

$^{181}\text{Ta}(^{12}\text{C},4n\gamma)$  1975De20

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	T. D. Johnson, Balraj Singh		NDS 142, 1 (2017)	15-Apr-2017

**1975De20:**  $^{181}\text{Ta}(^{12}\text{C},4n\gamma)$ , E=70-85 MeV; Ge(Li) detectors; measured  $E\gamma$ ,  $I\gamma$ ,  $I\gamma(\theta)$ ,  $\gamma\gamma$ -coin, delayed  $\gamma$ . Deduced levels,  $J^\pi$ ,  $T_{1/2}$ , conversion coefficients. A total of 32  $\gamma$  rays reported placed amongst 25 levels up to 4219 keV and four bands. Several  $\gamma$  rays were not placed in the level scheme. A comparison with later studies shows that most of these belong to  $^{189}\text{Au}$ .

Some of the cascades have either a different ordering of  $\gamma$  rays or a missed transition in a cascade, thus some of the level energies and  $J^\pi$  values above 2.5 MeV excitation given here do not match those in the Adopted dataset (where high-spin structures are mainly based on the more extensive work of [1992Ve05](#)), even when the same gamma rays seem involved.

 $^{189}\text{Au}$  Levels

E(level) <sup>†</sup>	$J^\pi$ <sup>‡</sup>	$T_{1/2}$	Comments
247.25@ 16	11/2-#	4.59# min 11	<a href="#">Additional information 1</a> . E(level): from Adopted Levels.
325.13& 10	9/2-#	190# ns 15	
484.0 5	7/2-		
491.6 5	5/2-		
646.1& 5	13/2-		
681.5@ 5	15/2-		
712.6 5	11/2-		
812.7 5	13/2-		
1105.1& 8	17/2-		
1411.6@ 7	19/2-		
1661.8& 9	21/2-		
1719.5 7	17/2-		E(level): level not confirmed in any other study, it is not included in the Adopted dataset.
2061.5 <sup>a</sup> 8	21/2-		$J^\pi$ : 21/2 <sup>(+)</sup> in Adopted Levels.
2203.7@ 8	23/2-		
2248.7 <sup>a</sup> 9	23/2-		$J^\pi$ : (25/2 <sup>+</sup> ) in Adopted Levels.
2298.8& 10	25/2-		
2399.1 9	(21/2-)		$J^\pi$ : (25/2 <sup>+</sup> ) in Adopted Levels.
2513.3 <sup>a</sup> 10	25/2-		$J^\pi$ : (27/2 <sup>+</sup> ) in Adopted Levels.
2552.7 <sup>b</sup> 9	21/2 <sup>+</sup>	9.3 ns 5	E(level): in Adopted dataset, the 9-ns isomer lies above a 2554.7, (27/2 <sup>-</sup> ) level at an unspecified energy. $J^\pi$ : (27/2 <sup>-</sup> ) in Adopted Levels. $T_{1/2}$ : $\gamma(t)$ ( <a href="#">1975De20</a> ).
2678.7 <sup>b</sup> 10	(25/2 <sup>+</sup> )		No such level in the Adopted dataset.
2712.9 <sup>c</sup> 12	29/2 <sup>+</sup>	440 ns 50	$T_{1/2}$ : $\gamma(t)$ ( <a href="#">1975De20</a> ). Note that the value is 242 ns 10 in Adopted Levels, taken from <a href="#">1997Pe26</a> . E(level), $J^\pi$ : in Adopted dataset, this isomer with $T_{1/2}$ =242 ns 10 is at 2554.8 keV, $J^\pi$ =31/2 <sup>+</sup> decaying by a 39-keV $\gamma$ transition.
2987.6 <sup>b</sup> 12	(29/2 <sup>+</sup> )		$J^\pi$ : (35/2 <sup>-</sup> ) in Adopted Levels. In the Adopted dataset, this level decays by 125.6 and 435.2 $\gamma$ rays.
3220.3 <sup>c</sup> 13	33/2 <sup>+</sup>		
3357.8 <sup>b</sup> 13	(33/2 <sup>+</sup> )		$J^\pi$ : (37/2 <sup>-</sup> ) in Adopted Levels.
4001.8 <sup>c</sup> 14	37/2 <sup>+</sup>		
4219.6 15			

<sup>†</sup> From least-squares fit to  $E\gamma$  values, assuming  $\Delta(E\gamma)$ =0.5 keV for each  $E\gamma$ , and keeping the energy of the 247 level as fixed.

