

Adopted Levels, Gammas

| Type | Author | History Citation | Literature Cutoff Date |
|-----------------|-----------------|---------------------|------------------------|
| Full Evaluation | Coral M. Baglin | NDS 113,2187 (2012) | 15-Sep-2012 |

Q(β^-)=-2005.9 18; S(n)=8634.79 11; S(p)=9396.7 19; Q(α)=-2963.2 21 [2012Wa38](#)
 Note: Current evaluation has used the following Q record -2005.9 18 8634.7911 9396.8 19-2964.3 23 [2011AuZZ](#).
 Q(β^-),S(n),S(p),Q(α): from [2011AuZZ](#); -2005.5 18, 8634.80 11, 9397.8 18, -2957.1 25, respectively, from [2003Au03](#).
 See ⁹¹Zr(n, γ) E=res for neutron resonance information; it has not been included in the present dataset.
Other Reactions.

⁹Be(⁸⁶Kr,3n γ): [2007SuZN](#): E(⁸⁶Kr)=280 MeV; GEMINI-II γ detector array; measured T_{1/2} using DSAM for high-spin states; data analysis not yet complete.

⁹¹Zr(⁷Li,⁶Li): [1993Yo01](#): E(⁷Li)=210 MeV, magnetic spectrograph, FWHM \approx 500 keV, 88.5% ⁹¹Zr target; observed resonances at E=0.0 MeV (Γ =0.6 MeV), 1.3 MeV (Γ =0.9 MeV), 3.6 MeV (Γ =1.2 MeV), 4.7 MeV (Γ =0.9 MeV), 5.5 MeV (Γ =1.0 MeV), 6.8 MeV (Γ =1.6 MeV) and 15.8 MeV (Γ =6.0 MeV); interpreted these resonances as single-particle states.

⁹²Zr(⁶Li,⁶Li'): [1993Ho02](#): E(⁶Li)=70 MeV, magnetic spectrometer, particle identification, 94.57% ⁹²Zr target, FWHM \approx 225 keV, $\theta(\text{lab})\approx 4^\circ-45^\circ$; measured $\sigma(\theta)$ for 934 and 2340 levels ($J^\pi=2^+$ and 3^- , respectively); deduced isospin character of transitions to the above two states (deformed optical model analysis). See also [1992Ho12](#).

For relativistic mean field calculation of g.s. properties of ⁹²Zr, see [2004He24](#).

For shell-model calculation of g factors and electromagnetic decay rates for lowest-energy 2⁺ (934) and 3⁻ (2340) levels, see [2004St11](#).

⁹²Zr Levels

Above 3 MeV, the correspondence between levels from different reactions is sometimes ambiguous. This is due, in part, to particle reaction energy resolution being inadequate for the existing level density, but also results from particle reaction data for which the authors do not state ΔE (viz., (α ,³He), (p,t), (³He,³He'), (t,t'), (d,³He)) and/or data for which the energy scale appears to include an unstated systematic uncertainty (viz.: (α ,³He), 10-30 keV low; (p,t), 5-10 keV low; (p,p') from [1966St15](#), 10-20 keV low). For theoretical work see, e.g., [1972Wa09](#), [1975GI07](#), [1976Te02](#), [1976Pr07](#), [1993Ha37](#), [2000Ho15](#).

Cross Reference (XREF) Flags

| | | |
|---|---|---|
| A ⁹² Y β^- decay | N ⁹⁴ Zr(p,t) | Others: |
| B ⁹² Nb ϵ decay (10.15 d) | O ⁹² Zr(p,p' γ) | AA ⁸⁹ Y(α ,p) |
| C ⁴⁸ Ca(⁴⁸ Ca,4n γ) | P ⁹² Zr(³ He, ³ He') | AB ⁹² Zr(γ ,xn), (γ ,pn) |
| D ⁸⁸ Sr(⁷ Li,2np γ) | Q ⁹³ Nb(μ^- ,n γ) | AC ⁹⁴ Mo(¹⁴ C, ¹⁶ O) |
| E ⁹⁰ Zr(t,p) | R ⁹³ Nb(d, ³ He), (pol d, ³ He) | AD ⁹⁶ Mo(d, ⁶ Li) |
| F ⁹¹ Zr(n, γ) E=thermal | S ⁹⁴ Mo(⁶ Li, ⁸ B) | AE ⁹¹ Zr(¹⁶ O, ¹⁵ O) |
| G ⁹¹ Zr(d,p), (pol d,p) | T ⁹² Zr(¹⁶ O, ¹⁶ O'), (¹⁸ O, ¹⁸ O') | AF ⁹¹ Zr(n, γ), (n,n) E=res |
| H ⁹¹ Zr(α , ³ He) | U ⁹² Nb ϵ decay (3.47 \times 10 ⁷ y) | AG ¹⁷³ Yb(²⁴ Mg,F γ), ¹⁷⁶ Yb(²⁸ Si,X γ), |
| I ⁹² Zr(n,n' γ) | V ⁹⁰ Zr(α , ² He) | AH ⁹² Zr(pol γ , γ'), (γ , γ') |
| J ⁹² Zr(p,p'), (pol p,p') | W Coulomb excitation | AI ²⁰⁸ Pb(⁹⁰ Zr,X γ) |
| K ⁹² Zr(α , α') | X ⁹² Zr(n,n') | AJ ⁸² Se(¹³ C,3n γ) |
| L ⁹² Zr(d,d'), (pol d,d) | Y ⁹⁵ Mo(n, α) | AK ⁹² Zr(α , α' γ) |
| M ⁹² Zr(t,t') | Z ⁹² Zr(e,e') | AL ⁹¹ Zr(n, γ) E=292 eV |

| E(level) [‡] | J ^{π} | T _{1/2} [#] | XREF | Comments |
|-----------------------|-------------------------------|-------------------------------|----------------------------|--|
| 0.0 ^b | 0 ⁺ | stable | ABCDEFGHIJKLMNPOQRSTUVWXYZ | XREF: Others: AA , AC , AD , AF , AG , AH , AI , AJ , AK , AL $\Delta\langle r^2 \rangle(92,90)=0.224\ 26$ (1999GaZX), $0.224\ 25$ (1988GaZS); $\Delta\langle r^2 \rangle(92,94)=0.170\ 19$ (1988GaZS). $\langle r^2 \rangle^{1/2}(\text{charge})=4.3057\ \text{fm}\ 9$ (2004An14). |
| 934.51 ^b | 4 2 ⁺ | 5.0 ps 4 | ABCDEFGHIJKLMNPOQRSTU WXYZ | XREF: Others: AA , AC , AD , AF , AG , AI , AJ , AK , AL |

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Adopted Levels, Gammas (continued)

⁹²Zr Levels (continued)

| E(level) [‡] | J ^π | T _{1/2} [#] | XREF | Comments |
|------------------------|-------------------|-------------------------------|--------------------------|---|
| 1382.77 7 | 0 ⁺ | 88 ps 3 | A EFG IJ L NO QRS WX | <p>$\mu = -0.360 20$ (1999Ja13)</p> <p>J^π: L=2 in (t,p), (p,t) and p,d,t,³He,α scattering. μ implies dominant role of d_{5/2} neutrons in wavefunction of this state (1999Ja13).</p> <p>T_{1/2}: from B(E2)=0.080 6 (Coulomb excitation).</p> <p>μ: from measured g-factor=-0.180 10 from $\gamma(\theta,H,t)$ in Coulomb excitation. Other μ: -0.06 10 from transient field integral PAC (1989Ra17, from 1980Ha31), assuming T_{1/2}=4.85 ps; -0.36 4 (2008We07; transient field).</p> <p>XREF: Others: AA, AC, AD, AH</p> <p>J^π: 448γ-934γ(θ) in ⁹²Y β^- decay indicates a 0-2-0 cascade; L=0 in (t,p) and (p,t).</p> <p>T_{1/2}: from ⁹²Y β^- decay. Other: 85 ps 15 from (p,p'γ).</p> |
| 1495.46 ^b 5 | 4 ⁺ | 102 ps 3 | A CDEFGHIJKLMN PQ STUVWX | <p>XREF: Others: AA, AC, AD, AF, AG, AH, AI, AJ, AK, AL</p> <p>$\mu = -2.0 4$ (1999Ja13)</p> <p>μ: from measured g-factor=-0.50 11 from $\gamma(\theta,H,t)$ in Coulomb excitation.</p> <p>J^π: L=4 in (t,p), (p,t), (p,p'), (t,t'), (α,α'). μ implies dominant role of d_{5/2} neutrons in wavefunction of this state (1999Ja13).</p> <p>T_{1/2}: from $\gamma\gamma(t)$, ⁹²Y β^- decay.</p> |
| 1847.27 4 | 2 ⁺ | 96 ^{&} fs 10 | AB EFGHIJKLMN P R T WX Z | <p>XREF: Others: AA, AC, AD, AF, AH</p> <p>$\mu = +1.5 10$ (2008We07)</p> <p>J^π: L=2 in (p,t), (p,p'), (t,t'), (α,α'), (³He,³He'), (t,p).</p> <p>μ: From measured g-factor in Coulomb excitation (transient field).</p> <p>Level exhibits structure expected for a mixed symmetry one-phonon Q excitation (2002We15).</p> |
| 2066.65 5 | 2 ⁺ | >0.76 ^{&} ps | AB EFGHIJKLM WX | <p>XREF: Others: AC, AD, AF, AL</p> <p>J^π: L=2 in (t,p), (p,p'), (α,α').</p> |
| 2182 10 | (2 ⁺) | | K | <p>J^π: L(α,α')=(2).</p> <p>Probably same level as in (p,p') at E=2180? 22.</p> |
| 2339.66 4 | 3 ⁻ | 0.28 ^{&} ps 3 | A EFGHIJKLMN P R T VWX | <p>XREF: Others: AD, AL</p> <p>J^π: L=3 in (t,p), (p,t), (p,p'), (d,d'), (t,t'), (³He,³He'), (α,α').</p> <p>For summary of B(E3)\uparrow data, see 1989Sp01; recommended value is 0.067 22 based on b₃ from angular distribution in (p,p'). This corresponds to 4.4% 15 of energy-weighted E3 sum rule.</p> |
| 2398.36 6 | 4 ⁺ | 149 ^{&} fs 16 | EFGHI K N WX | <p>XREF: Others: AB, AD, AF, AG</p> <p>XREF: X(2360).</p> <p>J^π: L=4 in (t,p) and (α,α'). Note: evaluator assumes J=1,3 from (n,n') for 2360 20 level to be in error; alternatively, an additional level may exist at that energy.</p> |
| 2473.4? 5 | (≤ 2) | | A | <p>J^π: γ ray to 0⁺ state.</p> |
| 2486.01 9 | 5 ⁻ | ≤ 3.5 ns | DEF IJKL N R WX | <p>XREF: Others: AB, AC, AD, AE, AG</p> <p>XREF: R(2450).</p> <p>J^π: L=5 in (t,p), (p,p'), (α,α') and analyzing power in (pol p,p') (1979De11). See comment on J(2486 level) in (n,γ).</p> |

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Adopted Levels, Gammas (continued)

