¹³⁹La(²⁸Si,4nγ) **1992Sc03**

| | Н | istory | |
|-----------------|---------------------------|----------------------|------------------------|
| Туре | Author | Citation | Literature Cutoff Date |
| Full Evaluation | C. W. Reich, Balraj Singh | NDS 111, 1211 (2010) | 12-Apr-2010 |

Includes reactions ¹²²Sn(⁴⁵Sc,4nγ); ¹⁴⁷Sm(¹⁹F,3nγ); ¹⁴⁸Sm(¹⁹F,4nγ).

1992Sc03, 1992ScZL: ¹³⁹La(²⁸Si,4n γ) E=150 MeV. Measured E γ , I γ , $\gamma\gamma$, $\gamma\gamma(\theta)$ (DCO) with an array of 12-Compton suppressed Ge detectors and 48 BGO detectors. Cranked shell-model and total-Routhian surface calculations. See 1995Sc39 for

theoretical analysis of $\pi 1/2$ [660], large deformation (triaxial superdeformed) band. 1993Sc13, 1992ScZL: ¹⁴⁷Sm(¹⁹F,3n γ) E=85 MeV. Measured lifetimes by DSAM (Doppler-shift attenuation) and RDDS (recoil-distance Doppler shift) methods. The detector array for the DSAM experiment consisted of 12 Compton-suppressed Ge

detectors and 10 BaF₂ detectors. For the RDDS method, the detector array contained 19 Ge detectors and 30 BaF₂ detectors. Others:

1992Li13: ¹⁴⁸Sm(¹⁹F,4n γ) E=92 MeV. Measured γ , $\gamma\gamma$ with three Compton-suppressed Ge detectors and two other Ge detectors. Two bands, each with a signature partner, were reported. No γ -ray intensities reported.

1994Ch77, 1990Gr18: 122 Sn(45 Sc,4n γ) E=192 MeV. Description of a computer code for analysis of 2-dimensional $\gamma\gamma$ data. Earlier measurements:

1986HoZD: ¹²²Sn(⁴⁵Sc,4n γ) E=192 MeV. Measured γ , $\gamma\gamma$, $\gamma\gamma(\theta)$ (DCO at 24° and 63°) with an array of five

Compton-suppressed Ge detectors and three additional Ge detectors. The inner ball consisted of 72 NaI detectors. γ -ray intensities were not reported. Three bands, two with signature partners, were reported.

1983RoZW: ¹⁴⁸Sm(¹⁹F,4n γ) E=80-105 MeV. Measured E γ , I γ , $\gamma\gamma$, $\gamma(\theta)$, excitation functions. One band with a signature partner reported.

1983WaZO: ¹⁴⁸Sm(¹⁹F,4n γ). Measured γ , $\gamma\gamma$ with an array of five Ge detectors and a multiplicity filter of NaI detectors. Evidence for h_{11/2} band (to 47/2⁻) and g_{7/2} band found. Details of this study are not available.

¹⁶³Lu Levels

The present level scheme is from 1992Sc03 with modifications as suggested by 2002Je05 (also 1999Do34). See also 1992Li13 and 1993Sc13. The detailed results from 2002Je05 and 1999Do34 are given in a separate ${}^{139}La({}^{29}Si,5n\gamma)$ data set.

| E(level) [†] | $J^{\pi \#}$ | $T_{1/2}^{\ddagger}$ | Comments |
|-------------------------------|--------------------------------|-------------------------------|---------------------------|
| 0.0 <i>j</i> | 1/2+° | | |
| 16.8 ^{dk} 3 | 3/2+° | | Additional information 1. |
| 62.19 8 | 5/2+ | | |
| 124.32 ⁸ 10 | 7/2+ | | |
| 190.7 ^j 8 | 5/2+ [°] | | |
| 195.29 ⁱ 11 | 7/2- | | |
| 210.2 ^h 3 | 9/2- | | |
| 223.8 6 | 7/2+ | | |
| 249.4 ^k 5 | 7/2+ [°] | | |
| 294.8 ⁱ 4 | $11/2^{-}$ | | |
| 310.51 ^{<i>f</i>} 25 | 9/2+ | | |
| 491.3 ^h 4 | 13/2- | | |
| 520.3 ^j 9 | 9/2+ ^c | | |
| 520.41 ⁸ 25 | $11/2^{+}$ | | |
| 620.0 ^k 6 | 11/2 ⁺ ^C | | |
| 643.8 ⁱ 4 | $15/2^{-}$ | 5.6 ^{&} ps +6-11 | |
| 754.5 <i>f</i> 3 | $13/2^{+}$ | | |
| 936.3 ^h 5 | $17/2^{-}$ | 1.4 ^{&} ps +8–7 | |
| 967.3 <mark>/</mark> 10 | 13/2+ ^c | | |
| 1007.7 <mark>8</mark> 3 | $15/2^{+}$ | | |
| | | | |

¹⁶³Lu Levels (continued)

| E(level) [†] | J π # | T _{1/2} ‡ | E(level) [†] | J ^{π#} | T _{1/2} ‡ |
|------------------------------|--------------------|------------------------------|-----------------------------------|-----------------|----------------------------------|
| 1105.7 ^k 8 | 15/2+ ^c | | 4442.7 ¹ 13 | $(41/2^+)$ | 0.15 ps +6-5 |
| 1114.4 ⁱ 5 | 19/2- | 1.9 ^{&} ps +2-4 | 4717.4 <mark>8</mark> 7 | $43/2^{+}$ | |
| 1281.9 f 4 | $17/2^{+}$ | - | 4757.8 ^h 7 | $45/2^{-}$ | |
| 1484.6 ^h 5 | $21/2^{-}$ | 0.9 ^{&} ps 3 | 5055.0 ^f 7 | 45/2+ | |
| 1501.2 ^j 11 | 17/2+ [°] | - | 5081.4 ¹ 14 | $(45/2^+)$ | 0.10 ps +4-3 |
| 1561.1 ⁸ 4 | 19/2+ | | 5129.0 ⁱ 7 | $47/2^{-}$ | 0.15 [@] ps 5 |
| 1668.5 ^k 9 | 19/2+ ^c | | 5385.6 ⁸ 7 | $47/2^{+}$ | |
| 1676.0 ⁱ 4 | 23/2- | 1.0 ^{&} ps +2-3 | 5502.0 ^h 7 | 49/2- | 0.11 [@] ps +5-3 |
| 1738.3 ¹ 13 | $(13/2^+)$ | _ | 5717.1 ^ƒ 7 | 49/2+ | |
| 1866.7 ^f 4 | $21/2^{+}$ | | 5778.4 ¹ 14 | $(49/2^+)$ | 0.08 ps +4-3 |
| 1935.0 ¹ 13 | $(17/2^+)$ | | 5913.4 ⁱ 8 | 51/2- | $0.12^{\textcircled{0}}$ ps +3-6 |
| 2102.6 ^h 5 | $25/2^{-}$ | | 6062.4 ⁸ 7 | $51/2^{+}$ | |
| 2138.6 ^g 4 | $23/2^{+}$ | | 6330.3 ^h 8 | 53/2- | $0.09^{\textcircled{0}}$ ps +6-4 |
| 2199.0 ^{el} 12 | $(21/2^+)$ | | 6412.3 ^f 7 | 53/2+ | - |
| 2275.4 ^j 11 | 23/2+ ^c | | 6530.4 ¹ 14 | $(53/2^+)$ | 0.055 ps +21-28 |
| 2305.9 ⁱ 5 | $27/2^{-}$ | 1.2 ^{&} ps +3-5 | 6785.7 ⁱ 8 | 55/2- | - |
| 2399.1 <i>^f 4</i> | $25/2^+$ | - | 6785.9 <mark>8</mark> 8 | 55/2+ | |
| 2513.7 ¹ 12 | $(25/2^+)$ | 3.3^{a} ps +7-5 | 7171.5 ^f 8 | 57/2+ | |
| 2613.3 ⁸ 5 | $27/2^{+}$ | _ | 7243.4 ^h 8 | 57/2- | |
| 2746.2 ^h 5 | 29/2- | | 7335.6 ¹ 15 | $(57/2^+)$ | 0.04 ps 3 |
| 2802.3 ^{<i>f</i>} 5 | $29/2^{+}$ | | 7581.5 ⁸ 8 | 59/2+ | |
| 2853.5 9 | $(29/2^{-})$ | | 7725.3 ⁱ 9 | 59/2- | |
| 2899.7 ¹ 12 | $(29/2^+)$ | 2.3^{a} ps +5-4 | 8008.8 ^f 8 | $61/2^+$ | |
| 2923.2 ⁱ 6 | 31/2- | _ | 8193.3 ¹ 15 | $(61/2^+)$ | 0.034 ^(a) ps +35-33 |
| 3002.7 <mark>8</mark> 5 | 31/2+ | | 8219.1 ^h 9 | 61/2- | |
| 3020.0 8 | $(31/2^{-})$ | | 8457.0 ⁸ 8 | 63/2+ | |
| 3121.6 ^h 6 | 33/2- | | 8924.4 ^{<i>f</i>} 9 | $65/2^+$ | |
| 3243.8 ^{<i>f</i>} 5 | $33/2^{+}$ | 0 | 9101.7 ¹ 16 | $(65/2^+)$ | |
| 3318.7 ¹ 6 | 35/2- | 4.2 ^{&} ps +5-6 | 9405.6 ⁸ 9 | $67/2^+$ | |
| 3349.7 ¹ 13 | $(33/2^+)$ | 0.9^{a} ps +5-3 | 9914.7 ⁵ 9 | 69/2+ | |
| 3482.4 <mark>8</mark> 5 | $35/2^+$ | | 10063.6 ¹ 17 | $(69/2^+)$ | |
| 3549.6 ^h 6 | $37/2^{-}$ | | 10423.8 ⁸ 9 | $71/2^{+}$ | |
| 3788.2 ^f 6 | $37/2^+$ | | 10976.8 ^f 10 | 73/2+ | |
| 3820.3 ^{<i>i</i>} 7 | 39/2- | | 11500.7 <mark>8</mark> 10 | 75/2+ | |
| 3864.6 ¹ 13 | $(37/2^+)$ | 0.31 ps +14-11 | 12094.2 ^{<i>f</i>} 14 | 77/2+ | |
| 4066.6 ⁸ 6 | 39/2+ | | 12621.6 ⁸ 14 | 79/2+ | |
| 4101.4 ["] 7 | 41/2- | | 13254.6? ⁰ <i>J</i> 17 | 81/2+ | |
| 4403.9/ 6 | $41/2^{+}$ | | 14480.0? ⁰ J 20 | 85/2+ | |
| 4428.8 ⁴ 7 | $43/2^{-}$ | | | | |