<sup>‡</sup> From [1975De20](#), except as noted. Several assignments are different, see Adopted Levels for  $J^\pi$  assignments taken from later and

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more detailed studies by [1992Ve05](#) and [1992Bo23](#) (also [1993Pe17](#)).

# From Adopted Levels.

@ Band(A):  $\pi h_{11/2}$  band.

& Band(B):  $\pi h_{9/2}$  band.

<sup>a</sup> Band(C): Band based on  $21/2^-$ .

<sup>b</sup> Band(D): Band based on  $21/2^+$ .

<sup>c</sup> Band(E): Band based on  $29/2^+$ .

$E_\gamma$	$I_\gamma$	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	$\gamma(^{189}\text{Au})$			Comments
						Mult. <sup>†</sup>	$\delta^\ddagger$	$\alpha^a$	
77.9 <i>1</i>		325.13	$9/2^-$	247.25	$11/2^-$				$E_\gamma$ : from Adopted Gammas. $E_\gamma=78.0$ in <a href="#">1975De20</a> .
<sup>x</sup> 103.5 <sup>#</sup>	38.0 <i>15</i>								Placed from a 2554, ( $27/2^-$ ) level in the Adopted dataset.
<sup>x</sup> 114.0	11.7 <i>15</i>								Placed from a 2989+x, ( $35/2^-$ ) level in the Adopted dataset.
126.0	8.3 <i>15</i>	2678.7	$(25/2^+)$	2552.7	$21/2^+$				Placed from a 5315, ( $51/2^+$ ) level in the Adopted dataset.
<sup>x</sup> 141.0	12.3 <i>15</i>								Placed from a 5315, ( $51/2^+$ ) level in the Adopted dataset.
150.3 <sup>#</sup>	5.9 <i>12</i>	2399.1	$(21/2^-)$	2248.7	$23/2^-$				Mult.: M1(+E2) in <a href="#">1975De20</a> based on intensity considerations in a cascade.
153.5 <sup>#</sup>	13.1 <i>13</i>	2552.7	$21/2^+$	2399.1	$(21/2^-)$	(E1)			Mult.: based on intensity considerations in a cascade.
166.5 <sup>&amp;</sup>		491.6	$5/2^-$	325.13	$9/2^-$				
187.1 <sup>@</sup>	32.0 <i>25</i>	2248.7	$23/2^-$	2061.5	$21/2^-$	M1(+E2)	<1.1	1.0 <i>2</i>	$\alpha(\text{exp})=1.2$ <i>4</i> ; $A_2=-0.32$ <i>7</i>
199.6	16.8 <i>17</i>	2712.9	$29/2^+$	2513.3	$25/2^-$	M2			$\alpha(\text{exp})=4.9$ <i>11</i> Transition related to 440-ns isomer and a fast component.
									$E_\gamma$ : transition from this isomer is not reported or confirmed in later studies ( <a href="#">1979Go15</a> , <a href="#">1992Ve05</a> , <a href="#">1992Bo23</a> , <a href="#">1993Pe17</a> and <a href="#">1997Pe26</a> ). This $\gamma$ is not included in the Adopted dataset.
217.8	8.7 <i>8</i>	4219.6		4001.8	$37/2^+$	(Q)			$A_2=+0.15$ <i>7</i> A 218.6 $\gamma$ is placed from a 4698, ( $47/2^+$ ) level in Adopted Levels.
									Mult.: (E2) in <a href="#">1975De20</a> .
236.8 <sup>&amp;</sup>		484.0	$7/2^-$	247.25	$11/2^-$				
<sup>x</sup> 251	3.2 <i>15</i>								A 253.3 $\gamma$ is placed from a 3223, ( $31/2^-$ ) level in the Adopted dataset.
<sup>x</sup> 256.5 <sup>#</sup>	6.1 <i>12</i>								Placed from a 2319 level in the Adopted dataset.
264.6	35.0 <i>35</i>	2513.3	$25/2^-$	2248.7	$23/2^-$	M1(+E2)	<1.0	0.32 <i>17</i>	$\alpha(\text{exp})=0.6$ <i>3</i> ( <a href="#">1975De20</a> ); $A_2=-0.27$ <i>27</i>
									Transition related to 440-ns isomer.
<sup>x</sup> 292.0 <sup>#</sup>	3.6 <i>18</i>								Placed from a 2543 level in the Adopted dataset.
307.7 <sup>#</sup>	7.4 <i>22</i>	1719.5	$17/2^-$	1411.6	$19/2^-$				$E_\gamma$ : $\gamma$ not confirmed in any other

