**Nuclear Data Section**

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**Memo CP-D/1009**

**Date:** 25 January 2021

**To:** Distribution

**From:** N. Otsuka

**Subject: Isomeric flag of Nb-102, Tc-102, Rh-108, Sb-128, Sb-132**

**Reference:** Memo CP-D/0888

Andrea Mattera (NNDC) informed that the independent isomeric yield ratios of 132Sb from low-energy neutron-induced fission in EXFOR 20589, 20878, 22017, 22161, 33011, 33016-33018 and 33029 are consistent except for EXFOR 20878.007-008 and 012 compiled from G.Paffarth and H.O.Denschlag, R,MAINZ-75,90,1976. This report gives the isomeric ratio of the independent fission yields IFY(2.8 min, 4+)/IFY(4.2 min, 8-) in Table 12. They do not mention which one is the ground state, and the ratios have been compiled in EXFOR as the -G/M ratios.

Memo CP-D/0888 identifies this assignment is opposite to the assignment in the Nuclear Wallet Cards. This falls into Type=L (“The ground state is not well established”) defined in CP-D/0888, for which I did not ask the originating centres to change the isomeric flags (i.e. the isomeric flagging is up to compiler’s choice as long as the flag is related with the half-life under DECAY-DATA).

I would like to propose adoption of the assignment in ENDF and NUBASE for 132Sb (i.e., -G for the 2.8 min state and -M for the 4.1 min state) in general considering the situation reported by Mattera. Balraj Singh (McMaster Univ.) reminded me presence of the comment line which mentions by an experimental evidence of Ex(8-)=150-250 keV [C.A.Stone et al., Phys.Rev.C39(1989)1963] and adoption of its mean (200±30 keV) in Nubase2016, and this could justify the assignment in ENDF and NUBASE.

Among 103 DECAY-DATA records providing the half-life of the 132Sb ground or metastable states in EXFOR Master 2020-12-19, isomeric flagging in the following subentries are opposite from the others:

20589.002, 20589.003, 20878.007, 20878.008,20878.012, 20878.013, 30691.002, 32666.001, 30751.002, 30751.004, G0500.001

and their corrections are recommended.

In this opportunity, I extracted all nuclides having Type=L cases in Memo CP-D/0888, and found the following 20 nuclides:

88Nb, 102Nb, 102Tc, 108Rh, 110Rh, 120In, 120Sb, 128Sb, 132Sb, 146La, 152Pm, 154Pm, 154Tb, 156Ho, 178Ta, 182Re, 236Np, 250Es, 261Rf, 265Sg

For underlined four nuclides, the ENSDF “Adopted levels, gammas” dataset (1) gives the isomeric transition probability, or (2) quotes an excitation energy determined by a mass measurement. I would like to propose the following isomeric flagging adopted in ENSDF/Nubase2016 for these four nuclides:

|  |  |  |  |
| --- | --- | --- | --- |
| **Nuclide** | **-G** | **-M** | **# of affected EXFOR data sets** |
| 102Nb | 4.3 sec | 1.3 sec | 2 |
| 102Tc | 5.28 sec | 4.35 min | 0 (all corrected) |
| 108Rh | 16.8 sec | 6.0 min | 11 |
| 128Sb | 9.05 h | 10.41 min | 0 (all corrected) |
| 132Sb | 2.79 min | 4.10 min | 10 |

ATOMKI, CNDC, JAEA and NNDC could consult this proposal with their ENDSF evaluators.