[†] From least-squares fit to $E\gamma'$ s. Note that the lowest state in 1992Sc03 is now placed at 17.0 keV by 2002Je05. The level scheme given by 1992Sc03 is modified in accordance with results from 2002Je05. This results in shifting the energies of the low-lying levels upwards by \approx 17 keV, moving lower by \approx 54 keV the positions of the $\pi7/2[404]$ and $\pi7/2[523]$ band members, and the lowest γ at 264 in SD band from 1484, (17/2⁺) to 1220, (13/2⁺) (1992Sc03) is now placed from a 2200, 21/2⁺ to 1936, 17/2⁺ level (2002Je05,1999Do34). Thus all the higher members of the SD band as shown by 1992Sc03 are pushed up in energy by \approx 715 keV and in spin by two units.

$^{139}La(^{28}Si,4n\gamma)$ 1992Sc03 (continued)

¹⁶³Lu Levels (continued)

[‡] From DSAM (1993Sc13,1992ScZL), unless otherwise stated.

- [#] The assignments are as proposed by 1992Sc03, based on $\gamma\gamma(\theta)$ (DCO) data and associated band structures. It is assumed that multipolarities are M1(+E2) for $\Delta J=1$ and E2 for $\Delta J=2$ transitions.
- [@] From DSAM (1992ScZL).
- & From RDDS (1992ScZL).
- ^a From RDDS (1993Sc13,1992ScZL).
- ^b Level proposed by 1992Sc03 in the $\pi 7/2$ [404] band is considered as uncertain since it is not given in the high-statistics experiment of 2002Je05 and 2004Je03. The level is not included in the 'Adopted Levels'.

^c From 2002Je05. ^d From ¹³⁹La(²⁹Si,5nγ).

- ^e A 533.9 γ from this level proposed by 1992Sc03 is now placed from 1500 level (2002Je05).
- ^f Band(A): $\pi 7/2[404]$ band, $\alpha = +1/2$. Strongly coupled proton band (1992Sc03).
- ^g Band(B): $\pi 7/2[404]$ band, $\alpha = -1/2$. Strongly coupled proton band (1992Sc03).
- ^h Band(C): $\pi 7/2[523]$ band, $\alpha = +1/2$. Strongly coupled proton band (1993Sc13). Of the two possible choices (1992Sc03) of $\pi 7/2[523]$ and $\pi 9/2[514]$, $\pi 7/2[523]$ is preferred (1993Sc13,1999Do34), based on the experimental Qt pattern with K=7/2 or 9/2 and a comparison of experimental and calculated B(M1) values.
- ⁱ Band(D): $\pi 7/2[523]$ band, $\alpha = -1/2$. Strongly coupled proton band (1993Sc13). See comments on signature partner of this band.
- ^{*j*} Band(E): $\pi 1/2[411]$ band, $\alpha = +1/2$. Band adopted from 2002Je05, 1999Do34.
- ^k Band(e): $\pi 1/2[411]$ band, $\alpha = -1/2$.
- ¹ Band(F): Triaxial SD-1 band (1995Sc39,1992Sc03). The lowest γ at 264 in SD-1 band from 1484, (17/2⁺) to 1220, (13/2⁺) (1992Sc03) is now placed from a 2200, $21/2^+$ to 1936, $17/2^+$ level (2002Je05, 1999Do34). Thus all the higher members of the SD-1 band as shown by 1992Sc03 are pushed up in energy by \approx 715 keV and in spin by two units. Configuration= $\pi i_{13/2}$, 1/2[660], $\alpha = +1/2$. $\beta_2 \approx 0.42$ (1993Sc13,1992Sc03); Qt=10.7 7 (1993Sc13, lifetime data). This value is about twice as large as that for other deformed bands for ¹⁶³Lu and in this mass region. See 1995Sc39 for discussion of this band and for a detailed comparison with population of a similar 1/2[660] large deformation (triaxial superdeformed) band in ¹⁶⁵Lu.

$\gamma(^{163}Lu)$

DCO ratios (1992Sc03) refer to $I\gamma(30^\circ)/I\gamma(90^\circ)$, where $I\gamma(30^\circ)$ is intensity along the 30° axis (in 30° x 90° $\gamma\gamma$ matrix) when gates are set on stretched $\Delta J=2$ transitions on the 90° axis. I $\gamma(90^\circ)$ is the intensity on the 90° axis while the gates are set on stretched $\Delta J=2$ transitions on the 30° axis. DCO ratio is \approx 1.0 for stretched $\Delta J=2$ (E2) and \approx 0.7 for $\Delta J=1$, dipole transitions.

| Intensities | in ¹⁴⁸ | ³ Sm(| 19 F, 4n γ |) | (1983 | RoZW) | |
|----------------------------|-------------------|------------------|------------------------|-----------------------------|-----------------------|-------|----|
| Εγ | Iγ | | E | ξγ | Iγ | | |
| 132.90 15 | 35 | 4 | | 349.3 | 1 | 105 | 5 |
| 152.70 15 | 74 | 8 | | 370.6 | 1 | 71 | 7 |
| 177.00 15 | | | 39 | 6.10 15 | | 71 7 | |
| 177.80 15 | 61 | 6 | | 426.90 | 15 | 32 | 3 |
| 180.00 15 | 13 | 2 | | 440.90 | 15 | 21 | 2 |
| 191.50 15 | 28 | 3 | | 445.10 | 15 | 99 | 5 |
| 196.80 15 | 242 | 12 | b | 470.8 | 1 | 168 | 8 |
| 198.80 15 | 69 | 7 | b | 501.90 | 15 | 15 | 2 |
| 203.00 15 | 47 | 5 | a | 548.20 | 15 | 44 | 5 |
| 231.0 1 | 47 | 5 | | 562.1 | 1 | 180 | 9 |
| 270.9 1 | 37 | 4 | | 609.10 | 15 | 26 | 3 |
| 281.50 15 | 53 | 6 | | 617.8 | 1 | 131 | 7 |
| 292.8 1 | 81 | 4 | | 618.00 | 15 | 14 | 2 |
| 327.70 15 | 18 | 2 | | 630.2 | 1 | 146 | 10 |
| 329.10 15 | 12 | 1 | | 644.10 | 15 | 39 | 4 |
| a: possible b: intensit | e cont ty is | ami unc | nation ertain | from 163 due to 1 | Yb ^{I9} F | line | - |

