

$^{31}\text{P}(\text{p},\gamma)$ 1997Br07,1975Bo42,1972Co13

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	Christian Ouellet, Balraj Singh		NDS 112, 2199 (2011)	24-Aug-2011

Corrections made Sept 20, 2022 by B. Singh (McMaster) to include the missing γ branching ratios from the 7921, 7975, 8296, 8407 and 8729 levels, as listed in Table 1 of 1997Br07, and in Table 32i of 1998En04 evaluation, which were inadvertently left out in the 2011 evaluation of data for the ENSDF database for ^{32}S .

$J^\pi(^{31}\text{P g.s.})=1/2^+$.

$E(\text{p})=811$ is a common absolute resonance strength by which other relative resonance strengths are compared (1978Pa03).

2006Tr03: 3 MeV protons from the University of Washington FN tandem accelerator. Target of ^{31}P implanted in a tantalum foil backing. HPGe detector for γ -rays. Measured $E\gamma$, mass excess.

2000Ya23: protons from the 3MV Pelletron accelerator at the Tokyo Institute of Technology. Ge detector with annular NaI Compton suppressor. High purity (99.99%) Zn_3P_2 targets. Centroid shift DSAM determination of lifetimes.

1998Ka31: protons from 5MV Van de Graaff accelerator, Institute of Nuclear Research in Debrecen. Target of ^{31}P implanted in Ta backing. γ -rays detected using Ge detector with BGO veto for high precision DSAM lifetime measurements. Monte-Carlo lineshape analysis. Comparison between shell model and experimental branching ratios and lifetimes.

1997Br07: 2-3.3 MeV protons from 7 MV Van de Graaff accelerator. P_3N_5 targets. Ge detector for $E\gamma$, $I\gamma$ and $\gamma(\theta)$ measurements.

1993II01: 0.16-0.37 MeV protons from the Ruhr-Universitat 400KV accelerator. Implanted ^{31}P targets in Ta backing from SNICS source at the University of Notre Dame of roughly 13 keV at 355 keV incident energy. Ge detector for excitation function and Resonance Strength measurements.

1991II01: 0.28-0.62 MeV protons from the 3MV Pelletron tandem accelerator at the Kellogg Radiation Laboratory of the California Institute of Technology as well as the 1 MV Van de Graaff accelerator at the University of Toronto. Targets of implanted ^{31}P in Ta backing, target thickness of roughly 15 keV at 355 keV incident energy. Measured excitation function, $I\gamma$ and resonance strengths using a Ge detector.

1986Zi08: 1 MeV protons from the Utrecht 3MV Van de Graaff accelerator. 99.99% pure ^{31}P targets. Measured yields to get resonance strengths using Ge detectors.

1981He09: 1.15 MeV protons from the Helsinki University Van de Graaff. Ge detectors. Measured $E\gamma$, $I\gamma$, $\gamma(\theta)$, and γ yields; deduced resonance strengths.

1978Pa03: 0.5-0.9 MeV protons from 5MV Pelletron accelerator at the University of Melbourne. Ge and NaI detectors for resonance strength measurement.

1976Ve03: protons from the 3MV Van de Graaff at the Centre de Recherches Nucleaires of Strasbourg-Cronenbourg. Measured $E\gamma$, $I\gamma$, $\gamma(\theta)$, lifetimes.

1975Bo42: protons from 800 kV electrostatic accelerator at the University of Melbourne and from the 3 MV Van de Graaff accelerator at AAEC research establishment at Lucas Heights. Natural Zn_2P_3 and pure phosphorus targets. Ge detectors used for high precision branching ratio measurements. Also from same group: 1975Ob02.

1977Ko07: Protons from the electrostatic accelerator at the Kharkov Physicotechnical Institute of the Academy of Sciences, Ukraine. Thin Zn_3P_2 targets. Measured $\gamma(\theta)$ using Ge detectors.

1975Ob02: protons from 800 kV electrostatic accelerator at the University of Melbourne. 99.999% pure red phosphorus targets. Ge detectors for yield and thus resonance strength measurements.

1975Bo42: protons from the 800 kV electrostatic accelerator at the University of Melbourne and the 3MV Van de Graaff at the AAEC research establishment at Lucas Heights. Both pure phosphorus and Zn_2P_3 foil targets. Ge detectors for precision measurements of $I\gamma$.