⁹²Zr Levels (continued)

| E(level) [‡] | J ^π | T _{1/2} [#] | XREF | | Comments |
|-----------------------|-------------------|---------------------------------|-----------|---|--|
| 2666.30 | | | J | X | XREF: Others: AA, AB, AE, AF XREF: J(2651). Excitation of level in (p,p') is not certain. |
| 2743.55 7 | 4 ⁻ | >2.63 ^{&} ps | F I | R | J ^π : D(+Q) 404γ and 258γ to 3 ⁻ 2340 and 5 ⁻ 2486, respectively; L(d, ³ He)=1. If the 2486 and 2744 states are treated as members of the (p _{1/2} ,g _{9/2}) doublet, they exhaust the p _{1/2} pickup strength in (d, ³ He). |
| 2752? [†] 11 | 3 ⁻ | | KLM | x | XREF: Others: AB, AG, AH XREF: x(2778). J ^π : L(α,α')=3. |
| 2819.54 7 | 2 ⁺ | 64 ^{&} fs 7 | A EFG IJK | x | XREF: Others: AB, AG, AH XREF: x(2778). |
| 2864.66 9 | 4 ⁺ | 0.24 ^{&} ps 3 | E G IJKLM | X | J ^π : L=2 in (t,p), (α,α'). XREF: Others: AB, AD, AE, AF XREF: J(2650). J ^π : L=4 in (t,p), (α,α'); however, if reported L(p,p')=(2) is correct, a (2 ⁺) level also must exist at approximately this energy. |
| 2904.08 18 | 0 ⁺ | 0.83 ^{&} ps +57-24 | EF I | | J ^π : L=0 in (t,p). |
| 2909.43 7 | 3 ⁺ | 216 ^{&} fs 24 | FG I | X | J ^π : L=0 in (d,p) on 5/2 ⁺ target; D+Q 1414γ to 4 ⁺ 1495. |
| 2957.4 ^b 3 | 6 ⁺ | ≤3.5 ns | CDE GH JK | | XREF: Others: AB, AC, AG, AI, AJ XREF: H(2944). J ^π : L(t,p)=6; supported by L(α,α')=(6) and (Q) 1462γ to 4 ⁺ 1495. |
| 3039.70 6 | 3 | 91 ^{&} fs 10 | A EF I lm | x | XREF: Others: AC, AD, AF, AL XREF: l(3040)m(3040)x(3063). J ^π : D(+Q) 2105γ to 2 ⁺ 934; D(+Q) 700γ to 3 ⁻ 2340; 296γ to 4 ⁻ 2744; J=3 from 700γ(θ) in (n,n'γ). |
| 3057.40 13 | 2 ⁺ | 98 ^{&} fs 10 | E G IJKlm | x | XREF: Others: AC, AD, AF XREF: J(3040)l(3040)m(3040)x(3063). J ^π : L=2 in (t,p), (α,α'). |
| 3124.61 11 | 1 ⁽⁺⁾ | 58 ^{&} fs 6 | G I | | XREF: Others: AA, AB, AD, AF XREF: G(3126). J ^π : D 3125γ to 0 ⁺ g.s.; L(d,p)=2 for 5/2 ⁺ target and uncertain state. |
| 3178.31 11 | 4 ⁺ | 54 ^{&} fs 6 | F IjK M | x | XREF: Others: AA, AC, AD, AG, AH XREF: j(3180)K(3187)M(3140)x(3187). J ^π : L=4 in (t,t'), (α,α'). E(level): if (α,α'), (t,t') and (n,n'γ) excite same level. |
| 3190.99 21 | (4 ⁻) | 153 ^{&} fs 18 | GhIj | x | XREF: Others: AA, AB, AD, AE, AG, AH XREF: h(3215)j(3180)x(3187). J ^π : L(d,p)=(3+5) for 5/2 ⁺ target; D(+Q) 1696γ to 4 ⁺ 1496, but J=5 requires δ(D,Q)=+0.36 5 and J=3 requires δ=-0.41 to -1.92 to 4 ⁺ level, violating RUL if π=-. E(level),J ^π : if (d,p), (α, ³ He) and (n,n'γ) excite same state. |
| 3236.9 6 | 4 ⁺ | | E Gh JKl | | XREF: Others: AA, AB, AD, AE |

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Adopted Levels, Gammas (continued)

⁹²Zr Levels (continued)

| E(level) [‡] | J ^π | T _{1/2} [#] | XREF | | | Comments |
|-----------------------|--------------------------------|--------------------------------|------|------------|---|--|
| 3262.62 4 | 2 ⁺ | 12.5 ^{&} fs 14 | A | FGHI k l M | x | XREF: h(3215)l(3250). J ^π : L=4 in (p,p'), (α,α'). |
| 3275.76 8 | 2 ⁺ ,3 ⁺ | 53 ^{&} fs 6 | | F I k | x | XREF: Others: AB, AC, AD, AE, AG, AH XREF: k(3273)l(3250)M(3240)x(3275). J ^π : L=0+2 in (d,p); E2 3263γ to 0 ⁺ g.s. |
| 3289.13 7 | 3 ⁺ | 174 ^{&} fs 19 | | FG I k | x | XREF: Others: AB, AD, AE, AG XREF: k(3273)x(3275). J ^π : M1+E2 2341γ to 2 ⁺ 934; D,Q 878γ to 4 ⁺ 2398. |
| 3304 10 | 6 ⁺ | | | E m | | XREF: Others: AB, AD XREF: m(3320). J ^π : L=6 in (t,p). |
| 3308.7 ^b 4 | (8 ⁺) | 1.18 ns 7 | CD | m r | | XREF: Others: AA, AB, AD, AG, AI, AJ XREF: m(3320)r(3310). J ^π : stretched Q transition to 6 ⁺ 2958 in (⁷ Li,2npγ). T _{1/2} : from recoil-distance measurements in ⁴⁸ Ca(⁴⁸ Ca,4nγ). |
| 3325? 8 | (⁺) | | | Gh j m r | | XREF: Others: AA, AB, AD, AG XREF: h(3327)j(3320)m(3320)r(3310). J ^π : L=(4) in (d,p). E(level): existence of level based on uncertain level in (d,p). |
| 3345 20 | 5 ⁻ | | | h j K m | | XREF: Others: AB, AD, AG XREF: h(3327)j(3320)m(3320). J ^π : L=5 in (α,α'). |
| 3371.48 8 | 1 ⁽⁻⁾ | 27 ^{&} fs 3 | A | EFg I | | XREF: Others: AC, AD, AG, AH XREF: g(3374). J ^π : L=(1) in (t,p); D 3371γ to 0 ⁺ g.s. |
| 3379.8 10 | (7 ⁻) | ≤3.5 ns | | D | | XREF: Others: AG J ^π : γ to 5 ⁻ in (⁷ Li,2npγ) and ¹⁷³ Yb(²⁴ Mg,Fγ). |
| 3382 20 | 3 ⁻ | | | g K n | | XREF: Others: AA, AC, AD, AG XREF: g(3374)n(3410). J ^π : L=3 in (α,α'). |
| 3407.83 17 | 2 ⁻ ,3 ⁻ | 0.30 ^{&} ps 4 | | I n | | XREF: Others: AA, AC, AD XREF: n(3410). J ^π : M1+E2 1068γ to 3 ⁻ 2340; D(+Q) 2473γ to 2 ⁺ 934; δ to 3 ⁻ is ≥0.3 if J=2. |
| 3446 14 | 3 ⁻ | | | jKLm | | XREF: Others: AC, AD XREF: j(3440)m(3440). J ^π : L=3 in (α,α'). |
| 3452.17 7 | (2) ⁺ | 58 ^{&} fs 6 | | F I j | | XREF: Others: AC, AD XREF: j(3440). J ^π : M1+E2 2518γ to 2 ⁺ 934; 1113γ to 3 ⁻ 2340; 2070γ to 0 ⁺ 1383. |
| 3463.04 15 | (4) ⁺ | 137 ^{&} fs +21-17 | E | I j m | | XREF: Others: AA, AC, AD, AE XREF: E(3451)j(3440)m(3440). E(level): values from (p,p') (1966St15) and E(t,p) are, respectively, 10-20 keV and 5-10 keV low. J ^π : E2(+M3) 2529γ to 2 ⁺ 934; L(t,p)=(4); 1968γ to 4 ⁺ 1495. |

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Adopted Levels, Gammas (continued)

⁹²Zr Levels (continued)

| E(level) [‡] | J ^π | T _{1/2} [#] | XREF | Comments |
|-----------------------|--|--------------------------------|----------|--|
| 3471.88 16 | 1 ⁺ | 5.3 ^{&} fs 6 | FGhI | XREF: Others: AC, AD, AF, AG, AH, AI XREF: G(3469)h(3479). |
| 3491 20 | (3 ⁻) | | K v | J ^π : L(d,p)=2 for 5/2 ⁺ target; M1 3471γ to 0 ⁺ g.s. XREF: Others: AC, AD, AE XREF: v(3540). |
| 3499.88 10 | 2 ⁺ | 53 ^{&} fs 5 | EF h v | J ^π : L=(3) in (α,α'). XREF: Others: AC, AD, AE, AG, AH, AI XREF: h(3479)v(3540). |
| 3589 10 | 0 ⁺ | | E k v | L=2 in (t,p). XREF: Others: AC, AD, AE, AG, AH XREF: k(3587)v(3540). |
| 3602 9 | (5 ⁻) | | E Gh k M | J ^π : L(t,p)=0+(5) for 3589+3602 doublet. XREF: Others: AB, AD, AE, AF, AG, AH, AI XREF: h(3597)k(3587)M(3620). |
| 3609.5 4 | (0 ⁺) | 151 ^{&} fs +26-23 | I | J ^π : L(t,p)=0+(5) for 3589+3602 doublet; L(d,p)=(3+5) for 5/2 ⁺ target; L=(5) in (t,t'). |
| 3628.33 7 | (4 ⁺) | 26 ^{&} fs 3 | EF hIjk | 2675γ to 2 ⁺ 934; J=(0) from excit in (n,n'γ). XREF: Others: AC, AD, AE, AF, AG, AI XREF: h(3597)j(3640). |
| 3638.2 3 | 1 ⁻ | 8.4 ^{&} fs 11 | Ijk | 2694γ to 2 ⁺ 934; 885γ to 4 ⁻ 2744; 2133γ to 4 ⁺ 1495; L(t,p)=2+(4) for 3628+3640 doublet so this is presumed to be the L=(4) component. XREF: Others: AB, AC, AD, AF, AH XREF: j(3620)k(3634). |
| 3640.28 11 | (2) ⁺ | 128 ^{&} fs 15 | EF hIjk | J ^π : E1 3638γ to 0 ⁺ g.s. XREF: Others: AB, AC, AD, AE, AF, AG, AI XREF: h(3597)j(3620)k(3634). |
| 3649.22 12 | 3 ⁺ | 56 ^{&} fs 7 | FGhI L X | J ^π : M1+E2 2706γ to 2 ⁺ 934; 1301γ to 3 ⁻ 2340; L(t,p)=2+(4) for 3628+3640 doublet, with L=(4) component associated with 3628 level on basis of that level's γ decay. XREF: Others: AD, AE, AG, AI XREF: h(3597). |
| 3667.1 10 | 1 | | | J ^π : M1+E2 2714γ to 2 ⁺ 934; M1+E2 2154γ to 4 ⁺ 1495. and 5 ⁻ levels; L(d,p)=2+4 for 5/2 ⁺ target. XREF: Others: AH J ^π ,E(level): from (γ,γ'). |
| 3675.8 4 | 3 ⁺ ,4 ⁺ ,5 ⁺ | 116 ^{&} fs +24-20 | I | J ^π : M1+E2 2180γ to 4 ⁺ 1495. |
| 3696.8 4 | 1 ⁽⁺⁾ | 17.3 ^{&} fs 28 | I | XREF: Others: AH J ^π : D 3697γ to 0 ⁺ g.s.; D+Q, Δπ=(no) 2762γ to 2 ⁺ 934. |
| 3704 7 | (4) ⁺ | | E Gh k | XREF: Others: AA, AD, AF, AG, AH XREF: h(3683)k(3711). |
| 3725 9 | + | | Gh k | J ^π : L(t,p)=(4); L(d,p)=2 for 5/2 ⁺ target. XREF: Others: AA, AD, AF, AG, AH XREF: h(3683)k(3711). |
| 3760 10 | 2 ⁺ | | E h | J ^π : L(d,p)=2 for 5/2 ⁺ target. XREF: Others: AD, AF, AH XREF: h(3683). |
| 3767 20 | 5 ⁻ | | K | J ^π : L(t,p)=2. J ^π : L(α,α')=5. |
| 3774.6 3 | (1,2) ⁺ | 17 ^{&} fs 5 | I | J ^π : 3775γ not M2 to 0 ⁺ g.s.; 2840γ to 2 ⁺ 934. |
| 3783 7 | (4) ⁺ | | E Gh | XREF: Others: AD, AF, AH |

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Adopted Levels, Gammas (continued)