а

¹⁶³₇₁Lu₉₂-4

| 1631 | [11 / A |
|------|---------------------|
| 71 | 5u ₉₂ -4 |

| 45.39 [#] 8 62.19 $5/2^+$ 16.8 $3/2^+$ Placement based on the proposed 16.8 level as the first excited state (1992bo34,20024c05). 62.14 [#] 5 124.32 $7/2^+$ 62.19 $5/2^+$ Placement based on the proposed 16.8 level as the first excited state (1992bo34,20024c05). 84.5.5 17.8 294.8 11/2 210.2 $9/2^-$ 124.32 $7/2^+$ 62.19 $5/2^+$ 133.0 [#] 10 195.29 $7/2^-$ 62.19 $5/2^+$ $(10^+)^{10}$ | E_{γ}^{\dagger} | I_{γ}^{\ddagger} | E _i (level) | \mathbf{J}_i^{π} | E_f | \mathbf{J}_{f}^{π} | Mult. | Comments |
|---|------------------------|-------------------------|------------------------|----------------------------|------------------|-----------------------------|-------------------------|--|
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | 45.39 [#] 8 | | 62.19 | 5/2+ | 16.8 | 3/2+ | | Placement based on the proposed 16.8 level as the first excited state (1999Do34,2002Je05). |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | 62.14 [#] 5 | | 124.32 | $7/2^{+}$ | 62.19 | $5/2^{+}$ | | |
| $ \begin{array}{llllllllllllllllllllllllllllllllllll$ | 70.98 [#] 8 | | 195.29 | 7/2- | 124.32 | 7/2+ | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 84.5 5 | 178 | 294.8 | 11/2- | 210.2 | 9/2- | | |
| $ \begin{array}{llllllllllllllllllllllllllllllllllll$ | 85.9 ^b | | 210.2 | 9/2- | 124.32 | $7/2^{+}$ | | |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | 101.6 10 | <4 | 3121.6 | 33/2- | 3020.0 | $(31/2^{-})$ | | |
| | 133.08 [#] 10 | | 195.29 | 7/2- | 62.19 | $5/2^{+}$ | | |
| $ \begin{array}{llllllllllllllllllllllllllllllllllll$ | 152.5 3 | 38 <i>3</i> | 643.8 | 15/2- | 491.3 | 13/2- | (D) ^{&} | R(DCO)=0.80 18. δ (O/D)=+0.22 1 (1983RoZW). |
| $ \begin{array}{llllllllllllllllllllllllllllllllllll$ | 161.9 10 | <2.0 | 223.8 | 7/2+ | 62.19 | $5/2^{+}$ | | |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | 173.8 10 | <1.0 | 190.7 | $5/2^{+}$ | 16.8 | $3/2^{+}$ | _ | |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | 177.0 <i>3</i> | 13.5 20 | 2923.2 | 31/2- | 2746.2 | 29/2- | (D) <mark>&</mark> | R(DCO)=0.74 20. |
| $ \begin{array}{llllllllllllllllllllllllllllllllllll$ | 178.1 <i>3</i> | 23 4 | 1114.4 | 19/2- | 936.3 | 17/2- | D& | R(DCO)=0.74 20. $\delta(Q/D)=+0.15 2$ (1983RoZW). |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | 186.2 3 | 42.0 25 | 310.51 | 9/2+ | 124.32 | 7/2+ | | |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | 189.0 <i>3</i> | 17.4 11 | 2802.3 | $29/2^{+}$ | 2613.3 | $27/2^+$ | 0 | |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | 191.4 <i>3</i> | 14.0 15 | 1676.0 | 23/2- | 1484.6 | 21/2- | (D+Q) ^{&} | R(DCO)=0.86 <i>18</i> . $\delta(Q/D)=+0.18 \ 9 \ (1983RoZW).$ |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | 196.5 <i>3</i> | 36.2 20 | 491.3 | 13/2- | 294.8 | 11/2- | (D) ^{&} | R(DCO)=0.76 20. $\delta(Q/D)=+0.03 2$ (1983RoZW). |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | 196.7 <mark>b</mark> | | 1935.0 | $(17/2^+)$ | 1738.3 | $(13/2^+)$ | | |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$ | 197.1.5 | 61 22 | 3318.7 | 35/2- | 3121.6 | 33/2- | (D) <mark>&</mark> | R(DCO)=0.76 20. |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 198 4 5 | 42.15 | 3121.6 | 33/2- | 2923.2 | $31/2^{-}$ | $(D)^{\&}$ | R(DCO)=0.76.20 |
| 203.3 <i>3</i> 8.0 <i>10</i> 2305.9 $27/2^{-}$ 2102.6 $25/2^{-}$ (D+Q) Mult: $\Delta J=1, D+Q$ transition from $\gamma(\theta)$ (1983RoZW). $\delta(Q/D)=+0.30 \ 8$ (1983RoZW). $\delta(Q/D)=+0.30 \ 8$ (1983RoZW). $\delta(Q/D)=+0.30 \ 8$ (1983RoZW). 209.9 <i>3</i> 13.3 <i>10</i> 520.41 11/2 ⁺ 310.51 9/2 ⁺ 230.9 <i>3</i> 48.4 20 3549.6 37/2 ⁻ 3318.7 35/2 ⁻ (D) ^{&} R(DCO)=0.71 <i>18</i> . $\delta(Q/D)=+0.25 \ 5$ (1983RoZW). 232.6 5 5 <i>3</i> 249.4 7/2 ⁺ 16.8 3/2 ⁺ 234.1 3 6.4 <i>12</i> 754.5 13/2 ⁺ 520.41 11/2 ⁺ 238.6 3 10.8 7 3482.4 35/2 ⁺ 3243.8 33/2 ⁺ 3002.7 31/2 ⁺ 235.2 3 8.0 <i>13</i> 1007.7 15/2 ⁺ 754.5 13/2 ⁺ 260.6 3 15.4 <i>15</i> 2399.1 25/2 ⁺ 2138.6 23/2 ⁺ 264.0 5 3.0 <i>10</i> 2199.0 (21/2 ⁺) 1935.0 (17/2 ⁺) 266.1 <i>10</i> <4 3121.6 33/2 ⁻ 2853.5 (29/2 ⁻) 270.7 <i>3</i> 34.5 <i>15</i> 3820.3 39/2 ⁻ 3549.6 37/2 ⁻ (D) ^{&} R(DCO)=0.80 <i>15</i> . $\delta(Q/D)=+0.22 \ 3$ (1983RoZW). 271.9 <i>3</i> 3.7 5 2138.6 23/2 ⁺ 1866.7 21/2 ⁺ 274.2 <i>3</i> 4.6 9 1281.9 17/2 ⁺ 1007.7 15/2 ⁺ 278.3 5 <12 4066.6 39/2 ⁺ 3788.2 37/2 ⁺ 279.2 5 3.0 6 1561.1 19/2 ⁺ 1281.9 17/2 ⁺ 281.0 5 10.5 <i>15</i> 491.3 13/2 ⁻ 210.2 9/2 ⁻ (Q) [@] R(DCO)=0.92 <i>13</i> . 281.1 5 33 <i>4</i> 4101.4 41/2 ⁻ 3820.3 39/2 ⁻ (D) ^{&} R(DCO)=0.92 <i>13</i> . 281.1 5 33 <i>4</i> 4101.4 41/2 ⁻ 3820.3 39/2 ⁻ (D) ^{&} R(DCO)=0.92 <i>13</i> . 281.1 5 33 <i>4</i> 4101.4 41/2 ⁻ 3820.3 39/2 ⁻ (D) ^{&} R(DCO)=0.92 <i>13</i> . 292.5 <i>3</i> 43.0 <i>15</i> 936.3 17/2 ⁻ 210.2 9/2 ⁻ Q) [@] R(DCO)=0.92 <i>13</i> . 292.5 <i>10</i> <2.0 520.3 9/2 ⁺ 223.8 7/2 ⁺ 298.7 <i>10</i> <4 3318.7 35/2 ⁻ 3020.0 (31/2 ⁻) 305.6 5 77.7 <i>15</i> 1866.7 21/2 ⁺ 156.1 1 19/2 ⁺ 156.1 1 19/2 ⁺ 156.1 1 19/2 ⁺ 271.2 3 20.0 3 <i>1</i> (1983RoZW). | 200.4 3 | 15.6 8 | 3002.7 | $31/2^+$ | 2802.3 | $\frac{31}{2}$ | (D) | R(DCC) 0.70 20. |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 203.3 3 | 8.0 10 | 2305.9 | 27/2- | 2102.6 | 25/2- | (D+Q) | Mult.: $\Delta J=1$, D+Q transition from $\gamma(\theta)$ (1983RoZW). |
