

$^{23}\text{Na}(\alpha, p\gamma)$ 1986G106, 1972Du05, 1974Be08

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	M. S. Basunia and A. M. Hurst		NDS 134,1 (2016)	1-Feb-2016

Others: 2015Ho09, 2015To10, 1984Bh03, 1981Dy01, 1974Na22, 1974Be43.

1986G106: Targets were prepared from evaporation of NaBr onto a carbon foil and for lifetime measurements onto a gold foil; 14.2 and 16 MeV α beam; protons were detected with an annular ΔE -E telescope, consists of two surface-barrier Si detectors, placed at 180° with respect to beam direction; γ rays were detected by two Ge(Li) detectors placed at 0° , 30° , 45° , 55° , 60° , and 90° with respect to beam direction; Measured E_γ , I_γ , γ -ray angular distribution, $p\gamma$ coin, p - γ -ray angular correlation, mean lifetime for Doppler-shift attenuation method.

1972Du05: $^{23}\text{Na}(\alpha, p\gamma)$, $E=4.6$ - 7.5 MeV; Ge(Li)-NaI(Tl) in anti-Compton and pair spectrometer mode; Measured E_γ , I_γ , deduced ^{26}Mg excited levels, mean lifetime using Doppler-shift attenuation method.

1974Be08: Target was prepared by evaporating NaCl onto Au foils; Projectile: α , $E=6.0$ - 7.0 MeV. Ge(Li) detector at 0° . Measured mean lifetime using recoil distance method.

 ^{26}Mg Levels

$E(\text{level})^\dagger$	$J^\pi^\dagger$	$T_{1/2}^\dagger$	Comments
0.0			
1809 2		453 [#] fs 27	
2938 2		141 [#] fs 8	
3588 2		6.7 [‡] ps 8	
3941 2		0.96 [‡] ps 8	$T_{1/2}$: Other: 0.71 ps 9 (1981Dy01).
4318 2			
4332 2		20 [#] fs 3	
4350 2		125 [@] fs 38	
4835 1		26 fs 6	$T_{1/2}$: Other: 28 fs 6 (1981Dy01).
4901 1		24 fs 6	$T_{1/2}$: Other: 29 fs 6 (1981Dy01).
4972 2		527 [@] fs 166	
5292 1		16 fs 8	$T_{1/2}$: Others: <7 fs (1972Du05), <11 fs (1981Dy01).
5475 1		19 fs 6	$T_{1/2}$: Others: 24 fs 10 (1974Be08), <70 fs (1972Du05).
5692 1		≤ 8.3 fs	$T_{1/2}$: Other: <35 fs (1972Du05).
5715 1		87 [‡] fs 24	$T_{1/2}$: Other: 33 fs 16 (1986G106).
6125 1		14 fs 6	
6256 2			
6623 1	4 ⁺	19 fs 5	
6634 1	0 to 4	≤ 7 fs	
6745 1		16 fs 8	
6878			
6978 1	5 ⁺	14 fs 5	
7063 1		≤ 7 fs	
7100 1		≤ 14 fs	
7242 1		≤ 7 fs	
7262 1		≤ 7 fs	
7283 1	4 ⁻	24 fs 8	
7350 2			
7369 2			
7395 1	5 ⁺	≤ 14 fs	
7543 1		≤ 7 fs	
7677 1	3 to 5	≤ 11 fs	
7725 2			
7773 1		≤ 7 fs	
7817 2			
7822 2			
7840 2			

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$^{23}\text{Na}(\alpha, p\gamma)$ **1986Gl06, 1972Du05, 1974Be08** (continued) ^{26}Mg Levels (continued)

$E(\text{level})^\dagger$	$J^\pi^\dagger$	$T_{1/2}^\dagger$	$E(\text{level})^\dagger$	$J^\pi^\dagger$	$T_{1/2}^\dagger$	$E(\text{level})^\dagger$	$T_{1/2}^\dagger$
7953 1	5^-	14 fs 6	9261 2			10122 2	
8036 2			9291 2			10184 2	
8050 2			9303 2			10234 2	
8184 2			9318 2			10350 2	
8202 1	6^+	≤ 14 fs	9327 2			10361 2	
8233 2			9371 2			10377 2	
8248 2			9383 1	$(4^+, 6^+)$	≤ 7 fs	10528 2	
8456 2			9423 2			10576 2	
8464 2			9471 2			10590 2	
8472 1	6^+	≤ 14 fs	9542 1	5	≤ 14 fs	10650 1	21 fs 6
8508 2			9574 2			10695 2	
8531 2			9590 2			10709 2	
8625 1	$3^-, 4^+, 5^-$	29 fs 6	9681 2			10766 2	
8670 1	3,5	≤ 7 fs	9771 2			10943 2	
8705 2			9814 2			11010 2	
8860 2			9829 1	$(5, 7)^+$	37 fs 10	11191 2	
8902 2			9900 2			11329 2	
8930 2			9927 2			11457 2	
9020 2			9939 2			11570 2	
9043 2			9966 2			12088 2	
9065 1	5	≤ 7 fs	9982 2			12196 2	
9112 1	6^+	≤ 11 fs	9989 1	6^+	≤ 7 fs	12479 2	
9169 1	6^-	26 fs 8	10042 2				
9206 2			10069 2				

 † From 1986Gl06, except otherwise noted. ‡ 1974Be08.

1981Dy01.

@ 1972Du05.

 $\gamma(^{26}\text{Mg})$

$E_i(\text{level})$	$E_\gamma^\ddagger$	$I_\gamma^\#$	E_f
1809	1809	100	0.0
2938	1129	90 1	1809
	2938	10 1	0.0
3588	1779	100	1809
3941	1003	67 3	2938
	2132	33 3	1809
4318	2509	100	1809
4332	1394	11 2	2938
	2523	85 4	1809
	4332	4 2	0.0
4350	1412	51 4	2938
	2541	49 4	1809
4835	1897	91 2	2938
	3026	4 1	1809
	4835	5 1	0.0
4901	960	4.0 5	3941
	1963	2.0 5	2938
	3092	94 1	1809
4972	2034	93 4	2938
	3163	7 4	1809
5292	1351	15 1	3941

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$^{23}\text{Na}(\alpha, p\gamma)$ **1986Gl06, 1972Du05, 1974Be08 (continued)** $\gamma(^{26}\text{Mg})$ (continued)

$E_i(\text{level})$	J_i^π	E_γ	$I_\gamma^\#$	E_f	Mult. @	$\delta^\&$	Comments
5292		2354	73 3	2938			
		3483	4 1	1809			
		5291	4 1	0.0			
5475		1157	58 2	4318			
		1534	29 2	3941			
		3666	13 1	1809			
5692		2754	29 4	2938			
		3883	61 4	1809			
		5691	10 2	0.0			
5715		1365	38 3	4350			
		1774	38 3	3941			
		2777	24 3	2938			
6125		1775	87 2	4350			
		2184	8 1	3941			
		4316	5 1	1809			
6256		564	7 4	5692			
		4447	93 4	1809			
6623	4 ⁺	1148	9 1	5475			
		1722	48 5	4901	D+Q	-0.26 +60-10	$A_2=0.26$ 3; $A_4=-0.02$ 3 (1986Gl06)
		2273	21 3	4350			
		2291	11 2	4332			
		2305	11 2	4318			
6634	0 to 4	3696	94 1	2938			
		4825	6 1	1809			
6745		3807	40 4	2938			
		4936	60 4	1809			
6878		2937	20 3	3941			
		3940	13 2	2938			
		5069	67 4	1809			
6978	5 ⁺	1263	4 1	5715			
		1503	50 4	5475	D+Q	-0.21 5	$A_2=-0.54$ 3; $A_4=0.03$ 3 (1986Gl06)
		2077	11 2	4901	D+Q	-1.0 6	$A_2=-0.82$ 8; $A_4=0.17$ 8 (1986Gl06)
		2628	4 1	4350			
		2660	17 2	4318	D+Q	-0.4 2	$A_2=-0.84$ 7; $A_4=0.22$ 6 (1986Gl06)
		3037	14 2	3941			$A_2=0.24$ 7; $A_4=-0.15$ 8 (1986Gl06)
7063		3475	48 6	3588			
		5253	52 6	1809			
7100		2265	23 4	4835			
		3159	32 5	3941			
		4162	35 5	2938			
		5290	10 3	1809			
7242		2407	10 2	4835			
		2892	22 4	4350			
		2910	25 4	4332			
		2924	19 4	4318			
		3301	24 4	3941			
7262		2912	6 1	4350			
		3321	17 2	3941			
		4324	31 5	2938			
		5452	46 6	1809			
7283	4 ⁻	2965	40 5	4318	D+Q	+0.5 4	$A_2=0.40$ 6; $A_4=-0.03$ 8 (1986Gl06)
		3342	60 6	3941	D+Q	+0.03 7	$A_2=-0.28$ 5; $A_4=-0.00$ 6 (1986Gl06)
7350		4412	50 7	2938			
		5540	27 5	1809			
		7349	23 5	0.0			
7369		3019	14 2	4350			