⁹²Zr Levels (continued)

| E(level) [‡] | J ^π | T _{1/2} [#] | XREF | Comments |
|-----------------------|-----------------------------------|-------------------------------|----------|---|
| 3804.7 5 | (≤4) | 9& fs +6-5 | I | XREF: h(3683). J ^π : L(d,p)=2 for 5/2 ⁺ target; L(t,p)=(4). E(level),J ^π : may be the same level as 3814 in (d,p) with J ^π =(1,2,3,4) ⁽⁺⁾ . 2870γ to 2 ⁺ 934. |
| 3814 10 | (4) ⁺ | | Gh N | XREF: Others: AB, AD, AH XREF: h(3802). |
| 3819.4 12 | (8 ⁻) | ≤3.5 ns | D | J ^π : L(d,p)=2 for 5/2 ⁺ target; L(p,t)=(4). XREF: Others: AG |
| 3830.31 9 | (1 ⁻ ,2 ⁺) | | F hI K | J ^π : D ΔJ=1 440γ to (7 ⁻) 3380 in (⁷ Li,2npγ). XREF: Others: AB, AD, AH XREF: h(3802). |
| 3891 10 | | | Gh Jkl | J ^π : 2447γ to 0 ⁺ 1383; 1490γ to 3 ⁻ 2340. XREF: Others: AB, AD, AG, AH, AI |
| 3902 10 | | | E G kl | XREF: h(3802)J(3870)k(3877)l(3900). J ^π : L(α,α')=4 for one or both of 3891 and 3902 levels. XREF: Others: AD, AG, AH, AI XREF: k(3877)l(3900). |
| 3915 1 | 1 | | | J ^π : L(α,α')=4 for one or both of 3891 and 3902 levels. XREF: Others: AH |
| 3944 20 | 5 ⁻ | | H jK r | J ^π ,E(level): from (γ,γ'); D 3915γ to 0 ⁺ g.s. XREF: Others: AC, AD, AI XREF: H(3909)j(3940)r(3940). |
| 3971 10 | | | G j n r | J ^π : L(α,α')=5. XREF: Others: AC, AD, AI XREF: j(3940)n(3990)r(3940). |
| 3983 10 | | | G jk n | J ^π : L(d,p)=2 on 5/2 ⁺ target for 3971+3983 doublet. XREF: Others: AC, AD, AI XREF: j(3990)k(4003)n(3990). |
| 3992 10 | 0 ⁺ | | E jk | J ^π : L(d,p)=2 on 5/2 ⁺ target for 3971+3983 doublet. E(level): doublet reported in (d,p). XREF: Others: AC, AD XREF: k(4003). |
| 3998.7? 12 | (9 ⁻) | ≤3.5 ns | D | J ^π : L(t,p)=0+(2). XREF: Others: AG |
| 4012 10 | + | | E Gh k | J ^π : crossover 619γ to (7 ⁻) 3380 in (²⁴ Mg,Fγ); D ΔJ=1 179γ to (8 ⁻) 3819 in ⁸⁸ Sr(⁷ Li,2npγ). XREF: Others: AC, AD, AH, AI XREF: h(3998)k(4003). |
| 4040 7 | 4 ⁺ | | E Gh JKL | J ^π : L(d,p)=2 for 5/2 ⁺ target. XREF: Others: AA, AB, AC, AD, AH, AI XREF: E(4031)h(3998)J(4020). |
| 4082 7 | 4 ⁺ | | E G K | E(level): (p,p') datum excluded from weighted average. J ^π : L=4 in (α,α') and (t,p). XREF: Others: AA, AC, AD, AG, AI XREF: E(4071)G(4093). |
| 4142 10 | 2 ⁺ ,3 ⁺ | | Gh | J ^π : L=4 in (t,p), (α,α'). XREF: Others: AA, AC, AE, AI XREF: h(4159). |
| 4161 10 | 4 ⁺ | | E h J | J ^π : L(d,p)=0+2 for 5/2 ⁺ target. XREF: Others: AA, AC, AE, AI XREF: h(4159)J(4150). |
| 4181 20 | 3 ⁻ | | K | E(level): from (t,p). J ^π : L(t,p)=4. |
| 4183 10 | (⁺) | | Gh | J ^π : L(α,α')=3. XREF: Others: AA, AC, AE, AI |

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{92}Zr Levels (continued)

| E(level) [‡] | J ^π | T _{1/2} [#] | XREF | Comments |
|-----------------------|-----------------------------------|-------------------------------|--------|---|
| 4213 11 | 2 ⁺ ,3 ⁺ | | Gh | XREF: h(4159). J ^π : L(d,p)=(2+4) for 5/2 ⁺ target. XREF: Others: AA, AC, AE, AI |
| 4256 10 | 4 ⁺ | | G K | XREF: h(4159). J ^π : L(d,p)=0+(2) for 5/2 ⁺ target. |
| 4270 | (5 ⁻) | | N r | J ^π : L(α,α')=4. XREF: Others: AB, AC, AH |
| 4283 10 | 0 ⁺ | | E r | XREF: r(4280). J ^π : L(p,t)=(5). XREF: Others: AB, AC, AH |
| 4296.6 ^b 4 | (10 ⁺) | ≤3.5 ns | CD | XREF: r(4280). J ^π : L(t,p)=0. XREF: Others: AG, AI, AJ |
| 4332 10 | 2 ⁺ | | E JK | J ^π : stretched (Q) 988γ to (8 ⁺) 3309 in (⁷ Li,2npy). XREF: Others: AA, AB, AC, AD, AF |
| 4380 | (4 ⁺) | | N | XREF: E(4332)J(4300)K(4316). E(level): from (t,p); may be 5-10 keV low. J ^π : L(t,p)=2. |
| 4397 20 | 2 ⁺ | | K | J ^π : L(p,t)=(4). |
| 4453 11 | (2 ⁺) | | Gh jkl | J ^π : L=2 in (α,α'). XREF: Others: AC, AD, AF |
| 4465 11 | 4 ⁺ | | Gh jkl | XREF: h(4430)j(4430)l(4460). E(level): from (d,p). J ^π : L=(2) for (p,p') doublet; L(d,p)=2 for doublet for 5/2 ⁺ target. |
| 4494 11 | | | G | XREF: Others: AC, AD, AF |
| 4504 11 | | | G | XREF: h(4430)j(4430)l(4460). E(level): from (d,p). |
| 4539 20 | 3 ⁻ | | K | J ^π : L(α,α')=4; L(d,p)=2 for doublet. |
| 4604 12 | + | | GH | J ^π : L(d,p)=2 for 4494+4504 doublet. |
| 4606 20 | (5 ⁻) | | K | J ^π : L(d,p)=2 for 4494+4504 doublet. |
| 4640 12 | - | | G | J ^π : L=3 in (α,α'). |
| 4670 12 | + | | G | J ^π : L=3 in (d,p) for 5/2 ⁺ target. |
| 4720 10 | (2 ⁺ ,3 ⁺) | | G JK | J ^π : L(d,p)=2 for 5/2 ⁺ target. |
| 4785 10 | (2 ⁺ ,3 ⁺) | | Gh K | J ^π : L(d,p)=(0+4) for 5/2 ⁺ target. XREF: Others: AC, AG, AH |
| 4807 20 | (3 ⁻) | | h Kl | XREF: h(4788). J ^π : L(d,p)=(0+2+4) for 5/2 ⁺ target. |
| 4813 12 | | | Gh l | XREF: Others: AA, AC, AG, AH |
| 4821 12 | | | Gh kl | XREF: h(4788)l(4810). J ^π : L=(3) in (α,α'). XREF: Others: AA, AC, AG, AH |
| 4847 12 | (-) | | G k | XREF: h(4788)l(4810). J ^π : L(d,p)=(2+4) for 4813+4821 doublet. |
| 4894 12 | (+) | | G | XREF: Others: AA, AC, AD, AG, AH |
| 4928 10 | 5 ⁻ | | G K | XREF: h(4788)k(4837)l(4810). J ^π : L(d,p)=(2+4) for 4813+4821 doublet. |
| 4947.2 ^b 7 | (12 ⁺) | ≤3.5 ns | CD | XREF: Others: AC, AD, AG, AH |

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

⁹²Zr Levels (continued)

| E(level) [‡] | J ^π | T _{1/2} [#] | XREF | Comments |
|-------------------------|-----------------------------------|-------------------------------|-------|---|
| 4977 12 | | | G | J ^π : stretched (Q) γ to (10 ⁺). |
| 4982 12 | | | G | J ^π : L(d,p)=2 for 4977+4982 doublet. |
| 5012 11 | - | | G K | J ^π : L(d,p)=2 for 4977+4982 doublet. |
| 5040 13 | (⁻) | | G | J ^π : L(d,p)=3 for 5/2 ⁺ target. |
| 5056 20 | 4 ⁺ | | K | J ^π : L(d,p)=(3) for 5/2 ⁺ target. |
| 5067 13 | 2 ⁺ ,3 ⁺ | | G | J ^π : L=4 in (α,α'). |
| 5091 13 | ⁺ | | G | J ^π : L(d,p)=0+2 for 5/2 ⁺ target. |
| 5115 11 | (4) ⁺ | | G K N | J ^π : L(d,p)=2 for 5/2 ⁺ target. |
| 5197 13 | | | G | J ^π : L(p,t)=(4); L(d,p)=2 for 5/2 ⁺ target. |
| 5215 13 | | | G | |
| 5278 13 | | | Gh | XREF: Others: AB , AE , AF , AI |
| | | | | XREF: h(5269). |
| 5310 13 | (2 ⁺ ,3 ⁺) | | Gh | J ^π : L(d,p)=(2,3) for 5/2 ⁺ target. |
| | | | | XREF: Others: AB , AE , AF , AI |
| | | | | XREF: h(5269). |
| 5358 13 | - | | G | J ^π : L(d,p)=(0+2+4) for 5/2 ⁺ target. |
| 5455 20 | | | K | J ^π : L(d,p)=3 for 5/2 ⁺ target. |
| 5490 | (0 ⁺) | | l N | XREF: Others: AA , AE |
| | | | | XREF: l(5510). |
| | | | | J ^π : L(p,t)=(0). |
| 5537 20 | | | Kl | XREF: Others: AA , AE |
| | | | | XREF: l(5510). |
| 5581 20 | (2 ⁺) | | K | J ^π : L=(2) in (α,α'). |
| 5680 | (4 ⁺) | | N | J ^π : L(p,t)=(4). |
| 5685 20 | 3 ⁻ | | K | J ^π : L=3 in (α,α'). |
| 5885 20 | 3 ⁻ | | K V | J ^π : L(α,α')=3. |
| 6045.5 ^{@b} 12 | (14 ⁺) | | C | XREF: Others: AG , AI , AJ |
| | | | | J ^π : γ to (12 ⁺); suggested value from |
| | | | | (⁴⁸ Ca,4nγ). |
| 6056 | 3 ⁻ | | K | J ^π : L(α,α')=3. |
| 6125 20 | | | K | |
| 6187 | 3 ⁻ | | K | J ^π : L(α,α')=3. |
| 6240 | (4 ⁺) | | N | J ^π : L(p,t)=(4). |
| 6334 | 3 ⁻ | | K | J ^π : L(α,α')=3. |
| 6436 | 3 ⁻ | | K | J ^π : L(α,α')=3. |
| 6990 90 | | | | V |
| 7.0×10 ³ 4 | | | P | Possible low energy octupole resonance |
| | | | | (1981Ya02). Note: E(res)≈6.3 MeV from |
| | | | | (α,α') (1980ToZS). |
| 7.4×10 ³ 1 | | | | V |
| 7445.8 ^{@b} 16 | (16 ⁺) | | C | XREF: Others: AG , AI , AJ |
| | | | | J ^π : 1400γ to (14 ⁺) 6046 in (⁴⁸ Ca,4nγ); band |
| | | | | assignment. |
| 8039.1? [@] 19 | (17,18 ⁺) | 42 ps 14 | C | XREF: Others: AJ |
| | | | | J ^π : D,E2 593γ feeds (16 ⁺) 7446. (17 ⁻) |
| | | | | suggested in (⁴⁸ Ca,4nγ), but (18 ⁺) suggested |
| | | | | in (¹³ C,3nγ). |
| | | | | T _{1/2} : from recoil-distance data, |
| | | | | ⁴⁸ Ca(⁴⁸ Ca,4nγ). |
| (8634.82 8) | 2 ⁺ ^a | | F | E(level): thermal neutron capture state(s); not a |
| | | | | discrete level. |
| 8.8×10 ³ 2 | 1 ⁺ | 1.4 MeV 2 | J | M1 giant resonance. |