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$^{181}\text{Ta}(^{12}\text{C},4n\gamma)$  **1975De20 (continued)** $\gamma(^{189}\text{Au})$  (continued)

$E_\gamma$	$I_\gamma$	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. <sup>†</sup>	Comments
308.9	23.2 25	2987.6	(29/2 <sup>+</sup> )	2678.7	(25/2 <sup>+</sup> )		study, not included in the Adopted dataset. A 308.6 $\gamma$ is placed from 2863+x, (33/2 <sup>-</sup> ) level in the Adopted dataset.
321.0	26 3	646.1	13/2 <sup>-</sup>	325.13	9/2 <sup>-</sup>		$A_2=+0.5$ 5
349.2 <sup>#</sup>	14.5 15	2552.7	21/2 <sup>+</sup>	2203.7	23/2 <sup>-</sup>	D	$A_2=-0.38$ 9 Mult.: (E1) in 1975De20, however, this contradicts mult=Q in Adopted dataset taken from $\gamma(\theta)$ data in 1979Go15.
370.2	12.0 15	3357.8	(33/2 <sup>+</sup> )	2987.6	(29/2 <sup>+</sup> )		Mult.: E2 in 1975De20.
387.5 <sup>&amp;</sup>		712.6	11/2 <sup>-</sup>	325.13	9/2 <sup>-</sup>		
434.3 <sup>@</sup>	100 5	681.5	15/2 <sup>-</sup>	247.25	11/2 <sup>-</sup>	(Q)	$A_2=+0.14$ 4
459.0	12.1 13	1105.1	17/2 <sup>-</sup>	646.1	13/2 <sup>-</sup>	(Q)	$A_2=+0.28$ 21
507.4	20 2	3220.3	33/2 <sup>+</sup>	2712.9	29/2 <sup>+</sup>		$A_2=+0.13$ 15 A 507.3 $\gamma$ is placed from a 3062, (35/2 <sup>+</sup> ) level in Adopted Levels. Mult.: E2 in 1975De20.
<sup>x</sup> 540.0	10.2 15						Placed from a 1353 level in the Adopted dataset.
556.7	5.4 6	1661.8	21/2 <sup>-</sup>	1105.1	17/2 <sup>-</sup>	(Q)	$A_2=+0.29$ 22 Mult.: E2 in 1975De20.
565.5	7.5 9	812.7	13/2 <sup>-</sup>	247.25	11/2 <sup>-</sup>		
<sup>x</sup> 634.5	5.5 9					(D)	$A_2=-0.27$ 27 Placed from a 4480, (43/2 <sup>+</sup> ) level in the Adopted dataset.
637.0	4.3 9	2298.8	25/2 <sup>-</sup>	1661.8	21/2 <sup>-</sup>	(Q)	$A_2=+0.62$ 38 Mult.: E2 in 1975De20.
649.8 <sup>@</sup>	61 5	2061.5	21/2 <sup>-</sup>	1411.6	19/2 <sup>-</sup>	D+Q	$A_2=-0.27$ 8 Mult.: M1+E2 in 1975De20.
729.8 <sup>@</sup>	96 5	1411.6	19/2 <sup>-</sup>	681.5	15/2 <sup>-</sup>	(Q)	$A_2=+0.14$ 4 Mult.: E2 in 1975De20.
781.5	11.5 15	4001.8	37/2 <sup>+</sup>	3220.3	33/2 <sup>+</sup>	(Q)	$A_2=+0.36$ 22 A 783.2 $\gamma$ is placed from a 3845, (39/2 <sup>+</sup> ) level in Adopted Levels. Mult.: E2 in 1975De20.
792.2 <sup>#</sup>	21.0 15	2203.7	23/2 <sup>-</sup>	1411.6	19/2 <sup>-</sup>	(Q)	$A_2=+0.19$ 8 Mult.: E2 in 1975De20.
1038.2 <sup>#</sup>	9.5 15	1719.5	17/2 <sup>-</sup>	681.5	15/2 <sup>-</sup>	D+Q	$A_2=-0.55$ 43 Placement from a 2451, 23/2 <sup>-</sup> level in the Adopted dataset. Mult.: M1+E2 in 1975De20. Note that $A_2$ is positive in $\gamma(\theta)$ data of 1979Go15 in ( $\alpha,6n\gamma$ ) suggesting mult=(Q).
<sup>x</sup> 1039.9	9.6 15						$A_2=+0.36$ 26 This $\gamma$ is not confirmed in any of the later high-spin studies.