1974Vi02: 0.3-1.4 MeV protons from Helsinki University 3 MV Van de Graaff. Ge detectors for $E\gamma$, $I\gamma$ and angular distribution measurements. Zn_3P_3 targets.

1973Ve08: 1.24-1.60 MeV from 4MV Van de Graaff accelerator at Orsay Institute and a 2MV Van de Graaff at the Centre for Nuclear Research, Strasbourg-Cronenbourg. Natural Phosphorus targets. Measured $E(\gamma)$, $I\gamma$, $\gamma(\theta)$ using Ge and NaI detectors. Others by same group: 1973Ve06, 1976Ve03.

1973Ko28: 1.8-2.8 MeV protons from electrostatic accelerator at the Physical Technical Institute of the Ukrainian Academy of Sciences. Zn_3P_2 targets with Germanium detectors for $E(\gamma)$ measurements.

1973Ve08: protons from the 4 mv Van de Graaff, Institut de Physique Nucleaire, Orsay and 2 mv Van de Graaff at the Centre de

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- Recherches Nucleaires Strasbourg-Cronenbourg. Both NaI and Ge detectors for $E\gamma$, $I\gamma$, resonance strength and $\gamma(\theta)$ measurements. Natural red phosphorus targets. Also by the same group: [1973Ve06](#), [1970Ga26](#).
- [1972Co13](#): 0.3-1.1 MeV protons from Cockroft-Walton accelerator, $E=1$ -2 MeV from 3MV Van de Graaff at Atomic Energy Board South Africa. Measured $E\gamma$ and $I\gamma$ using Ge detectors, lifetimes through DSAM, angular distributions. High purity zinc phosphide targets.
- [1972Le29](#): 1.1-1.6 MeV protons from 4MV Van de Graaff accelerator at the Center for Nuclear Studies Bordeaux-Gradignan. Ge and NaI detectors. Zinc phosphorus targets. Measured $I\gamma$ and resonance strengths. Also from same group: [1969Th03](#) with $E=0.811$ -1.555 MeV and DSAM for lifetime measurements.
- [1971Re15](#): 0.5-0.8 MeV protons from 1 MeV Cockroft-Walton accelerator at the University of Witwatersrand. Compressed natural red phosphorus targets. Authors claim Zinc phosphide in their energy range produced Doppler shifts too small to accurately measure. Ge detectors used for DSAM determination of lifetimes.
- [1971In02](#): protons from Chalk River MP tandem accelerator and 3MV Van de Graaff accelerator at Queens University. Ge detectors used for $E(\gamma)$, $\gamma(\theta)$, $\gamma\gamma(\theta)$ and py coin. NaI crystal used in conjunction with a ^{88}Y source for continuous energy scale calibration. Natural zinc phosphide targets. DSAM for lifetime measurements.
- [1970Fo13](#): 2-4 MeV protons from Helsinki University 3MV Van de Graaff. Measured $E\gamma$, $I\gamma$. Zn_2P_3 targets. Also [1970Ho25](#).
- [1969Pi10](#): 1.248-1.583 MeV protons from the University of Oregon Van de Graaff accelerator. Ultrapure (99.999%) Zn_3P_2 targets. Ge detectors for $I\gamma$, angular distribution measurements. DSAM for lifetime measurements. Also [1974Ch09](#) by the same group.
- [1966En04](#): 0.3-2.1 MeV protons from the Utrecht 850 keV Cockroft-Walton generator and the 3 MeV Van de Graaff. NaI crystals for absolute resonance strength measurements.
- [1968Do14](#): protons from the University of Oslo Van de Graaff. Zn_3P_2 targets. NaI detectors for angular correlation measurements.
- [1964Sm03](#): Protons from Utrecht cascade and Van de Graaff generators. Targets of Zn_3P_2 . NaI crystals for $E(\gamma)$ and angular distributions.
- [1964Ch04](#): University of Michigan facility. Zn_3P_2 and P_4S_6 targets. Measured yields, $I\gamma$ and angular distributions.
- [1963Sp03](#), [1965Sp05](#): protons from Helsinki University 3MV Van de Graaff. NaI detectors for $E\gamma$, $I\gamma$, $\gamma(\theta)$, $\gamma\gamma(\theta)$ and resonance strength measurements.
- [1963Te01](#): protons from the 500 KV Van de Graaff generator at the Natuurkundig Laboratory der Riksuniversiteit, Groningen. Zinc phosphide targets. NaI detectors for $I\gamma$ and $\gamma(\theta)$ measurements.
- [1962Ne10](#): protons from 550 kv Cockroft-Walton at Iowa State University. Thick amorphous phosphorus targets. NaI detectors for angular distribution measurements.
- [1962Be39](#): protons from 800 kV Cockroft-Walton accelerator at the Central Research Institute, Budapest. NaI and plastic detectors for $E\gamma$, $\gamma(\theta)$ measurements.
- [1961An01](#): 700-1600 keV protons from Blindern Van de Graaff accelerator. 90 degree electrostatic analyzer and NaI scintillation counter with PMT. Targets of Zn_3P_2 and Cu_3P_2 .

