| | Histo | ory | |
|-----------------|----------------------------|-------------------|------------------------|
| Type | Author | Citation | Literature Cutoff Date |
| Full Evaluation | G. Gürdal, E. A. Mccutchan | NDS 136, 1 (2016) | 1-Jul-2016 |

 $\begin{array}{lll} Q(\beta^-) = -654.6 \ 16; \ S(n) = 9218.4 \ 21; \ S(p) = 11117.5 \ 24; \ Q(\alpha) = -5983.3 \ 24 & 2012Wa38 \\ S(2n) = 15700.5 \ 21; \ S(2p) = 20679 \ 4 \ (2012Wa38). & \end{array}$

 α : Additional information 1.

⁷⁰Zn Levels

Cross Reference (XREF) Flags

| | | A B C D E F | ⁷⁰ Cu $β$ ⁻ decay (44.5 s) ⁷⁰ Cu $β$ ⁻ decay (33 s) ⁷⁰ Cu $β$ ⁻ decay (6.6 s) ⁷⁰ Ga $ε$ decay ⁶⁸ Zn(t,p) ⁷⁰ Zn(p,p'),(pol p,p') | $\begin{array}{cccccccccccccccccccccccccccccccccccc$ |
|--|-----------|----------------------------|---|---|
| E(level) [†] | J^{π} | T _{1/2} | XREF | Comments |
| 0.0 [‡] | 0+ | ≥3.8×10 ¹⁸ y | ABCDEFGHIJKLMNOPQ | $\%2\beta^-$ =? $T_{1/2}$: from 2011Be39 for $2\nu2\beta^-$ decay; also determined $T_{1/2} \ge 3.2 \times 10^{19}$ for $0\nu2\beta^-$ decay. Others: $\ge 2.3 \times 10^{17}$ for $2\nu2\beta^-$ decay and $\ge 1.8 \times 10^{19}$ for $0\nu2\beta^-$ decay (2010Be41, 2010BeZO, 2009Be27, earlier results by same group as 2011Be39), $\ge 2.2 \times 10^{17}$ (2007B115, 2006Zu02), $\ge 1.3 \times 10^{16}$ for $2\nu2\beta^-$ decay and $\ge 0.7 \times 10^{18}$ for $0\nu2\beta^-$ decay (2005Da47), $\ge 1.3 \times 10^{16}$ (2003Ki08), $>4.8 \times 10^{14}$ y (1952Fr23). |
| 884.92 [‡] 8 | 2+ | 3.65 ps <i>21</i> | ABC EFGHIJKLMNOPQ | Q=-0.233 22 (1976Ne06); μ =+0.76 4 (2009Mu06) β_2 =0.20 (1993Mo15) μ : from transient field technique in Coulomb Excitation. Others: +0.76 8 (2002Ke02), 0.82 20 (1979BrZP), 0.60 18 (1977HaZW), all from transient field technique in Coulomb Excitation, and 0.60 14 (1979Fa06) from IMPAC. T _{1/2} : weighted average of 3.67 ps 21 from DSAM and 3.60 ps 35 from RDDS, both in Coulomb Excitation. Others: 3.7 ps 12 from RDDS in 238 U(76 Ge,Xγ), 2.5 ps 2 from B(E2)=0.205 19 in (e,e'), 3.3 ps 3 from B(E2)=0.160 14 in Coulomb Excitation. J ^π : L(t,p)=2. Q: from (e,e'); extracted using anharmonic-vibrator model and is model dependent. β ₂ : from (pol p,p'). Other: 0.220 from (α,α'). |
| 1070.76 9 | 0+ | 3.90 ns 20 | CEGIKL | $T_{1/2}$: from $(p,p'\gamma)$. J^{π} : $L(t,p)=0$. |
| 1554 [@] 5 1759.16 <i>10</i> | 2+ | 1.32 ps <i>21</i> | F H BC EF HIJKL | μ=+0.94 44 (2009Mu06) XREF: E(1767)F(1764). J^π: L(p,p')=2, L(d,³He)=1(+3), strong population in Coulomb excitation. T_{1/2}: from DSAM in Coulomb Excitation. Others: 1.4 ps 4 from B(E2)=0.0050 13 from (e,e'), 0.24 ps +24-12 from DSAM in (n,n'γ). μ: from transient field technique in Coulomb excitation. Other: +0.84 38 from reanalysis of transient field data (2010Mo14). |
| 1786.75 [‡] <i>10</i> | 4+ | 2.9 ps 8 | AB EF I KLMN | μ =+1.48 56 (2009Mu06) |

⁷⁰Zn Levels (continued)

| E(level) [†] | ${ m J}^{\pi}$ | $T_{1/2}$ | XREF | Comments |
|---|---|--------------------|-------------------|--|
| | | · | | $J^{\pi} \colon L(t,p)=4.$ |
| | | | | $T_{1/2}$: weighted average of 2.0 ps $+9-11$ from RDDS in 238 U(76 Ge,X γ) and 3.4 ps 8 from RDDS in Coulomb Excitation. Other: 1.32 ps 14 from DSAM in Coulomb Excitation (2009Mu06). |
| | | | | μ : from transient field technique in Coulomb excitation. Other: +0.84 52 from reanalysis of transient field data (2010Mo14). |
| 1957.28 <i>12</i> | 2+ | | C EF HI KL | Q XREF: H(1945). J^{π} : L(t,p)=2. |
| 2140.64 <i>17</i> | 0^{+} | | C EF I L | XREF: F(2150)L(2126). |
| 2375 [@] 5 | $(2,1,3)^+$ | | F H | J^{π} : L(t,p)=0. Q XREF: Q(2300?). |
| 2538.31 <i>11</i> | 2+ | 0.21 ps +28-8 | B F I KL | J^{π} : L(p,p')=2. $T_{1/2}$: from DSAM in (n,n' γ). |
| | | · | | J ^{π} : from L(d, 3 He)=1+3 and J=2 from $\gamma(\theta)$ in (n,n' γ). 2004Va08 in 70 Cu β^- decay (33 s) assign (3 ⁺) to this level, however, this is unlikely given its direct population in Coulomb excitation. L(p,p')=(0) is discrepant. |
| 2665 [@] 5 2693.40 <i>11</i> | 2 ⁺ 4 ⁺ | 0.28 ps +35-14 | EF L AB EF I K | J^{π} : L(t,p)=2. $T_{1/2}$: from DSAM in (n,n' γ). |
| | | 0.20 ps . cc 1. | | J^{π} : $L(p,p')=4$. |
| 2805 [@] 5 2859.49 11 | 3- | 0.201 ps <i>14</i> | F B EF HI K | β_3 =0.20 (1993Mo15) J ^{π} : L(t,p)=3; analyzing power consistent with 3 ⁻ in (pol p,p'). |
| | | | | β_3 : from (pol p,p'). $T_{1/2}$: from DSAM in Coulomb Excitation. |
| 2895.10 [‡] <i>13</i> 2949.67 <i>18</i> | (6 ⁺) 1 ⁺ ,2 ⁺ ,3 ⁺ | 0.042 ps +21-14 | A K MN I KL | N J^{π} : 1108 γ to 4 ⁺ , band assignment. XREF: L(?). J^{π} : M1+E2 2064 γ to 2 ⁺ . $T_{1/2}$: from DSAM in (n,n' γ). |
| 2954 [@] 5 | | | F | E(level): possibly the same as 2949.2-keV level, although $L(p,p')=(1)$ is discrepant with Adopted J^{π} . |
| 2978.26 <i>23</i> 3022 [#] <i>10</i> | 4+ | | B EF K | J^{π} : $L(t,p)=4$. |
| 3022" 10 | | | L | E(level): possibly the same as 3037.6-keV level, although $L(d, {}^{3}He)=(1)$ is discrepant with Adopted J^{π} . |
| 3038.15 11 | 5- | 1.04 ps 7 | AB EF HIK MN | makes $J^{\pi}=4^-$ or 6^- unlikely. $J^{\pi}=4^-$ proposed in $(n,n'\gamma)$ based on population strength and $J^{\pi}=4^+$ proposed in $^{208}\text{Pb}(^{64}\text{Ni},X\gamma)$. |
| | | | | $T_{1/2}$: from DSAM in Coulomb Excitation. Configuration= $((\pi 2p_{3/2})^2(\nu 2p_{1/2})^{-1}(\nu 1g_{9/2}))$ |
| 3222.08 10 | 1 | | I | (2004Va08). J^{π} : from $\gamma(\theta)$ in $(n,n'\gamma)$. |
| 3235 5 | 3+,4+,5+ | | EF | E(level): from (p,p') . J^{π} : from $L(p,p')=4$. |
| 3246.71 <i>11</i> | (3-,4+) | | В | J^{π} : strong β feeding from J^{π} =3 ⁻ parent, 209 γ to 5 ⁻ , 708 γ to 2 ⁺ . |
| 3328 [@] 5 | (0 ⁺) | | EF | E(level): possibily the same as the 3235-keV level. J^{π} : L(t,p)=(0). |
| 3342.0 <i>3</i> | 3- | | A E H | J^{π} : $L(\alpha, \alpha') = 3$. |
| 3419 [@] 5 | (3)- | | EF | J^{π} : $L(t,p)=(3)$, $L(p,p')=3$. |