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$^{23}\text{Na}(\alpha, p\gamma)$ **1986Gl06, 1972Du05, 1974Be08 (continued)** $\gamma(^{26}\text{Mg})$ (continued)

$E_i(\text{level})$	J_i^π	E_γ	$I_\gamma^\#$	E_f	J_f^π	Mult. @	$\delta\&$	Comments
7369		3428	40 4	3941				
		5559	13 2	1809				
		7368 [†]	33	0.0				
7395	5 ⁺	1680	50 4	5715		D+Q	-0.14 2	$A_2=-0.52$ 3; $A_4=0.03$ 3 (1986Gl06)
		2494	18 2	4901				
		3045	13 1	4350				
		3077	7 2	4318				
		3454	12 1	3941				
7543		3211	47 5	4332				
		3602	10 3	3941				
		4605	33 5	2938				
		5733	10 3	1809				
7677	3 to 5	1552	17 2	6125				
		1962	48 4	5715				$A_2=0.38$ 4; $A_4=-0.08$ 5 (1986Gl06)
		2776	21 3	4901				
		3359	14 2	4318				
7725		3407	75 5	4318				
		3784	25 5	3941				
7773		2298	15 4	5475				
		2938	15 4	4835				
		3455	10 3	4318				
		3832	5 7	3941				
		4835	10 3	2938				
7817		3485	100	4332				
7822		3881	40 5	3941				
		4884	40 5	2938				
		6012	20 4	1809				
7840		3522	20 4	4318				
		4252	43 5	3588				
		4902	27 5	2938				
		6030	10 3	1809				
7953	5 ⁻	2238	32 3	5715				
		3635	68 3	4318				
8036		5097	100	2938				
8050		6240	100	1809				
8184		5245	38 5	2938				
		6374	62 5	1809				
8202	6 ⁺	1224	20 2	6978	5 ⁺	D(+Q)	-0.03 4	$A_2=-0.40$ 11; $A_4=0.01$ 8 (1986Gl06)
		3301	35 3	4901				$A_2=0.42$ 4; $A_4=-0.18$ 5 (1986Gl06)
		3884	45 4	4318				$A_2=0.42$ 3; $A_4=-0.23$ 4 (1986Gl06)
8233		6423	40 6	1809				
		8232	60 6	0.0				
8248		5309	100	2938				
8456		6646	100	1809				
8464		4146	100	4318				
8472	6 ⁺	1494	24 3	6978	5 ⁺	D+Q	-0.32 10	$A_2=-0.63$ 10; $A_4=-0.01$ 8 (1986Gl06)
		3571	63 4	4901				$A_2=0.39$ 2; $A_4=-0.26$ 6 (1986Gl06)
		4154	13 2	4318				
8508		6698	60 6	1809				
		8507	40 6	0.0				
8531		4181	85 3	4350				
		5592	15 3	2938				
8625	3 ⁻ , 4 ⁺ , 5 ⁻	2002	85 3	6623	4 ⁺	D+Q	+0.03 1	$A_2=-0.13$ 3; $A_4=-0.10$ 4 (1986Gl06)
		4307	15 3	4318		D(+Q)	-0.13 14	$A_2=-0.34$ 8; $A_4=-0.05$ 9 (1986Gl06)
8670	3, 5	3195	35 5	5475				$A_2=-0.14$ 4; $A_4=0.06$ 5 (1986Gl06)
		4352	65 5	4318				$A_2=-0.53$ 5; $A_4=-0.02$ 5 (1986Gl06)

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$^{23}\text{Na}(\alpha, p\gamma)$ **1986Gl06, 1972Du05, 1974Be08 (continued)** $\gamma(^{26}\text{Mg})$ (continued)

$E_i(\text{level})$	J_i^π	E_γ	$I_\gamma^\#$	E_f	J_f^π	Mult. @	$\delta^\&$	Comments
8705		3230	13 3	5475				
		4387	45 5	4318				
		4764	29 4	3941				
		5766	13 3	2938				
8860		4542 [†]	24 6	4318				
		5921	31 6	2938				
		7050	45 8	1809				
8902		4552	30 5	4350				
		4584 [†]	30 5	4318				
		4960	40 7	3941				
8930		2307	18 4	6623	4 ⁺			
		3215	36 5	5715				
		3455	27 5	5475				
		4988	19 4	3941				
9020		4702	100	4318				
9043		6104	100	2938				
9065	5	1670	17 3	7395	5 ⁺	D+Q	+0.6 4	$A_2=0.64$ 11; $A_4=-0.31$ 15 (1986Gl06)
		4164	17 3	4901				
		4747	66 5	4318		D(+Q)	<0.00	$A_2=-0.19$ 6; $A_4=-0.12$ 7 (1986Gl06)
9112	6 ⁺	1717	8 2	7395	5 ⁺			
		2489	8 2	6623	4 ⁺			
		3637	50 6	5475				$A_2=0.45$ 4; $A_4=-0.20$ 4 (1986Gl06)
		4211	16 3	4901				
		4794	18 3	4318				
9169	6 ⁻	1216	54 4	7953	5 ⁻	D+Q	-0.14 6	$A_2=-0.57$ 3; $A_4=-0.02$ 3 (1986Gl06)
		1774	21 3	7395	5 ⁺	D+Q	+0.07 5	$A_2=-0.10$ 3; $A_4=-0.12$ 4 (1986Gl06)
		1886	13 2	7283	4 ⁻			$A_2=0.14$ 5; $A_4=-0.25$ 8 (1986Gl06)
		2191	12 2	6978	5 ⁺			
9206		4888	100	4318				
9261		5319	100	3941				
9291		7481	100	1809				
9303		4984	100	4318				
9318		4985	100	4332				
9327		5385	75 3	3941				
		6388	25 3	2938				
9371		5429	100	3941				
9383	(4 ⁺ , 6 ⁺)	1181	6 1	8202	6 ⁺			
		2405	29 4	6978	5 ⁺	D+Q	-0.14 6	$A_2=-0.55$ 4; $A_4=-0.01$ 4 (1986Gl06)
		2760	15 2	6623	4 ⁺	Q		$A_2=0.44$ 5; $A_4=-0.20$ 7 (1986Gl06)
		3668	39 5	5715		Q		$A_2=0.42$ 4; $A_4=-0.14$ 5 (1986Gl06)
		5064	11 2	4318				
9423		6484	60 6	2938				
		7613	40 6	1809				
9471		5529	100	3941				
9542	5	2564	3.3 10	6978	5 ⁺	D(+Q)	+0.3 5	$A_2=1.10$ 29; $A_4=-0.39$ 27 (1986Gl06)
		3827	14 2	5715				
		4641	21 4	4901				
		5223	62 6	4318		D+Q	+0.06 5	$A_2=-0.23$ 4; $A_4=0.07$ 5 (1986Gl06)
9574		3449	75 5	6125				
		6635	25 5	2938				E_γ : Not reported in (n, γ) – 1992Wa06 – so not adopted.
9590		6651	60 8	2938				
		7780	40 8	1809				
9681		7871	100	1809				
9771		4870	50 8	4901				
		5452	50 8	4318				