 ^{32}S Levels

$E(\text{level})^\dagger$	J^π	$T_{1/2}$	Comments
0	0^+		
2230.5 3	2^+	152 fs 21	E(level): from 1972Co13 . J^π : from $\gamma(\theta)$ 1973Ve08 . Additional information 1. $T_{1/2}$: weighted average of 175 fs 28 (1998Ka31), 135 fs 49 (1974Ch09), 128 fs 52 (1972Co12), 243 fs 42 (1971In02), 180 fs 55 (1969Th03), 121 fs 21 (1971Re15).
3776.0 12		0.67 ps 14	E(level): from 1974Vi02 . Additional information 2. $T_{1/2}$: weighted average of 0.9 ps 3 (1998Ka31), >0.52 ps (1971In02), 0.36 ps 21 (1969Pi10), 0.70 ps 14 (1974Ch09), 0.83 ps 38 (1972Co12).
4281.2 10	2^+	27.3 fs 10	E(level): from 1974Vi02 . Additional information 3. J^π : from $\gamma\gamma(\theta)$ (1971In02). $T_{1/2}$: weighted average of 40.0 fs 14 (1998Ka31), 20 fs 1 (1969Pi10), 35 fs 9 (1969Th03), 25 fs 6 (1972Co12), 55 fs 7 (1971In02), 29.0 fs 27 (2000Ya23).
4459.1 8	4^+	0.14 ps 4	E(level): from 1974Vi02 . J^π : from $\gamma\gamma(\theta)$ 1971In02 .

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$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)** ^{32}S Levels (continued)