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

⁹²Zr Levels (continued)

| E(level) [‡] | J ^π | T _{1/2} [#] | XREF | Comments |
|-------------------------|---------------------------------|-------------------------------|----------|--|
| 9127.5 ^b 19 | (18 ⁺) | | | XREF: Others: AG |
| 9722.2 22 | (≤20) | | | J ^π : 1681γ to (16 ⁺) 7446. XREF: Others: AJ J ^π : 1683γ feeds (17,18 ⁺) 8039 level. (20 ⁺) suggested in (¹³ C,3nγ); |
| 13.2×10 ³ 1 | 2 ⁺ | 3.8 MeV 2 | | Z J ^π : E2 excitation in (e,e'). GQR. T=0. |
| 13.7×10 ³ 5 | 2 ⁺ & 4 ⁺ | | J | J ^π : L(p,p')=2+4. GMR including 13200, 2 ⁺ resonance seen in (e,e'). |
| 15.7×10 ³ 1 | 0 ⁺ | 4.0 MeV 2 | | Z J ^π : E0 excitation in (e,e'). Isoscalar giant monopole resonance. |
| 16.20×10 ³ 5 | 1 ⁻ | 4.68 MeV | | Z XREF: Others: AB Γ: from (γ,xn)+(γ,np). J ^π : E1 excitation in (γ,xn)+(γ,np). GDR. T=1. |
| 17.5×10 ³ 3 | 0 ⁺ & 4 ⁺ | 3.3 MeV | J | Γ: from (p,p'). J ^π : L(p,p')=0+4 giant multipole resonances. |
| 25.1×10 ³ 3 | 3 ⁻ | 6.3 MeV 3 | P | Z J ^π : E3 excitation in (e,e'). T=0. High energy isoscalar octupole giant resonance. |
| 28.1×10 ³ 3 | 2 ⁺ | 5.9 MeV 2 | | Z J ^π : E2 excitation in (e,e'). Isovector GQR. |

[†] State reported also in numerous ⁹²Zr inelastic scattering spectra. Evaluator believes these observations can be attributed largely, if not entirely, to a known 3⁻ ⁹⁰Zr state contributing in these experiments via the typical ≈3% ⁹⁰Zr target impurity. It is unclear whether excitation of the 4⁻ 2744 level via inelastic scattering is masked by the impurity or absent altogether.

[‡] From least-squares fit to adopted E_γ for levels deexcited by gammas, ignoring tentatively-placed lines and allowing 1 keV uncertainty in E_γ whenever no transition from a given level has an author-assigned uncertainty; from weighted average of data from cross-referenced reactions otherwise.

[#] Half-life from ⁸⁸Sr(⁷Li,2npγ) for E(level)<8500, width from (e,e') for E(level)≥8500, except as noted.

@ ΔE=3 keV if 1 keV is assumed for unknown ΔE(γ).

& From DSAM in (n,n'γ).

^a J^π=2⁺,3⁺ for thermal n capture on 5/2⁺ target. J^π=2⁺ is adopted because γγ(θ) data indicate very little, if any, mixing for 6295γ to 3⁻ state if J=2 but considerable mixing if J=3. Also, γ decay to both 0⁺ and 4⁺ levels is observed from the capture state.

^b Band(A): π=+ ΔJ=2 sequence. Yrast sequence built on 0⁺ g.s. (2002Fo03).

Adopted Levels, Gammas (continued)

| $\gamma(^{92}\text{Zr})$ | | | | | | | | | |
|--------------------------|----------------|------------------------|--------------------|---------|----------------|-----------|-------------------|-------------------|--|
| $E_i(\text{level})$ | J_i^π | E_γ^\dagger | I_γ^\dagger | E_f | J_f^π | Mult.‡ | δ^\ddagger | $I_{(\gamma+ce)}$ | Comments |
| 934.51 | 2 ⁺ | 934.47 4 | 100 | 0.0 | 0 ⁺ | E2 | | | B(E2)(W.u.)=6.4 6 E _γ : weighted average of 934.47 7 from β ⁻ decay, 934.44 10 from ε decay (10.15 d), 934.46 5 from (n,γ) E=thermal and 934.5 1 from (n,n'γ). Mult.: Q to 0 ⁺ , from γ(θ) in (⁷ Li,2npγ); Δπ=no from RUL. E2 confirmed by α(exp) in ⁹² Nb ε decay (10.15 d). |
| 1382.77 | 0 ⁺ | 448.26 7 | 100 | 934.51 | 2 ⁺ | E2 | | | B(E2)(W.u.)=14.4 5 E _γ : weighted average of 448.5 1 (from β ⁻ decay), 448.13 7, 448.22 10, 448.3 2 (all from (n,γ) E=thermal) and 448.3 1 (from (n,n'γ)). (the unweighted average is 448.29 6.). Mult.: mult=Q to 2 ⁺ , from γγ(θ) in ⁹² Y β ⁻ decay; not M2, from RUL. |
| | | 1383 | | 0.0 | 0 ⁺ | E0 | | 0.196 19 | I _(γ+ce) : from (p,p'γ). E0 transition strength ρ ² (E0)=0.0081 8 calculated by 1999Wo07. |
| 1495.46 | 4 ⁺ | 560.92 15 | 100 | 934.51 | 2 ⁺ | E2 | | | B(E2)(W.u.)=4.05 12 E _γ : weighted average of 561.1 1 from β ⁻ decay and (n,n'γ), 561.0 2 from (⁷ Li,2npγ) and 560.93 5 from (n,γ) E=thermal. Mult.: mult=Q from γ(θ) in (⁷ Li,2npγ); not M2 from RUL. δ(Q,O)=+0.04 2 from (n,n'γ), +0.01 +11-9 or +1.6 +4-3 from γγ(θ) in ⁹² Y β ⁻ decay. B(M3)(W.u.) exceeds RUL, unless δ<0.00033. |
| 1847.27 | 2 ⁺ | 912.72 6 | 100.0 23 | 934.51 | 2 ⁺ | (M1(+E2)) | -0.002 25 | | B(M1)(W.u.)=0.201 22; B(E2)(W.u.)=0.001 +25-1 I _γ : from (n,n'γ). Mult.: mult=D(+Q) from ⁹² Nb(10.15 d) ε decay; Δπ=no from level scheme. δ: unweighted average of -0.04 2 in (n,n'γ), and -0.01 3 and +0.044 17 from ε decay (10.15 d). |
| | | 1847.27 5 | 51 3 | 0.0 | 0 ⁺ | E2 | | | B(E2)(W.u.)=3.7 5 E _γ : weighted average of 1847.3 1, 1847.5 3, 1847.27 9 and 1847.2 1 from β ⁻ decay, ε decay (10.15 d), (n,γ) E=thermal and (n,n'γ), respectively. I _γ : unweighted average of 58 4, 47.8 22, 52 8 and 44.6 23 from β ⁻ decay, ε decay (10.15 d), (n,γ) E=thermal and (n,n'γ), respectively (weighted average is 47.9 25). |
| 2066.65 | 2 ⁺ | 219.07 ^b 15 | 0.64 10 | 1847.27 | 2 ⁺ | | | | I _γ : weighted average of 0.61 12 from (n,n'γ), 0.71 20 from (n,γ) E=thermal. |
| | | 571.28 15 | 0.60 20 | 1495.46 | 4 ⁺ | | | | |
| | | 1132.12 5 | 100 3 | 934.51 | 2 ⁺ | (M1+E2) | -3.2 +5-4 | | B(M1)(W.u.)<0.0022; B(E2)(W.u.)<15 E _γ : weighted average of 1132.17 14, 1132.11 6 and 1132.1 1 |

Adopted Levels, Gammas (continued)

$\gamma(^{92}\text{Zr})$ (continued)

| <u>$E_i(\text{level})$</u> | <u>J_i^π</u> | <u>E_γ^\dagger</u> | <u>I_γ^\dagger</u> | <u>E_f</u> | <u>J_f^π</u> | <u>Mult.[‡]</u> | <u>δ^\ddagger</u> | <u>α^a</u> | <u>Comments</u> |
|---------------------------------------|-----------------------------|--------------------------------------|--------------------------------------|-------------------------|-----------------------------|--------------------------|-------------------------------------|------------------------------|---|
| 2066.65 | 2 ⁺ | 2066.7 [@] 4 | 0.53 [@] 7 | 0.0 | 0 ⁺ | E2 | | | from ε decay, (n, γ) E=thermal and (n,n' γ), respectively. Other E_γ : 1132.4 1 from β^- decay. Mult.: D+Q from $\gamma\gamma(\theta)$ in (n, γ) and (n,n' γ); adopted $\Delta\pi$ =no. δ : from $\delta=-3.2 +5-4$ or $+0.85$ 7 from 2005Fr17 in (n,n' γ) and $-2.7 +8-15$ from (n, γ) E=thermal. Other δ : $-2.4 +3-4$ or -1.04 11 (1978GI04) in (n,n' γ). B(E2)(W.u.)<0.0042 Mult., δ : Q ($\delta=0$) from $\gamma(\theta)$ in (n,n' γ); not M2 from RUL. |
| 2339.66 | 3 ⁻ | 272.85 ^b 24 | | 2066.65 | 2 ⁺ | | | | E_γ, I_γ : E_γ from (n, γ) E=thermal. Branch absent in β^- decay and (n,n' γ) and one (n, γ) E=thermal study, and I_γ data from the two (n, γ) E=thermal studies that report it are discrepant. B(E1)(W.u.)=0.00067; B(M2)(W.u.) \leq 1.3 I_γ : unweighted average of 11.7 7 from (n,n' γ), 10.6 9 from (n, γ) E=thermal and 10.1 6 from β^- decay. Weighted average is 10.7 5. Mult.: D(+Q) from $\gamma(\theta)$ in (n,n' γ), $\Delta\pi$ =yes from level scheme. δ : $+0.01$ 3 from (n,n' γ); however, B(M2)(W.u.) exceeds RUL, unless δ <0.009. |
| | | 492.37 10 | 10.8 5 | 1847.27 | 2 ⁺ | (E1(+M2)) | \leq 0.009 | | B(E1)(W.u.) \geq 0.00036; B(M2)(W.u.) \leq 1.2 Mult.: D+Q from $\gamma(\theta)$ in (n,n' γ), $\Delta\pi$ =yes from level scheme. δ : $+0.13$ 4 (1978GI04) from (n,n' γ); however, B(M2)(W.u.) exceeds RUL, unless δ <0.02. |
| | | 844.12 6 | 29.9 19 | 1495.46 | 4 ⁺ | (E1+M2) | \leq 0.02 | | I_γ : unweighted average of 32.3 18 from (n,n' γ), 31.1 22 from (n, γ) E=thermal and 26.2 17 from β^- decay. Weighted average is 29.6 20. B(E1)(W.u.)=0.00030 4 I_γ : weighted average from (n,n' γ), (n, γ) E=thermal and β^- decay. Mult.: mult=D(+Q) from $\gamma\gamma(\theta)$ in (n, γ), ^{92}Y β^- decay, and from $\gamma(\theta)$ in (n,n' γ); adopted $\Delta\pi$ =yes. δ : $-0.019 +21-20$ from $\gamma\gamma(\theta)$ in ^{92}Y β^- decay. Others: $+0.03$ 2 from $\gamma(\theta)$ in (n,n' γ); evaluator rejects value of $+0.18 +20-15$ from $\gamma\gamma(\theta)$ in (n, γ). B(M2)(W.u.) exceeds RUL, unless δ <0.04. |
| | | 1405.06 5 | 100 4 | 934.51 | 2 ⁺ | (E1) | | | B(E3)(W.u.)=18.3 11 E_γ, I_γ : from β^- decay. Other E_γ (I_γ): 2339.4 22 (0.4 7) in (n, γ) E=thermal. Mult.: from form factor in (e,e'). B(E3)(W.u.): from (e,e'). However, B(E3)(W.u.)=48 13 from adopted $T_{1/2}$ and branching=0.30 7 from β^- decay; a branch of 0.11 would be required to reduce this B(E3)(W.u.) to the value obtained in (e,e'), suggesting branching may be overestimated in β^- decay. |
| | | 2339.9 1 | \approx 0.11 | 0.0 | 0 ⁺ | E3 | | 0.00049 | |

