## (HI,xnγ) 1993De40

| Type | Author | History Citation | Literature Cutoff Date |
|---|---|---|---|
| Full Evaluation | N. Nica | NDS 154, 1 (2018) | 20-Nov-2018 |

Includes (HI,xnypγ).
$^{114}$Cd($^{30}$Si,p3nγ), $^{114}$Cd($^{29}$Si,p2nγ) E=110-140 MeV (1993De40,1989De39).
$^{110}$Pd($^{37}$Cl,α3nγ) (1993De40).
Measured: γ, γγ, γ(θ), DCO (at E($^{30}$Si)=130 MeV) (1993De40).
Level scheme is from 1993De40.

### $^{140}$Pm Levels

E(A),J(A) Band with $J_0=11^-$.
E(B),J(B) Band with $J_0=15$.
E(D),J(D) Band with $J_0=14$.

| E(level) | $J^{\pi}$ † | $T_{1/2}$ | Comments |
|---|---|---|---|
| 0.0+x | $8^-$ | | E(level): x=431 *28* from Adopted Levels.<br>Configuration=$\pi d_{5/2}\otimes\nu_{11/2}$ (1993De40). |
| 386.2+x | $8^+$ | 1.0 ns *+10−5* | $T_{1/2}$: from timing spectra in between prompt 402γ and 386γ (1990De40). |
| 407.5+x | $9^+$ | | |
| 532.3+x | $10^+$ | | |
| 806.0+x | $9^-$ | | |
| 934.4+x | $11^+$ | | |
| 1308.5+x | $12^+$ | | |
| 1601.5+x | $11^-$ | | |
| 1690.3+x | 12 | | |
| 1873.5+x | $13^+$ | | |
| 2096.9+x | $13^-$ | | |
| 2209.2+x | 12 | | |
| 2557.1+x | $14^+$ | | |
| 2570.9+x | $14^+$ | | |
| 2595.6+x | 13 | | |
| 2625.1+x | 14 | | |
| 2665.3+x | 13 | | |
| 2748.0+x | 15 | | |
| 2776.9+x | 13 | | |
| 2905.7+x | 14 | | |
| 2992.8+x | 16 | | |
| 3132.5+x | 15 | | |
| 3372.7+x | 16 | | |
| 3386.5+x | 16 | | |
| 3498.9+x | 17 | | |
| 3652.3+x | 17 | | |
| 4043.6+x | 18 | | |
| 4128.2+x | 18 | | |
| 4393.5+x | 19 | | |
| 4508.8+x | 19 | | |
| 5021.1+x | 20 | | |

† Adopted by 1993De40 based on Iγ balance and DCO (can differ from $J^{\pi}$ values in the Adopted Levels, Gammas dataset). No parity values were adopted by 1993De40 above 2580+x.

**(HI,xnγ) 1993De40 (continued)**

γ($^{140}$Pm)