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$^{23}\text{Na}(\alpha, p\gamma)$ **1986Gl06, 1972Du05, 1974Be08 (continued)** $\gamma(^{26}\text{Mg})$ (continued)

$E_i(\text{level})$	J_i^π	E_γ $\ddagger$	I_γ $\#$	E_f	J_f^π	Mult. $@$	δ $\&$	Comments
9814		5495	100	4318				
9829	(5,7) ⁺	1357	6 1	8472	6 ⁺			
		1627	89 2	8202	6 ⁺			
		2434	5 1	7395	5 ⁺			$A_2=-0.35$ 2; $A_4=-0.01$ 2 (1986Gl06)
9900		6961	100	2938				
9927		5025	100	4901				
9939		5620	100	4318				
9966		5064	60 5	4901				
		7027	40 5	2938				
9982		6040	100	3941				
9989	6 ⁺	1517	17 3	8472	6 ⁺	D+Q	-0.17 10	$A_2=0.32$ 7; $A_4=0.07$ 9 (1986Gl06)
		3011	69 5	6978	5 ⁺	D+Q	-0.09 5	$A_2=-0.44$ 5; $A_4=-0.04$ 6 (1986Gl06)
		5670	14 3	4318				
10042		4327	45 6	5715				
		5140	23 4	4901				
		5723	32 4	4318				
10069		5167	100	4901				
10122		5803	100	4318				E_γ : Comparable 5800.69 γ reported in (n, γ) – 1992Wa06 from capture state.
10184		5282	100	4901				
10234		5332	100	4901				
10350		4875	50 9	5475				E_γ : Not reported in (n, γ) – 1992Wa06.
		5448	50 9	4901				E_γ : Not reported in (n, γ) – 1992Wa06.
10361		5459	50 9	4901				E_γ : Not reported in (n, γ) – 1992Wa06.
		6010	50 9	4350				
10377		4662	100	5715				
10528		4813	60 10	5715				
		6195	40 10	4332				
10576		2045	46 4	8531				
		3598	54 4	6978	5 ⁺			
10590		1421	100	9169	6 ⁻			E_γ : Not reported in (n, γ) – 1992Wa06.
10650		1481	36 5	9169	6 ⁻			
		2697	64 5	7953	5 ⁻			
10695		3300	100	7395	5 ⁺			
10709		4993	100	5715				
10766		6415	69 6	4350				
		7827	31 6	2938				
10943		1560	10 2	9383	(4 ⁺ ,6 ⁺)			
		1774	61 5	9169	6 ⁻			
		2318	29 4	8625	3 ⁻ ,4 ⁺ ,5 ⁻			
11010		6108	38 7	4901				
		6691	62 7	4318				
11191		3238	42 8	7953	5 ⁻			
		5475	58 8	5715				
11329		3934	64 5	7395	5 ⁺			
		4351	36 5	6978	5 ⁺			
11457		6555	100	4901				
11570		3098	55 8	8472	6 ⁺			
		4175	45 8	7395	5 ⁺			
12088		4693	44 8	7395	5 ⁺			
		5109	56 8	6978	5 ⁺			
12196		3724	31 5	8472	6 ⁺			
		3994	69 5	8202	6 ⁺			
12479		2650	61 6	9829	(5,7) ⁺			
		4277	39 6	8202	6 ⁺			

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$^{23}\text{Na}(\alpha, \text{p}\gamma)$ [1986G106](#), [1972Du05](#), [1974Be08](#) (continued)

$\gamma(^{26}\text{Mg})$ (continued)

† Uncertain placement in (n, γ) ([1992Wa06](#)) – not adopted.

‡ From level energy differences, recoil energy subtracted.

From [1986G106](#).

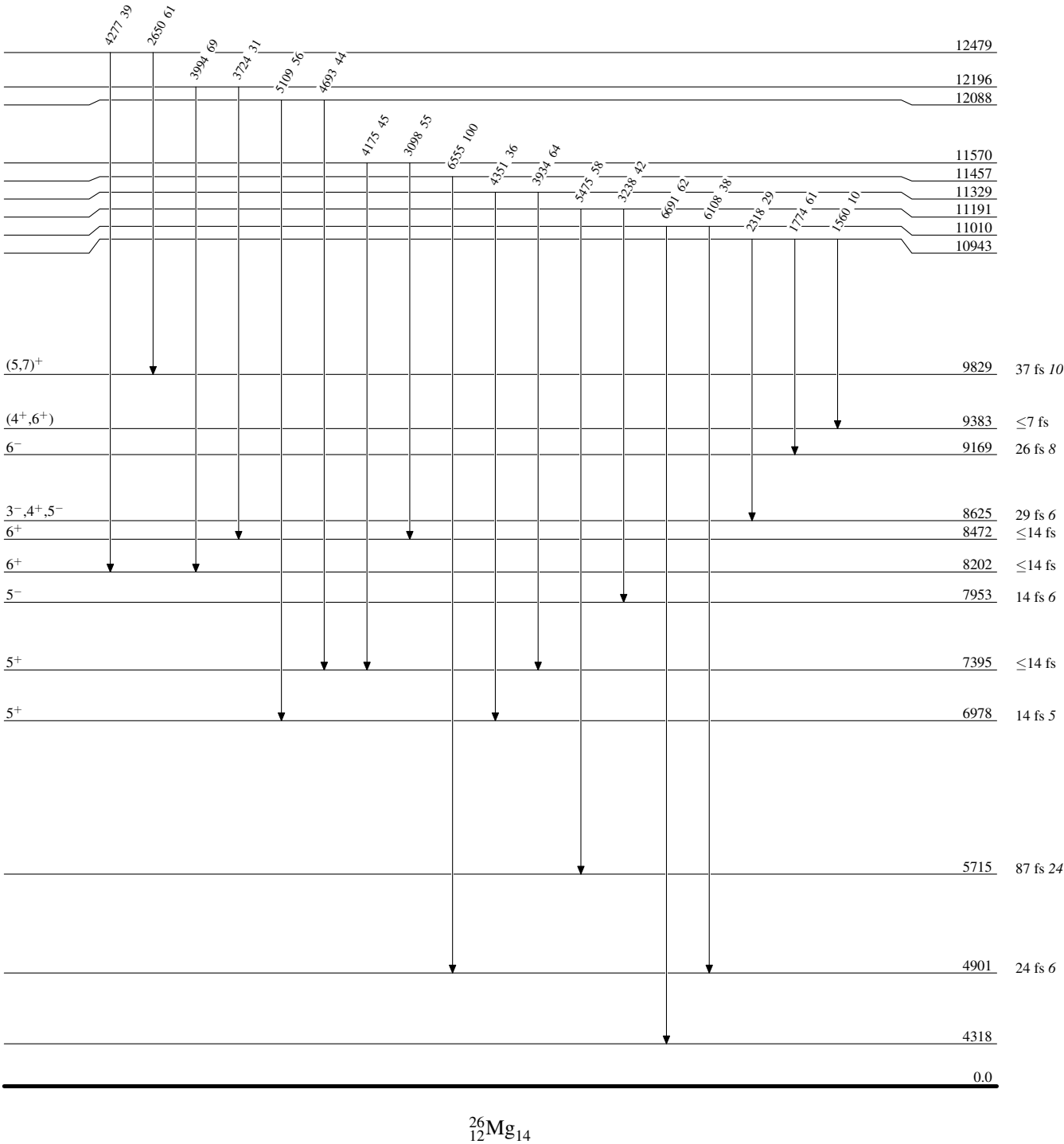
@ Assigned by evaluators, based on angular distribution coefficients.

& From [1986G106](#).