Adopted Levels, Gammas (continued)

$\gamma(^{92}\text{Zr})$ (continued)

| $E_i(\text{level})$ | J_i^π | E_γ^\dagger | I_γ^\dagger | E_f | J_f^π | Mult. [‡] | δ^\ddagger | α^a | Comments |
|---------------------|----------------|-----------------------|--------------------|---------|----------------|--------------------|-------------------|------------|--|
| 2398.36 | 4 ⁺ | 902.92 7 | 100.0 21 | 1495.46 | 4 ⁺ | M1+E2 | -0.11 +3-2 | | B(M1)(W.u.)=0.147 17; B(E2)(W.u.)=2.3 13 I _γ : weighted average from (n,n'γ) and (n,γ) E=thermal. Other δ: +1.30 +13-30 or -0.13 9 from (n,n'γ). B(E2)(W.u.)=5.9 7 B(E2)(W.u.): if δ=0; see comment on δ. I _γ : weighted average of 35.9 23 from (n,n'γ) and 27 7 from (n,γ) E=thermal. δ: -0.13 +5-6 (2005Fr17) in (n,n'γ). However, B(M3)(W.u.) violates RUL, unless δ<0.0007. Other δ: -0.13 +9-5 (1978GI04) from (n,n'γ). |
| | | 1463.81 10 | 35 3 | 934.51 | 2 ⁺ | E2(+M3) | | | |
| 2473.4? | (≤2) | 2473.6 ^b 2 | 100 | 0.0 | 0 ⁺ | | | | |
| 2486.01 | 5 ⁻ | 990.52 9 | 100 | 1495.46 | 4 ⁺ | (E1) | | | B(E1)(W.u.)≥9.8×10 ⁻⁸ May also deexcite the 3057 level. Mult.: mult=D or D(+Q) to 4 ⁺ , from γ(θ) in (⁷ Li,2npγ) and (n,n'γ), respectively; Δπ=yes from level scheme. δ: +0.04 (1978GI04) in (n,n'γ). |
| 2743.55 | 4 ⁻ | 257.57 10 | 90 5 | 2486.01 | 5 ⁻ | (M1(+E2)) | -0.01 +2-3 | 0.01624 | B(M1)(W.u.)<0.30 B(M1)(W.u.): if δ=0. I _γ : from (n,n'γ). 72 7 from (n,γ) E=thermal if I(404γ)=57. Mult.: D(+Q) from (n,n'γ); Δπ=no from level scheme. Other δ(D,Q)=+0.09 +8-5 or ≤-22.9 from (n,n'γ). I _γ : from (n,γ) E=thermal branching renormalized so I(404γ)=57. B(M1)(W.u.)<0.028; B(E2)(W.u.)<0.57 I _γ : from (n,n'γ). Mult.: D(+Q) from (n,n'γ); Δπ=no from level scheme. Other δ: 0.00 4 or -7 +2-16 from 1978GI04 in (n,n'γ). B(E1)(W.u.)<2.5×10 ⁻⁵ ; B(M2)(W.u.)<0.20 I _γ : from (n,n'γ). Mult.: D(+Q) from (n,n'γ); Δπ=yes from level scheme. Other δ: -0.13 4 from 1978GI04 in (n,n'γ). |
| | | 344.8 3 | 4.0 16 | 2398.36 | 4 ⁺ | | | | |
| | | 403.83 9 | 57 3 | 2339.66 | 3 ⁻ | (M1(+E2)) | +0.04 2 | | |
| | | 1248.00 11 | 100 5 | 1495.46 | 4 ⁺ | (E1(+M2)) | +0.02 +6-4 | | |
| 2819.54 | 2 ⁺ | 972.30 9 | 100 4 | 1847.27 | 2 ⁺ | (M1(+E2)) | +0.01 2 | | B(M1)(W.u.)=0.196 24; B(E2)(W.u.)=0.022 +87-22 I _γ : weighted average from β ⁻ decay, (n,n'γ) and (n,γ) E=thermal. Mult.: from γ(θ) in (n,n'γ), assuming Δπ from level scheme. δ: +2.3 +2-1 also possible, but less likely (2005Fr17) in (n,n'γ). Other δ: -0.18 4 or +4.5 +12-8 from 1978GI04 in (n,n'γ). |
| | | 1436.2 ^b 6 | 4.7 21 | 1382.77 | 0 ⁺ | | | | |
| | | 1885.00 12 | 38.7 23 | 934.51 | 2 ⁺ | (M1+E2) | | | I _γ : unweighted average of 34.2 19 from (n,n'γ), 41 4 from from (n,γ) E=thermal and 41 5 from β ⁻ decay. Weighted average is 36.0 21. Mult.: D+Q from γ(θ) in (n,n'γ), Δπ=no from level scheme. δ: -0.14 4 or +3.7 +7-5 from (n,n'γ). |

Adopted Levels, Gammas (continued)

$\gamma(^{92}\text{Zr})$ (continued)

| $E_i(\text{level})$ | J_i^π | E_γ^\dagger | I_γ^\dagger | E_f | J_f^π | Mult. [‡] | δ^\ddagger | Comments |
|---------------------|----------------|--------------------|--------------------|---------|----------------|--------------------|-------------------|--|
| 2819.54 | 2 ⁺ | 2819.8 3 | 4.6 4 | 0.0 | 0 ⁺ | E2 | | B(E2)(W.u.)=0.048 7 E _γ : from β ⁻ decay. Other: 2819.3 7 from (n,n'γ). |
| 2864.66 | 4 ⁺ | 465.94 21 | 10.6 17 | 2398.36 | 4 ⁺ | (M1(+E2)) | -0.01 +15-13 | I _γ : weighted average of 4.5 4 from (n,n'γ) and 6.1 18 from β ⁻ decay. B(M1)(W.u.)=0.068 15; B(E2)(W.u.)=0.03 +99-3 I _γ : weighted average of 11.1 10 from (n,n'γ) and 8.0 22 from (n,γ) E=thermal. |
| | | 1369.25 10 | 100 4 | 1495.46 | 4 ⁺ | M1+E2 | -0.49 5 | Mult.: D(+Q) from (n,n'γ); Δπ=no from level scheme. B(M1)(W.u.)=0.021 3; B(E2)(W.u.)=2.7 6 I _γ : weighted average of 100 5 from (n,n'γ) and 100 5 from (n,γ) E=thermal. |
| | | 1930.13 18 | 30 4 | 934.51 | 2 ⁺ | E2(+M3) | -0.02 4 | B(E2)(W.u.)=0.76 15 I _γ : unweighted average of 26.7 17 from (n,n'γ) and 34 3 from (n,γ) E=thermal. Other δ(Q,O)=+0.32 +19-28 or ≥+3.73 (1978GI04) for 1928.7γ in (n,n'γ). |
| 2904.08 | 0 ⁺ | 837.4 @ 2 | 100 @ 5 | 2066.65 | 2 ⁺ | | | Other E _γ : 836.8 2 from (n,γ) E=thermal. |
| 2909.43 | 3 ⁺ | 1969.6 @ 3 | 44 @ 5 | 934.51 | 2 ⁺ | E2 | | B(E2)(W.u.)=0.28 +9-20 |
| | | 569.47 17 | 3.9 11 | 2339.66 | 3 ⁻ | | | E _γ , I _γ : From (n,γ); alternative placement in (n,n'γ) not adopted. |
| | | 842.69 15 | 32 4 | 2066.65 | 2 ⁺ | M1+E2 | -0.25 +7-9 | B(M1)(W.u.)=0.026 5; B(E2)(W.u.)=2.4 14 |
| | | 1414.01 11 | 60 4 | 1495.46 | 4 ⁺ | M1+E2 | | δ: -0.50 +6-7 or -1.49 +16-14 from (n,n'γ). |
| | | 1974.93 10 | 100 17 | 934.51 | 2 ⁺ | M1+E2 | +0.13 +0-4 | B(M1)(W.u.)=0.0066 15; B(E2)(W.u.)=0.030 7 |
| 2957.4 | 6 ⁺ | 471.3 &b | | 2486.01 | 5 ⁻ | | | |
| | | 559.6 &b | | 2398.36 | 4 ⁺ | | | |
| | | 1461.93 26 | 100 | 1495.46 | 4 ⁺ | (E2) | | B(E2)(W.u.)≥0.00098 E _γ : weighted average of 1461.8 3 in (n,γ) E=thermal and 1462.3 5 from (⁷ Li,2npγ). Mult.: mult=(Q) from γ(θ) in (⁷ Li,2npγ); (6) ⁺ to 4 ⁺ transition. |
| 3039.70 | 3 | 295.77 19 | 4.2 8 | 2743.55 | 4 ⁻ | | | |
| | | 700.10 9 | 23.8 21 | 2339.66 | 3 ⁻ | D(+Q) | +0.08 10 | |
| | | 1192.49 27 | 4.6 12 | 1847.27 | 2 ⁺ | D(+Q) | +0.02 +3-2 | |
| | | 2105.18 8 | 100 7 | 934.51 | 2 ⁺ | D(+Q) | -0.04 +4-9 | δ: if J=3. Other δ: -1.6 +5-8 if J(3039 level)=2 from (n,n'γ). |
| 3057.40 | 2 ⁺ | 717.9 @ 2 | 31.5 @ 19 | 2339.66 | 3 ⁻ | D(+Q) | -0.03 7 | Other E _γ : 717.7 3 from (n,γ) E=thermal. Mult.: D(+Q) from γ(θ) in (n,n'γ); Δπ=no from level scheme. δ: from 2005Fr17; other δ: +0.41 +17-14 or +4.5 +31-18 (1978GI04); all δ from (n,n'γ). |
| | | 990.5 @ 2 | ≈100 @ | 2066.65 | 2 ⁺ | | | Doubly placed in (n,n'γ); also deexcites 2486 level. |
| | | 1674.9 @ 5 | 6.7 @ 5 | 1382.77 | 0 ⁺ | E2 | | B(E2)(W.u.)=0.64 20 |
| | | 2123.0 @ 3 | 39.1 @ 21 | 934.51 | 2 ⁺ | M1+E2 | +0.69 16 | B(M1)(W.u.)=0.0034 11; B(E2)(W.u.)=0.37 16 |
| | | 3057.2 @ 5 | 8.2 @ 7 | 0.0 | 0 ⁺ | E2 | | B(E2)(W.u.)=0.039 12 |

Adopted Levels, Gammas (continued)