⁷⁰Zn Levels (continued)

| 3464 6 5 4 $^{+}$ A BF H JF: L(Lp)=4. 3476.8 14 A M H Signer Sign | E(level) [†] | \mathbf{J}^{π} | XREF | 7 | Comments | | | | |
|--|-------------------------------|--------------------|------|----|---|--|--|--|--|
| 3598 5 S F F F L J ^π L(L,p)=5, L(p,p')=5, L=1 in (d, ³ He) is discrepant. | 3464 [@] 5 | 4+ | EF H | | J^{π} : L(t,p)=4. | | | | |
| 3598, 98, 14 3634, 99, 22, 2+ 3680° 5 0° 3710, 7 6 2° 4 EF L 37: L(t,p)=2. 3750° 5 0°, 17: 2-7) 3755, 4° 375, 4° 376, 6° 377, 7 6 2° 4 EF L 37: L(t,p)=2. 3755, 4° 375, 4° 376, 6° 377, 7 6 2° 4 EF L 37: L(t,p)=2. 375, 4° 378, 16 22 A M 388, 16 22 A M 388, 16 22 A M 388, 16 22 A M 390, 10 (5,6°) A 390, 10 (5,6°) A 390, 10 (5,6,7°) A 400, 14 0 15 (5,6,7°) A 406, 10 0 4° 4136° 10 2°, 1,1°, 3+ 4146, 13 4172° 10 5° F H 378, L(t,p)=2. 379, L(t,p)=1. 379, L(t,p)=1. 379, L(t,p)=2. 379, L(t,p)=2. 379, L(t,p)=2. 379, L(t,p)=2. 379, L(t,p)=2. 379, L(t,p)=3. 379, L(t,p)=4. 379, L(t,p)=4. 379, L(t,p)=4. 379, L(t,p)=4. 379, L(t,p)=4. 379, L(t,p)=5. 420, L(t,p)=5. 420, L(t,p)=5. 420, L(t,p)=5. 420, L(t,p)=5. 420, L(t,p)=5. 420, L(t,p)=6. 420, L(| | | A | M | • | | | | |
| $3680^{\circ} 5 0^{+} \qquad \text{EF H } L \qquad J^{\pi}; \ L(t,p)=2, \ L(t,p)=1, \ L(t,p)=3); \ L(t,p)=2, \ L(t,p)=3); \ L(t,p)=2, \ L(t,p)=3, \ L(t,p)=$ | | 5- | | | J^{π} : L(t,p)=5, L(p,p')=5; L=1 in (d, ³ He) is discrepant. | | | | |
| 3680 | | 2+ | | | J^{π} : L(t,p)=2. | | | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 3680 [@] 5 | 0^{+} | EF H | L | J^{π} : L(t,p)=0; L=1(+3) in (d, ³ He) is discrepant. | | | | |
| 3750 ${}^{\circ}$ 5 (0°,1°,2°) EF | | 2+ | | | | | | | |
| 3755.4 $^{\frac{1}{2}}$ 10 (8*) 3788.16 22 A H Set Per E(level): possible doublet; L(p,p')=(1)+4. 3844.6 5 1 Fer Per Per Per Per Per Per Per Per Per P | 3750 [@] 5 | $(0^-,1^-,2^-)$ | EF | | | | | | |
| 3788.16 22 A 8136 5 816 27 3813 6 5 817 8184 6 6 (5.6 ⁺) A 8188 8 6 (4) ⁺ 3904.0 4 (5.6 ⁺) A 3914 10 3948 6 5 1 | 3755.4 [‡] 10 | | | MN | | | | | |
| 3844. 6 (5,6+) A FF H J ^π : L(t,p)=1. J ^π : direct β ⁻ feeding from $J^{\pi}=6^-$ parent, 2062γ to 4+. 3888. 5 (4)+ EF H J ^π : L(t,p)=4. J ^π : L(t,p)=4. J ^π : L(t,p)=2. EF J ^π : L(t,p)=2. E(level): from (t,p). J ^π : L(t,p)=3. A L(t,p)=4. J ^π : L(t,p)=4. J ^π : L(t,p)=3. A L(t,p)=4. J ^π : L(t,p)=4. J ^π : L(t,p)=3. A L(t,p)=4. J ^π : L(t,p)=5. L(t,p)=5. J ^π : L(t,p)=6. J ^π : L(t,p)= | | (-) | A | | 6 | | | | |
| 3848.4.6 (5,6*) A J ^π : direct β ^π feeding from J^{π} =6 ⁻ parent, 2062γ to 4*. 3888 β 5 (4)* EF h J ^π : L(p,p')=4. 3914 10 EF h J ^π : L(p,p')=4. 3994 10 EF H J ^π : L(t,p)=1. 3999 10 2* EF H J ^π : L(t,p)=2. E(level): from (t,p). J ^π : direct β ^π feeding from J^{π} =6 ⁻ parent, 963γ to 5 ⁻ . 4016 10 3*.4*.5* EF EF L(t,p)=4. 4136 β 10 2*.1*,13* EF L(t,p)=4. 4146.1 3 I J ^π : L(t,p)=4. 4146.1 3 I J ^π : L(t,p)=1. 37*: L(t,p)=4. 417.9* 10 5 ⁻ FH XREF: H(4200). J ^π : L(t,p)=5. L(t,α)=5. J ^π : L(t,p)=6. Direct β ^π feeding from J^{π} =6 ⁻ parent, 1023γ to 5 ⁻ . 4291 10 2* EF EF EF L(t,p)=6. Direct β ^π feeding from J^{π} =6 ⁻ parent, 1023γ to 5 ⁻ . 31*: L(t,p)=6. Direct β ^π feeding from J^{π} =6 ⁻ parent, 1023γ to 5 ⁻ . 4291 10 3*. 4*.5* FF L(t,p)=6. L(t,α)=6. Direct β ^π feeding from J^{π} =6 ⁻ parent, 1023γ to 5 ⁻ . 31*: L(t,p)=6. Direct β ^π feeding from J^{π} =6 ⁻ parent, 1023γ to 5 ⁻ . 31*: L(t,p)=6. Direct β ^π feeding from J^{π} =6 ⁻ parent, 1023γ to 5 ⁻ . 31*: L(t,p)=6. Direct β ^π feeding from J^{π} =6 ⁻ parent, 1023γ to 5 ⁻ . 31*: L(t,p)=6. Direct β ^π feeding from J^{π} =6 ⁻ parent, 1023γ to 5 ⁻ . 31*: L(t,p)=6. Direct β ^π feeding from J^{π} =6 ⁻ parent, 1023γ to 5 ⁻ . 31*: L(t,p)=6. Direct β ^π feeding from J^{π} =6 ⁻ parent, 1023γ to 5 ⁻ . 31*: L(t,p)=6. Direct β ^π feeding from J^{π} =6 ⁻ parent, 1023γ to 5 ⁻ . 31*: L(t,p)=6. Direct β ^π feeding from J^{π} =6 ⁻ parent, 1023γ to 5 ⁻ . 31*: L(t,p)=6. Direct β ^π feeding from J^{π} =6 ⁻ parent, 1023γ to 5 ⁻ . 31*: L(t,p)=6. Direct β ^π feeding from J^{π} =6 ⁻ parent, 1023γ to 5 ⁻ . 31*: L(t,p)=6. Direct β ^π feeding from J^{π} =6 ⁻ parent, 1026γ to 5 ⁻ . 31*: L(t,p)=6. Direct β ^π feeding from J^{π} =6 ⁻ parent, 1023γ to 5 ⁻ . 31*: L(t,p)=6. Direct β ^π feeding from J^{π} =6 ⁻ parent, 1023γ to 5 ⁻ . 31*: L(t,p)=6. Direct β ^π feeding from J^{π} =6 ⁻ parent, 1023γ to 5 ⁻ . 31*: L(t,p)=6. Direct β ^π feeding from J^{π} =6 ⁻ parent, 1026γ to 5 ⁻ . 31*: L(t,p)=6. Direct β ^π feeding from J^{π} =6 ⁻ parent, 1026γ | 3813 [@] 5 | | EF | | E(level): possible doublet; $L(p,p')=(1)+4$. | | | | |
| 3888 5 (4) + EF h J ^π : L(p,p')=4. J ^π : direct β ⁻ feeding from J^{π} =6 ⁻ parent, 2117γ to 4 ⁺ . 3904.0 4 (5.6 ⁺) A J ^π : direct β ⁻ feeding from J^{π} =6 ⁻ parent, 2117γ to 4 ⁺ . 3914 I^{π} EF J ^π : L(t,p)=1. 3999 I^{π} E H J ^π : L(t,p)=2. E(level): from (t,p). J ^π : L(t,p)=2. E(level): from (t,p). J ^π : L(p,p')=4. 4061.40 I^{π} EF E(level): doublet in (t,p). J ^π : L(p,p')=4. J ^π : L(t,p)=2. J ^π : L(t,p)=2. J ^π : L(t,p)=4. J ^π : L(t,p)=4. J ^π : L(t,p)=2. J ^π : L(t,p)=3. J ^π : L(t,p)=4. J ^π : L(t,p)=6. J ^π : L(t,p)=6. J ^π : L(t,p)=7. J | 3844 [@] 5 | 1- | EF h | | J^{π} : L(t,p)=1. | | | | |
| 3904.0 4 (5.6+) A | | $(5,6^+)$ | A | | J^{π} : direct β^{-} feeding from $J^{\pi}=6^{-}$ parent, 2062 γ to 4 ⁺ . | | | | |
| 3914 $I0$ 3948 $^{\odot}$ 5 1^{-} 3999 $I0$ 2 $^{+}$ E H I^{π} : L(t,p)=1. 4001.46 $I5$ (5,6,7 $^{-}$) A 4016 $I0$ 3 $^{+}$,4 $^{+}$,5 $^{+}$ EF 406.6 $^{\odot}$ $I0$ 4 $^{+}$ 4136 $^{\odot}$ $I0$ 2 $^{+}$,1 $^{+}$ 417. L(t,p)=2. 4146.1 3 4172 $^{\odot}$ $I0$ 5 $^{-}$ 4264.5 7 (5,6,7 $^{-}$) A 4291 $I0$ 2 $^{+}$ 4308.99 $I8$ (5,6,7 $^{-}$) A 4309 $I8$ (5,6,7 $^{-}$) A 4309 $I8$ (5,6,7 $^{-}$) A 4309 | 3888 [@] 5 | $(4)^{+}$ | EF h | | J^{π} : $L(p,p')=4$. | | | | |