| $E_\gamma$ [†] | $I_\gamma$ [†] | $E_i$(level) | $J_i^\pi$ | $E_f$ | $J_f^\pi$ | Mult.[‡#@] | Comments |
|---|---|---|---|---|---|---|---|
| (21.3) | | 407.5+x | $9^+$ | 386.2+x | $8^+$ | | |
| 124.8 *1* | 86 *11* | 532.3+x | $10^+$ | 407.5+x | $9^+$ | M1+E2 | DCO=0.89 *9* (1993De40) |
| 129.1 *3* | 4 *1* | 2905.7+x | 14 | 2776.9+x | 13 | D+Q | DCO=0.91 *11* (1993De40) |
| 177.1 *3* | 13 *3* | 2748.0+x | 15 | 2570.9+x | $14^+$ | | DCO=0.82 *8* (1993De40) |
| 190.6 *3* | 4 *1* | 2748.0+x | 15 | 2557.1+x | $14^+$ | | DCO=0.81 *13* (1993De40) |
| 226.9 *2* | 31 *4* | 3132.5+x | 15 | 2905.7+x | 14 | D+Q | DCO=0.74 *7* (1993De40)<br>$A_2$=0.18 *5*, $A_4$=0.08 *7* (1993De40). |
| 240.9 *3* | 8 *2* | 2905.7+x | 14 | 2665.3+x | 13 | D+Q | DCO=0.72 *10* (1993De40) |
| 244.8 *2* | 17 *4* | 2992.8+x | 16 | 2748.0+x | 15 | D+Q | DCO=0.67 *7* (1993De40)<br>$A_2$=0.37 *13*, $A_4$=0.16 *18* (1993De40). |
| 254.0 *2* | 35 *4* | 3386.5+x | 16 | 3132.5+x | 15 | D+Q | DCO=0.72 *4* (1993De40)<br>$A_2$=0.16 *3*, $A_4$=0.09 *4* (1993De40). |
| 265.8 *2* | 25 *3* | 3652.3+x | 17 | 3386.5+x | 16 | D+Q | DCO=0.70 *4* (1993De40)<br>$A_2$=0.09 *5*, $A_4$=0.14 *7* (1993De40). |
| 273.7 *2* | 40 *9* | 806.0+x | $9^-$ | 532.3+x | $10^+$ | D+Q | DCO=0.79 *5* (1993De40) |
| 310.1 *3* | 10 *3* | 2905.7+x | 14 | 2595.6+x | 13 | D+Q | DCO=0.70 *7* (1993De40) |
| 374.1 *1* | 47 *8* | 1308.5+x | $12^+$ | 934.4+x | $11^+$ | D(+Q) | DCO=0.66 *6* (1993De40) |
| 386.2 *1* | 100 | 386.2+x | $8^+$ | 0.0+x | $8^-$ | E1 | DCO=0.75 *15* (1993De40)<br>$A_2$=0.42 *2*, $A_4$=0.01 *3* (1993De40).<br>Mult.: 1993De40 argument: pure D, ΔJ=0 based on γ(θ) and DCO; E1 from comparison with N=79 isotone $^{142}$Eu (1990Bi07,2000Tu01). |
| 386.4 *3* | 10 *3* | 2595.6+x | 13 | 2209.2+x | 12 | D+Q | DCO=1.34 *8* (1993De40) |
| 391.3 *2* | 32 *4* | 4043.6+x | 18 | 3652.3+x | 17 | | DCO=0.72 *7* (1993De40)<br>$A_2$=0.50 *5*, $A_4$=0.12 *7* (1993De40). |
| 399.4 *2* | 6 *1* | 806.0+x | $9^-$ | 407.5+x | $9^+$ | | DCO=1.20 *20* (1993De40) |
| 402.1 *1* | 70 *7* | 934.4+x | $11^+$ | 532.3+x | $10^+$ | (M1+E2) | DCO=0.65 *4* (1993De40)<br>$A_2$=0.29 *2*, $A_4$=0.02 *3* (1993De40). |
| 407.5 *2* | 28 *6* | 407.5+x | $9^+$ | 0.0+x | $8^-$ | E1 | DCO=0.85 *6* (1993De40)<br>$A_2$=0.00 *5*, $A_4$=0.05 *8* (1993De40).<br>Mult.: 1993De40 argument: D, ΔJ=1 based on DCO; E1 from comparison with N=79 isotone $^{142}$Eu (1990Bi07,2000Tu01). |
| 419.8 *2* | 20 *5* | 806.0+x | $9^-$ | 386.2+x | $8^+$ | D | DCO=0.66 *6* (1993De40) |
| 456.3 *1* | 4 *1* | 2665.3+x | 13 | 2209.2+x | 12 | | |
| 465.2 *2* | 20 *3* | 4508.8+x | 19 | 4043.6+x | 18 | D+Q | DCO=0.72 *6* (1993De40)<br>$A_2$=0.06 *3*, $A_4$=0.08 *4* (1993De40). |
| 495.4 *2* | 39 *4* | 2096.9+x | $13^-$ | 1601.5+x | $11^-$ | E2 | DCO=1.39 *8* (1993De40)<br>$A_2$=0.27 *4*, $A_4$=0.08 *6* (1993De40). |
| 506.1 *3* | 17 *4* | 3498.9+x | 17 | 2992.8+x | 16 | D(+Q) | DCO=0.62 *6* (1993De40) |
| 528.2 *2* | 25 *5* | 2625.1+x | 14 | 2096.9+x | $13^-$ | D+Q | DCO=0.71 *5* (1993De40)<br>$A_2$=0.68 *5*, $A_4$=0.11 *7* (1993De40). |
| 565.0 *2* | 23 *3* | 1873.5+x | $13^+$ | 1308.5+x | $12^+$ | (M1+E2) | DCO=0.70 *5* (1993De40)<br>$A_2$=0.41 *8*, $A_4$=0.11 *12* (1993De40). |
| 697.4 *2* | 12 *3* | 2570.9+x | $14^+$ | 1873.5+x | $13^+$ | (M1+E2) | DCO=0.90 *18* (1993De40) |
| 747.6 *2* | 24 *5* | 3372.7+x | 16 | 2625.1+x | 14 | E2 | DCO=1.42 *10* (1993De40)<br>$A_2$=0.19 *4*, $A_4$=0.08 *6* (1993De40). |
| 755.5 *3* | 17 *5* | 4128.2+x | 18 | 3372.7+x | 16 | E2 | DCO=1.50 *20* (1993De40) |
| 755.9 *3* | 9 *2* | 1690.3+x | 12 | 934.4+x | $11^+$ | D(+Q) | DCO=0.58 *12* (1993De40) |
| 776.4 *2* | 4 *1* | 1308.5+x | $12^+$ | 532.3+x | $10^+$ | E2 | DCO=1.57 *32* (1993De40) |
| 795.5 *1* | 35 *4* | 1601.5+x | $11^-$ | 806.0+x | $9^-$ | E2 | DCO=1.48 *11* (1993De40)<br>$A_2$=0.27 *4*, $A_4$=0.08 *6* (1993De40). |
| 805.7 *4* | 5 *3* | 806.0+x | $9^-$ | 0.0+x | $8^-$ | | |
| 892.9 *3* | 10 *3* | 5021.1+x | 20 | 4128.2+x | 18 | E2 | DCO=1.48 *15* (1993De40) |
| 894.6 *3* | 6 *2* | 4393.5+x | 19 | 3498.9+x | 17 | E2 | DCO=1.45 *15* (1993De40) |
| 974.5 *3* | 7 *1* | 2665.3+x | 13 | 1690.3+x | 12 | D+Q | DCO=1.00 *25* (1993De40) |