| 209.9.5 13.3 IO 520.41 11/2 ⁺ 310.51 9/2 ⁺ 214.1 3 17.2 9 2613.3 27/2 ⁺ 2399.1 25/2 ⁺ 230.9 3 48.4 20 3549.6 37/2 ⁻ 3318.7 35/2 ⁻ (D) ^{&} R(DCO)=0.71 <i>I8.</i> $\delta(Q/D)=+0.25 5 (1983 RoZW).$ 232.6 5 5.3 249.4 7/2 ⁺ 16.8 3/2 ⁺ 234.1 3 6.4 <i>I</i> 2 754.5 13/2 ⁺ 520.41 11/2 ⁺ 238.6 3 10.8 7 3482.4 35/2 ⁺ 3243.8 33/2 ⁺ 241.1 3 11.3 <i>IO</i> 3243.8 33/2 ⁺ 3002.7 31/2 ⁺ 253.2 3 8.0 <i>I</i> 3 1007.7 15/2 ⁺ 754.5 13/2 ⁺ 260.6 3 15.4 <i>I</i> 5 2399.1 25/2 ⁺ 2138.6 23/2 ⁺ 264.0 5 3.0 <i>IO</i> 2199.0 (21/2 ⁺) 1935.0 (17/2 ⁺) 268.1 <i>IO</i> <4 3121.6 33/2 ⁻ 2853.5 (29/2 ⁻) 270.7 3 34.5 <i>I</i> 5 3820.3 39/2 ⁻ 3549.6 37/2 ⁻ (D) ^{&} R(DCO)=0.80 <i>I</i> 5. $\delta(Q/D)=+0.22 3 (1983 RoZW).$ 271.9 3 3.7 5 2138.6 23/2 ⁺ 1866.7 21/2 ⁺ 278.3 5 <12 4066.6 39/2 ⁺ 3788.2 37/2 ⁺ 278.3 5 <12 4066.6 39/2 ⁺ 3788.2 37/2 ⁺ 278.1 5 10.5 <i>I</i> 5 491.3 13/2 ⁻ 210.2 9/2 ⁻ (Q) [@] R(DCO)=0.92 <i>I</i> 3. 281.1 5 33 4 4101.4 41/2 ⁻ 3820.3 39/2 ⁻ (D) ^{&} R(DCO)=0.92 <i>I</i> 3. 281.1 5 33 4 4101.4 41/2 ⁻ 3820.3 39/2 ⁻ (D) ^{&} R(DCO)=0.92 <i>I</i> 3. 281.1 5 33 4 4101.4 41/2 ⁻ 3820.3 39/2 ⁻ (D) ^{&} R(DCO)=0.92 <i>I</i> 3. 292.5 3 43.0 <i>I</i> 5 936.3 17/2 ⁻ 643.8 15/2 ⁻ D ^{&} R(DCO)=0.92 <i>I</i> 3. 292.5 7 7.7 <i>I</i> 5 1866.7 21/2 ⁺ 1561.1 19/2 ⁺ 1231.9 17/2 ⁺ 293.7 <i>IO</i> <2.0 520.3 9/2 ⁺ 223.8 7/2 ⁺ 294.7 <i>IO</i> <2.0 520.3 9/2 ⁺ 223.8 7/2 ⁺ 295.7 <i>IO</i> | | | | 4.4 /a h | | o /e+ | | $\delta(Q/D) = +0.30 \ 8 \ (1983 \text{RoZW}).$ |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 209.9 3 | 13.3 10 | 520.41 | 11/2+ | 310.51 | 9/2 ⁺ | | |
| 230.9 3 48.4 20 3349.6 $31/2$ 318.7 $35/2$ (D) | 214.1 3 | 17.29 | 2015.5 | 27/2 | 2399.1 | 25/2 | (D) & | P(DCO) 0.71.19 |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 230.9 3 | 48.4 20 | 3549.0 | 37/2 | 3318.7 | 35/2 2/2 | (D) | $\delta(Q/D) = 0.7178.$ $\delta(Q/D) = +0.255 (1983 \text{RoZW}).$ |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 232.6 5 | 5 5 | 249.4 | 1/2' | 16.8 | $\frac{3}{2}$ | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 234.1 5 | 0.4 IZ 10.8 7 | 734.3 3482 A | $\frac{15}{2}$ $35/2^+$ | 320.41 | $\frac{11/2}{33/2^+}$ | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 241.1 3 | 11.3 10 | 3243.8 | $33/2^+$ | 3002.7 | $31/2^+$ | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 253.2 3 | 8.0 13 | 1007.7 | $15/2^+$ | 754.5 | $13/2^+$ | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 260.6 3 | 15.4 15 | 2399.1 | $25/2^+$ | 2138.6 | $23/2^+$ | | |
| 268.1 10 <4 3121.6 $33/2^{-}$ 2853.5 (29/2 ⁻) 270.7 3 34.5 15 3820.3 $39/2^{-}$ 3549.6 $37/2^{-}$ (D) ^{&} R(DCO)=0.80 15 . $\delta(Q/D)=+0.22 \ 3 \ (1983 \text{RoZW})$. 271.9 3 3.7 5 2138.6 23/2 ⁺ 1866.7 21/2 ⁺ 274.2 3 4.6 9 1281.9 17/2 ⁺ 1007.7 15/2 ⁺ 278.3 5 <12 4066.6 39/2 ⁺ 3788.2 37/2 ⁺ 279.2 5 3.0 6 1561.1 19/2 ⁺ 1281.9 17/2 ⁺ 281.0 5 10.5 15 491.3 13/2 ⁻ 210.2 9/2 ⁻ (Q) [@] R(DCO)=0.92 13 . 281.1 5 33 4 4101.4 41/2 ⁻ 3820.3 39/2 ⁻ (D) ^{&} R(DCO)=0.92 13 . 292.5 3 43.0 15 936.3 17/2 ⁻ 643.8 15/2 ⁻ D ^{&} R(DCO)=0.92 13 . 296.5 10 <2.0 520.3 9/2 ⁺ 223.8 $7/2^{+}$ 298.7 10 <4 3318.7 35/2 ⁻ 3020.0 (31/2 ⁻) 305.6 5 $7.7 \ 15 \ 1866.7 \ 21/2^{+}$ 1561.1 19/2 ⁺ | 264.0 5 | 3.0 10 | 2199.0 | $(21/2^+)$ | 1935.0 | $(17/2^+)$ | | |
| 270.7 3 34.5 15 3820.3 $39/2^{-}$ 3549.6 $37/2^{-}$ (D) R(DCO)=0.80 15. $\delta(Q/D)=+0.22 3 (1983 \text{RoZW}).$ 271.9 3 3.7 5 2138.6 23/2 ⁺ 1866.7 21/2 ⁺ 274.2 3 4.6 9 1281.9 17/2 ⁺ 1007.7 15/2 ⁺ 278.3 5 <12 4066.6 39/2 ⁺ 3788.2 37/2 ⁺ 279.2 5 3.0 6 1561.1 19/2 ⁺ 1281.9 17/2 ⁺ 281.0 5 10.5 15 491.3 13/2 ⁻ 210.2 9/2 ⁻ (Q) R(DCO)=0.92 13. 281.1 5 33 4 4101.4 41/2 ⁻ 3820.3 39/2 ⁻ (D) R(DCO)=0.92 13. 292.5 3 43.0 15 936.3 17/2 ⁻ 643.8 15/2 ⁻ D R(DCO)=0.99 24. $\delta(Q/D)=+0.03 1 (1983 \text{RoZW}).$ 296.5 10 <2.0 520.3 9/2 ⁺ 223.8 7/2 ⁺ 298.7 10 <4 3318.7 35/2 ⁻ 3020.0 (31/2 ⁻) 305.6 5 7.7 15 1866.7 21/2 ⁺ 1561.1 19/2 ⁺ | 268.1 10 | <4 | 3121.6 | 33/2- | 2853.5 | $(29/2^{-})$ | 0 <u>-</u> | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 270.7 3 | 34.5 15 | 3820.3 | 39/2- | 3549.6 | 37/2- | (D) ^{&} | R(DCO)=0.80 15. $\delta(Q/D)=+0.22 3 (1983 \text{RoZW}).$ |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 271.9 3 | 3.7 5 | 2138.6 | $23/2^+$ | 1866.7 | $21/2^+$ | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 274.23 | 4.6 9 | 1281.9 | 17/2+ | 1007.7 | 15/2 ' | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 278.3 3 | <12 | 4000.0 | $\frac{39}{2^{+}}$ | 3788.2 1281.0 | $\frac{57}{2^+}$ | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 219.25 | 10 5 15 | /01.2 | 13/2- | 210.2 | 0/2- | $(0)^{\textcircled{0}}$ | R(DCO) = 0.92.13 |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 201.0 5 | 22 4 | 471.3 | 13/2 | 2020.2 | 20/2- | | $R(DCO) = 0.02 \ I2$ |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 201.1 3 | 33 4 42 0 15 | 4101.4 | 41/2 | 3620.3 | 39/2 15/2- | (D) ²² | $R(DCO) = 0.92 \ 15.$ |
| 296.5 10 <2.0 | 292.5 3 | 43.0 15 | 936.3 | 17/2 | 643.8 | 15/2 | D | $\kappa(DCO)=0.99~24.$ $\delta(Q/D)=+0.03~l~(1983RoZW).$ |
| 305.65 7.7 15 1866.7 21/2 ⁺ 1561.1 19/2 ⁺ | 296.5 10 | <2.0 | 520.3 | 9/2° 35/2- | 223.8 | $1/2^{-1}$ | | |
| | 305.6.5 | 7.7 15 | 1866.7 | $\frac{33/2}{21/2^+}$ | 1561.1 | (31/2) 19/2 ⁺ | | |