| 3948 $^{\circ}$ 5 1 $^{-}$ EF H J^{π} : L(t,p)=1. 2999 10 2 $^{+}$ E H J^{π} : L(t,p)=2. E(level): from (t,p). 3 $^{+}$ 4,4 $^{+}$ 5 $^{+}$ EF J^{π} : L(p,p')=4. 4016 10 3 $^{+}$,4 $^{+}$,5 $^{+}$ EF J^{π} : L(p,p')=4. 4060 $^{\circ}$ 10 4 $^{+}$ EF J^{π} : L(p,p')=4. 4136 $^{\circ}$ 10 2 $^{+}$,1 $^{+}$,3 $^{+}$ EF J^{π} : L(p,p')=2. 4146.1 3 I J^{π} : proposed as 3 $^{-}$ in (n,n'γ) based on population strength. 4172 $^{\circ}$ 10 5 $^{-}$ F H J^{π} : L(p,p')=5, L(α,α')=5. J^{π} : direct β feeding from J^{π} =6 parent, 1226γ to 5 $^{-}$. 4291 10 2 $^{+}$ EF J^{π} : L(p,p')=4. 4144 10 3 $^{+}$,4 $^{+}$,5 $^{+}$ F J^{π} : L(p,p')=4. 4444 10 3 $^{+}$,4 $^{+}$,5 $^{+}$ F J^{π} : L(p,p')=4. 4444 10 3 $^{+}$,4 $^{+}$,5 $^{+}$ F J^{π} : L(p,p')=4. 4444 10 3 $^{+}$,4 $^{+}$,5 $^{+}$ F J^{π} : L(p,p')=4. 4588.8 3 (5,6,7) A 4710.1 5 (5,6,7) A 4849.2 3 (5,6,7) A 4935.9 † 14 (10 $^{+}$ MN 1 $^{\pi}$: direct β feeding from J^{π} =6 parent, 1271γ to 5 $^{-}$. 4710.1 5 (5,6,7) A 4935.9 † 14 (10 $^{+}$ MN 1 $^{\pi}$: direct β feeding from J^{π} =6 parent, 1270γ to 4 $^{+}$. 4935.9 † 14 (10 $^{+}$ MN 1 $^{\pi}$: direct β feeding from J^{π} =6 parent, 3062γ to 4 $^{+}$. 4935.9 † 14 (10 $^{+}$ MN 1 $^{\pi}$: direct β feeding from J^{π} =6 parent, 3062γ to 4 $^{+}$. 4935.9 † 14 (10 $^{+}$ MN 1 $^{\pi}$: direct β feeding from J^{π} =6 parent, 3062γ to 4 $^{+}$. | | $(5,6^+)$ | | | J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent, 2117 γ to 4 ⁺ . | | | | |
| 3999 10 2* E H J ^r : L(t,p)=2. E(level): from (t,p). 401.46 15 (5,6,7^-) A J ^r : direct β ⁻ feeding from J ^π =6 ⁻ parent, 963γ to 5 ⁻ . 4016 10 3 ⁺ ,4 ⁺ ,5 ⁺ EF E(level): doublet in (t,p). J ^r : L(t,p)=4. 406.40 16 (5,6,7^-) A J ^r : direct β ⁻ feeding from J ^π =6 ⁻ parent, 1023γ to 5 ⁻ . 4066 10 4 ⁺ EF J ^r : L(p,p')=2. 4136 10 2 ⁺ ,1 ⁺ ,3 ⁺ EF J ^π : L(p,p')=2. 4146.1 3 I J ^π : proposed as 3 ⁻ in (n,n'γ) based on population strength. 4172 10 5 ⁻ F H XREF: H(4200). J ^r : L(t,p)=5, L(α,α')=5. J ^r : direct β ⁻ feeding from J ^π =6 ⁻ parent, 1226γ to 5 ⁻ . 4291 10 2 ⁺ EF E(level): weighted average of 4297 10 from (t,p) and 4284 10 from (p,p'). J ^r : L(p,p')=4. 4308.99 18 (5,6,7 ⁻) A F J ^r : L(p,p')=4. 4444 10 3 ⁺ ,4 ⁺ ,5 ⁺ F J ^r : L(p,p')=4. 4444 10 3 ⁺ ,4 ⁺ ,5 ⁺ F J ^r : L(p,p')=4. 4444 17 (5,6,7 ⁻) A J ^r : direct β ⁻ feeding from J ^π =6 ⁻ parent, 1271γ to 5 ⁻ . 4514.27 23 (5,6,7 ⁻) A J ^r : direct β ⁻ feeding from J ^π =6 ⁻ parent, 1426.5γ to 5 ⁻ . 4788.8 3 (5,6,7 ⁻) A J ^r : direct β ⁻ feeding from J ^π =6 ⁻ parent, 1476γ to 5 ⁻ . J ^r : direct β ⁻ feeding from J ^π =6 ⁻ parent, 1751γ to 5 ⁻ . 4791.7 10 (5,6,7) A J ^r : direct β ⁻ feeding from J ^π =6 ⁻ parent, 151γ to 5 ⁻ . 4791.7 10 (5,6,7) A J ^r : direct β ⁻ feeding from J ^π =6 ⁻ parent, 3062γ to 4 ⁺ . 4935.9 14 (10 ⁺) MN J ^r : 1180.5γ to (8 ⁺), band assignment. 5061.3 5 (5,6,7) A | | | E | | | | | | |
| E(level): from (t,p). 4001.46 15 (5,6,7") A 4016 10 3 ⁺ ,4 ⁺ ,5 ⁺ EF 4061.40 16 (5,6,7") A 4066 0 10 4 ⁺ EF 4136 0 10 2 ⁺ ,1 ⁺ ,3 ⁺ EF 41461.3 I 4172 10 5 ⁻ FH 4291 10 2 ⁺ EF 4308.99 18 (5,6,7") A 4508.99 18 (5,6,7") A 4508.99 18 (5,6,7") A 4508.99 18 (5,6,7") A 4508.99 18 (5,6,7") A 4608 10 3 ⁺ ,4 ⁺ ,5 ⁺ F 4508.23 (5,6,7") A 4508.23 (5,6,7") A 4518.23 (5,6,7") A 4518.24 (6,7") A 4518.25 (6,6,7") A 4528.25 (5,6,7") A 4538.3 (5,6,7") A 4538.3 (5,6,7") A 4549.2 (5,6,7") A 4558.2 (5,6,7") A 4570.1 (6,6,7") A 4570.1 (6,6,7") A 4570.1 (6,6,7") A 4570.2 (6,6,7") A 4570.2 (6,6,7") A 4570.3 (6,6,7") A 4770.1 (6,6,7") A | | | | | | | | | |
| 4001.46 15 (5,6,7") A J^{π} : direct β" feeding from J^{π} =6" parent, 963γ to 5". E(level): doublet in (t.p). J^{π} : $L(p,p')$ =4. J^{π} : direct β" feeding from J^{π} =6" parent, 1023γ to 5". J^{π} : $L(p,p')$ =4. J^{π} : direct β" feeding from J^{π} =6" parent, 1023γ to 5". J^{π} : $L(p,p')$ =2. J^{π} : $L(p,p')$ =2. J^{π} : $L(p,p')$ =2. J^{π} : $L(p,p')$ =5. $L(p,p')$ =5. $L(p,p')$ =5. $L(p,p')$ =6. $L(p,p')$ =6. $L(p,p')$ =7. $L(p,p')$ =7. $L(p,p')$ =8. $L(p,p')$ =8. $L(p,p')$ =8. $L(p,p')$ =9. $L(p,p')$ =9. $L(p,p')$ =1. $L(p,p')$ =1. $L(p,p')$ =1. $L(p,p')$ =2. $L(p,p')$ =2. $L(p,p')$ =3. $L(p,p')$ =4. $L(p,p')$ =6. $L(p,p')$ =6. $L(p,p')$ =7. $L(p,p')$ =8. $L(p,p')$ =8. $L(p,p')$ =8. $L(p,p')$ =8. $L(p,p')$ =8. $L(p,p')$ =8. $L(p,p')$ =9. $L(p,p')$ =1. $L(p,p')$ =2. $L(p,p')$ =3. $L(p,p')$ =4. $L(p,p')$ =5. $L(p,p')$ =6. $L(p,p')$ 9. $L($ | 3999 <i>10</i> | 2+ | Е Н | | | | | | |
| 4016 10 3 ⁺ , 4 ⁺ , 5 ⁺ EF E(level): doublet in (t,p). J^{π} : L(p,p')=4. J^{π} : L(p,p')=4. J^{π} : L(p,p')=2. J^{π} : L(p,p')=5. J^{π} : L(p,p')=5. J^{π} : L(p,p')=6. J^{π} : L(p,p')=7. J^{π} : L(p,p')=8. J^{π} : L(p,p')=9. J^{π} : | 4001 46 15 | (5 6 7-) | Δ. | | | | | | |
| 3 Jπ: L(p,p')=4. 4061.40 16 (5,6,7−) A 4066 10 4+ EF 4136 10 2+1,+3+ EF 41440.1 3 4172 10 5− FH XREF: H(4200). Jπ: L(p,p')=5, L(α,α')=5. 4264.5 7 (5,6,7−) A 4291 10 2+ EF 4308.99 18 (5,6,7−) A 4308.99 18 (5,6,7−) A 4308.99 18 (5,6,7−) A 4444 10 3+4+5+ F 4444 10 3+4+5+ F 4444 10 3+4+5+ F 4458.8 3 (5,6,7−) A 4588.8 3 (5,6,7−) A 4710.1 5 (5,6,7−) A 4710.1 6 (5,6,7−) A 4710.1 7 (6,6,7−) A 4710.1 8 (6,6−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−− | | | | | | | | | |
| 4061.40 16 (5,6,7 ⁻) A | 1010 10 | 5 ,. ,5 | | | | | | | |
| 4136 $^{\textcircled{@}}$ 10 2+,1+,3+ | | $(5,6,7^{-})$ | A | | | | | | |
| 4146.1 3 4172 10 5 F H XREF: H(4200). J ^{π} : L(p,p')=5, L(α , α')=5. 4264.5 7 (5,6,7 A EF 4308.99 18 (5,6,7 A FF 4444 10 3+,4+,5+ FF 4464.77 17 (5,6,7 A FF 4514.27 23 (5,6,7 A FF) 4518.8 8 3 (5,6,7 A FF) 458.8 8 3 (5,6,7 A FF) 4791.1 5 (5,6,7 A FF) 4791.1 5 (5,6,7 A FF) 4791.1 5 (5,6,7 A FF) 4791.1 6 (5,6,7 A FF) 4791.1 7 10 (5,6,7 A FF) 4791.1 7 10 (5,6,7 A FF) 4791.1 7 10 (5,6,7 A FF) 4791.2 10 5 FF 4791.3 10 5 FF 47 | | 4+ | EF | | J^{π} : L(t,p)=4. | | | | |