$^{23}\text{Na}(\alpha,\text{p}\gamma)$ 1986Gl06,1972Du05,1974Be08

Level Scheme

Intensities: % photon branching from each level

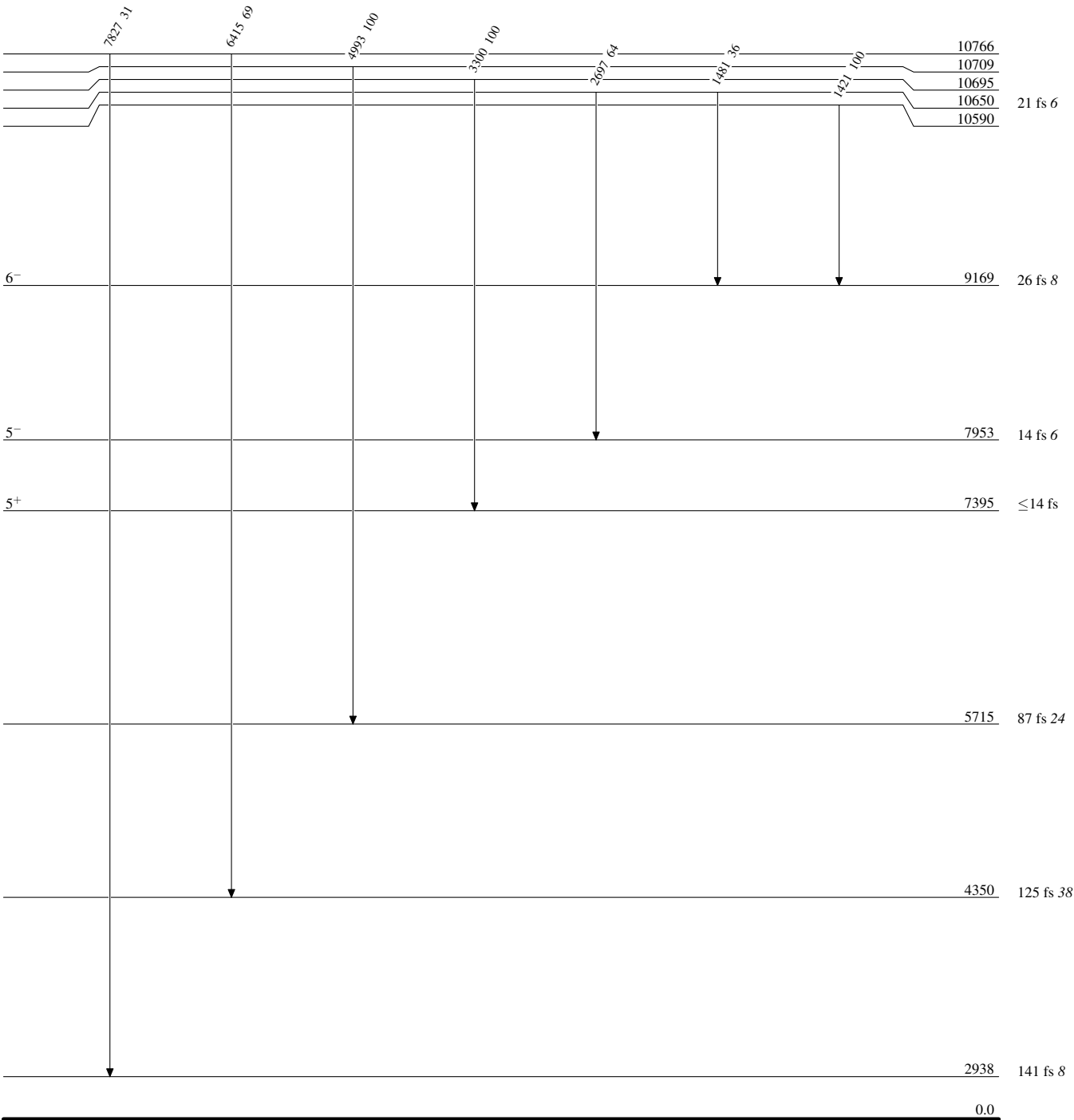


$^{26}_{12}\text{Mg}_{14}$

²³Na(α ,p γ) 1986G106,1972Du05,1974Be08

Level Scheme (continued)

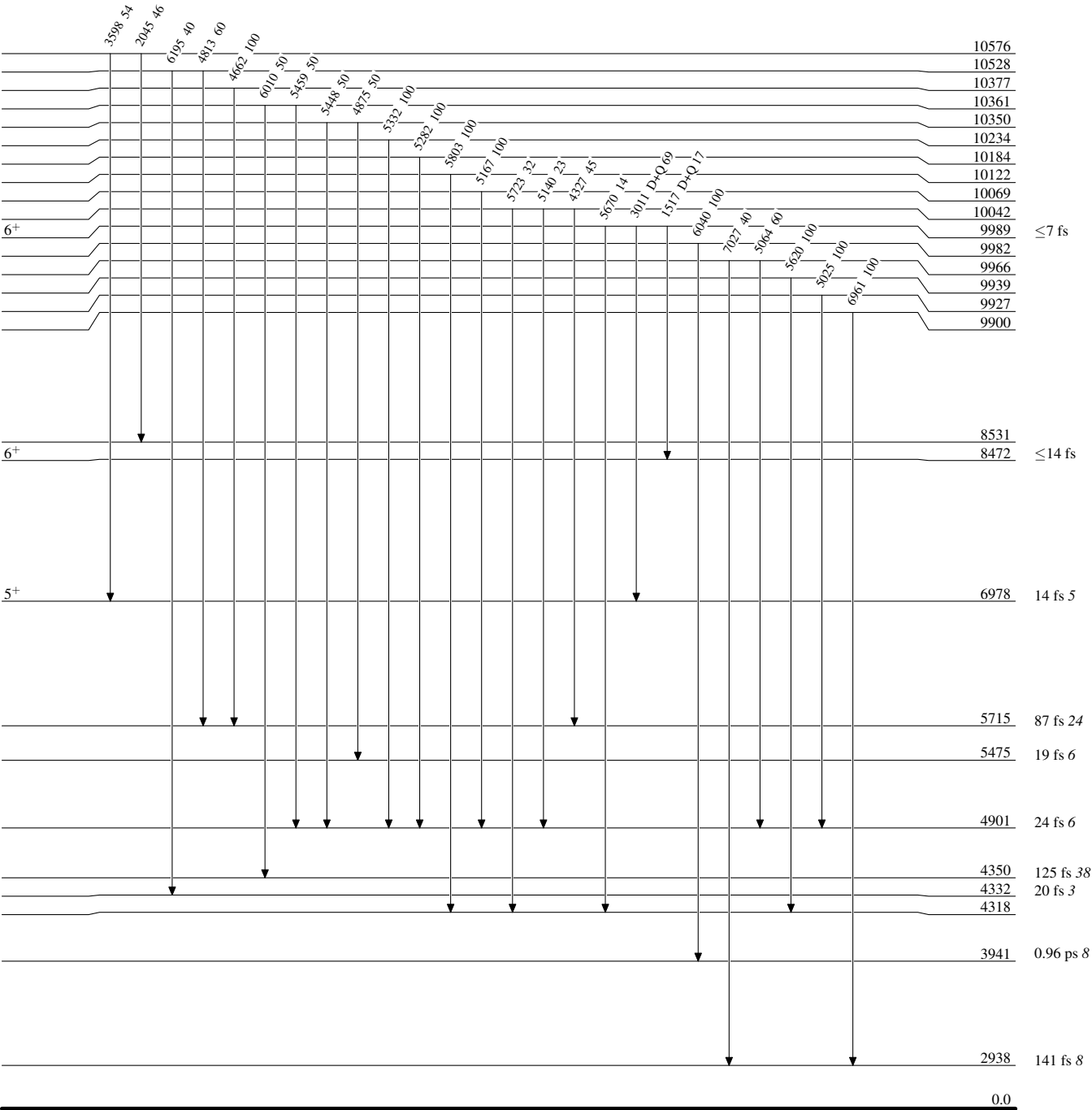
Intensities: % photon branching from each level



²³Na(α ,p γ) 1986G106,1972Du05,1974Be08

Level Scheme (continued)

