY,,SPA	1.85+-0.10
23026.015	2	96-CM-247	N,F	1-H-3,TER,FY,SPA	1.85+-0.20
23026.016	1	96-CM-244	0,F	2-HE-4,TER,FY	3.16+-0.09
23026.016	2	96-CM-244	0,F	1-H-3,TER,FY	1.98+-0.24
23026.017	1	96-CM-246	0,F	2-HE-4,TER,FY	2.49+-0.12
23026.017	2	96-CM-246	0,F	1-H-3,TER,FY	1.72+-0.24
23026.018	1	96-CM-248	0,F	2-HE-4,TER,FY	2.30+-0.10
23026.018	2	96-CM-248	0,F	1-H-3,TER,FY	1.79+-0.21

23048 (Data source [6])

23048.002	1	96-CM-244	0,F	1-H-3,TER,FY	1.91+-0.41
23048.003	1	96-CM-243	N,F	1-H-3,TER,FY,SPA	1.77+-0.39
23048.004	1	98-CF-251	N,F	1-H-3,TER,FY,,SPA	2.37+-0.58
23048.005	1	98-CF-249	N,F	1-H-3,TER,FY,SPA	2.20+-0.35

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