| 4172 $^{\textcircled{@}}$ 10 5 $^{-}$ F H XREF: H(4200). J ^π : L(p,p')=5, L(α,α')=5. 4264.5 7 (5,6,7) A J ^π : direct β feeding from J ^π =6 parent, 1226γ to 5 $^{-}$. 4291 10 2 $^{+}$ EF E(level): weighted average of 4297 10 from (t,p) and 4284 10 from (p,p'). J ^π : L(t,p)=L(p,p')=2. 4308.99 18 (5,6,7) A F J ^π : direct β feeding from J ^π =6 parent, 1271γ to 5 $^{-}$. 4367 10 3 $^{+}$, 4 $^{+}$, 5 $^{+}$ F J ^π : L(p,p')=4. 4444 10 3 $^{+}$, 4 $^{+}$, 5 $^{+}$ F J ^π : L(p,p')=4. 4464.77 17 (5,6,7) A J ^π : direct β feeding from J ^π =6 parent, 1426.5γ to 5 $^{-}$. 4514.27 23 (5,6,7) A J ^π : direct β feeding from J ^π =6 parent, 1476γ to 5 $^{-}$. 4588.8 3 (5,6,7) A J ^π : direct β feeding from J ^π =6 parent, 1551γ to 5 $^{-}$. 4710.1 5 (5,6,7) A J ^π : direct β feeding from J ^π =6 parent. 4791.7 10 (5,6,7) A J ^π : direct β feeding from J ^π =6 parent. 4849.2 3 (5,6 $^{+}$) A J ^π : direct β feeding from J ^π =6 parent. 4849.2 3 (5,6,7) A J ^π : direct β feeding from J ^π =6 parent. 4849.2 3 (5,6,7) A J ^π : direct β feeding from J ^π =6 parent. 4849.2 3 (5,6,7) A J ^π : direct β feeding from J ^π =6 parent. 4935.9 14 (10 $^{+}$) MN J ^π : 1180.5γ to (8 $^{+}$), band assignment. 5061.3 5 (5,6,7) A J ^π : direct β feeding from J ^π =6 parent. | | $2^+,1^+,3^+$ | EF | | | | | | |
| 3 Jπ: L(p,p')=5, L(α,α')=5. 4264.5 7 (5,6,7-) A Jπ: direct β- feeding from Jπ=6- parent, 1226γ to 5 E(level): weighted average of 4297 10 from (t,p) and 4284 10 from (p,p'). Jπ: L(t,p)=L(p,p')=2. 4308.99 18 (5,6,7-) A F Jπ: L(p,p')=4. 4444 10 3+,4+,5+ F Jπ: L(p,p')=4. 4464.77 17 (5,6,7-) A Jπ: direct β- feeding from Jπ=6- parent, 1426.5γ to 5 4514.27 23 (5,6,7-) A Jπ: direct β- feeding from Jπ=6- parent, 1476γ to 5 4588.8 3 (5,6,7-) A Jπ: direct β- feeding from Jπ=6- parent, 1271γ to 4+. 4588.8 3 (5,6,7-) A Jπ: direct β- feeding from Jπ=6- parent, 1551γ to 5 4710.1 5 (5,6,7) A Jπ: direct β- feeding from Jπ=6- parent. 4791.7 10 (5,6,7) A Jπ: direct β- feeding from Jπ=6- parent. 4791.7 10 (5,6,7) A Jπ: direct β- feeding from Jπ=6- parent. 4849.2 3 (5,6+) A Jπ: direct β- feeding from Jπ=6- parent. 4849.2 3 (5,6+) A Jπ: direct β- feeding from Jπ=6- parent. 4791.7 10 (5,6,7) A Jπ: direct β- feeding from Jπ=6- parent. 4791.7 10 (5,6,7) A Jπ: direct β- feeding from Jπ=6- parent. 4849.2 3 (5,6+) A Jπ: direct β- feeding from Jπ=6- parent. 4849.2 3 (5,6+) A Jπ: direct β- feeding from Jπ=6- parent. 4791.7 10 (5,6,7) A Jπ: direct β- feeding from Jπ=6- parent. 4791.7 10 (5,6,7) A Jπ: direct β- feeding from Jπ=6- parent. 4791.7 10 (5,6,7) A Jπ: direct β- feeding from Jπ=6- parent. 4791.7 10 (5,6,7) A Jπ: direct β- feeding from Jπ=6- parent. 4791.7 10 (5,6,7) A Jπ: direct β- feeding from Jπ=6- parent. 4791.7 10 (5,6,7) A Jπ: direct β- feeding from Jπ=6- parent. 4791.7 10 (5,6,7) A Jπ: direct β- feeding from Jπ=6- parent. 4791.7 10 (5,6,7) A Jπ: direct β- feeding from Jπ=6- parent. 4791.7 10 (5,6,7) A Jπ: direct β- feeding from Jπ=6- parent. 4791.7 10 (5,6,7) A Jπ: direct β- feeding from Jπ=6- parent. 4791.7 10 (5,6,7) A Jπ: direct β- feeding from Jπ=6- parent. 4791.7 10 (5,6,7) A Jπ: direct β- feeding from Jπ=6- parent. 4791.7 10 (5,6,7) A Jπ: direct β- feeding from Jπ=6- parent. 4791.7 10 (5,6,7) A Jπ: direct β- feeding from Jπ=6- parent. 4791.7 10 (| | | I | | J^{π} : proposed as 3 ⁻ in $(n,n'\gamma)$ based on population strength. | | | | |
| 4264.5 7 (5,6,7 ⁻) A J^{π} : direct β^- feeding from J^{π} =6 ⁻ parent, 1226 γ to 5 ⁻ . E(level): weighted average of 4297 10 from (t,p) and 4284 10 from (p,p γ). J^{π} : L(t,p)=L(p,p γ)=2. J^{π} : direct β^- feeding from J^{π} =6 ⁻ parent, 1271 γ to 5 ⁻ . J^{π} : L(p,p γ)=4. J^{π} : L(p,p γ)=4. J^{π} : direct β^- feeding from J^{π} =6 ⁻ parent, 1426.5 γ to 5 ⁻ . J^{π} : direct β^- feeding from J^{π} =6 ⁻ parent, 1426.5 γ to 5 ⁻ . J^{π} : direct β^- feeding from J^{π} =6 ⁻ parent, 1476 γ to 5 ⁻ . J^{π} : direct β^- feeding from J^{π} =6 ⁻ parent, 1476 γ to 5 ⁻ . J^{π} : direct β^- feeding from J^{π} =6 ⁻ parent, 171 γ to 4 ⁺ . J^{π} : direct β^- feeding from J^{π} =6 ⁻ parent, 1551 γ to 5 ⁻ . J^{π} : direct β^- feeding from J^{π} =6 ⁻ parent. J^{π} : direct β^- feeding from J^{π} =6 ⁻ parent. J^{π} : direct β^- feeding from J^{π} =6 ⁻ parent. J^{π} : direct J^{π} feeding from J^{π} =6 ⁻ parent. J^{π} : direct J^{π} feeding from J^{π} =6 ⁻ parent. J^{π} : direct J^{π} feeding from J^{π} =6 ⁻ parent. J^{π} : direct J^{π} feeding from J^{π} =6 ⁻ parent. J^{π} : direct J^{π} feeding from J^{π} =6 ⁻ parent. J^{π} : direct J^{π} feeding from J^{π} =6 ⁻ parent. J^{π} : direct J^{π} feeding from J^{π} =6 ⁻ parent. J^{π} : direct J^{π} feeding from J^{π} =6 ⁻ parent. J^{π} : direct J^{π} feeding from J^{π} =6 ⁻ parent. J^{π} : direct J^{π} feeding from J^{π} =6 ⁻ parent. J^{π} : direct J^{π} feeding from J^{π} =6 ⁻ parent. J^{π} : direct J^{π} feeding from J^{π} =6 ⁻ parent. J^{π} : direct J^{π} feeding from J^{π} =6 ⁻ parent. J^{π} : direct J^{π} feeding from J^{π} =6 ⁻ parent. J^{π} : direct J^{π} feeding from J^{π} =6 ⁻ parent. J^{π} : direct J^{π} feeding from J^{π} =6 ⁻ parent. J^{π} : direct J^{π} feeding from J^{π} =6 ⁻ parent. J^{π} | 4172 [@] <i>10</i> | 5- | F H | | | | | | |
| 4291 10 2+ EF E(level): weighted average of 4297 10 from (t,p) and 4284 10 from (p,p'). J^{π} : L(t,p)=L(p,p')=2. 4308.99 18 (5,6,7 ⁻) A F J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent, 1271γ to 5 ⁻ . 4367 10 3+,4+,5+ F J^{π} : L(p,p')=4. 4444 10 3+,4+,5+ F J^{π} : L(p,p')=4. 4464.77 17 (5,6,7 ⁻) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent, 1426.5γ to 5 ⁻ . 4514.27 23 (5,6,7 ⁻) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent, 1476γ to 5 ⁻ . 4588.8 3 (5,6,7 ⁻) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent, 2771γ to 4 ⁺ . 4588.8 3 (5,6,7 ⁻) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent, 1551γ to 5 ⁻ . 