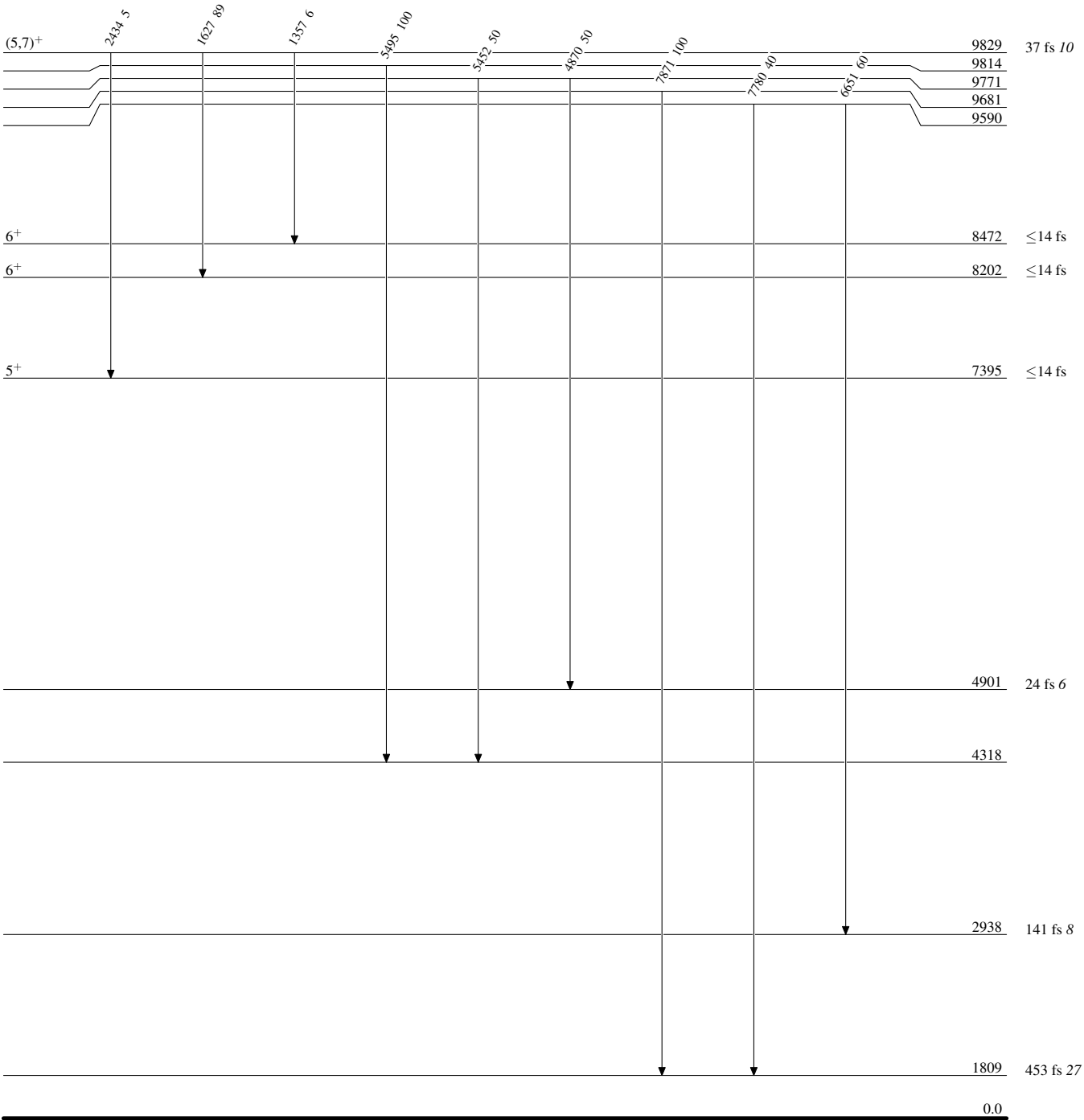
Intensities: % photon branching from each level



²³Na(α ,p γ) 1986Gl06,1972Du05,1974Be08

Level Scheme (continued)

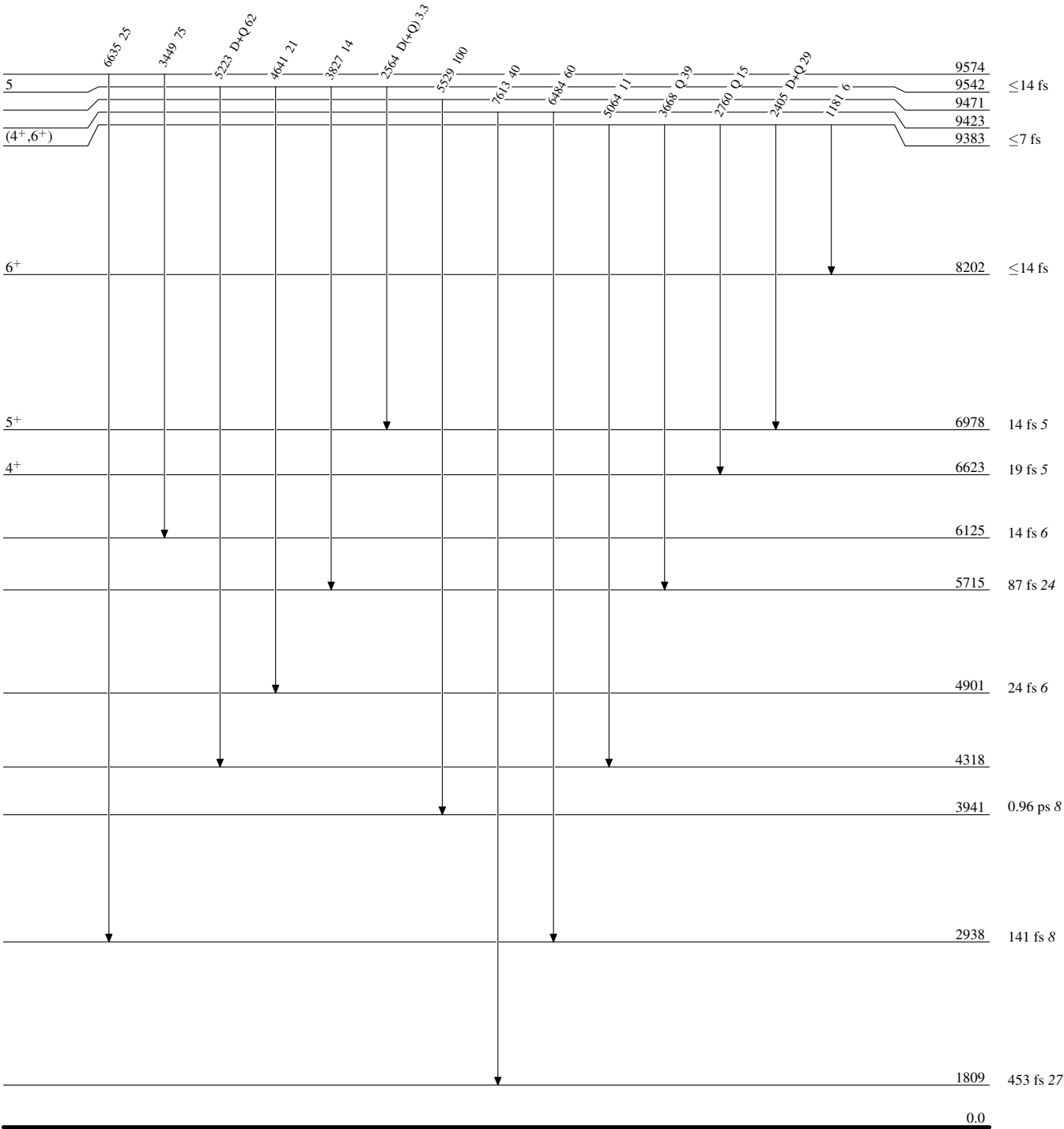
Intensities: % photon branching from each level



²³Na(α ,p γ) 1986G106,1972Du05,1974Be08

Level Scheme (continued)