139 La(28 Si,4n γ) **1992Sc03** (continued)

γ ⁽¹⁶³Lu) (continued)</sup>

| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | E_{γ}^{\dagger} | I_{γ} ‡ | E_i (level) | \mathbf{J}_i^{π} | E_f | \mathbf{J}_{f}^{π} | Mult. | Comments |
|--|--|-------------------------------|----------------------------|---|----------------------------|---------------------------------------|------------------------|--|
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 305.9 5 313.7 3 314.7 3 | 8.0 20 6.9 8 8.1 9 | 3788.2 4717.4 2513.7 | $\overline{37/2^+}$ $43/2^+$ $(25/2^+)$ | 3482.4 4403.9 2199.0 | $35/2^+$ $41/2^+$ $(21/2^+)$ | | |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | 327.4 5 | 12 4 | 4428.8 | 43/2- | 4101.4 | $41/2^{-}$ | (D) <mark>&</mark> | R(DCO)=0.80 18. |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | 329.0 5 | 11.5 12 | 4757.8 | $45/2^{-}$ | 4428.8 | 43/2- | & | R(DCO)=0.80 18. |
| $ \begin{array}{llllllllllllllllllllllllllllllllllll$ | 329.6 5 | 2.5 15 | 520.3 | 9/2+ | 190.7 | $5/2^+$ | | |
| 331.5 5 5.2 971.7.1 49(2 ⁺) 538.5.6 47/2 ⁺ 337.4 5 7.0 0 505.0 45(2 ⁺) 471.7.4 43/2 ⁺ 343.3 6.1.5 606.2 517.7.1 49/2 ⁺ 43/2 ⁺ 471.7.4 43/2 ⁺ 349.9 3 6.0 20 641.3 81.5/2 294.8 11/2 ⁺ (E2) ⁶ R(DCO)=0.82 17. 370.2 2.4.2 144.4 9/2 ⁺ 294.4 1/2 ⁺ (E2) ⁶ R(DCO)=0.82 17. 371.6.3 0.3.5 5 600.0 11/2 ⁺ 249.4 7/2 ⁺ (D2) ⁶ R(DCO)=0.82 17. 373.6.3 0.3.2 512.00 47/2 ⁻ 47/2 ⁺ 35.7 (Q) (D) ⁶ R(DCO)=0.82 18.3 386.63 3.5.3 717.1.5 57/2 ⁺ 6412.3 37/2 ⁺ 49/2 ⁺ 45/2 ⁺ 45/2 ⁺ 386.63 3.5.1 202.1 231.7 25/2 ⁺ 41/2 ⁺ < | 330.5 5 | 6.0 20 | 5385.6 | $47/2^{+}$ | 5055.0 | $45/2^{+}$ | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 331.5 5 | 5.5 20 | 5717.1 | 49/2+ | 5385.6 | 47/2+ | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 337.4 5 | 7.9 10 | 4403.9 | $41/2^+$ | 4066.6 | 39/2+ | | |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | 337.7 5 345.3 <i>3</i> | 7.0 <i>10</i> 6.1 <i>5</i> | 5055.0 6062.4 | $45/2^+$ $51/2^+$ | 4717.4 5717.1 | 43/2+ 49/2+ | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 349.0 3 | 60.0 20 | 643.8 | 15/2- | 294.8 | 11/2- | (E2) [@] | R(DCO)=0.82 17. |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 349.9 3 | 3.8 7 | 6412.3 | 53/2 ⁺ | 6062.4 | 51/2+ | | B(DCO) = 0.92.19 |
| 370.55362.0011/2" 1/2"249.47/2" 4757.845/2" 45/2"371.010.925512.9047/2" 4757.845/2" 45/2"45/2" 45/2"45/2" 45/2"373.636.356785.955/2" 6412.36412.353/2" 21/4.229/2" 29/2"385.639.510289.7(29/2")2513.7(25/2") 293.531/2"2613.327/2" 292.2395.512331.8735/2" 292.220/2" 201.327/2"(Q)Mult: $\Delta J=2, Q \text{ from } \gamma(\theta)$ (1983RoZW).396.1322.1 20520.4111/2" 22.3.8122.37/2" 292.2(Q)Mult: $\Delta J=2, Q \text{ from } \gamma(\theta)$ (1983RoZW).396.2.5<2 | 370.2 3 | 24.2 23 | 1484.0 | 21/2 | 1114.4 | 19/2 | (D) | $\kappa(DCO)=0.82$ 18. $\delta(Q/D)=+0.05$ 3 (1983RoZW). |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | 370.5 5 | 53 | 620.0 | $\frac{11}{2^+}$ | 249.4 | $7/2^+$ | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 371.2 3 | 10.9 25 | 5129.0 | 47/2 | 4/5/.8 | 45/2 | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 373.6.3 | 9.0 20 | 6785 9 | 49/2 55/2 ⁺ | 6412.3 | 47/2 53/2 ⁺ | | |
| 385.6 33.5 37171.557/2+ 57/2+6785.955/2+ 57/2+386.0 39.5 102899.7(29/2+)251.37(2+ 251.327/2+395.1 322.1 20520.4111/2+223.231/2-396.1 322.1 20520.4111/2+223.87/2+403.1 314.0 122802.329/2+2399.125/2+410.1 37.1 107581.559/2+57/2+411.4 310.4 125913.451/2-5502.0426.6 319 32102.625/2-1676.023/2-426.6 319 32102.625/2-1676.023/2-440.3 314 42746.229/2-2305.927/2-440.3 314 42746.229/2-2305.927/2-444.0 323.7 20754.513/2+510.3445.0 3390.1696.317/2-413.815/2-444.0 323.7 108457.063/2+8008.8447.0 53.5 1096.317/2+2138.6447.0 53.5 1096.317/2+2138.6447.7 310.3 82613.327/2+2138.6448.0 323.7 20754.513/2+449.7 312.3 63482.435/2+477.7 312.3 63482.435/2+477.7 312.3 63482.435/2+477.7 312.3 63482.435/2+477.7 312.3 63482.435/2+477.7 310 | 375.4.5 | 8.3 | 3121.6 | $33/2^{-}$ | 2746.2 | $\frac{33/2}{29/2^{-}}$ | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 385.6 3 | 3.5 3 | 7171.5 | $57/2^+$ | 6785.9 | 55/2+ | | |
| $\begin{array}{llllllllllllllllllllllllllllllllllll$ | 386.0 <i>3</i> | 9.5 10 | 2899.7 | $(29/2^+)$ | 2513.7 | $(25/2^+)$ | | |
| 395.512.43318.735/22923.231/2*396.1322.120520.4111/2*124.327/2*(Q)Mult: $\Delta J=2$, Q from $\gamma(\theta)$ (1983RoZW).403.1314.0122802.329/2*2399.125/2*171.557/2*411.4310.4125913.451/2*550.049/2*49/2*416.999.5126330.353/2*5913.451/2*426.61922102.625/2*1676.023/2*(D)Mult:: $\Delta J=1$, D(+Q) transition from $\gamma(\theta)$ (1983RoZW).427.34.8.58008.861/2*7581.559/2*(D)Mult:: $\Delta J=1$, D(+Q) transition from $\gamma(\theta)$ (1983RoZW).427.314.42746.229/2*2305.927/2*(D)Mult:: $\Delta J=1$, D(+Q) transition from $\gamma(\theta)$ (1983RoZW).441.5313.0203243.833/2*2802.329/2*441.5445.039.016936.317/2*491.313/2*447.033.510967.313/2*500.8861/2*447.710.3 82613.327/2*213.623/2*E2.@474.7310.3 82613.327/2*213.623/2*474.7310.3 82613.327/2*213.623/2*474.7310.3 82613.327/2*213.623/2*474.7310.3 82613.327/2*213.623/ | 389.4 <i>3</i> | 8.6 5 | 3002.7 | $31/2^{+}$ | 2613.3 | $27/2^+$ | | |