4710.1 5 (5,6,7) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent. 4791.7 10 (5,6,7) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent. 4849.2 3 (5,6 ⁺) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent. 4791.7 10 (5,6,7) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent. 4791.7 10 (5,6,7) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent. 4791.7 10 (5,6,7) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent. 4791.7 10 (5,6,7) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent. 4791.7 10 (5,6,7) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent. 4791.7 10 (5,6,7) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent. 4791.7 10 (5,6,7) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent. 4791.7 10 (5,6,7) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent. 4791.7 10 (5,6,7) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent. 4791.7 10 (5,6,7) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent. 4791.7 10 (5,6,7) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent. 4791.7 10 (5,6,7) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent. 4791.7 10 (5,6,7) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent. 4791.7 10 (5,6,7) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent. 4791.7 10 (5,6,7) A J^{π} : direct β^- feeding from J | | | | | | | | | |
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| 4367 10 $3^+, 4^+, 5^+$ F J^π : $L(p, p') = 4$. 4444 10 $3^+, 4^+, 5^+$ F J^π : $L(p, p') = 4$. 4464.77 17 $(5,6,7^-)$ A J^π : direct β^- feeding from $J^\pi = 6^-$ parent, 1426.5 γ to 5^- . 4514.27 23 $(5,6,7^-)$ A J^π : direct β^- feeding from $J^\pi = 6^-$ parent, 1476 γ to 5^- . 4558.2 3 $(5,6^+)$ A J^π : direct β^- feeding from $J^\pi = 6^-$ parent, 2771 γ to 4^+ . 4588.8 3 $(5,6,7^-)$ A J^π : direct β^- feeding from $J^\pi = 6^-$ parent, 1551 γ to 5^- . 4710.1 5 $(5,6,7)$ A J^π : direct β^- feeding from $J^\pi = 6^-$ parent. 4791.7 10 $(5,6,7)$ A J^π : direct β^- feeding from $J^\pi = 6^-$ parent. 4849.2 3 $(5,6^+)$ A J^π : direct β^- feeding from $J^\pi = 6^-$ parent. 4935.9 ‡ 14 (10^+) MN J^π : 1180.5 γ to (8^+) , band assignment. 5061.3 5 $(5,6,7)$ A J^π : direct β^- feeding from $J^\pi = 6^-$ parent. | 4308.99 18 | $(5,6,7^{-})$ | A F | | | | | | |
| 4464.77 17 (5,6,7 ⁻) A J^{π} : direct β ⁻ feeding from J^{π} =6 ⁻ parent, 1426.5γ to 5 ⁻ . 4514.27 23 (5,6,7 ⁻) A J^{π} : direct β ⁻ feeding from J^{π} =6 ⁻ parent, 1476γ to 5 ⁻ . 4558.2 3 (5,6) ⁺ A J^{π} : direct β ⁻ feeding from J^{π} =6 ⁻ parent, 2771γ to 4 ⁺ . 4588.8 3 (5,6,7 ⁻) A J^{π} : direct β ⁻ feeding from J^{π} =6 ⁻ parent, 1551γ to 5 ⁻ . 4710.1 5 (5,6,7) A J^{π} : direct β ⁻ feeding from J^{π} =6 ⁻ parent. 4791.7 10 (5,6,7) A J^{π} : direct β ⁻ feeding from J^{π} =6 ⁻ parent. 4849.2 3 (5,6) ⁺ A J^{π} : direct β ⁻ feeding from J^{π} =6 ⁻ parent, 3062γ to 4 ⁺ . 4935.9‡ 14 (10 ⁺) MN J^{π} : 1180.5γ to (8 ⁺), band assignment. 5061.3 5 (5,6,7) A J^{π} : direct β ⁻ feeding from J^{π} =6 ⁻ parent. | 4367 10 | 3+,4+,5+ | | | | | | | |
| 4514.27 23 (5,6,7 ⁻) A J ^π : direct β ⁻ feeding from J^{π} =6 ⁻ parent, 1476γ to 5 ⁻ . 4558.2 3 (5,6 ⁺) A J ^π : direct β ⁻ feeding from J^{π} =6 ⁻ parent, 2771γ to 4 ⁺ . 4588.8 3 (5,6,7 ⁻) A J ^π : direct β ⁻ feeding from J^{π} =6 ⁻ parent, 1551γ to 5 ⁻ . 4710.1 5 (5,6,7) A J ^π : direct β ⁻ feeding from J^{π} =6 ⁻ parent. 4791.7 10 (5,6,7) A J ^π : direct β ⁻ feeding from J^{π} =6 ⁻ parent. 4849.2 3 (5,6 ⁺) A J ^π : direct β ⁻ feeding from J^{π} =6 ⁻ parent. 4935.9 [‡] 14 (10 ⁺) MN J ^π : 1180.5γ to (8 ⁺), band assignment. 5061.3 5 (5,6,7) A J ^π : direct β ⁻ feeding from J^{π} =6 ⁻ parent. | | | F | | | | | | |
| 4558.2 3 (5,6 ⁺) A J ^π : direct β ⁻ feeding from J^{π} =6 ⁻ parent, 2771γ to 4 ⁺ . 4588.8 3 (5,6,7 ⁻) A J ^π : direct β ⁻ feeding from J^{π} =6 ⁻ parent, 1551γ to 5 ⁻ . 4710.1 5 (5,6,7) A J ^π : direct β ⁻ feeding from J^{π} =6 ⁻ parent. 4791.7 10 (5,6,7) A J ^π : direct β ⁻ feeding from J^{π} =6 ⁻ parent. 4849.2 3 (5,6 ⁺) A J ^π : direct β ⁻ feeding from J^{π} =6 ⁻ parent, 3062γ to 4 ⁺ . 4935.9 [‡] 14 (10 ⁺) MN J ^π : 1180.5γ to (8 ⁺), band assignment. 5061.3 5 (5,6,7) A J ^π : direct β ⁻ feeding from J^{π} =6 ⁻ parent. | | | | | J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent, 1426.5 γ to 5 ⁻ . | | | | |
| 4588.8 3 (5,6,7 ⁻) A J ^π : direct β ⁻ feeding from $J^{\pi}=6^{-}$ parent, 1551γ to 5 ⁻ . 4710.1 5 (5,6,7) A J ^π : direct β ⁻ feeding from $J^{\pi}=6^{-}$ parent. 4791.7 10 (5,6,7) A J ^π : direct β ⁻ feeding from $J^{\pi}=6^{-}$ parent. 4849.2 3 (5,6 ⁺) A J ^π : direct β ⁻ feeding from $J^{\pi}=6^{-}$ parent, 3062γ to 4 ⁺ . 4935.9 [‡] 14 (10 ⁺) MN J ^π : 1180.5γ to (8 ⁺), band assignment. 5061.3 5 (5,6,7) A J ^π : direct β ⁻ feeding from $J^{\pi}=6^{-}$ parent. | | | | | | | | | |
| 4710.1 5 (5,6,7) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent. 4791.7 10 (5,6,7) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent. 4849.2 3 (5,6 ⁺) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent, 3062γ to 4 ⁺ . 4935.9 [‡] 14 (10 ⁺) MN J^{π} : 1180.5γ to (8 ⁺), band assignment. 5061.3 5 (5,6,7) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent. | | | | | I^{π} : direct R^{-} feeding from $I^{\pi} = 6^{-}$ parent 1551 α to 5 | | | | |
| 4791.7 10 (5,6,7) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent. 4849.2 3 (5,6 ⁺) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent, 3062γ to 4 ⁺ . 4935.9 [‡] 14 (10 ⁺) MN J^{π} : 1180.5γ to (8 ⁺), band assignment. 5061.3 5 (5,6,7) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent. | | | | | J^{π} : direct β^{-} feeding from $J^{\pi}=6^{-}$ parent. | | | | |
| 4849.2 3 (5,6 ⁺) A J^{π} : direct β^- feeding from J^{π} =6 ⁻ parent, 3062 γ to 4 ⁺ . 4935.9 [‡] 14 (10 ⁺) MN J^{π} : 1180.5 γ to (8 ⁺), band assignment. 5061.3 5 (5,6,7) A J^{π} : direct β^- feeding from J^{π} =6 ⁻ parent. | | | | | | | | | |
| 5061.3 5 (5,6,7) A J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent. | 4849.2 <i>3</i> | | | | | | | | |
| | 4935.9 [‡] <i>14</i> | (10^+) | | MN | J^{π} : 1180.5 γ to (8 ⁺), band assignment. | | | | |
| 6116.2 [‡] 17 (12 ⁺) MN J^{π} : 1180.3 γ to (10 ⁺), band assignment. | | (5,6,7) | Α | | J^{π} : direct β^- feeding from $J^{\pi}=6^-$ parent. | | | | |
| | 6116.2 [‡] <i>17</i> | (12^+) | | MN | J^{π} : 1180.3 γ to (10 ⁺), band assignment. | | | | |