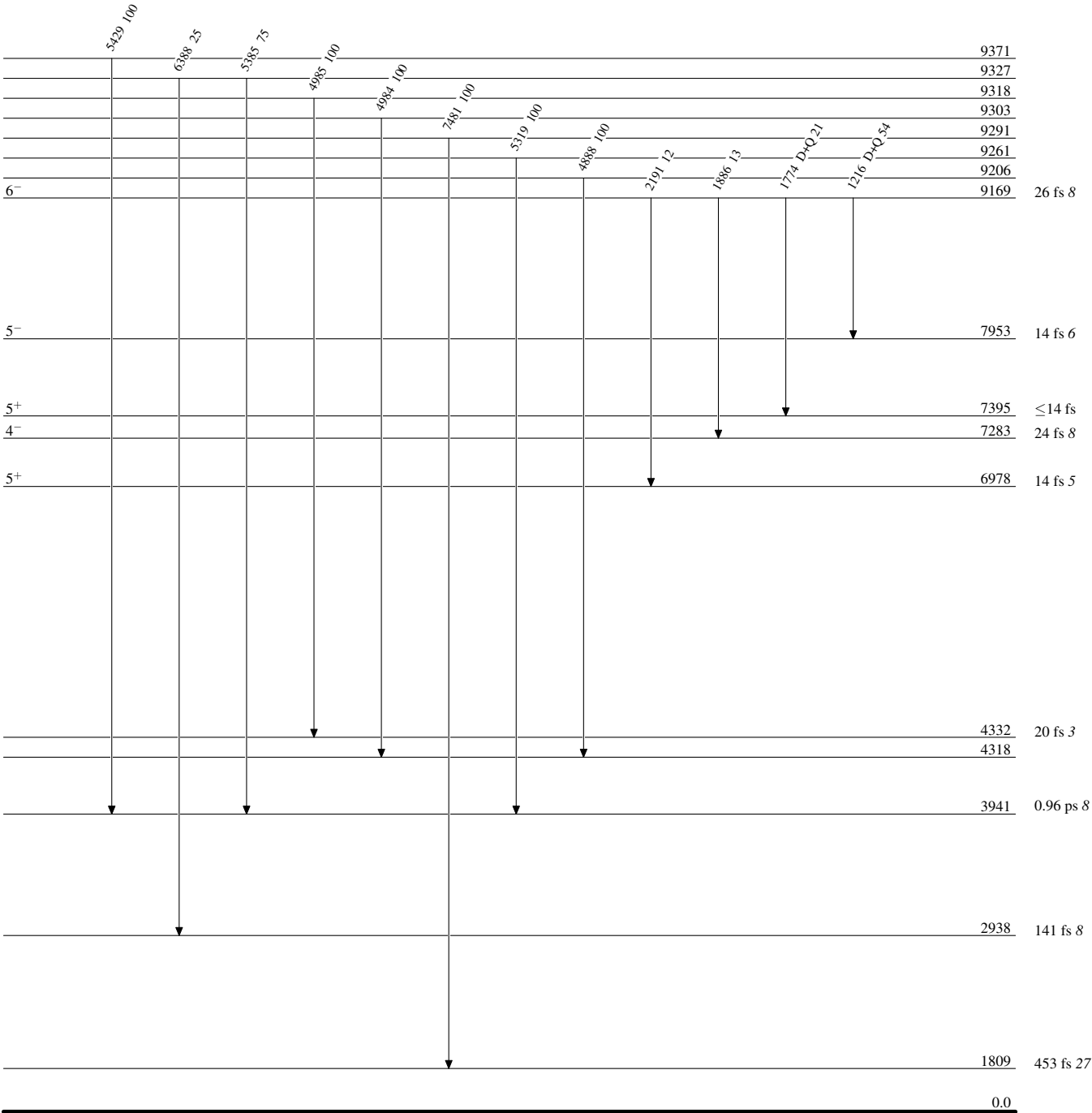
Intensities: % photon branching from each level



²³Na(α ,p γ) 1986G106,1972Du05,1974Be08

Level Scheme (continued)

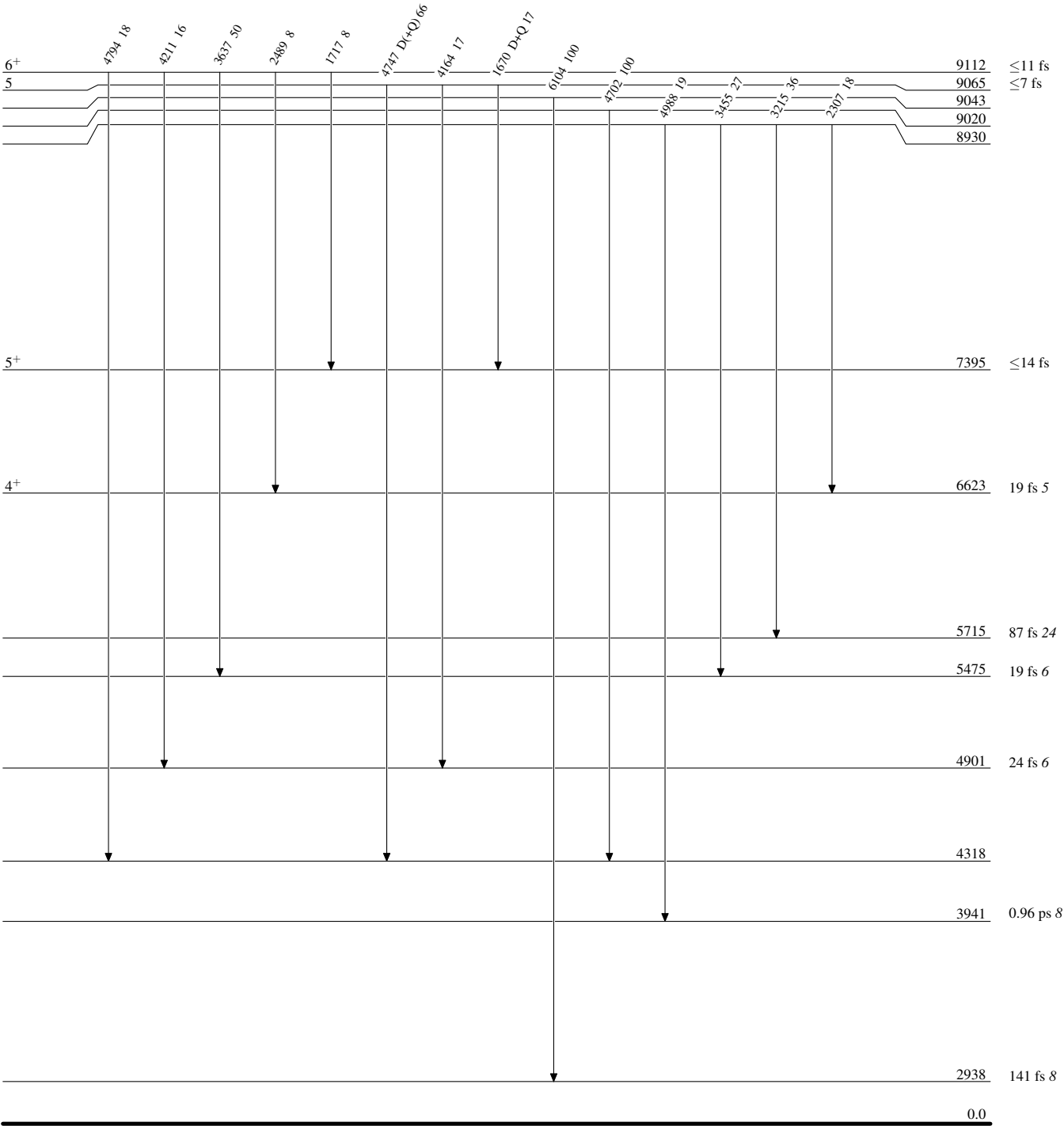
Intensities: % photon branching from each level



²³Na(α ,p γ) 1986Gl06,1972Du05,1974Be08

Level Scheme (continued)