Continued on next page (footnotes at end of table)

**(HI,xn$\gamma$) 1993De40 (continued)**

$\gamma(^{140}Pm)$ (continued)

| $E_\gamma$ [†] | $I_\gamma$ [†] | $E_i$(level) | $J_i^\pi$ | $E_f$ | $J_f^\pi$ | Mult.[‡#@] | Comments |
|---|---|---|---|---|---|---|---|
| 1248.6 *2* | 9 *2* | 2557.1+x | $14^+$ | 1308.5+x | $12^+$ | E2 | DCO=1.45 *15* (1993De40)<br>$A_2$=0.13 *21*, $A_4$=0.67 *31* (1993De40). |
| 1262.5 *7* | 8 *2* | 2570.9+x | $14^+$ | 1308.5+x | $12^+$ | E2 | DCO=1.80 *40* (1993De40) |
| 1274.8 *3* | 10 *3* | 2209.2+x | 12 | 934.4+x | $11^+$ | (M1+E2) | DCO=0.77 *15* (1993De40) |
| 1468.4 *3* | 10 *3* | 2776.9+x | 13 | 1308.5+x | $12^+$ | D+Q | DCO=0.88 *8* (1993De40) |

† From 1993De40.

‡ From 1993De40 based on $\gamma(\theta)$ ($A_2$, $A_4$ values are given without sign although not all are supposed to be positive reason for which the evaluator adopted no sign) and DCO measurements. Although no expected values for D and Q transitions for the DCO ratios are given from the values listed in Table 1 it appears that for pure stretched dipoles this is about 0.6 and for pure stretched quadrupoles this is about 1.5, with mixed D+Q transitions in between. Based on the heavy ion population reaction with deformation and rotation of the core stretched quadrupoles are very likely E2 while mixed D+Q are tentatively M1+E2. Level scheme or systematics and theoretical arguments are also used explicitly or implictly by the authors. Two pure dipoles were assigned as E1.

