MEMO CP-C/66

Date: August 31, 1979

From: T.W. Burrows & V. McLane

Subject: Excited States, Fission Isomers (New Proposal)

Reference: Memo CP-A/14, CP-B/29

Excited States

We do not agree to the addition of the state code 'E' as proposed in Memo CP-A/14. Reactions which lead to a nucleus in a given excited state are now defined as "Partial Reactions", and such a change would result in having to convert a very large number of entries which have already been transmitted.

We do agree that the present system does not adequately handle the coding of reactions which lead to the same end product through different reaction mechanisms. We think the case cited in Memo CP-A/14 should be handled by the introduction of a new branch code.

We propose the following addition to dictionary 31:

INT Production of the product nucleus through a specific level or emitting a specific gamma or particle group.

Fission Isomers

We have had difficulties in properly coding the production of fission isomers, also known as shape isomers, in the Bibliography of Integral Charged-Particle Nuclear Data. We would expect that this difficulty would also be found in coding the spontaneous fission data from such isomers. Since there are many levels above the ground state and metastable states which have half lives of the same order of magnitude ($\lesssim$ 1 msec) as the fission isomers, we feel that the isomer codes M, M1, M2, etc., are not appropriate for the fission isomers. Therefore, we suggest that the codes F, F1, F2, etc., be introduced to identify fission isomers in conformity with the nomenclature of ref. 1. As an example, there is ^{244}Am, which has both a metastable state and two fission isomers (reference 2). The coding for the various states would be:

95-AM-244-G	$T_{1/2}$ = 10.1h
95-AM-244-M	$T_{1/2} \approx$ 26m
95-AM-244-F1	$T_{1/2}$ = 0.85ms
95-AM-244-F2	$T_{1/2} \approx$ 6.5μs.

The data contained in Fig. 2 of reference 3 (which was cited in reference 2) would be coded in the Reaction formalism as follows:

95-AM-241(D,P)95-AM-242-G,,SIG,,	Prompt fission
95-AM-241(D,P)95-AM-242-F,,SIG,,	Isomer fission
95-AM-243(D,P)95-AM-244-G,,SIG,,	Prompt fission
95-AM-243(D,P)95-AM-244-F1,,SIG,,	Isomer fission

References

1. C.M. Lederer, et al. Table of Isotopes, 7th Edition (John Wiley and Sons, New York, 1978).
U.S. Shirley, et al. Nuclear Wallet Cards (Lawrence Berkeley Laboratory, Berkeley, CA., 1979).

2. M.R. Schmorak. Nucl. Data Sheets 17, 391 (1976).

3. S. Bjornholm, et al. Yad. Fiz. 8, 459 (1968); Sov. Nucl. Phys. 8, 267 (1969).

The following would replace the first paragraph in the LEXFOR entry on Isomeric States.

An isomeric state is defined as a long-lived energy state, where long-lived is, generally, accepted to mean having a measurable half-life (i.e., greater than $\sim 10^{-15}$ sec).

For practical applications, a metastable state will be defined in EXFOR as an energy state having a half-life of the order of .1 milliseconds or longer.

A fission isomer, also known as a shape isomer, is defined as an energy state whose primary mode of decay is spontaneous fission.

Metastable states and fission isomers of nuclei are indicated by an isomer code following the isotope code, e.g., 95-AM-242-M1. (See EXFOR page VIII.2 for a complete list of codes.)

Other isomeric state production should be coded as partial reaction data.

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