 $^{^{\}dagger}$ From a least-squares fit to E γ , by evaluators, for levels connected by γ rays. For levels from transfer reactions, corresponding † Band(A): yrast band. # From (d,³He). @ From (p,p'),(pol p,p').

| | | | | | A | dopted Leve | els, Gammas (co | ntinued) | |
|--------------------|----------------------------------|--|---|---|--------|---------------|------------------------------|-------------------|---|
| | | | | | | | γ (⁷⁰ Zn) | | |
| $E_i(level)$ | \mathbf{J}_i^{π} | $\mathrm{E}_{\gamma}^{\dagger}$ | ${\rm I}_{\gamma}{}^{\dagger}$ | $\mathrm{E}_f \mathrm{J}_f^\pi$ | Mult.‡ | $\delta^{\#}$ | α | $I_{(\gamma+ce)}$ | Comments |
| 884.92 | 2+ | 884.88 9 | 100 | 0.0 0+ | E2 | | 3.97×10 ⁻⁴ | | $\alpha(K)$ =0.000356 5; $\alpha(L)$ =3.58×10 ⁻⁵ 5; $\alpha(M)$ =5.12×10 ⁻⁶ 8; $\alpha(N)$ =2.04×10 ⁻⁷ 3 B(E2)(W.u.)=16.7 10 Mult.: from Coulomb Excitation from 0 ⁺ ground state. |
| 1070.76 | 0+ | 185.85 [@] 3 | 100 | 884.92 2+ | [E2] | | 0.0634 | | $\alpha(K)$ =0.0563 8; $\alpha(L)$ =0.00613 9; $\alpha(M)$ =0.000871 13; $\alpha(N)$ =3.07×10 ⁻⁵ 5 B(E2)(W.u.)=37.3 19 E _{γ} : other: 184.4 2 in (n,n' γ). |
| | | 1067 | | 0.0 0+ | E0 | | | <0.3 | $I_{(\gamma+ce)}$: for 100 transitions of 185.9 γ as measured in $(p,p'\gamma)$. Mult.: from internal conversion data in $(p,p'\gamma)$. E_{γ} : from $(p,p'\gamma)$. |
| 1759.16 | 2+ | 874.33 [@] 8 | 100 [@] 9 | 884.92 2+ | M1+E2 | +0.75 15 | 3.58×10 ⁻⁴ 9 | | $\alpha(K)$ =0.000321 9; $\alpha(L)$ =3.21×10 ⁻⁵ 9; $\alpha(M)$ =4.61×10 ⁻⁶ 12; $\alpha(N)$ =1.85×10 ⁻⁷ 5 B(E2)(W.u.)=10 4; B(M1)(W.u.)=0.0095 23 Mult.: D+Q from $\gamma(\theta)$ in $(n,n'\gamma)$, $\Delta\pi$ =no from level scheme. |
| | | 1759.6 [@] 2 | 68 [@] 7 | 0.0 0+ | [E2] | | 2.86×10^{-4} | | $\alpha(K)=7.92\times10^{-5}\ 11;\ \alpha(L)=7.86\times10^{-6}\ 11;$ $\alpha(M)=1.127\times10^{-6}\ 16;\ \alpha(N)=4.56\times10^{-8}\ 7$ B(E2)(W.u.)=0.60 12 |
| 1786.75 | 4+ | 901.7 <i>I</i> | 100 | 884.92 2+ | [E2] | | 3.78×10^{-4} | | $\alpha(K)$ =0.000339 5; $\alpha(L)$ =3.41×10 ⁻⁵ 5; $\alpha(M)$ =4.88×10 ⁻⁶ 7; $\alpha(N)$ =1.95×10 ⁻⁷ 3 B(E2)(W.u.)=19 6 |
| 1957.28 2140.64 | 2 ⁺ 0 ⁺ | 1072.2 [@] <i>I</i> 1255.6 ^a 2 | 100 100 | 884.92 2 ⁺ 884.92 2 ⁺ | | | | | |
| 2538.31 | 2+ | 751.5 ^a 2 | ≈18 ^a | 1786.75 4+ | [E2] | | 6.06×10 ⁻⁴ | | $\alpha(\mathrm{K}){=}0.000543~8;~\alpha(\mathrm{L}){=}5.49{\times}10^{-5}~8;~\alpha(\mathrm{M}){=}7.86{\times}10^{-6}$ $11;~\alpha(\mathrm{N}){=}3.11{\times}10^{-7}~5$ B(E2)(W.u.)=73 44 |
| | | 779.1 [@] 2 1653.9 [@] 2 | 40 [@] 4 100 [@] 7 | 1759.16 2 ⁺ 884.92 2 ⁺ | M1+E2 | -1.5 3 | 2.39×10 ⁻⁴ 5 | | I _γ : other: 58 in (n,n'γ). $\alpha(K)=8.78\times10^{-5}$ 14; $\alpha(L)=8.72\times10^{-6}$ 14; $\alpha(M)=1.250\times10^{-6}$ 19; $\alpha(N)=5.06\times10^{-8}$ 8 B(E2)(W.u.)=4.9 +49-21; $B(M1)(W.u.)=0.0040$ +40-20 Mult.: D+Q from $\gamma(\theta)$ in (n,n'γ), $\Delta\pi=$ no from level scheme. |
| | | 2537.9 ^a 3 | 20 ^a | 0.0 0+ | [E2] | | 6.18×10^{-4} | | $\alpha(K)=4.09\times10^{-5}$ 6; $\alpha(L)=4.05\times10^{-6}$ 6; $\alpha(M)=5.81\times10^{-7}$ 9; $\alpha(N)=2.36\times10^{-8}$ 4 B(E2)(W.u.)=0.17 10 |
| 2693.40 | 4+ | 735.5 ^a 2 | 11 ^a | 1957.28 2+ | [E2] | | 6.43×10^{-4} | | $\alpha(K)=0.000576 \ 8; \ \alpha(L)=5.82\times10^{-5} \ 9; \ \alpha(M)=8.33\times10^{-6}$ $12; \ \alpha(N)=3.30\times10^{-7} \ 5$ $B(E2)(W.u.)=26 +26-14$ |
| | | 906.5 1 | 92 12 | 1786.75 4 ⁺ | | | | | C. M. GAA C. C. C. |

