

**Nuclear Data Section
International Atomic Energy Agency
P.O.Box 100, A-1400 Vienna, Austria**

Memo CP-D/569

Date: 2 July 2009
To: Distribution
From: N. Otsuka

Subject: Dictionaries 31 and 236- provisional fragment mass (PRV)

In prelim 2211 (and also in prelim.2191 and 2207), several entries give fission data for “provisional mass” of fission fragment. This should be distinguished from pre-neutron emission fission fragment mass (primary fission fragment mass PRE) and post-neutron emission fission fragment mass (secondary fission fragment mass SEC).

In general, there are momentum and mass conservations for fission:

$$m_1^* E_1^* = m_2^* E_2^* \quad (\text{momentum conservation in center-of-mass system})$$

$$m_1^* + m_2^* = m_f \quad (\text{mass conservation})$$

, where m_i ($i=1, 2$) and m_f denote the mass of fission fragment and compound nucleus, respectively. Asterisk means the quantity before neutron emission. If we assume the velocity of fission fragment is unchanged by prompt neutron emission ($v_i = v_i^*$), we can derive the pre-neutron emission fission fragment mass from above equations:

$$m_1^* = m_f v_2 / (v_1 + v_2),$$

$$m_2^* = m_f v_1 / (v_1 + v_2)$$

$$E_{\text{tot}}^* = (1/2) m_f v_1 v_2$$

$$m_1 = 2E_1 / v_1^2,$$

$$m_2 = 2E_2 / v_2^2$$

Therefore we can obtain pre-neutron emission fission fragment masses m_i^* , pre-neutron emission total kinetic energy E_{tot}^* and post-neutron emission fission fragment masses m_i if we can measure velocities (v_i) and kinetic energies (E_i) of two post-neutron emission fragments (2v2E method) [1].

Authors of old articles sometimes introduced the provisional fission fragment mass μ_i which satisfies the following relation:

$$\mu_1 E_1 = \mu_2 E_2$$

$$\mu_1 + \mu_2 = m_f$$

, and obtained μ_i from measurement of the kinetic energies of post-neutron emission fission fragments E_i [2]. I would propose to the following new branch code and quantity codes for provisional fission fragment mass.

Dictionary 31 (Branch codes)

PRV Provisional (For use in fission)

Dictionary 236 (Quantities)

PRV, AP, HF Most probable provisional mass for heavy fragment

PRV, AP, LF Most probable provisional mass for light fragment

Sum rule: If sum of two fragment masses is equal to compound mass, they are pre-neutron emission fragment masses PRE or provisional fragment masses PRV.

Checking of the following entries is necessary:

PRELIM.2191: 21752,

PRELIM.2207: 21313, 21543, 21544, 21545, 21771

.

References

[1] For example, I. Nishinaka *et al.*, Phys.Rev.C**70**(2004)014609

[2] H. W. Schmitt *et al.*, Phys. Rev. **141** (1966) 1146

Distribution:

blokhin@ippe.ru
chiba@earth.sgu.ac.jp
claes.nordborg@oecd.org
ganesan@barc.gov.in
gezg@ciae.ac.cn
hasegawa@nea.fr
henriksson@near.fr
hongwei@ciae.ac.cn
jhchang@kaeri.re.kr
kaltchenko@kinr.kiev.ua
katakura.junichi@jaea.go.jp
kato@nucl.sci.hokudai.ac.jp
kirarlyb@atomki.hu
l.vrapcenjak@iaea.org
manuel.bossant@oecd.org
manokhin@ippe.ru
mmarina@ippe.ru
mwherman@bnl.gov
nicolas.soppera@oecd.org

nklimova@kinr.kiev.ua
n.otsuka@iaea.org
nrhc@jcprg.org
oblozinsky@bnl.gov
ogritzay@kinr.kiev.ua
otto.schwerer@aon.at
samaev@obninsk.ru
s.babykina@polyn.kiae.su
scyang@kaeri.re.kr
s.dunaeva@iaea.org
stakacs@atomki.hu
stanislav.hlavac@savba.sk
taova@expd.vniief.ru
tarkanyi@atomki.hu
varlamov@depni.sinp.msu.ru
vlasov@kinr.kiev.ua
vmclane@optonline.net
v.zerkin@iaea.org
yolee@kaeri.re.kr