<sup>†</sup> From  $\gamma(\theta)$  data, and a few from ce data when conversion coefficients are given.

<sup>‡</sup> Deduced by evaluators from ce data.

<sup>#</sup> Transition related to the 9.3-ns isomer.

<sup>@</sup> Transition related to the 440-ns and 9.3-ns isomers.

<sup>&</sup> From level-scheme Fig. 1 in 1975De20, not listed in authors' Table 1.

<sup>a</sup> Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation

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$^{181}\text{Ta}(^{12}\text{C},4n\gamma)$  **1975De20** (continued)

$\gamma(^{189}\text{Au})$  (continued)

based on  $\gamma$ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.  
<sup>x</sup>  $\gamma$  ray not placed in level scheme.

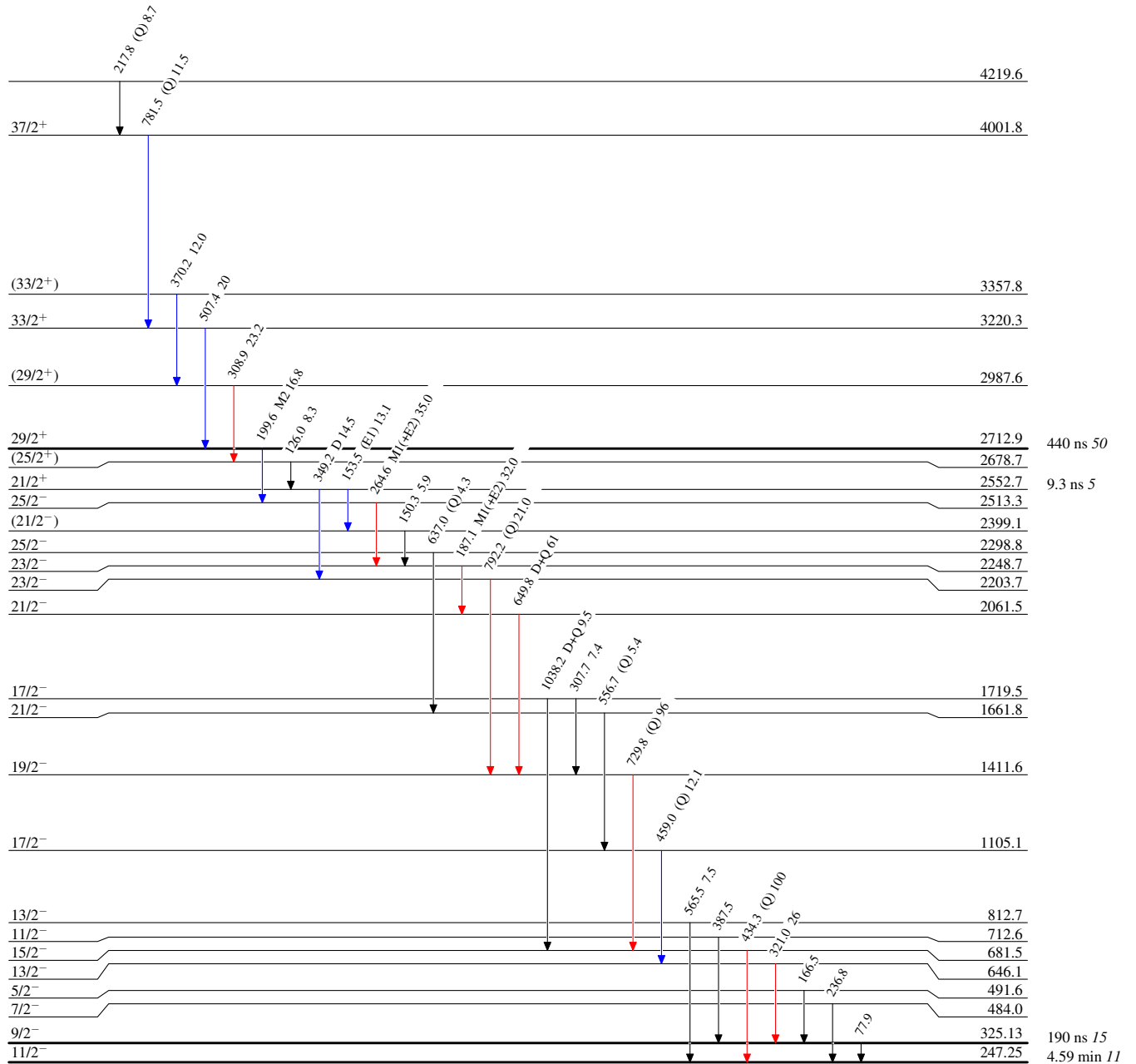
$^{181}\text{Ta}(^{12}\text{C},4n\gamma)$  1975De20