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γ (70Zn) (continued)

| l | $E_i(level)$ | \mathtt{J}_i^{π} | $\mathrm{E}_{\gamma}^{\dagger}$ | ${\rm I}_{\gamma}{}^{\dagger}$ | E_f | \mathbf{J}_f^π | Mult.‡ | $\delta^{\#}$ | α | Comments |
|---|--------------|----------------------|---------------------------------------|--------------------------------|--------------------|--------------------|--------|---------------|-----------------------|--|
| | 2693.40 | 4+ | 934.9 ^a 3 | 30 ^a | 1759.16 | 2+ | [E2] | | 3.46×10 ⁻⁴ | $\alpha(K)$ =0.000310 5; $\alpha(L)$ =3.12×10 ⁻⁵ 5; $\alpha(M)$ =4.46×10 ⁻⁶ 7; $\alpha(N)$ =1.782×10 ⁻⁷ 25 B(E2)(W.u.)=21 +2 <i>I</i> - <i>I</i> 2 |
| | | | 1809.2 ^a 3 | 100 ^a 16 | 884.92 | 2+ | [E2] | | 3.04×10^{-4} | $\alpha(K)=7.51\times10^{-5} \ 11; \ \alpha(L)=7.46\times10^{-6} \ 11; \ \alpha(M)=1.069\times10^{-6} \ 15; \ \alpha(N)=4.32\times10^{-8} \ 6$ B(E2)(W.u.)=2.6 +26-15 |
| | 2859.49 | 3- | 902 | | 1957.28 | 2+ | | | | E_{γ} : observed only in Coulomb Excitation. |
| | | | 1072.2 ^{&} 1 | 100& 13 | 1786.75 | | [E1] | | 1.12×10^{-4} | $\alpha(K)$ =0.0001001 14; $\alpha(L)$ =9.94×10 ⁻⁶ 14; $\alpha(M)$ =1.423×10 ⁻⁶ 20; $\alpha(N)$ =5.74×10 ⁻⁸ 8 |
| | | | 1100.5 2 | 45 <mark>&</mark> 5 | 1759.16 | 2+ | [E1] | | 1.15×10^{-4} | B(E1)(W.u.)=0.00068 11 $\alpha(K)=9.54\times10^{-5}$ 14; $\alpha(L)=9.47\times10^{-6}$ 14; $\alpha(M)=1.356\times10^{-6}$ 19; |
| | | | 1100.3** 2 | 43** 3 | 1/39.10 | 2. | [EI] | | 1.13×10 | $\alpha(K) = 9.34 \times 10^{-5} 14$, $\alpha(L) = 9.47 \times 10^{-5} 14$, $\alpha(M) = 1.536 \times 10^{-5} 19$; $\alpha(N) = 5.47 \times 10^{-8} 8$ B(E1)(W.u.)=0.00028 5 |
| | | | 1975.0 ^{&} 4 | 93 & 7 | 884.92 | 2+ | [E1] | | 6.56×10 ⁻⁴ | $\alpha(K)=3.61\times10^{-5} 5$; $\alpha(L)=3.57\times10^{-6} 5$; $\alpha(M)=5.11\times10^{-7} 8$; $\alpha(N)=2.07\times10^{-8} 3$ B(E1)(W.u.)=0.000100 13 |
| | 2895.10 | (6^+) | 1108.4 <i>I</i> | 100 | 1786.75 | | | | | 3(21)(\(\text{\text{\$\tinit\\$}\\ \\etitt{\$\text{\$\text{\$\text{\$\text{\$\text{\$\tinx{\$\text{\$\texitex{\$\text{\$\texitt{\$\text{\$\text{\$\texitex{\$\}}}}}}}}}}}}}}}}}}}}}}}}}}}}}}}}}}}} |
| | 2949.67 | $1^+, 2^+, 3^+$ | 1191.9 ^a 3 | 72 ^a | 1759.16 | | | | | |
| | | | 2064.1 ^a 2 | 100 ^a | 884.92 | 2+ | M1+E2 | +3.8 5 | 4.04×10 ⁻⁴ | $\alpha(K)=5.87\times10^{-5}$ 9; $\alpha(L)=5.82\times10^{-6}$ 9; $\alpha(M)=8.34\times10^{-7}$ 12; $\alpha(N)=3.38\times10^{-8}$ 5 B(E2)(W.u.)=11 +4-6; B(M1)(W.u.)=0.0022 +10-13 Mult.: D+Q from $\gamma(\theta)$ in (n,n' γ), E1+M2 excluded by comparison to RUL. |
| | 2978.26 | 4+ | 1191.5 <mark>&</mark> 2 | 100 | 1786.75 | | | | | |
| | 3038.15 | 5- | 1251.7 <i>I</i> | 100 | 1786.75 | 4+ | [E1] | | 1.68×10^{-4} | $\alpha(K)=7.56\times10^{-5} II; \alpha(L)=7.49\times10^{-6} II; \alpha(M)=1.073\times10^{-6} I5; \alpha(N)=4.34\times10^{-8} 6$ |
| | 3222.08 | 1 | 2155.0 ^{ac} 1 | ≈33 ^a | 1070.76 | 0+ | | | | B(E1)(W.u.)=0.000195 14 E_{γ} : level energy difference gives E_{γ} =2151.3, transition not included in least-squares fitting. |
| | | | 3222.0^{a} 1 | $\approx 100^{a}$ | 0.0 | | | | | |
| | 3246.71 | $(3^-,4^+)$ | 208.75 ^{&} 7 | 55 <mark>&</mark> 4 | 3038.15 | | | | | |
| | | | 387.10 5 | 54 <mark>&</mark> 4 | 2859.49 | | | | | |
| | | | 553.2 ^{&} 1 | 28 <mark>&</mark> 4 | 2693.40 | | | | | |
| | | | 708.42 7 | 100 & 5 | 2538.31 | | | | | |
| | 3342.0 | 3- | 1460.4 ^{&} 2 1555.2 3 | 20 & 4 100 | 1786.75 1786.75 | | | | | |
| | 3476.68 | 3 | 438.2 2 | 22.2 10 | 3038.15 | | | | | |
| | | | 783.1 2 | 7.8 10 | 2693.40 | 4+ | | | | |
| | 3598.98 | | 1690.3 <i>2</i> 560.82 <i>8</i> | 100.0 <i>16</i> 100 | 1786.75 3038.15 | | | | | |
| | 3370.70 | | 300.02 0 | 100 | 5050.15 | J | | | | |

