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Memo CP-D/611

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To: Distribution
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Subject: **E-RL-CM: Relative energy in center-of-mass system?**
Reference: Memo CP-E/051 (Rev.)

There are two heading codes E-RL and E-RL-CM in the current dictionary 24:

E-RL	Relative Energy of Outgoing Particle, Lab. System
E-RL-CM	Relative Energy of Outgoing Particle, C. M. System

It is, however, useless to have two codes for the laboratory and center-of-mass system because the relative energy of outgoing particles is always defined as the sum of the kinetic energy in the center-of-mass system.

E-RL-CM has been already used in 3 subentries: C0988.005, C1660.002 and C1660.004, and E-RL is used in 8 subentiries (C0988.004, C1676.002-003, E2096.002-006). I propose to make obsolete E-RL-CM, and keep only E-RL in dictionary 24.

Dictionary 24 (Data Headings)

E-RL-CM (*Obsolete*)

Relative energy of the two body system is often used to study the structure of the unstable nucleus. For example, T. Nakamura *et al*.[1] shows the spectrum of the relative energy E_{rel} for the ^{14}C + n system from the ^{15}C Coulomb break up by the Pb target. $E^*(^{15}C) = E_{rel}(^{14}C\text{- n}) + S(n)$, where S(n) it the neutron separation energy of ^{15}C.

Relative energy can be also defined for three or more particle systems. T. Nakamura *et al*.[2] shows the spectrum of the three-body relative energy E_{rel} for the ^{9}Li + n + n system in the ^{11}Li Coulomb break up by the Pb target. $E^*(^{11}Li) = E_{rel}(^{9}Li\text{-n-n}) + S(2n)$, where S(2n) is the two neutron separation energy of . ^{11}Li

For reaction, $1+2 \rightarrow 3+4+\ldots+n$, the centre-of-mass incident energy E_{cm} (EN-CM) is related with relative energy of the outgoing particles E_{rel} (E-RL) as follows:

$$E_{cm}(1+2) + Q = E_{rel}(3+4+\ldots+n)$$

, where Q is the Q-value of the reaction

References

[1] T. Nakamura *et al.*, Phys. Rev. C. **79**(2009) 035805 (EXFOR C1676, Similar data are also compiled in E2139.)
[2] T. Nakamura *et al.*, Phys. Rev. Lett. **96**(2006) 252502 (EXFOR E1991)

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