# For all transitions deexciting levels above 2580+x no nore assignments of electric or magnetic character were attemped by 1993De40 based on their measured multipolarities (probably because of less statistics for such transitions). However the evaluator continued to adopt E2 for Q as these assignments are very likely.

@ Additional information 1.

**(HI,xnγ) 1993De40**

Level Scheme

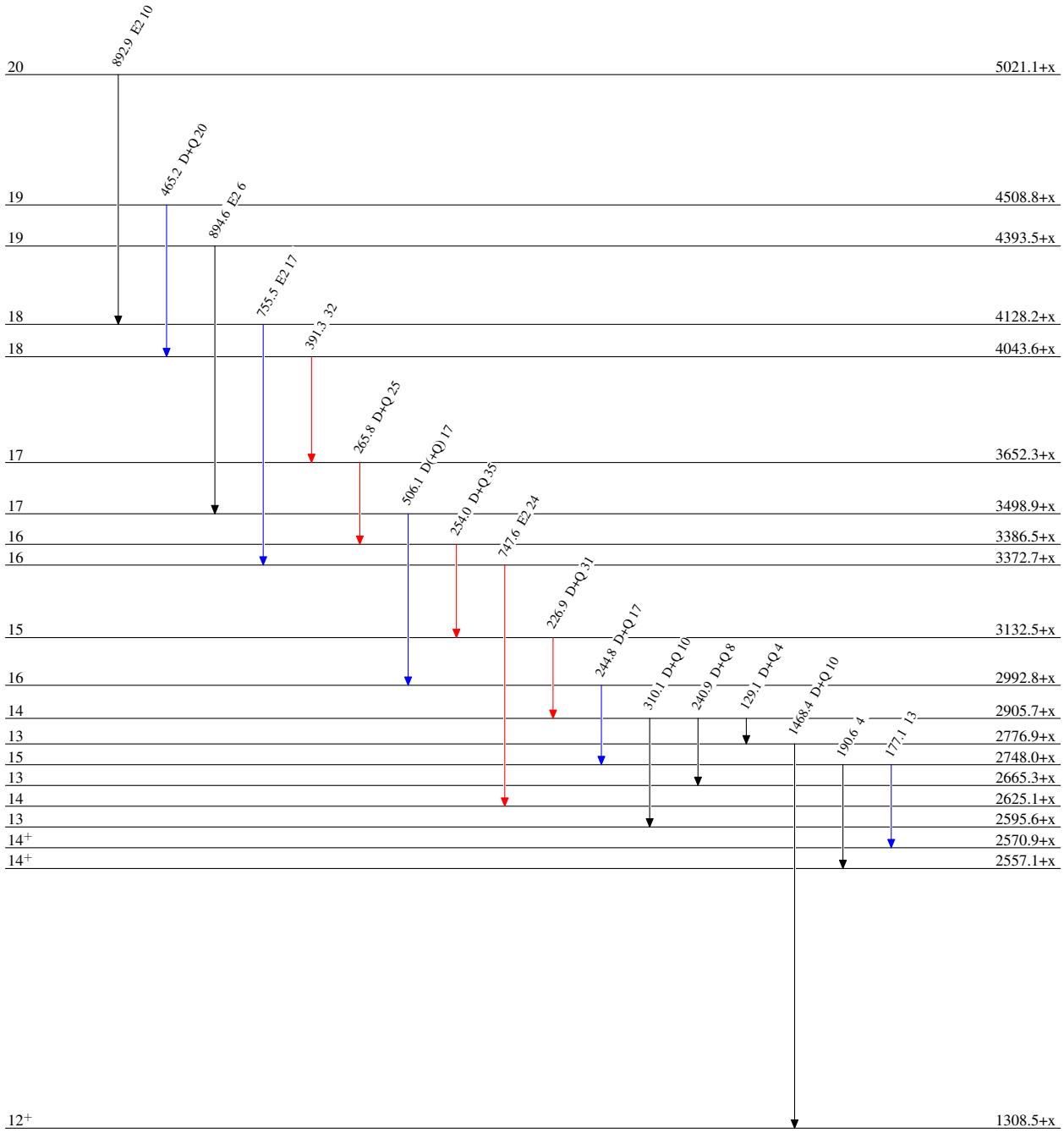
Intensities: Relative $I_\gamma$

Legend

$I_\gamma < 2\% \times I_\gamma^{max}$

$I_\gamma < 10\% \times I_\gamma^{max}$

$I_\gamma > 10\% \times I_\gamma^{max}$

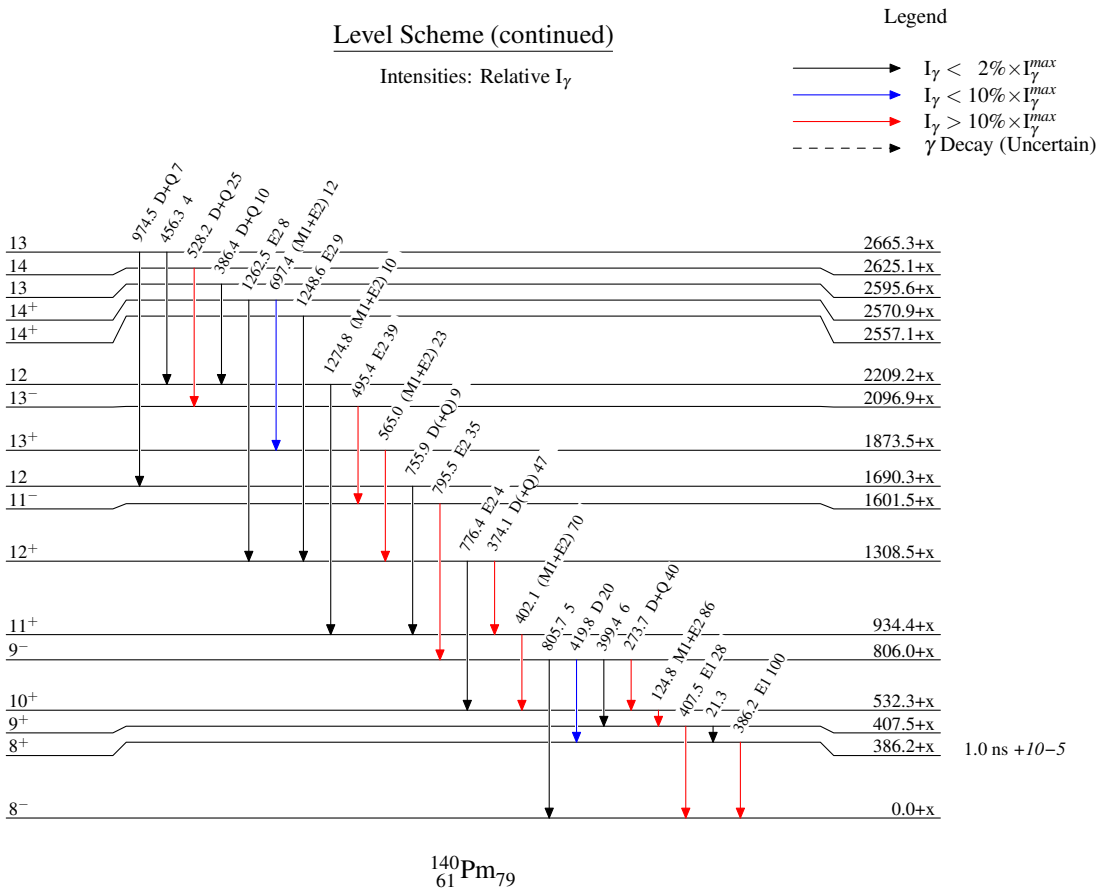



$^{140}_{61}Pm_{79}$

**(HI,xnγ) 1993De40**

## Level Scheme (continued)

Intensities: Relative $I_\gamma$




$^{140}_{61}Pm_{79}$