| 396.1 322.1 20520.4111/2*124.327/2*(Q)Mult: ΔJ=2, Q from $\gamma(\theta)$ (1983RoZW).403.1 314.0 122802.329/2*2399.125/2*410.1 37.1 107581.559/2*7171.557/2*416.9 39.5 126330.353/2*5913.451/2*426.6 319 32102.625/2*1676.023/2*(D)427.3 34.8 58008.861/2*7581.559/2*428.0 318.0 223549.637/2*3121.633/2*440.3 314.42746.229/2*2305.927/2*(D)441.5 313.0 203243.833/2*2802.329/2*445.0 339.0 16936.317/2*491.313/2*445.0 39.0 16936.317/2*491.313/2*447.7 53.5 10967.313/2*520.39/2*447.6 3100.0 201114.419/2*643.815/2*470.7 312.3 63482.435/2*300.731/2*474.7 310.3 82613.327/2*230.731/2*487.3 323 31007.715/2*520.4111/2*487.3 323 31007.715/2*520.4111/2*487.3 323 31007.715/2*520.4111/2*487.3 323 31007.715/2*520.4111/2*527.4 318.8 19128.971/2*734.513/2*527. | 395.5 5 | 12 4 | 3318.7 | 35/2- | 2923.2 | $31/2^{-}$ | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 396.1 3 | 22.1 20 | 520.41 | 11/2 | 124.32 | 7/2 | (Q) | Mult.: $\Delta J=2$, Q from $\gamma(\theta)$ (1983RoZW). |
| 400.1 3 7.1 10 7581.5 59/2 ⁺ 1715.5 57/2 ⁺ 411.4 3 10.4 12 5913.4 51/2 ⁻ 5502.0 49/2 ⁻ 426.6 3 19 3 2102.6 25/2 ⁻ 1676.0 23/2 ⁻ (D) 427.3 3 4.8 5 8008.8 61/2 ⁺ 7581.5 59/2 ⁺ 428.0 3 18.0 22 3549.6 37/2 ⁻ 3121.6 33/2 ⁻ 440.3 3 14 4 2746.2 29/2 ⁻ 2305.9 27/2 ⁻ (D) 411.5 3 13.0 20 3243.8 33/2 ⁺ 2802.3 29/2 ⁺ 444.0 3 23.7 20 754.5 13/2 ⁺ 310.51 9/2 ⁺ 444.0 3 23.7 20 754.5 13/2 ⁺ 310.51 9/2 ⁺ 444.0 3 23.7 20 754.5 13/2 ⁺ 310.51 9/2 ⁺ 445.0 3 39.0 16 936.3 17/2 ⁻ 491.3 13/2 ⁻ 447.0 5 3.5 10 967.3 13/2 ⁺ 520.3 9/2 ⁺ 448.2 5 2.0 10 8457.0 63/2 ⁺ 8008.8 61/2 ⁺ 450.0 3 9.5 12 3349.7 (33/2 ⁺) 2899.7 (29/2 ⁺) 470.6 3 100.0 20 1114.4 19/2 ⁻ 643.8 15/2 ⁻ 123.6 3482.4 35/2 ⁺ 3002.7 31/2 ⁺ 479.7 3 12.3 6 3482.4 35/2 ⁺ 3049.7 (33/2 ⁺) 50.6 3 24.2 20 50.15 1501.2 17/2 ⁺ 97.3 13/2 ⁺ 514.5 3 14.4 0 378.8 2 37/2 ⁺ 3243.8 33/2 ⁺ Placement from 2002Je05. | 396.2.3 | <2 | 620.0 2802.3 | $\frac{11/2}{20/2^+}$ | 223.8 | 1/2 ⁺ 25/2 ⁺ | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 403.13 | 71 10 | 2602.5 7581.5 | 29/2 59/2+ | 2399.1 7171 5 | 23/2 57/2 ⁺ | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 411.4.3 | 10.4 12 | 5913.4 | $51/2^{-}$ | 5502.0 | $49/2^{-}$ | | |
| 426.6 3 19 3 2102.6 $25/2^{-}$ 1676.0 $23/2^{-}$ (D) Mult.: $\Delta J=1, D(+Q)$ transition from $\gamma(\theta)$ (1983RoZW). 427.3 3 4.8 5 8008.8 $61/2^{+}$ 7581.5 $59/2^{+}$ 428.0 3 18.0 22 3549.6 $37/2^{-}$ 3121.6 $33/2^{-}$ 440.3 3 14 4 2746.2 $29/2^{-}$ 2305.9 $27/2^{-}$ (D) Mult.: $\Delta J=1, D(+Q)$ transition from $\gamma(\theta)$ (1983RoZW). 441.5 3 13.0 20 3243.8 $33/2^{+}$ 2802.3 $29/2^{+}$ 444.0 3 23.7 20 754.5 $13/2^{+}$ 310.51 $9/2^{+}$ 445.0 3 39.0 16 936.3 $17/2^{-}$ 491.3 $13/2^{-}$ 447.0 5 $3.5 10$ 967.3 $13/2^{+}$ 520.3 $9/2^{+}$ 447.0 5 $3.5 10$ 967.3 $13/2^{+}$ 2809.7 $(29/2^{+})$ 470.6 3 100.0 20 1114.4 $19/2^{-}$ 643.8 $15/2^{-}$ E2 [@] R(DCO)=1.16 12. 474.7 3 10.3 8 2613.3 $27/2^{+}$ 2138.6 $23/2^{+}$ 479.7 3 12.3 6 3482.4 $35/2^{+}$ 3002.7 $31/2^{+}$ 487.3 3 23 3 1007.7 $15/2^{+}$ 520.41 $11/2^{+}$ 487.3 3 23 3 1007.7 $15/2^{+}$ 520.41 $11/2^{+}$ $^{*}492^{d}$ 501.6 3 24.2 20 3820.3 $39/2^{-}$ 3318.7 $35/2^{-}$ (Q) [@] R(DCO)=0.94 11. 514.9 3 10.0 10 3864.6 $(37/2^{+})$ 3349.7 $(33/2^{+})$ 527.4 3 18.8 19 1281.9 $17/2^{+}$ 754.5 $13/2^{+}$ 532.5 3 6.5 6 2399.1 $25/2^{+}$ 1866.7 $21/2^{+}$ 533.9 5 5.0 15 1501.2 $17/2^{+}$ 967.3 $13/2^{+}$ 532.5 3 1.4 I 0 3788.2 $37/2^{+}$ 1224 $383/2^{+}$ 501.6 3 72.4 $318.87 - 31/2^{+}$ 754.5 $13/2^{+}$ 502.6 $310.2 - 3820.3 - 39/2^{-}$ 318.7 $35/2^{-}$ (Q) [@] R(DCO)=0.94 11. 91.6 $310.2 - 30.25 + 10.2 - 17/2^{+} - 96.7 - 31/2^{+}$ 532.5 $3 - 6.5 - 6 - 2399.1 - 25/2^{+} - 1866.7 - 21/2^{+}$ 533.9 5 5.0 15 1501.2 $17/2^{+} - 324.3 - 33/2^{+}$ 50.1 $63 - 31.4 I = 32.2 - 37/2^{+} - 324.3 - 33/2^{+}$ 50.1 $63 - 31.4 = 37/2^{+} - 324.3 - 33/2^{+}$ 50.1 $63 - 32.9 - 31.4 = 37/2^{+} - 324.3 - 33/2^{+}$ 50.2 $5 - 31.4 = 10$ $10 - 3788.2 - 37/2^{+} - 324.3 - 33/2^{+}$ 50.2 $5 - 31.4 = 10$ $3788.2 - 37/2^{+} - 324.3 - 33/2^{+}$ 50.2 $5 - 31.4 = 10$ $3788.2 - 37/2^{+} - 324.3 - 33/2^{+}$ 50.2 $5 - 31.4 = 10$ $3788.2 - 37/2^{+} - 324.3 - 33/2^{+}$ 50.2 $5 - 31.4 = 10$ $3788.2 - 37/2^{+} - 324.3 - 33/2^{+}$ 50.2 $5 - 31.4 = 10$ $3788.2 - 37/2^{+} - 324.3 - 3$ | 416.9 3 | 9.5 12 | 6330.3 | 53/2- | 5913.4 | 51/2- | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 426.6 3 | 19 <i>3</i> | 2102.6 | 25/2- | 1676.0 | 23/2- | (D) | Mult.: $\Delta J=1$, D(+Q) transition from $\gamma(\theta)$ (1983RoZW). $\delta(Q/D)=+0.075$ (1983RoZW). |