Level Scheme

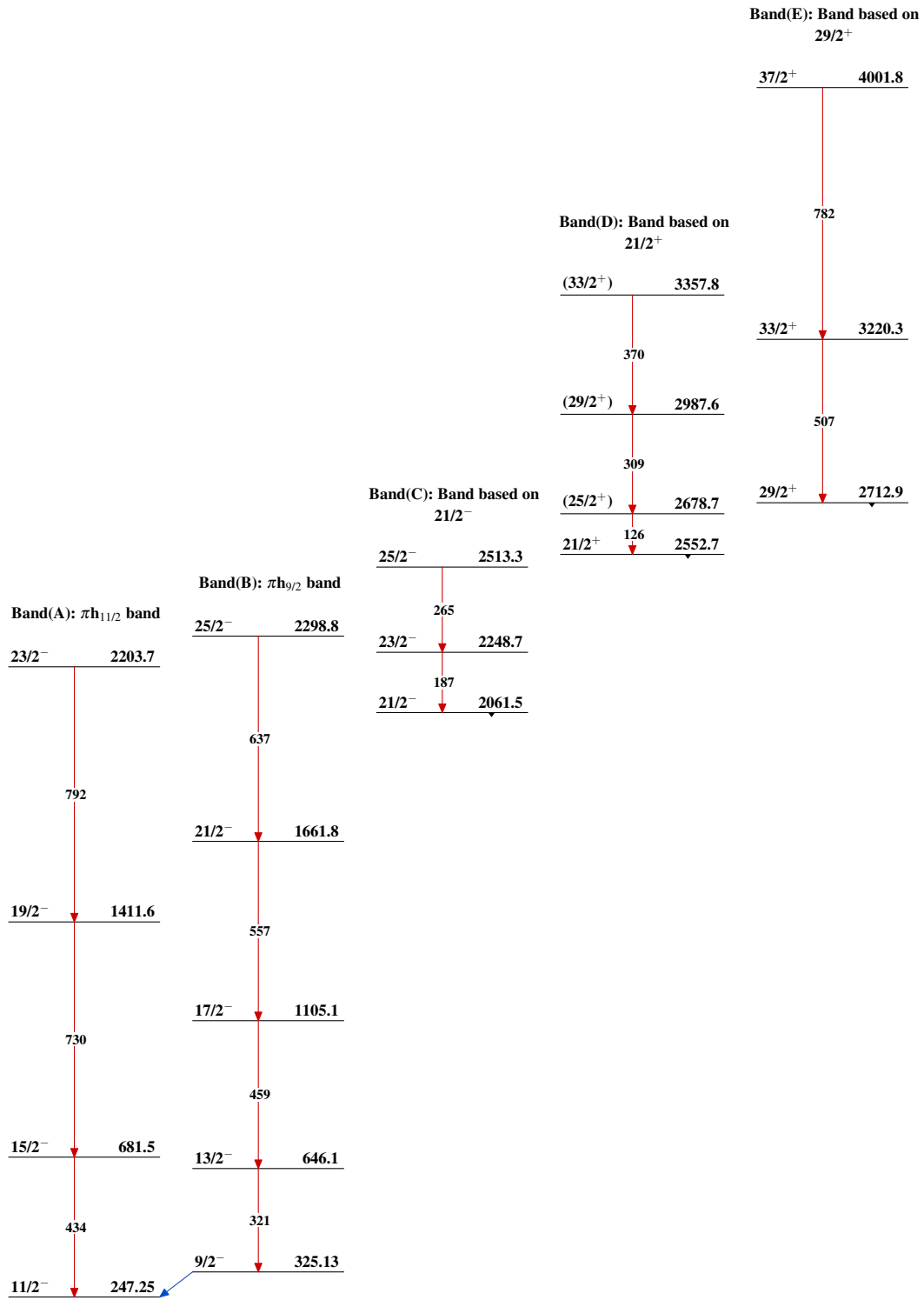
Intensities: Relative  $I_\gamma$

Legend

- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$



$^{189}_{79}\text{Au}_{110}$

$^{181}\text{Ta}(^{12}\text{C},4n\gamma)$  1975De20 $^{189}_{79}\text{Au}_{110}$