Appendix **DECAY-DATA records summarized in Memo CP-D/0888 with Type=L**

Corrected: The flag was corrected after distribution of Memo CP-D/0888.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Nuclide** | **Subentry** | **T1/2(EXFOR)** | **T1/2(Wallet)** | **Corrected** | **Proposal** |
| 41-NB-88-M | C1944.002 | 14.3MIN | 7.78MIN | G |   |
| **41-NB-102** | **21701.003** | **1.3SEC** | **4.3SEC** |  | **M** |
| **41-NB-102-M** | **E2036.005** | **4.3SEC** | **1.3SEC** |  | **G** |
| 43-TC-102 | 11923.010 | 4.5MIN | 5.28SEC | M |   |
| 45-RH-108-G | 10772.006 | 6.MIN | 16.8SEC | M |   |
| **45-RH-108-G** | **22415.012** | **6.0MIN** | **16.8SEC** |  | **M** |
| **45-RH-108-G** | **22433.023** | **6.0MIN** | **16.8SEC** |  | **M** |
| **45-RH-108-G** | **E1701.003** | **6.MIN** | **16.8SEC** |  | **M** |
| **45-RH-108-G** | **E2036.005** | **5.9MIN** | **16.8SEC** |  | **M** |
| **45-RH-108-M** | **10145.015** | **16.8SEC** | **6.0MIN** |  | **G** |
| **45-RH-108-M** | **30336.032** | **18.SEC** | **6.0MIN** |  | **G** |
| **45-RH-108-M** | **E1701.003** | **16.8SEC** | **6.0MIN** |  | **G** |
| **45-RH-108-M** | **E2036.002** | **16.8SEC** | **6.0MIN** |  | **G** |
| **45-RH-108-M** | **E2036.003** | **16.8SEC** | **6.0MIN** |  | **G** |
| **45-RH-108-M** | **E2036.005** | **16.8SEC** | **6.0MIN** |  | **G** |
| **45-RH-108-M** | **E2036.006** | **16.8SEC** | **6.0MIN** |  | **G** |
| 45-RH-110-G | E2036.002 | 3.3SEC | N/A |   |   |
| 49-IN-120 | 40798.005 | 51.0SEC | 3.08SEC | M |   |
| 49-IN-120-G | 11957.003 | 50.SEC | 3.08SEC | M2 |   |
| 49-IN-120-G | 20540.012 | 45.4SEC | 3.08SEC |   |   |
| 49-IN-120-G | 20540.014 | 45.4SEC | 3.08SEC |   |   |
| 49-IN-120-G | O0407.071 | 47.3SEC | 3.08SEC | Deleted. |   |
| 51-SB-120 | 11645.022 | 5.8D | 15.89MIN |   |   |
| 51-SB-120 | C2001.007 | 6.0D | 15.89MIN | M |   |
| 51-SB-120 | D0495.095 | 6.D | 15.89MIN | M |   |
| 51-SB-120-G | A0291.003 | 5.76D | 15.89MIN |   |   |
| 51-SB-120-M | A0085.018 | 15.8MIN | 5.76D |   |   |
| 51-SB-120-M | A0291.003 | 16.MIN | 5.76D |   |   |
| 51-SB-120-M | C0556.004 | 15.9MIN | 5.76D | G |   |
| 51-SB-128-M | 20589.004 | 9.1HR | 10.4MIN | G |   |
| 51-SB-132 | 21701.004 | 252.SEC | 2.79MIN | M |   |
| **51-SB-132** | **30691.002** | **4.21MIN** | **2.79MIN** |  | **M** |
| 51-SB-132 | 32666.001 | 252.0SEC | 2.79MIN | M |   |
| **51-SB-132-G** | **20589.002** | **4.2MIN** | **2.79MIN** |  | **M** |
| **51-SB-132-G** | **20589.003** | **4.2MIN** | **2.79MIN** |  | **M** |
| **51-SB-132-G** | **20878.007** | **4.2MIN** | **2.79MIN** |  | **M** |
| **51-SB-132-G** | **20878.008** | **4.2MIN** | **2.79MIN** |  | **M** |
| **51-SB-132-G** | **20878.012** | **4.2MIN** | **2.79MIN** |  | **M** |
| **51-SB-132-G** | **20878.013** | **4.2MIN** | **2.79MIN** |  | **M** |
| 51-SB-132-G | 22161.002 | 252.SEC | 2.79MIN | M |   |
| **51-SB-132-G** | **30751.002** | **4.21MIN** | **2.79MIN** |  | **M** |
| **51-SB-132-G** | **30751.004** | **4.21MIN** | **2.79MIN** |  | **M** |
| **51-SB-132-G** | **G0500.001** | **4.2MIN** | **2.79MIN** |  | **M** |
| 57-LA-146 | 30691.002 | 11.1SEC | 6.27SEC |   |   |
| 61-PM-152-M1 | 12033.029 | 6.5MIN | 13.8MIN |   |   |
| 61-PM-152-M2 | 31439.002 | 13.8MIN | 7.52MIN |   |   |
| 61-PM-154-M | 12705.002 | 162.SEC | 1.73MIN |   |   |
| 65-TB-154-M1 | A0680.002 | 9.HR | 22.7HR |   |   |
| 65-TB-154-M1 | A0680.004 | 9.HR | 22.7HR |   |   |
| 65-TB-154-M1 | D4241.004 | 9.994HR | 22.7HR |   |   |
| 65-TB-154-M1 | D6180.003 | 9.4HR | 22.7HR |   |   |
| 65-TB-154-M1 | E2074.006 | 9.HR | 22.7HR |   |   |