$\gamma(^{92}\text{Zr})$ (continued)

| $E_i(\text{level})$ | J_i^π | E_γ^\dagger | I_γ^\dagger | E_f | J_f^π | Mult. [‡] | δ^\ddagger | Comments |
|---------------------|--------------------------------|------------------------|--------------------|---------|----------------|--------------------|-------------------|---|
| 3124.61 | 1 ⁽⁺⁾ | 1057.97 10 | 49 3 | 2066.65 | 2 ⁺ | D(+Q) | | E_γ : from (n, γ) E=thermal. Other E_γ : 1058.0 3 from (n,n' γ). I_γ : from (n,n' γ). δ : -3.1 +15-59 or -0.02 20 from (n,n' γ). |
| | | 1741.6@ 3 | 100@ 5 | 1382.77 | 0 ⁺ | D | | E_γ matches that for γ placed from possible 3237 level in (n, γ) E=thermal. Additional information 1. |
| | | 2190.3@ 5 | 27.3@ 17 | 934.51 | 2 ⁺ | | | |
| | | 3124.5@ 5 | 31.4@ 18 | 0.0 | 0 ⁺ | D | | |
| 3178.31 | 4 ⁺ | 779.94 10 | 100.0 15 | 2398.36 | 4 ⁺ | M1(+E2) | -0.04 4 | B(M1)(W.u.)=0.68 8; B(E2)(W.u.)=1.9 +38-19 I_γ : from (n,n' γ). Mult.: D+Q from (n,n' γ); $\Delta\pi$ =no from level scheme. |
| | | 2243.80 26 | 25.8 15 | 934.51 | 2 ⁺ | E2(+M3) | +0.06 +10-9 | B(E2)(W.u.)=1.53 20 I_γ : from (n,n' γ); 27 4 from (n, γ) E=thermal. |
| 3190.99 | (4 ⁻) | 1695.5 2 | 100 | 1495.46 | 4 ⁺ | D(+Q) | -0.02 +4-3 | Other δ : -0.09 13 (1978GI04), also from (n,n' γ). |
| 3236.9 | 4 ⁺ | 1741.8 ^b 2 | 100 | 1495.46 | 4 ⁺ | D+Q | -1.09 +9-10 | Placement may Be questionable; see comment on 1742 γ from 3125 level. |
| 3262.62 | 2 ⁺ | 2328.17 13 | 100.0 17 | 934.51 | 2 ⁺ | (M1+E2) | -0.06 3 | B(M1)(W.u.)=0.108 13; B(E2)(W.u.)=0.07 +8-7 I_γ : from (n,n' γ). Mult.: D+Q from $\gamma(\theta)$ in (n,n' γ); $\Delta\pi$ =no from level scheme. δ : from (2005Fr17); other δ : -0.27 +9-5 (1978GI04); both from (n,n' γ). B(E2)(W.u.)=1.13 15 I_γ : from (n,n' γ). Mult.: Q from (γ,γ'); not M2 from RUL. |
| | | 3262.54 4 | 29.3 17 | 0.0 | 0 ⁺ | E2 | | |
| 3275.76 | 2 ⁺ ,3 ⁺ | 366.62 ^b 19 | 8.3 17 | 2909.43 | 3 ⁺ | | | Uncertain γ in (n, γ), absent in (n,n' γ) so may be misplaced. |
| | | 877.45 10 | 23.1 15 | 2398.36 | 4 ⁺ | D,Q | | I_γ : from (n,n' γ). Other: 29 6 from (n, γ) E=thermal. δ : >+10 or +0.08 +4-5 from (n,n' γ). δ : +0.13 +0-4 if J=3, ∞ or -0.52 +11- ∞ if J=2 from (n,n' γ). Branch is absent in (n, γ) E=thermal. |
| | | 1209.22 10 | 100 6 | 2066.65 | 2 ⁺ | Q(+D) | | |
| | | 1428.7@ 5 | 4.2@ 5 | 1847.27 | 2 ⁺ | | | |
| | | 2340.90 16 | 45 4 | 934.51 | 2 ⁺ | M1+E2 | +4.4 +8-5 | B(M1)(W.u.)=0.00040 15; B(E2)(W.u.)=1.46 22 |
| 3289.13 | 3 ⁺ | 379.60 10 | 78 4 | 2909.43 | 3 ⁺ | D(+Q) | | I_γ : from (n,n' γ). Other I_γ : 55 12 in (n, γ) E=thermal. δ : +0.02 6 or +1.5 2 from (n,n' γ). |
| | | 891.0 4 | 5 3 | 2398.36 | 4 ⁺ | | | |
| | | 1222.47 9 | 93 5 | 2066.65 | 2 ⁺ | M1+E2 | | I_γ : from (n,n' γ). Data from (n, γ) E=thermal are discrepant. δ : +0.68 +9-7 or +2.3 4 from (n,n' γ). B(M1)(W.u.)=0.0031 5; B(E2)(W.u.)=0.09 4 |
| | | 1441.2 3 | 26.4 18 | 1847.27 | 2 ⁺ | M1+E2 | +0.24 5 | E_γ : weighted average of 1441.6 5 from (n,n' γ) and 1441.0 4 from (n, γ) E=thermal. |
| | | 1793.87 23 | 33.8 26 | 1495.46 | 4 ⁺ | M1+E2 | +0.22 5 | I_γ : from (n,n' γ). Other: 12 3 from (n, γ) E=thermal. B(M1)(W.u.)=0.0021 3; B(E2)(W.u.)=0.033 15 I_γ : weighted average of 35.2 22 from (n,n' γ) and 29 4 from (n, γ) E=thermal. |

Adopted Levels, Gammas (continued)

$\gamma(^{92}\text{Zr})$ (continued)

| $E_i(\text{level})$ | J_i^π | E_γ^\dagger | I_γ^\dagger | E_f | J_f^π | Mult. [‡] | δ^\ddagger | α^a | Comments |
|---------------------|--------------------------------|--|------------------------|-------------------------------|--|--------------------|-------------------|------------|---|
| 3289.13 | 3 ⁺ | 2354.80 13 | 100 9 | 934.51 | 2 ⁺ | M1+E2 | +0.29 3 | | B(M1)(W.u.)=0.0027 4; B(E2)(W.u.)=0.042 10 |
| 3308.7 | (8 ⁺) | 351.3 2 | 100 | 2957.4 | 6 ⁺ | E2 | | 0.01276 | B(E2)(W.u.)=3.59 22 Mult.: Q from $\gamma(\theta)$ in (⁷ Li,2np γ); not M2, from RUL. |
| 3371.48 | 1 ⁽⁻⁾ | 1032.0 3 1988.71 10 | 2.8 7 100 13 | 2339.66 1382.77 | 3 ⁻ 0 ⁺ | (E1) | | | B(E1)(W.u.)=0.00079 15 Mult.: D from $\gamma(\theta)$ in (n,n' γ); $\Delta\pi$ from level scheme. I γ : average of 43.1 26 from (n,n' γ) and 47.0 26 from (n, γ) E=thermal. Mult.: D(+Q) from $\gamma(\theta)$ in (n,n' γ), $\Delta\pi$ =yes from level scheme. δ : +0.11 18 or -5 +3-27 from (n,n' γ). B(E1)(W.u.)=8.2 \times 10 ⁻⁵ 14 I γ : unweighted average of 43 3 from (n,n' γ), 60 7 from (n, γ) E=thermal, 50 7 from β^- decay. (weighted average is 46 4.). Mult.: D from (γ,γ'); $\Delta\pi$ from level scheme. E γ : from ¹⁷³ Yb(²⁴ Mg,F γ) ⁹² Zr. |
| | | 2436.92 10 | 45.1 20 | 934.51 | 2 ⁺ | (E1+(M2)) | | | |
| | | 3371.2 3 | 51 5 | 0.0 | 0 ⁺ | (E1) | | | |
| 3379.8 | (7 ⁻) | 893.8 | 100 | 2486.01 | 5 ⁻ | | | | |
| 3407.83 | 2 ⁻ ,3 ⁻ | 1068.2@ 2 | 100@ 4 | 2339.66 | 3 ⁻ | M1+E2 | | | δ : +5.8 21 or +0.36 +6-5 if J=2 from (n,n' γ). Other δ : +1.2 +7-5 if J=2, -1.7 +7-28 if J=3, -0.13 4 if J=4 from $\gamma(\theta)$ in (n,n' γ). B(E1)(W.u.)=3.1 \times 10 ⁻⁵ 5; B(M2)(W.u.)=0.15 +22-15 Other E γ (I γ): 2473.6 2 (159 19) from (n, γ) E=thermal. Mult.: D(+Q) from (n,n' γ); $\Delta\pi$ =yes from level scheme. |
| | | 2473.2@ 3 | 73@ 4 | 934.51 | 2 ⁺ | (E1+(M2)) | +0.08 6 | | |
| 3452.17 | (2) ⁺ | 632.12 ^b 24 1112.65 22 1604.86 10 | 7.7 19 21.7 90 4 | 2819.54 2339.66 1847.27 | 2 ⁺ 3 ⁻ 2 ⁺ | M1+E2 [#] | -1.5 +5-8 | | I γ : from (n,n' γ). Other I γ : 23 8 from (n, γ) E=thermal. B(M1)(W.u.)=0.008 4; B(E2)(W.u.)=7.4 18 I γ : weighted average of 86 6 from (n, γ) E=thermal and 92 5 from (n,n' γ). Other I γ : 36 3 from (n,n' γ). |
| | | 1956.60 12 2069.5 4 2517.73 11 | 67 6 16 5 100 4 | 1495.46 1382.77 934.51 | 4 ⁺ 0 ⁺ 2 ⁺ | M1+E2 | +2.0 12 | | B(M1)(W.u.)=0.0016 16; B(E2)(W.u.)=1.0 3 I γ : from (n,n' γ). B(E2)(W.u.)=0.41 +6-7 B(E2)(W.u.): if pure E2. δ : +0.11 10 from (n,n' γ); B(M3)(W.u.) exceeds RUL, unless $\delta\leq 0.005$. Other I γ : 24 5 from (n, γ) E=thermal. |
| 3463.04 | (4) ⁺ | 1967.53 15 2528.7@ 5 | 100.0 23 33.8@ 23 | 1495.46 934.51 | 4 ⁺ 2 ⁺ | E2+(M3) | \leq +0.005 | | |
| 3471.88 | 1 ⁺ | 2089.6@ 5 2537.1 2 | 17.9@ 14 39.2 23 | 1382.77 934.51 | 0 ⁺ 2 ⁺ | (M1) M1 | | | B(M1)(W.u.)=0.052 8 Mult.: D from $\gamma(\theta)$ in (n,n' γ); $\Delta\pi$ =no from level scheme. B(M1)(W.u.)=0.063 9 I γ : from (n,n' γ); 37 3 from (n, γ) E=thermal. δ : 0.0 3 or -3.4 +17-280 from (n,n' γ); M1 from (pol γ,γ'). |

Adopted Levels, Gammas (continued)

$\gamma(^{92}\text{Zr})$ (continued)

| $E_i(\text{level})$ | J_i^π | E_γ^\dagger | I_γ^\dagger | E_f | J_f^π | Mult. [‡] | δ^\ddagger | Comments |
|---------------------|-------------------|---|---|--|---|-------------------------|-------------------|---|
| 3471.88 | 1 ⁺ | 3471.9 @ 5 | 100 @ 5 | 0.0 | 0 ⁺ | M1 | | B(M1)(W.u.)=0.063 9 Other E_γ (I_γ): 3472.6 3 (100 16) from (n, γ) E=thermal. Mult.: from (pol γ, γ'); confirmed by $\gamma(\theta)$ in (n,n' γ). |
| 3499.88 | 2 ⁺ | 224.7 3 590.67 22 680.65 21 1159.54 16 | 3.6 12 10.8 24 9.6 24 22.4 18 | 3275.76 2909.43 2819.54 2339.66 | 2 ⁺ ,3 ⁺ 3 ⁺ 2 ⁺ 3 ⁻ | (E1(+M2)) | -0.04 15 | B(E1)(W.u.)=0.00038 5; B(M2)(W.u.)=2.1 +155-21 I_γ : from (n,n' γ). Other: 30 4 from (n, γ) E=thermal. Mult.: D(+Q) from $\gamma(\theta)$ in (n,n' γ); $\Delta\pi$ =yes from level scheme. Other E_γ (I_γ): 1433.9 3 (51 12) from (n, γ) E=thermal. Other E_γ (I_γ): 1652.79 13 (69 6) from (n, γ) E=thermal. δ : -0.11 +3-5 or +3.3 +6-4. Branch is absent in (n, γ) E=thermal. δ : -0.62 +16-27 or -7 +3-57. B(E2)(W.u.)=0.35 4 Other E_γ (I_γ): 3500.8 6 (100 25) from (n, γ) E=thermal. |
| 3609.5 | (0 ⁺) | 1762.3 @ 5 2674.8 @ 5 | 29 @ 4 100 @ 4 | 1847.27 934.51 | 2 ⁺ 2 ⁺ | | | |
| 3628.33 | (4 ⁺) | 588.32 24 808.67 22 884.74 11 1229.81 22 2132.90 11 2693.86 12 | 1.6 4 2.9 4 17.5 17 3.6 7 25.8 25 100 11 | 3039.70 3 2819.54 2 ⁺ 2743.55 4 ⁻ 2398.36 4 ⁺ 1495.46 4 ⁺ 934.51 2 ⁺ | 3 2 ⁺ 4 ⁻ 4 ⁺ 4 ⁺ 2 ⁺ | | | |
| 3638.2 | 1 ⁻ | 2255.4 @ 3 3638.0 @ 5 | 14.1 @ 16 100.0 @ 16 | 1382.77 0.0 | 0 ⁺ 0 ⁺ | (E1) E1 | | B(E1)(W.u.)=0.00043 8 Mult.: D from $\gamma(\theta)$ in (n,n' γ); $\Delta\pi$ =yes from level scheme. B(E1)(W.u.)=0.00072 10 Mult.: from (pol γ, γ'). |
| 3640.28 | (2 ⁺) | 601.1 ^b 3 821.0 3 1301.0 5 2705.76 12 | 3.3 13 4.0 13 9 3 100 15 | 3039.70 3 2819.54 2 ⁺ 2339.66 3 ⁻ 934.51 2 ⁺ | 3 2 ⁺ 3 ⁻ 2 ⁺ | M1+E2 | | I_γ : from (n,n' γ). I_γ : 100.0 26 from (n,n' γ). δ : +3.5 4 or -0.12 +3-4 from (n,n' γ). |
| 3649.22 | 3 ⁺ | 1162.7 3 1251.16 18 1800.74 ^b 27 2153.68 18 | 35 8 52 4 26 4 100 7 | 2486.01 2398.36 1847.27 1495.46 | 5 ⁻ 4 ⁺ 2 ⁺ 4 ⁺ | M1+E2 D(+Q) M1+E2 | | I_γ : weighted average of 56 6 from (n, γ) E=thermal and 50 5 from (n,n' γ). δ (D,Q)=+12 +52-6 or +0.22 +7-8 from (n,n' γ). I_γ : from (n,n' γ); 43 11 from (n, γ) E=thermal. δ (D,Q)=-3.8 +9-14 or -0.08 8 from (n,n' γ). I_γ : from (n,n' γ); 100 11 from (n, γ) E=thermal. δ (D,Q)=-3.9 +7-9 or -0.12 4 from (n,n' γ). |

