Memo CP-C/61

Date: August 22, 1979

From: T.W. Burrows & V. McLane TWB

Subject: New quantity codes

Reference: CP-D/86 of 6/8/79
CP-C/56 of 5/22/78
CP-C/51 of 12/14/78

In CP-C/51 we proposed new quantities codes. These were repeated without explanation in CP-C/56. These codes were:

1. ,ASY,FF
2. CUM/DL,FY
3. ,NU,G,
   PAR,NU,G

A further discussion of these proposals follows along with a discussion of the suggestion in CP-D/86 for a new code in dictionary 32, "MLT", to be used for gamma or particle multiplicity.

Please remove the request for "CUM/DL,FY." This was requested to handle isomer fission as opposed to prompt fission, and there should be better ways of handling this.

Gamma and Particle Multiplicities

We are including in the Bibliography of Integral Charged-Particle Nuclear Data gamma and particle multiplicities, since in heavy-ion physics measurements of such multiplicities are a standard method for deriving information on the production cross sections.

We are willing to accept the suggestion in CP-D/86 to introduce a new code, "MLT," in Dict. 32 to be used for gamma or particle multiplicity. However, we suggest that the codes "NU" and "ETA" retain their special definitions with respect to fission and that "MLT" be used for all other multiplicities, including neutron multiplicities. The following dictionary and manual additions and changes would be required:

Dictionary 32:

	MLT	Particle yield per event
||	ETA	Average neutron yield per nonelastic event for thermally fissile isotopes.

old: neutron-yield per absorption

cc/ Alice
Dayday
Kammer
Kimmel
Hendrickson
Okamoto
Schwarer

Dictionary 36:

INTEGRAL CROSS SECTIONS, GENERAL USE

,MLT	No	(MULTIPLICITY) *SF4 = PARTICLE CONSIDERED.
,MLT,G	No	(GAMMA MULTIPLICITY)
,MLT,N	No	(NEUTRON MULTIPLICITY)
PAR,MLT	No	(PARTIAL MULTIPLICITY) *SF4 = PARTICLE CONSIDERED
PAR,MLT,G	No	(PARTIAL GAMMA MULTIPLICITY)
PAR,MLT,N	No	(PARTIAL NEUTRON MULTIPLICITY)

Attached is a proposed LEXFOR entry Particle_Yields to replace the existing entry on Neutron_Yields.

Asymmetry of Fission Product Yield

Unfortunately, we garbled the code as requested in CP-C/51 and CP-C/56. We meant to request the code ",FY,FF,ASY" to identify the asymmetry of the fission yield; that is, the ratio of the heavy fragments to the light fragments. Dict. 36 currently contains the code POL,FF,ASY. This is misleading and should be deleted. This would require a modification in Dict. 34, and an addition to Dict. 36.

Dictionary 34:

change: ASY Asymmetry

Dictionary 36:

add: ,FY,FF,ASY FY (ASYMMETRY OF FISSION-PRODUCT YIELD)
RATIO OF HEAVY FRAGMENTS TO LIGHT FRAGMENTS

Delete: ,POL,FF,ASY

References

Multiplicities: R.S. Simon et al. Nucl. Phys. A290, 253(1977).

References (cont'd)

Asymmetry: F. Dickmann et al. in Physics and Chemistry of Fission (IAEA,Vienna,1969), p.25.

Sol Pearlstein

TWB/lh

Distribution: H. Behrens
F.E. Chukreev
G. Dearnaley
V. Manokhin
A. Marcinkowski
H. Muenzel
S. Pearlstein
J.J. Schmidt ✓
H. Tanaka
N. Tubbs
NNDC

[Proposed LEXFOR entry]

PARTICLE YIELD

Particle Yield

Multiplicity

Definition: Particle yield per event

Quantity code: MLT in REACTION SF6.

The particle considered must be given in SF4 or SF7.

Examples:

(-----(P,A)-----,,MLT,G) gamma yield from (p,α) reaction

(-----(N,X)O-G-O,,MLT) Gamma yield from all neutron-induced reactions.

The neutron yield from fissionable isotopes is taken as a special case, and the following conventions are used.

Nu-bar ($\bar{\nu}$)

Definition: Average number of fission-neutrons emitted per fission event

Quantity-codes:	ISO-QUANT	REACTION
total nu-bar	NU	(N,F),,NU
prompt nu-bar	NU,,PR	(N,F),PR,NU
delayed nu-bar	NU,,DL	(N,F),DL,NU

Sum-rule: total nu-bar = prompt plus delayed nu-bar.

See also Delayed Fission Neutron Data

Eta

Definition: The average neutron yield per nonelastic event.

For the thermally fissile isotopes, where fission and capture are, up to a certain threshold, the only nonelastic processes, eta is defined as average neutron yield per absorption.

Quantity code:	ISO-QUANT	REACTION
For thermally fissile nuclei:	ETA	(N,ABS),,ETA
in general:	NON/ETA	(N,NON),,ETA
Eta at resonance	ETA,RES	(N,ABS),,ETA,,RES

For thermally fissioning nuclei, Eta is related to Nu (neutron yield per fission) and Alpha (capture-to-fission ration by:

$$\eta = \bar{\nu} \frac{\sigma_f}{\sigma_a}$$