| 65-TB-154-M2 | A0680.002 | 23.HR | 9.4HR |   |   |
| 65-TB-154-M2 | A0680.003 | 23.HR | 9.4HR |   |   |
| 65-TB-154-M2 | D4241.005 | 22.7HR | 9.4HR |   |   |
| 65-TB-154-M2 | D6180.004 | 22.7HR | 9.4HR |   |   |
| 65-TB-154-M2 | E2074.006 | 22.6HR | 9.4HR |   |   |
| 67-HO-156-M1 | O0768.196 | 56.MIN | 9.5SEC |   | G |
| 73-TA-178-G | A0283.008 | 2.2HR | N/A |   |   |
| 73-TA-178-G | A0567.002 | 9.3MIN | N/A |   |   |
| 73-TA-178-G | A0635.003 | 9.31MIN | N/A |   |   |
| 73-TA-178-G | B0032.002 | 9.4MIN | N/A |   |   |
| 73-TA-178-G | D4227.005 | 2.25HR | N/A |   |   |
| 73-TA-178-M | 33004.016 | 2.36HR | 9.31MIN |   |   |
| 73-TA-178-M | A0598.006 | 2.5HR | 9.31MIN |   |   |
| 73-TA-178-M | A0635.003 | 2.45HR | 9.31MIN |   |   |
| 73-TA-178-M | A0676.002 | 2.45HR | 9.31MIN |   |   |
| 73-TA-178-M | A0721.003 | 2.36HR | 9.31MIN |   |   |
| 73-TA-178-M | A0904.142 | 2.36HR | 9.31MIN |   |   |
| 73-TA-178-M | B0032.002 | 2.1HR | 9.31MIN |   |   |
| 73-TA-178-M | C0402.003 | 2.2HR | 9.31MIN |   |   |
| 73-TA-178-M | D4233.013 | 2.36HR | 9.31MIN |   |   |
| 73-TA-178-M | D4254.003 | 2.36HR | 9.31MIN |   |   |
| 73-TA-178-M | D6181.012 | 2.50HR | 9.31MIN |   |   |
| 73-TA-178-M | E2074.006 | 2.45HR | 9.31MIN |   |   |
| 73-TA-178-M | O0768.184 | 2.36HR | 9.31MIN |   |   |
| 73-TA-178-M1 | O0276.434 | 9.25MIN | N/A |   |   |
| 73-TA-178-M1 | O0781.004 | 2.36HR | N/A |   |   |
| 73-TA-178-M1 | O1018.004 | 2.36HR | N/A |   |   |
| 73-TA-178-M1 | O1019.004 | 2.36HR | N/A |   |   |
| 73-TA-178-M1 | O1020.004 | 2.36HR | N/A |   |   |
| 73-TA-178-M1 | O1021.004 | 2.36HR | N/A |   |   |
| 75-RE-182-G | A0070.002 | 12.7HR | 64.0HR | M |   |
| 75-RE-182-G | A0070.003 | 12.7HR | 64.0HR | M |   |
| 75-RE-182-G | A0070.004 | 12.7HR | 64.0HR | M |   |
| 75-RE-182-G | A0168.168 | 12.7HR | 64.0HR |   |   |
| 75-RE-182-G | A0194.186 | 12.7HR | 64.0HR | M |   |
| 75-RE-182-G | A0195.095 | 12.7HR | 64.0HR | M |   |
| 75-RE-182-G | A0195.146 | 12.7HR | 64.0HR | M |   |
| 75-RE-182-M | A0070.002 | 64.HR | 12.7HR | G |   |
| 75-RE-182-M | A0070.003 | 64.HR | 12.7HR | G |   |
| 75-RE-182-M | A0070.004 | 64.HR | 12.7HR | G |   |
| 75-RE-182-M | A0168.167 | 64.HR | 12.7HR |   |   |
| 75-RE-182-M | A0194.185 | 64.HR | 12.7HR | ! |   |
| 75-RE-182-M | A0195.094 | 64.HR | 12.7HR | G |   |
| 75-RE-182-M | A0195.145 | 64.HR | 12.7HR | G |   |
| 93-NP-236 | 40898.002 | 22.5HR | 153E+3YR | M |   |
| 93-NP-236 | A0322.005 | 22.HR | 153E+3YR | M |   |
| 93-NP-236 | A0528.003 | 22.5HR | 153E+3YR | M |   |
| 93-NP-236 | V1002.599 | 22.5HR | 153E+3YR |   |   |
| 93-NP-236-G | 10294.002 | 22.HR | 153E+3YR |   |   |
| 93-NP-236-G | 12251.004 | 5000.YR | 153E+3YR |   |   |
| 93-NP-236-G | 12251.005 | 5000.YR | 153E+3YR |   |   |
| 99-ES-250 | A0410.004 | 0.09D | 8.6HR |   |   |
| 104-RF-261-M1 | E2324.001 | 68.SEC | 1.9SEC |   |   |
| 104-RF-261-M1 | E2371.002 | 68.SEC | 1.9SEC |   |   |
| 104-RF-261-M1 | E2371.003 | 68.SEC | 1.9SEC |   |   |
| 104-RF-261-M1 | E2371.004 | 68.SEC | 1.9SEC |   |   |
| 104-RF-261-M1 | E2438.002 | 68.SEC | 1.9SEC |   |   |
| 104-RF-261-M1 | E2438.006 | 68.SEC | 1.9SEC |   |   |
| 104-RF-261-M2 | E2324.001 | 1.9SEC | 78SEC |   |   |
| 104-RF-261-M2 | E2371.002 | 2.6SEC | 78SEC |   |   |
| 104-RF-261-M2 | E2371.003 | 2.6SEC | 78SEC |   |   |
| 104-RF-261-M2 | E2371.004 | 2.6SEC | 78SEC |   |   |
| 104-RF-261-M2 | E2438.003 | 1.9SEC | 78SEC |   |   |
| 104-RF-261-M2 | E2438.006 | 1.9SEC | 78SEC |   |   |
| 106-SG-265-M2 | E2371.003 | 14.4SEC | 8.9SEC |   |   |
| 106-SG-265-M2 | E2371.004 | 14.4SEC | 8.9SEC |   |   |

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