Adopted Levels, Gammas (continued)

| $\gamma(^{92}\text{Zr})$ (continued) | | | | | | | | |
|--------------------------------------|--|----------------------|--------------------|---------|-----------------------------------|--------------------|-------------------|---|
| $E_i(\text{level})$ | J_i^π | E_γ^\dagger | I_γ^\dagger | E_f | J_f^π | Mult. [‡] | δ^\ddagger | Comments |
| 3649.22 | 3 ⁺ | 2714.1 4 | 73 5 | 934.51 | 2 ⁺ | M1+E2 | -0.73 +12-18 | B(M1)(W.u.)=0.0038 10; B(E2)(W.u.)=0.28 9 I _γ : from (n,n'γ); 97 16 from (n,γ) E=thermal. |
| 3667.1 | 1 | 3667 | 100 | 0.0 | 0 ⁺ | D | | E _γ : from level-energy difference. Mult.: from (γ,γ'); if M1, B(M1)(W.u.)=0.0037 6 (2002We15 in (γ,γ')). |
| 3675.8 | 3 ⁺ ,4 ⁺ ,5 ⁺ | 2180.3 @ 4 | 100 @ | 1495.46 | 4 ⁺ | M1+E2 | +3.6 +6-5 | B(M1)(W.u.)=0.0013 5; B(E2)(W.u.)=3.7 +7-8 Mult.: D+Q from γ(θ) in (n,n'γ); Δπ=no from RUL. |
| 3696.8 | 1 ⁽⁺⁾ | 2762.3 @ 4 | 99 @ 7 | 934.51 | 2 ⁺ | (M1+E2) | +1.3 +28-8 | B(M1)(W.u.)=0.011 +31-11; B(E2)(W.u.)=3 +5-3 Mult.: D+Q from γ(θ) in (n,n'γ); Δπ=(no) from RUL. |
| | | 3696.5 @ 7 | 100 @ 7 | 0.0 | 0 ⁺ | (M1) | | B(M1)(W.u.)=0.0127 24 Mult.: D from (γ,γ'); Δπ=no from level scheme. |
| 3774.6 | (1,2 ⁺) | 1708.1 @ 5 | 49 @ 10 | 2066.65 | 2 ⁺ | | | |
| | | 1927.1 @ 5 | 35 @ 7 | 1847.27 | 2 ⁺ | | | |
| | | 2839.9 @ 5 | 100 @ 20 | 934.51 | 2 ⁺ | | | |
| | | 3774.6 @ 8 | 46 @ 9 | 0.0 | 0 ⁺ | | | Mult.: not M2 from RUL. |
| 3804.7 | (≤4) | 2870.1 @ 5 | 100 @ | 934.51 | 2 ⁺ | | | |
| 3819.4 | (8 ⁻) | 439.6 5 | 100 | 3379.8 | (7 ⁻) | D | | Mult.: from γ(θ) in (⁷ Li,2npy). |
| 3830.31 | (1 ⁻ ,2 ⁺) | 378.21 16 | 38 6 | 3452.17 | (2 ⁺) | | | |
| | | 790.70 11 | 75 15 | 3039.70 | 3 | | | |
| | | 1490.7 3 | 92 18 | 2339.66 | 3 ⁻ | | | I _γ : from (n,n'γ). |
| | | 1763.39 18 | 58 6 | 2066.65 | 2 ⁺ | | | |
| | | 2447.3 3 | 34 6 | 1382.77 | 0 ⁺ | | | |
| | | 2895.1 @ 10 | 100 @ 18 | 934.51 | 2 ⁺ | | | |
| 3915 | 1 | 3915 | 100 | 0.0 | 0 ⁺ | D | | E _γ : from level-energy difference. Mult.: from (γ,γ'); if M1, B(M1)(W.u.)=0.022 3 (2002We15 in (γ,γ')). |
| 3998.7? | (9 ⁻) | 179.4 ^b 5 | 57 6 | 3819.4 | (8 ⁻) | D | | Mult.: from γ(θ) in (⁷ Li,2npy). |
| | | 618.8 ^b | ≈100 | 3379.8 | (7 ⁻) | | | E _γ : from ¹⁷³ Yb(²⁴ Mg,Fγ) ⁹² Zr. |
| 4296.6 | (10 ⁺) | 987.9 2 | 100 | 3308.7 | (8 ⁺) | (Q) | | Mult.: from γ(θ) in (⁷ Li,2npy). |
| 4947.2 | (12 ⁺) | 650.6 5 | 100 | 4296.6 | (10 ⁺) | (E2) | | B(E2)(W.u.)≥0.056 Mult.: (Q) from γ(θ) in (⁷ Li,2npy); not M2, from RUL. |
| 6045.5 | (14 ⁺) | 1098.3 | 100 | 4947.2 | (12 ⁺) | | | E _γ : from ¹⁷³ Yb(²⁴ Mg,Fγ) ⁹² Zr. |
| 7445.8 | (16 ⁺) | 1400.3 | 100 | 6045.5 | (14 ⁺) | | | E _γ : from ¹⁷³ Yb(²⁴ Mg,Fγ) ⁹² Zr. |
| 8039.1? | (17,18 ⁺) | 593 ^b | 100 | 7445.8 | (16 ⁺) | D,E2 | | Mult.: from RUL. |
| (8634.82) | 2 ⁺ | 4804.7 | | 3830.31 | (1 ⁻ ,2 ⁺) | | | |
| | | 4985.1 7 | 2.8 8 | 3649.22 | 3 ⁺ | | | |
| | | 4995.0 3 | 6.7 8 | 3640.28 | (2 ⁺) | | | |
| | | 5006.1 3 | 11.8 8 | 3628.33 | (4 ⁺) | | | |

Adopted Levels, Gammas (continued)

$\gamma(^{92}\text{Zr})$ (continued)

| $E_i(\text{level})$ | J_i^π | E_γ^\dagger | I_γ^\dagger | E_f | J_f^π | Comments |
|---------------------|--------------------|--------------------------|--------------------|---------|--------------------------------|---|
| (8634.82) | 2 ⁺ | 5134.6 3 | 3.6 4 | 3499.88 | 2 ⁺ | |
| | | 5162.5 3 | 3.6 4 | 3471.88 | 1 ⁺ | |
| | | 5183.0 5 | 7.0 14 | 3452.17 | (2) ⁺ | |
| | | 5263.2 5 | 21.6 24 | 3371.48 | 1 ⁽⁻⁾ | |
| | | 5347.1 | | 3289.13 | 3 ⁺ | |
| | | 5359.5 | | 3275.76 | 2 ⁺ ,3 ⁺ | |
| | | 5371.2 5 | 6.1 14 | 3262.62 | 2 ⁺ | |
| | | 5594.7 4 | 1.6 4 | 3039.70 | 3 | |
| | | 5815.0 3 | 1.2 4 | 2819.54 | 2 ⁺ | |
| | | 6237.2 6 | 1.2 4 | 2398.36 | 4 ⁺ | |
| | | 6294.88 12 | 100 3 | 2339.66 | 3 ⁻ | |
| | | 6568.2 | | 2066.65 | 2 ⁺ | |
| | | 7139.5 | | 1495.46 | 4 ⁺ | |
| | | 7251.8 9 | 0.4 4 | 1382.77 | 0 ⁺ | |
| | | 7701.2 | | 934.51 | 2 ⁺ | |
| | | 8634.4 2 | 5.1 4 | 0.0 | 0 ⁺ | |
| 9127.5 | (18 ⁺) | 1681.3 ^{&b} | 100 | 7445.8 | (16 ⁺) | |
| 9722.2 | (≤ 20) | 1683 ^b | | 8039.1? | (17,18 ⁺) | E_γ : from (¹³ C,3n γ) only. |

[†] From (n, γ) E=thermal, except as noted. Uncertainty in E_γ from this source may include 100 eV systematic uncertainty combined in quadrature with experimental statistical uncertainty.

[‡] From $\gamma(\theta)$ in (n,n' γ), except as noted, assigning $\Delta\pi$ =no from RUL whenever relevant.

For additional mult and δ information, see $\gamma(\theta)$ from (n,n' γ).

@ From (n,n' γ).

& from ¹⁷³Yb(²⁴Mg,F γ)⁹²Zr; unconfirmed in ¹⁷⁶Yb(²⁸Si,X γ) or ¹⁷⁶Yb(³¹P,X γ) so placement shown as tentative here.

^a Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

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

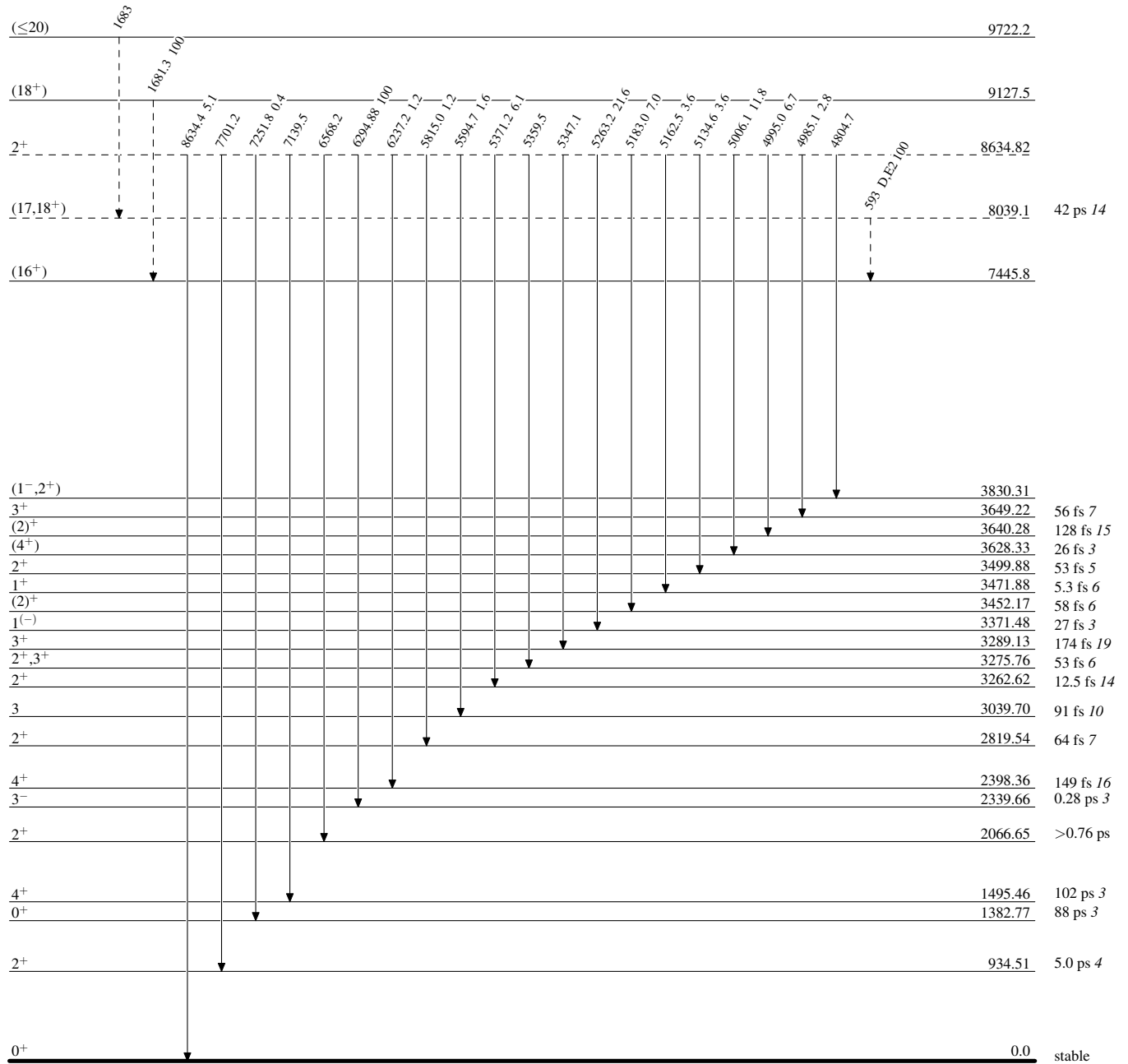
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