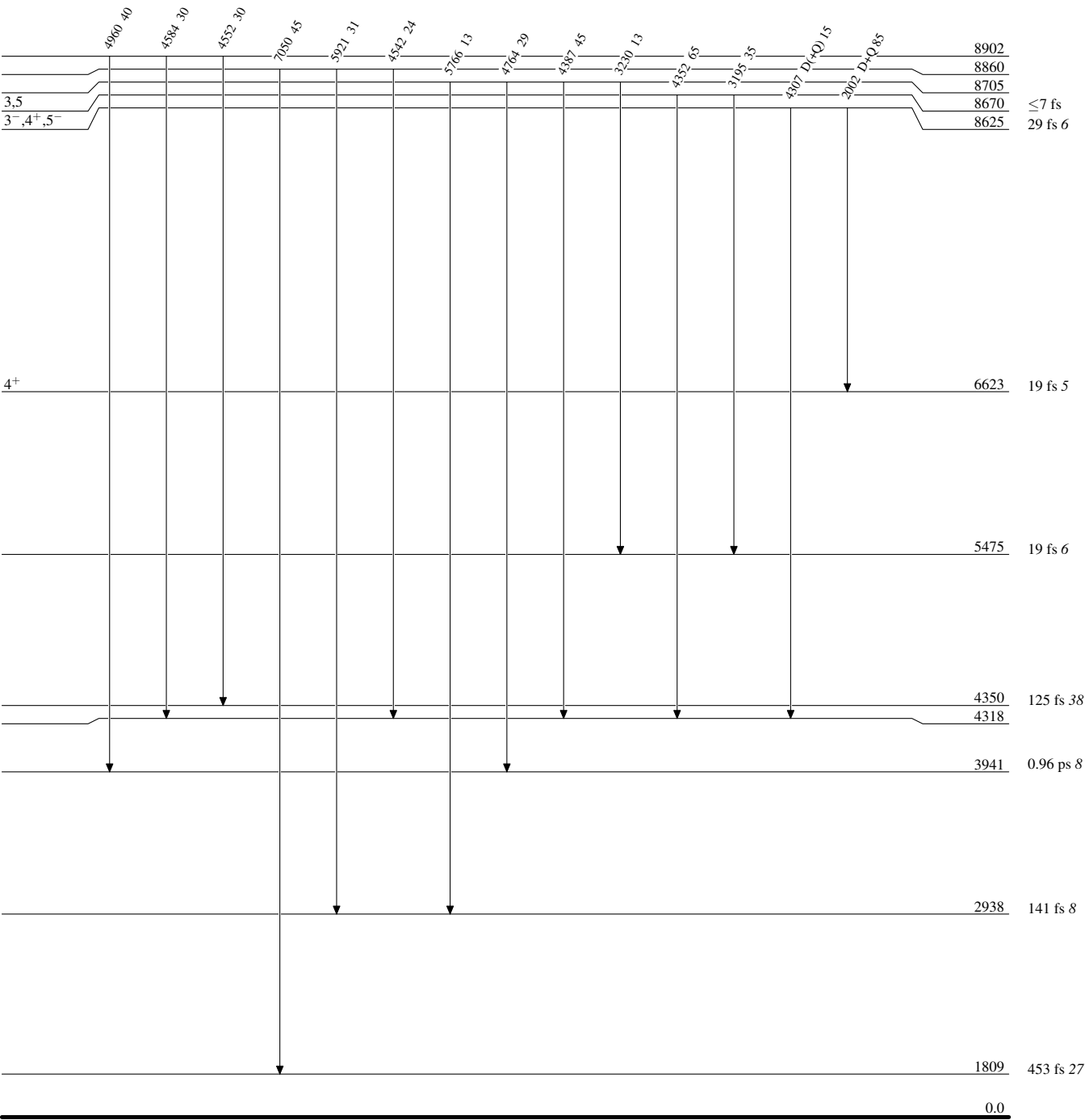
Intensities: % photon branching from each level



²³Na(α ,p γ) 1986Gl06,1972Du05,1974Be08

Level Scheme (continued)

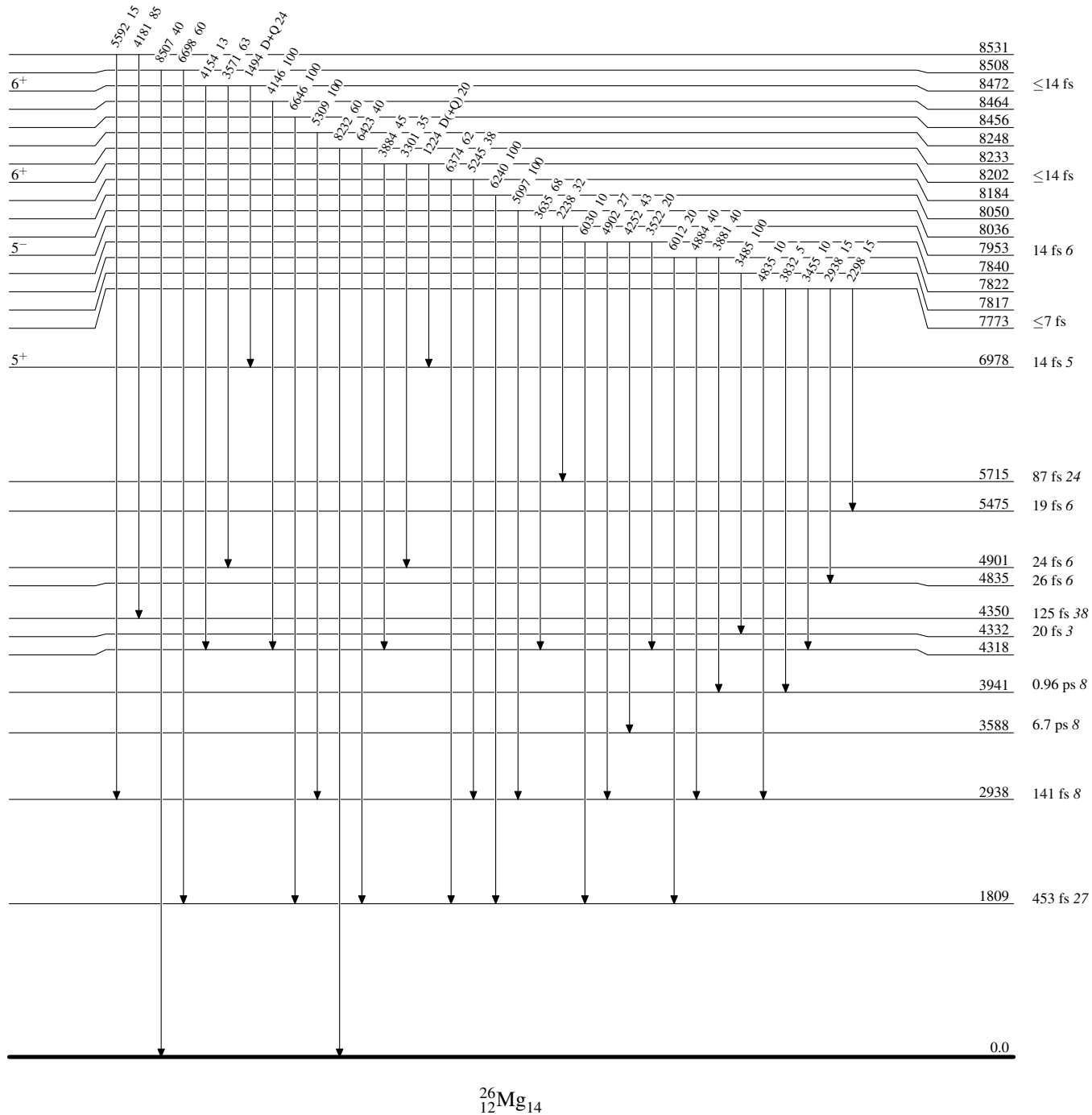
Intensities: % photon branching from each level



$^{23}\text{Na}(\alpha, p\gamma)$ 1986Gl06, 1972Du05, 1974Be08

Level Scheme (continued)