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γ (70Zn) (continued)

| $E_i(level)$ | \mathbf{J}_i^{π} | E_{γ}^{\dagger} | I_{γ}^{\dagger} | E_f J_f^{π} | E_i (level) | \mathbf{J}_i^{π} | E_{γ}^{\dagger} | I_{γ}^{\dagger} | \mathbf{E}_f \mathbf{J}_f^{π} |
|--------------|----------------------|------------------------|------------------------|---------------------------|---------------|----------------------|------------------------|------------------------|-------------------------------------|
| 3634.99 | 2+ | 1875.8 [@] 2 | 100 | 1759.16 2+ | 4464.77 | $(5,6,7^{-})$ | 988.0 <i>3</i> | 28 <i>3</i> | 3476.68 |
| 3710.7 | 2+ | 1951.5 ^a 6 | 100 | 1759.16 2 ⁺ | | | 1426.5 2 | 100 4 | 3038.15 5 |
| 3755.4 | (8^{+}) | 860.3 ^b | 100 | 2895.10 (6 ⁺) | | | 1569.8 2 | 32 <i>3</i> | 2895.10 (6+) |
| 3788.16 | | 750.0 2 | 63 4 | 3038.15 5 | 4514.27 | $(5,6,7^{-})$ | 1476.1 2 | 100 | 3038.15 5 |
| | | 893.1 6 | 100 5 | 2895.10 (6 ⁺) | 4558.2 | $(5,6^+)$ | 1520.1 <i>3</i> | 67 5 | 3038.15 5 |
| 3848.4 | $(5,6^+)$ | 2061.6 6 | 100 | 1786.75 4 ⁺ | | | 2771.2 6 | 100 4 | 1786.75 4 ⁺ |
| 3904.0 | $(5,6^+)$ | 2117.2 4 | 100 | 1786.75 4 ⁺ | 4588.8 | $(5,6,7^{-})$ | 1550.6 <i>3</i> | 100 | 3038.15 5 |
| 4001.46 | $(5,6,7^{-})$ | 963.3 <i>1</i> | 100 | 3038.15 5- | 4710.1 | (5,6,7) | 1815.0 <i>5</i> | 100 | 2895.10 (6 ⁺) |
| 4061.40 | $(5,6,7^{-})$ | 584.7 <i>1</i> | 100 8 | 3476.68 | 4791.7 | (5,6,7) | 1315 <i>1</i> | 100 | 3476.68 |
| | | 1023.3 2 | 70 <i>7</i> | 3038.15 5 | 4849.2 | $(5,6^+)$ | 1954.2 <i>3</i> | 100 4 | 2895.10 (6 ⁺) |
| 4146.1 | | 1107.9 ^a 3 | 100 | 3038.15 5 | | | 3062.1 <i>6</i> | 85 <i>4</i> | 1786.75 4+ |
| 4264.5 | $(5,6,7^{-})$ | 1226.3 7 | 100 | 3038.15 5- | 4935.9 | (10^+) | 1180.5 <mark>b</mark> | 100 | 3755.4 (8+) |
| 4308.99 | $(5,6,7^{-})$ | 1270.8 2 | 100 5 | 3038.15 5 | 5061.3 | (5,6,7) | 2166.2 5 | 100 | 2895.10 (6 ⁺) |
| | | 1413.9 2 | 43 4 | 2895.10 (6 ⁺) | 6116.2 | (12^{+}) | 1180.3 ^b | 100 | 4935.9 (10 ⁺) |

 $^{^{\}dagger}$ From $^{70}\mathrm{Cu}~\beta^-$ decay (44.5 s), except where noted.

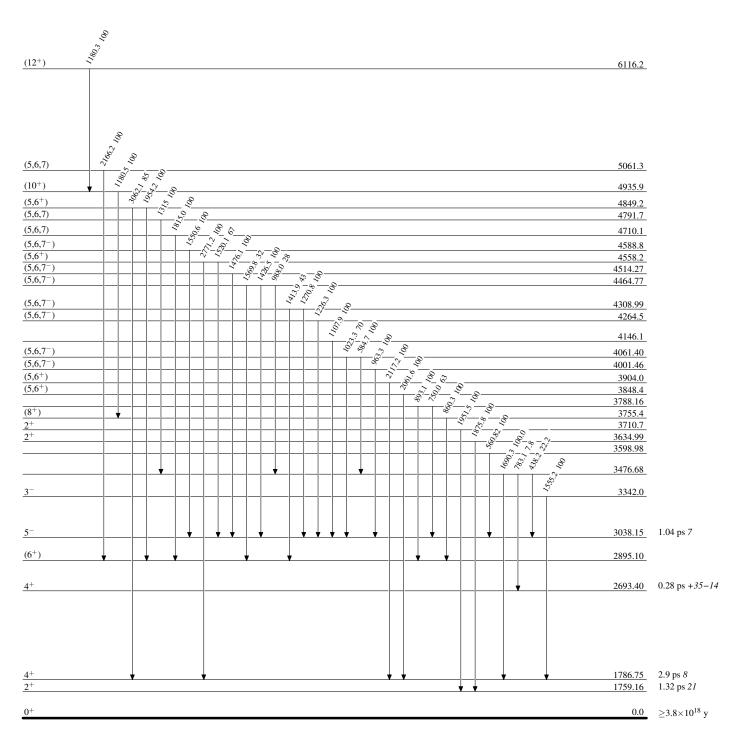
[‡] From $\gamma(\theta)$ in $(n,n'\gamma)$, except where noted. # From $\gamma(\theta)$ in $(n,n'\gamma)$. @ From γ^{0} Cu β^{-} decay (6.6 s). & From γ^{0} Cu β^{-} decay (33 s).

^a From $(n,n'\gamma)$. ^b From ²⁰⁸Pb(⁶⁴Ni,X γ).

^c Placement of transition in the level scheme is uncertain.

Level Scheme

Intensities: Relative photon branching from each level

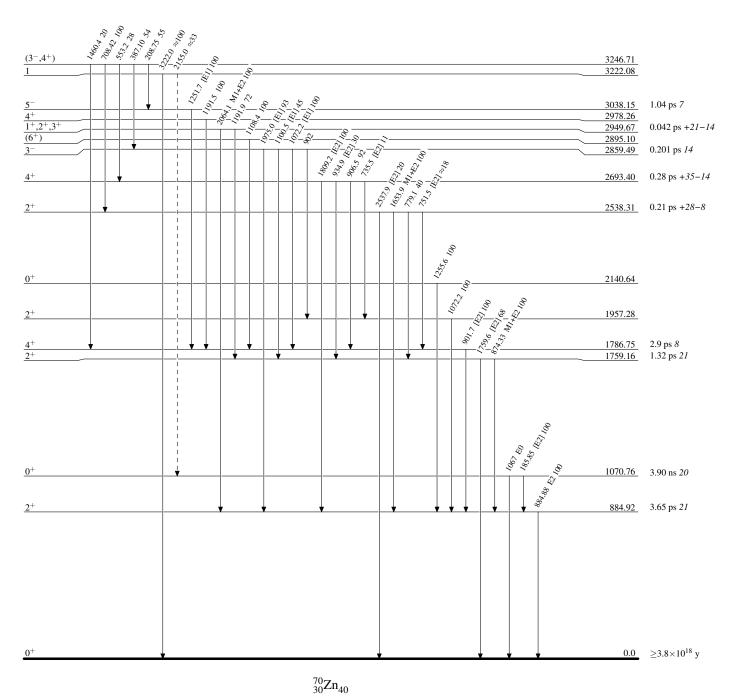


Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

---- γ Decay (Uncertain)



Band(A): Yrast band