| 428.0 3 18.0 22 3549.6 $37/2^-$ 3121.6 $33/2^-$ 440.3 3 14 4 2746.2 29/2 ⁻ 2305.9 27/2 ⁻ (D) Mult: ΔJ=1, D(+Q) transition from $\gamma(\theta)$ (1983RoZW). 441.5 3 13.0 20 3243.8 $33/2^+$ 2802.3 29/2 ⁺ 444.0 3 23.7 20 754.5 13/2 ⁺ 310.51 9/2 ⁺ 445.0 3 39.0 16 936.3 17/2 ⁻ 491.3 13/2 ⁻ 447.0 5 3.5 10 967.3 13/2 ⁺ 520.3 9/2 ⁺ 448.2 5 2.0 10 8457.0 63/2 ⁺ 8008.8 61/2 ⁺ 450.0 3 9.5 12 3349.7 (33/2 ⁺) 2899.7 (29/2 ⁺) 470.6 3 1000.20 1114.4 19/2 ⁻ 643.8 15/2 ⁻ 477.7 3 12.3 6 3482.4 35/2 ⁺ 3002.7 31/2 ⁺ 487.3 2 23 3 1007.7 15/2 ⁺ 620.0 11/2 ⁺ 487.3 2 23 3 1007.7 15/2 ⁺ 520.41 11/2 ⁺ *492 ^a 501.6 3 24.2 20 3820.3 39/2 ⁻ 3318.7 35/2 ⁻ 514.9 3 100.10 3864.6 (37/2 ⁺) 3349.7 (33/2 ⁺) 527.4 3 188.19 1281.9 17/2 ⁺ 754.5 13/2 ⁺ 533.9 5 5.0 15 1501.2 17/2 ⁺ 967.3 13/2 ⁺ 533.9 5 5.0 15 1501.2 17/2 ⁺ 967.3 13/2 ⁺ 534.5 3 11.4 10 3788.2 37/2 ⁺ 324.8 33/2 ⁺ Placement from 2002Je05. | 427.3 <i>3</i> | 4.8 5 | 8008.8 | $61/2^+$ | 7581.5 | 59/2+ | | |
| 440.3 <i>s</i> 14 <i>4</i> 2746.2 29/2 ⁺ 2305.9 27/2 ⁻ (D) Mult: $\Delta J=1$, D(+Q) transition from $\gamma(\theta)$ (1983RoZW). 441.5 <i>s</i> 13.0 20 3243.8 33/2 ⁺ 2802.3 29/2 ⁺ 444.0 <i>s</i> 23.7 20 754.5 13/2 ⁺ 310.51 9/2 ⁺ 445.0 <i>s</i> 39.0 <i>l</i> 6 936.3 17/2 ⁻ 491.3 13/2 ⁻ 447.0 <i>s</i> 3.5 <i>l</i> 0 967.3 13/2 ⁺ 520.3 9/2 ⁺ 448.2 <i>s</i> 2.0 <i>l</i> 0 8457.0 63/2 ⁺ 8008.8 61/2 ⁺ 450.0 <i>s</i> 9.5 <i>l</i> 2 3349.7 (33/2 ⁺) 2899.7 (29/2 ⁺) 470.6 <i>s</i> 100.0 20 1114.4 19/2 ⁻ 643.8 15/2 ⁻ 470.7 <i>s</i> 12.3 <i>6</i> 3482.4 35/2 ⁺ 3002.7 31/2 ⁺ 479.7 <i>s</i> 12.3 <i>6</i> 3482.4 35/2 ⁺ 3002.7 31/2 ⁺ 485.7 <i>s</i> 6.0 2 <i>s</i> 1105.7 15/2 ⁺ 620.0 11/2 ⁺ 487.3 <i>s</i> 23 <i>s</i> 1007.7 15/2 ⁺ 520.41 11/2 ⁺ 487.3 <i>s</i> 23 <i>s</i> 1007.7 15/2 ⁺ 520.41 11/2 ⁺ 501.6 <i>s</i> 24.2 20 3820.3 39/2 ⁻ 3318.7 35/2 ⁻ 514.9 <i>s</i> 10.0 <i>l</i> 0 3864.6 (37/2 ⁺) 3349.7 (33/2 ⁺) 527.4 <i>s</i> 18.8 <i>l</i> 9 1281.9 17/2 ⁺ 754.5 13/2 ⁺ 533.9 <i>s</i> 5.0 <i>l</i> 5 1501.2 17/2 ⁺ 967.3 13/2 ⁺ 533.9 <i>s</i> 5.0 <i>l</i> 5 1501.2 17/2 ⁺ 967.3 13/2 ⁺ 544.5 <i>s</i> 11.4 <i>l</i> 0 3788.2 37/2 ⁺ 3243.8 33/2 ⁺ | 428.0 3 | 18.0 22 | 3549.6 | 37/2- | 3121.6 | 33/2- | - | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 440.3 3 | 14 4 | 2746.2 | 29/2- | 2305.9 | 27/2- | (D) | Mult.: $\Delta J=1$, D(+Q) transition from $\gamma(\theta)$ (1983RoZW). $\delta(Q/D) = -0.01 \ I3 \ (1983RoZW).$ |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 441.5 3 | 13.0 20 | 3243.8 | $33/2^+$ | 2802.3 | $29/2^+$ | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 444.0 3 | 23.7 20 | 754.5 | 13/2 | 310.51 | 9/2' | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 445.05 | 39.0 10 | 930.3 | $\frac{1}{2}$ | 491.5 | $\frac{15}{2}$ $\frac{0}{2^+}$ | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 447.0 5 | 20.10 | 8457.0 | $\frac{13/2}{63/2^+}$ | 8008.8 | $\frac{5}{2}$ | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 450.0 3 | 9.5 12 | 3349.7 | $(33/2^+)$ | 2899.7 | $(29/2^+)$ | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 470.6 <i>3</i> | 100.0 20 | 1114.4 | 19/2- | 643.8 | $15/2^{-}$ | E2 [@] | R(DCO)=1.16 12. |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 474.7 <i>3</i> | 10.3 8 | 2613.3 | 27/2+ | 2138.6 | $23/2^{+}$ | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 479.7 3 | 12.3 6 | 3482.4 | 35/2+ | 3002.7 | $31/2^+$ | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 485.7 5 | 6.0 25 | 1105.7 | $15/2^+$ | 620.0 | $11/2^+$ | | |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | 487.3 3 ^x 492 ^a | 23 3 | 1007.7 | 15/2 | 520.41 | 11/2 | | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 501.6 <i>3</i> | 24.2 20 | 3820.3 | 39/2- | 3318.7 | 35/2- | (Q) [@] | R(DCO)=0.94 11. |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 514.9 <i>3</i> | 10.0 10 | 3864.6 | $(37/2^+)$ | 3349.7 | $(33/2^+)$ | | |
| 532.5 3 $6.5 6$ 2399.1 $25/2^+$ 1866.7 $21/2^+$ 533.9 5 $5.0 15$ 1501.2 $17/2^+$ 967.3 $13/2^+$ Placement from 2002Je05. 544.5 3 $11.4 10$ 3788.2 $37/2^+$ 3243.8 $33/2^+$ | 527.4 3 | 18.8 19 | 1281.9 | $17/2^+$ | 754.5 | $13/2^+$ | | |
| 535.9 5 5.0 15 1501.2 $1/2^{-1}$ 967.3 $13/2^{-1}$ Placement from 2002Je05. 544.5 3 11.4 10 3788.2 $37/2^{+1}$ 3243.8 $33/2^{+1}$ | 532.5 3 | 6.5 6 | 2399.1 | $\frac{25}{2^+}$ | 1866.7 | $\frac{21}{2^+}$ | | |
| | 555.95 544.53 | 5.015 11.410 | 3788.2 | $\frac{17/2}{37/2^+}$ | 3243.8 | $\frac{15/2}{33/2^+}$ | | Flacement IIOIII 2002Je03. |