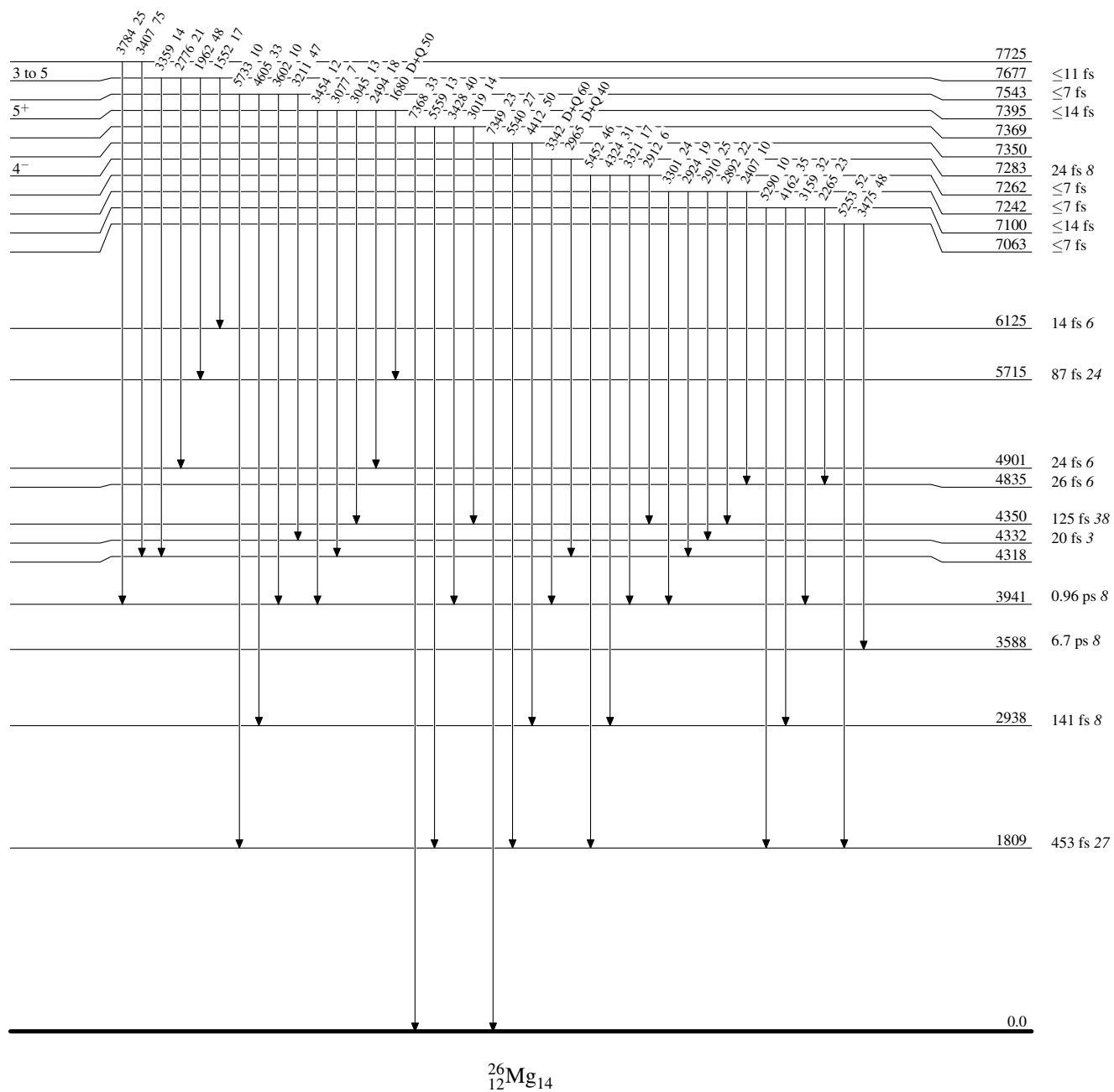
Intensities: % photon branching from each level



$^{23}\text{Na}(\alpha, p\gamma)$ 1986Gl06, 1972Du05, 1974Be08

Level Scheme (continued)

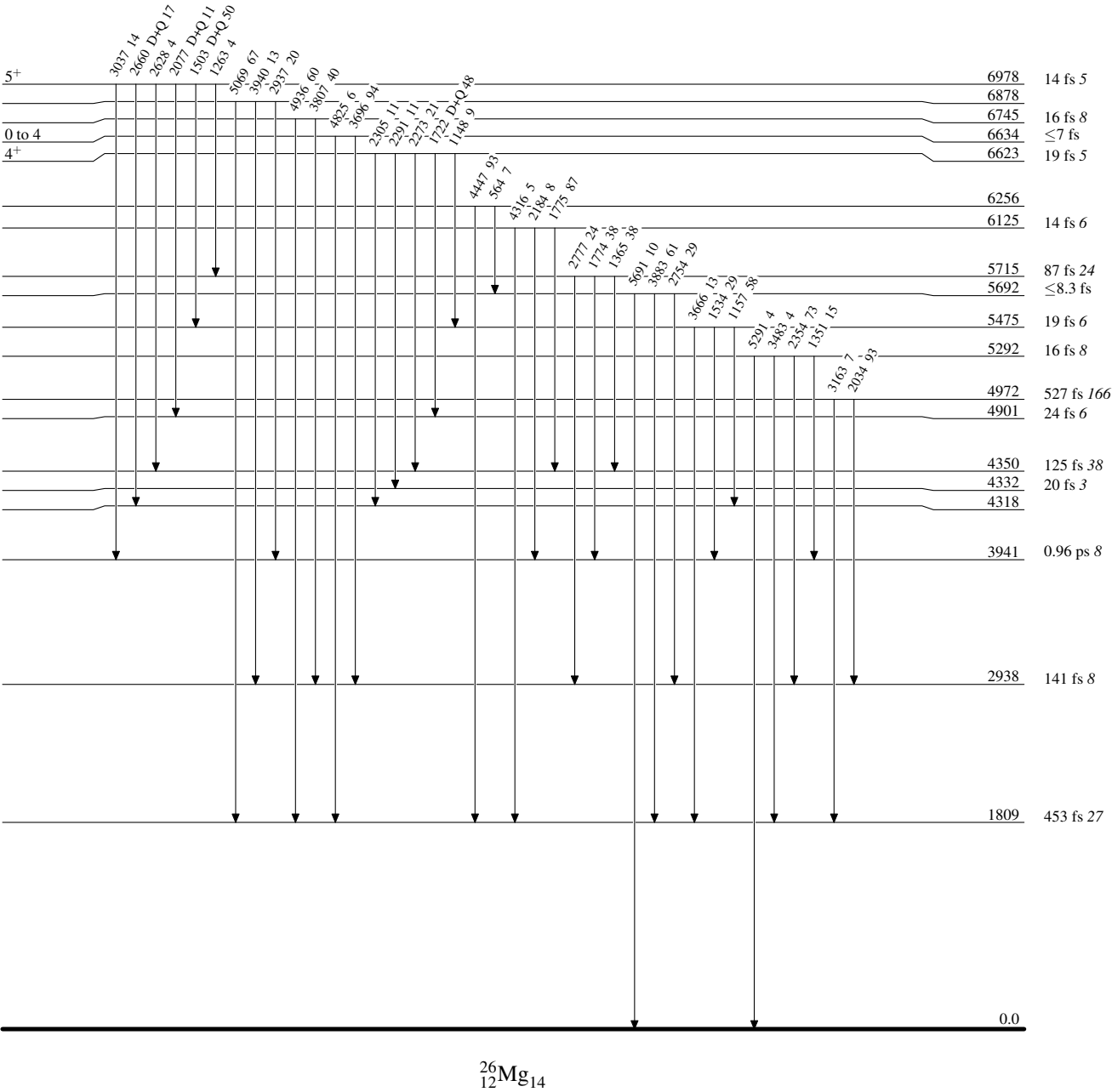
Intensities: % photon branching from each level



²³Na(α,pγ) 1986Gl06,1972Du05,1974Be08

Level Scheme (continued)

Intensities: % photon branching from each level



$^{23}\text{Na}(\alpha, p\gamma)$ 1986Gl06, 1972Du05, 1974Be08

Level Scheme (continued)

Intensities: % photon branching from each level

