**Nuclear Data Section**

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**Memo CP-D/1009 (Rev.)**

**Date:** 26 April 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 -M/G ratios.

Memo CP-D/0888 reports this assignment (M/G) is opposite to the assignment in the Nuclear Wallet Cards.

132SB L **0.0 (4)+ 2.79 M** 7 E

132SB2 L %B-=100

132SBX L XREF=A

132SB cL J$M1+E2 |g from (3)+. Configuration=|pg{-7/2}~#|nd{-3/2}{+-1}.

132SB2cL J|p=3+ is not completely ruled out

132SB cL T$ weighted average of 2.70 min {I15} (1972Na10), 2.80 min {I10}

132SB2cL (1974Ke08), 2.80 min {I7} (1975Ba36), 2.79 min {I10} (1975NuZX).

132SB3cL Other: 2.1 min {I3} (1973Er18). Others: 1974Fo06,

132SBxcL 1974Gr29, 1973Mc09, 1973Ke25, 1972Ke20, 1966St25, 1956Pa20

132SB L **0+X (8-) 4.10 M** 5 AM

132SBX L XREF=A(?)B$

132SB2 L %B-=100

132SB cL **E$x=150-250 keV** (1989St06). Other: 200 {I30} (2017Au03)

However, the level energy of the 2.8 min state is “0+X” in ENSDF. This falls into Type=L (“The ground state is not well established”) defined in CP-D/0888, and the assignment M/G has been unchanged after this memo.

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) for better consistency with the other datasets , and replace M/G with G/M in 20878.007-008 and 012~~in general considering the situation reported by Mattera~~. Balraj Singh (McMaster Univ.) reminded me (1) 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 (2) adoption of its mean (200±30 keV) in Nubase2016. These 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 proposed (see appendix).

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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