-----▶ γ Decay (Uncertain)



$^{92}_{40}\text{Zr}_{52}$

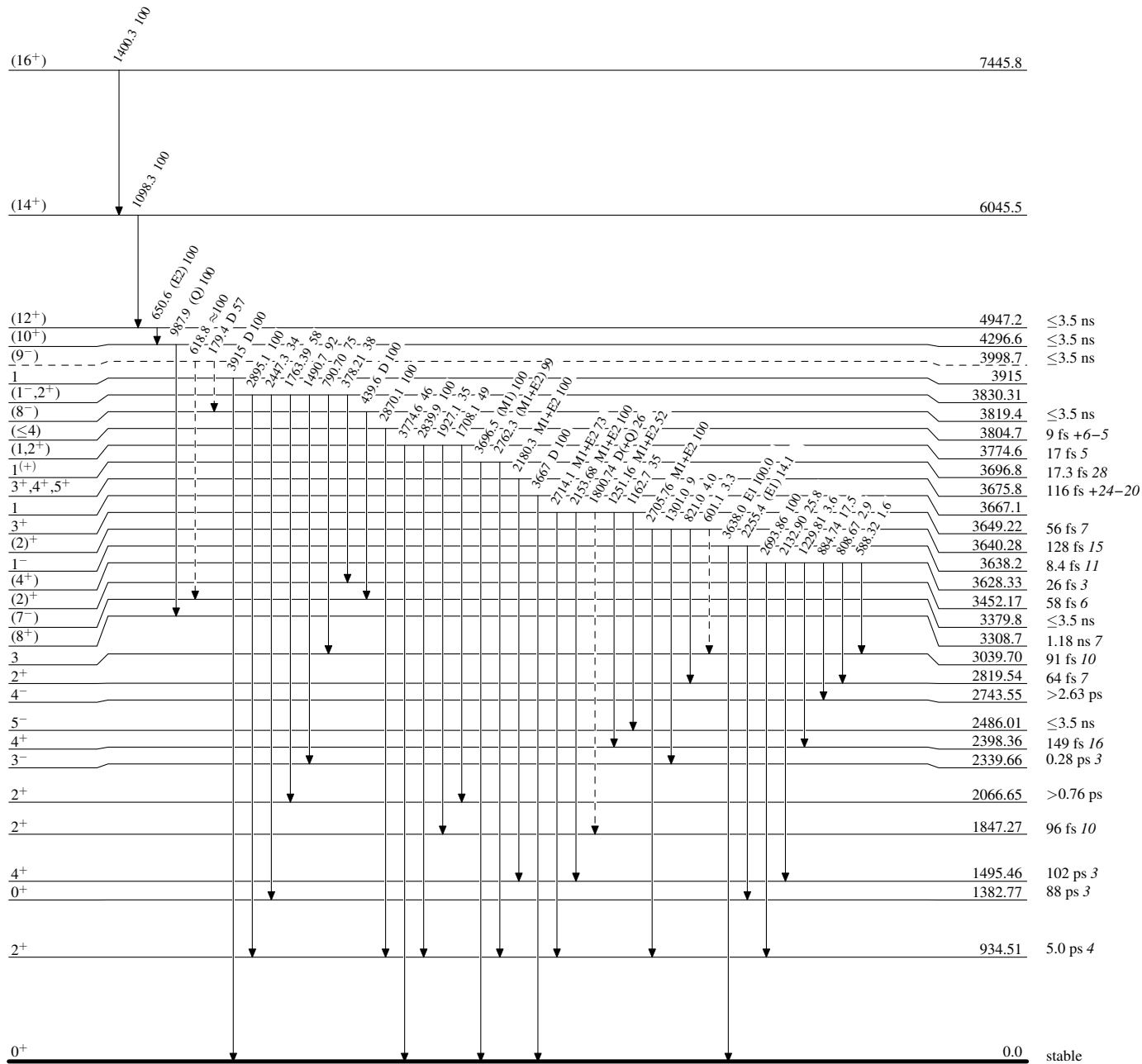
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

-----> γ Decay (Uncertain)



$^{92}_{40}\text{Zr}_{52}$

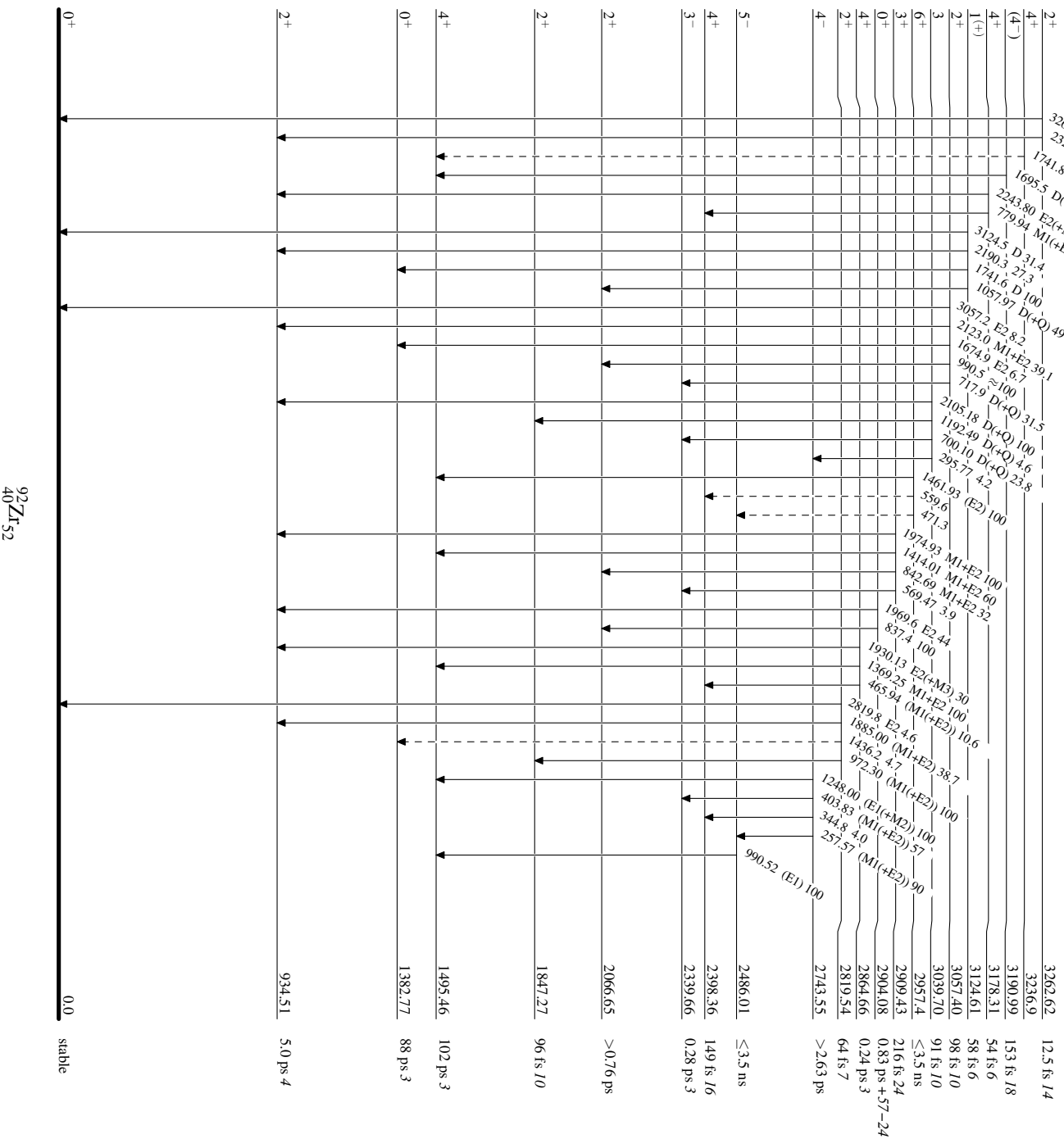
Adopted Levels, Gammas

Level Scheme (continued)

Legend

Intensities: Relative photon branching from each level

-----▶ γ Decay (Uncertain)



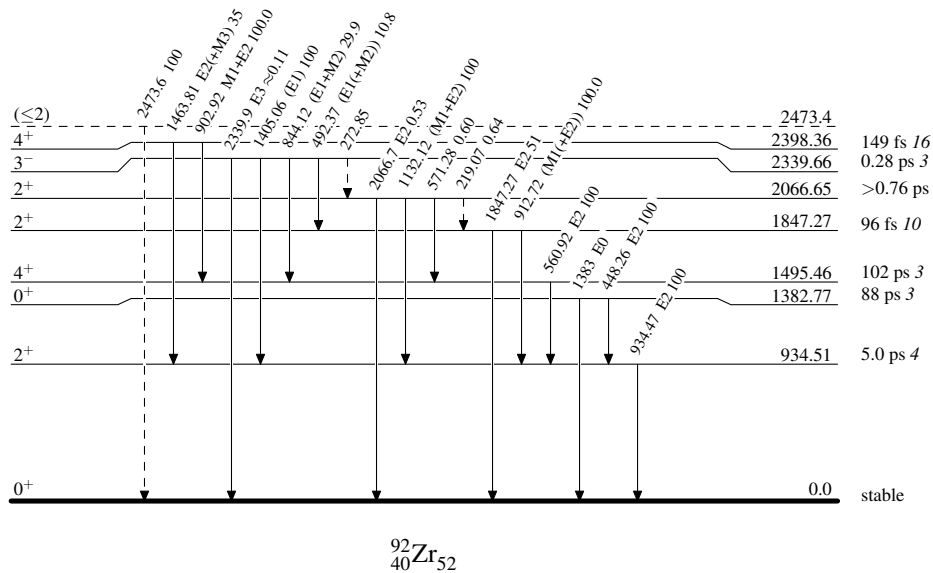
Adopted Levels, Gammas

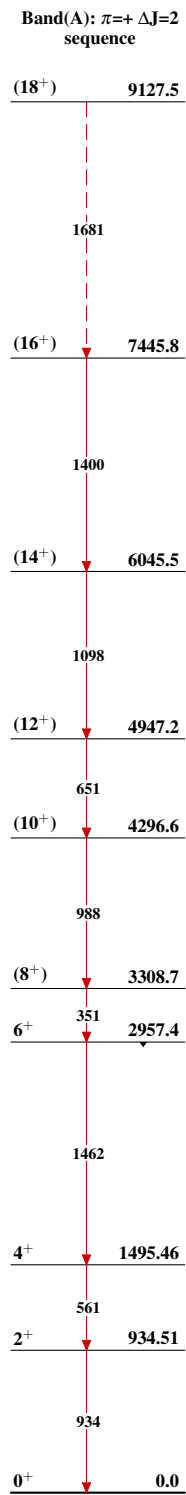
Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

-----▶ γ Decay (Uncertain)



Adopted Levels, Gammas $^{92}_{40}\text{Zr}_{52}$