Continued on next page (footnotes at end of table)

γ ⁽¹⁶³Lu) (continued)</sup>

| E_{γ}^{\dagger} | I_{γ}^{\ddagger} | E _i (level) | \mathbf{J}_i^{π} | $\mathbf{E}_f \qquad \mathbf{J}_f^{\pi}$ | Mult. | Comments |
|---------------------------|-------------------------|------------------------|------------------------------|--|------------------|---|
| 548.3 <i>3</i> | 26 3 | 1484.6 | 21/2- | 936.3 17/2- | (E2) | Mult.: $\Delta J=2$, Q from $\gamma(\theta)$ (1983RoZW). |
| 551.8 <i>3</i> | 30.0 25 | 4101.4 | $41/2^{-}$ | 3549.6 37/2- | (Q) [@] | R(DCO)=0.82 21. |
| 553.4 <i>3</i> | 23.2 15 | 1561.1 | $19/2^{+}$ | 1007.7 15/2+ | | |
| 561.6 <i>3</i> | 105.9 22 | 1676.0 | 23/2- | 1114.4 19/2- | E2 [@] | R(DCO)=1.01 11. |
| 562.8 5 | 4.0 20 | 1668.5 | $19/2^{+}$ | 1105.7 15/2+ | | |
| 577.5 3 | 20.1 18 | 2138.6 | $23/2^{+}$ | 1561.1 19/2+ | | |
| 57813 | 10 5 10 | 4442 7 | $(41/2^+)$ | $3864.6(37/2^+)$ | | |
| 584.2 5 | <15 | 4066.6 | $39/2^+$ | 3482.4 35/2+ | | |
| 584.8 5 | 25 3 | 1866.7 | $21/2^{+}$ | 1281.9 17/2+ | | |
| 606.9 5 | 3.5 23 | 2275.4 | $23/2^{+}$ | 1668.5 19/2+ | ~ | |
| 608.5 5 | 17 4 | 4428.8 | 43/2- | 3820.3 39/2- | Q [@] | R(DCO)=1.16 14. |
| 615.7 <i>3</i> | 11.0 15 | 4403.9 | $41/2^{+}$ | 3788.2 37/2+ | Ø | |
| 617.3 5 | 90 15 | 2923.2 | 31/2- | 2305.9 27/2- | Q | R(DCO)=0.95 10. |
| 618.0 5 | 24 4 | 2102.6 | 25/2- | 1484.6 21/2- | Q <mark>@</mark> | R(DCO)=0.95 10. |
| 629.9 <i>3</i> | 86.3 22 | 2305.9 | 27/2- | 1676.0 23/2- | E2 | R(DCO)=1.21 10. |
| 638.7 3 | 9.5 10 | 5081.4 | (45/2+) | 4442.7 (41/2+) | | |
| 643.6 3 | 23.9 12 | 2746.2 | $\frac{29}{2^{-}}$ | $2102.6 \ 25/2^{-1}$ | (Q) | R(DCO)=1.0 3. |
| 650.0 <i>5</i> | 15 4 15 4 | 4/1/.4 | $45/2^{+}$ $45/2^{+}$ | $4000.0 39/2^{+}$ $4403.9 41/2^{+}$ | | |
| 656.4.3 | 17 6 15 | 4757.8 | 45/2- | $4101 4 41/2^{-1}$ | @ | R(DCO) = 1.0.3 |
| 662.0 <i>3</i> | 10.8 11 | 5717.1 | $49/2^+$ | $5055.0 \ 45/2^+$ | | R(DCO)-1.0 5. |
| 668.2 3 | 11.1 12 | 5385.6 | $47/2^{+}$ | 4717.4 43/2+ | | |
| 676.8 <i>3</i> | 10.3 6 | 6062.4 | $51/2^{+}$ | 5385.6 47/2+ | | |
| 695.2 <i>3</i> | 10.2 9 | 6412.3 | $53/2^+$ | 5717.1 49/2+ | | |
| 697.03 | 9.0 10 | 5778.4 | (49/2) | 5081.4 (45/2') | | |
| 697.8 | 15 2 20 | 2199.0 | $(21/2^{+})$ | 1501.2 17/2* | | |
| 700.2 3 | <4 | 3020.0 | $(31/2^{-})$ | $2305 9 27/2^{-1}$ | | |
| 723 1 3 | 9010 | 2399.1 | 25/2+ | $1676.0 \ 23/2^{-1}$ | D& | R(DCO)=0.58.22 |
| 723.5 5 | 5.5 20 | 6785.9 | $55/2^+$ | $6062.4 \ 51/2^+$ | D | (1) (0) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1 |
| 744.2 3 | 22 3 | 5502.0 | 49/2- | 4757.8 45/2- | | |
| 750.9 10 | <4 | 2853.5 | $(29/2^{-})$ | 2102.6 25/2- | | |
| 752.0 3 | 7.0 8 | 6530.4 | $(53/2^+)$ | $5778.4 (49/2^+)$ | | |
| 739.2 3 784 5 3 | 8.00 143.15 | /1/1.5 5013 / | 51/2 | $51200 \ 47/2^{-1}$ | | |
| 795.7 3 | 7.0 6 | 7581.5 | 59/2 ⁺ | 6785.9 55/2+ | | |
| 805.2 3 | 5.2 6 | 7335.6 | $(57/2^+)$ | 6530.4 (53/2 ⁺) | | |
| 828.3 <i>3</i> | 16.0 18 | 6330.3 | 53/2- | 5502.0 49/2- | | |
| 837.3 3 | 8.5 8 | 8008.8 | $61/2^+$ | 7171.5 57/2+ | | |
| 857.73 | 3.3 5 | 8193.3 | $(61/2^{+})$ | $7335.6 (57/2^{+})$ | | |
| 87553 | 8610 | 0785.7 8457.0 | $\frac{55/2}{63/2^+}$ | 7581 5 59/2 ⁺ | | |
| 908.4 5 | 1.4 8 | 9101.7 | $(65/2^+)$ | $8193.3 (61/2^+)$ | | |
| 913.1 3 | 9.8 10 | 7243.4 | 57/2- | 6330.3 53/2- | | |
| 915.6 <i>3</i> | 4.0 5 | 8924.4 | $65/2^+$ | 8008.8 61/2+ | | |
| 939.6 3 | 10.0 17 | 7725.3 | $59/2^{-}$ | 6785.7 55/2 ⁻ | | |
| 948.6 <i>3</i> 061.0 5 | 5.0 5 | 9405.6 10063.6 | 6/2' (69/2 ⁺) | 8457.0 $63/2^{+}$ | | |
| 975.7 3 | 2.0 10 | 8219.1 | (09/2) | 7243.4 57/2- | | |
| 990.3 <i>3</i> | 4.1 4 | 9914.7 | $69/2^+$ | 8924.4 65/2+ | | |
| 1018.2 <i>3</i> | 2.7 5 | 10423.8 | $71/2^{+}$ | 9405.6 67/2+ | | |
| 1062.1 3 | 3.3 4 | 10976.8 | $73/2^{+}$ | 9914.7 69/2+ | | |

Continued on next page (footnotes at end of table)

$\gamma(^{163}$ Lu) (continued)

| E_{γ}^{\dagger} | I_{γ}^{\ddagger} | E_i (level) | \mathbf{J}_i^{π} | E_f | \mathbf{J}_f^{π} |
|---|--|---|---|--|--|
| 1076.9 <i>3</i> 1117.4 <i>10</i> 1120.8 <i>10</i> 1160.4 <i>10</i> 1225 <i>4 10</i> | 4.1 7 1.5 <i>15</i> 1.5 <i>15</i> 2.0 <i>15</i> | 11500.7 12094.2 12621.6 13254.6? | 75/2 ⁺ 77/2 ⁺ 79/2 ⁺ 81/2 ⁺ 85/2 ⁺ | 10423.8 10976.8 11500.7 12094.2 | 71/2 ⁺ 73/2 ⁺ 75/2 ⁺ 77/2 ⁺ |

[†] Uncertainties are 0.3 for strong and well resolved lines, 0.5 for doublets and when intensity uncertainty is \geq 25%, and 1.0 for weak or uncertain lines.

[‡] Uncertainties are 5-10%, but a few intense Iy's (230.9 γ , 292.5 γ , 349.0 γ , 445.0 γ , 470.6 γ , 561.6 γ , 629.9 γ) are quoted (1992Sc03) with 2-4% uncertainty.

[#] From Adopted Gammas.

[@] DCO ratio is consistent with $\Delta J=2$ (E2).

& DCO ratio is consistent with $\Delta J=1$ (dipole), but $\Delta J=2$ does not seem to be ruled out by the quoted R(DCO).

^{*a*} A possible 492-578 cascade proposed by 1992Sc03 above the 486-563-607 cascade is given in the level scheme of 2002Je05 also, but higher up in the 1/2[411] band.

^b From 2002Je05.

 $x \gamma$ ray not placed in level scheme.



¹⁶³₇₁Lu₉₂

8



 $^{163}_{71}Lu_{92}$



¹⁶³₇₁Lu₉₂



 $^{163}_{71}Lu_{92}$

¹³⁹La(²⁸Si,4nγ) 1992Sc03

Level Scheme (continued)

Intensities: Relative $I_{\boldsymbol{\gamma}}$



¹⁶³₇₁Lu₉₂

¹³⁹La(²⁸Si,4nγ) 1992Sc03



¹⁶³₇₁Lu₉₂



¹⁶³₇₁Lu₉₂