E(level) [†]	J ^π	T _{1/2}	Comments
4695.3 4	1 ⁺	0.244 ps 50	Additional information 4. T _{1/2} : weighted average of 0.15 ps 4 (1971In02), 0.14 ps 6 (1974Ch09). E(level): from 1972Co13.
5006.2 3	3 ⁻	0.23 ps 3	Additional information 5. J ^π : from γ(θ) 1973Ve08. T _{1/2} : weighted average of 0.27 ps 7 (1971In02), 0.37 ps 3 (1969Pi10), 0.12 ps 7 (1969Th03), 0.3 ps 3 (1998Ka31), 0.170 ps 35 (1974Ch09), 0.159 ps 38 (1972Co12). E(level): from 1976Ve03.
5412.6 10	3 ⁺	164 fs 28	J ^π : from γ(θ) (1973Ve08), parity from polarization measurements (1968Do14). Additional information 6. T _{1/2} : weighted average of 1.0 ps 17 (1969Pi10), 0.17 ps 3 (1969Th03), 0.26 ps 5 (1998Ka31), 1.07 ps 26 (1974Ch09), 0.7 ps 28 (1971Re15), 0.24 ps 55 (1972Co12), 0.42 ps 10 (1976Ve03). E(level): from 1972Co13.
5546.2 12	2 ⁺	57 fs 8	Additional information 7. J ^π : from γ(θ) 1972Co13, large mixing ratio exclude negative parity. T _{1/2} : contaminating transition in lineshape leads to often quoted 150 fs lifetime (1998Ka31), proper value of τ=237 fs 40 (1998Ka31) or T _{1/2} 1/2=164 fs 28. E(level): from 1974Vi02.
5797.6 10		5.5 fs 34	Additional information 8. T _{1/2} : weighted average of 0.08 ps 2 (1971In02), 0.030 ps 24 (1969Pi10), 0.047 ps 8, (1969Th03), 0.066 ps 8 (1998Ka31), 0.07 ps 2 (1972Co12). E(level): from 1972Co13.
6222.9 8	2 ⁻	48 fs 6	Additional information 9. T _{1/2} : from 1972Co12. E(level): from 1974Vi02.
6410 2	1,2,3,4		Additional information 10. J ^π : from γ(θ) 1973Ve08, positive parity is ruled out by transition to 2230 level which would have an M2 strength greater than 40 W.u.
6621.7 3	4 ⁻	0.36 ps 6	T _{1/2} : weighted average of 55 fs 14 (1971In02), 76 fs 35 (1969Pi10), 42 fs 10 (1969Th03), 52.8 ps 65 (2000Ya23), 90 ps 28 (1971Re15), 38 fs 7 (1972Co12), 52 fs 10 (1976Ve03). E(level): 6410 2 (1974Vi02). E(level): from 1976Ve03.
6666.1 10	2 ⁺	40 fs 5	J ^π : from γ(θ) 1973Ve08. Additional information 11. T _{1/2} : weighted average of 0.26 ps 6 (1969Pi10), 0.7 ps > (1969Th03), 0.55 ps 8 (1998Ka31), 0.39 ps 8 (1974Ch09), 0.29 ps 7 (1972Co12), 0.68 ps 17 (1976Ve03). E(level): from 1972Co13.
6761.6 10	2,3	260 fs 35	Additional information 12. T _{1/2} : weighted average of 49 fs 21 (1971In02), 37 fs 9 (1969Pi10), 61 fs 6 (1998Ka31), 54.1 fs 58 (2000Ya23), 15 fs 5 (1972Co12). E(level): from 1972Co13.
6851.5 15	4 ⁺	66 fs 17	Additional information 13. J ^π : from γ(θ) 1972Co13, Weisskopf estimates exclude J=1,2. T _{1/2} : from 1998Ka31.
7001.44 36	1	1.5 fs 5	Additional information 14. J ^π : from γ(θ) (1981He09), 6852→4282 E2 since M2 strength would exceed RUL. E(level): from 2006Tr03.
7115.3 10	2 ⁺	1.73 fs 35	Additional information 15. J ^π : from γ(θ) 1973Ve08.
7190.1 15	1 ⁺	8.0 fs 21	Additional information 16. J ^π : from angular distribution and E2+M1 γ-decay to 2230 (2 ⁺) (1974Vi02).
7350.0 6	3 ⁽⁺⁾		Additional information 17. T _{1/2} : other: 4.9 fs 17 (2000Ya23). J ^π : from γ(θ) 1997Br07.

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$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)** ^{32}S Levels (continued)

E(level) [†]	J ^π	T _{1/2}	S	Comments
7367				Additional information 18.
7434 3		7.7 fs 10		E(level): from γ decay in 1997Br07 .
7483.9 10	2 ⁺	4.9 fs 12		Additional information 19.
				Additional information 20.
				T _{1/2} : other: 5.8 fs 8 (2000Ya23).
				J ^π : from $\gamma(\theta)$ 1981He09 , g.s. transition M2 strength would exceed RUL.
7535.7 10		3.3 fs 10		Additional information 21.
7567				E(level): from γ decay in 1997Br07 .
				Additional information 22.
7637.0 10				Additional information 23.
7701.44 36	3	66 fs 19		J ^π : from $\gamma(\theta)$ 1997Br07 .
				Additional information 24.
7882.9 9	4 ⁺			J ^π : from $\gamma(\theta)$ 1997Br07 .
				Additional information 25.
7921.0 10				Additional information 26.
7950.1 4	4 ⁻	146 fs 35		Additional information 27.
				J ^π : from $\gamma(\theta)$ 1976Ve03 , negative parity since 7950→5006 would have a M2 strength of 100 W.u. higher than RUL with positive parity.
7974.9 7	3	<21 fs		J ^π : from $\gamma(\theta)$ 1997Br07 .
				Additional information 28.
				21% of intensity unaccounted for by 1997Br07 .
8125.32 24				E(level): from 2006Tr03 .
				Additional information 29.
8191.1 6	4			J ^π : from $\gamma(\theta)$ 1997Br07 .
				Additional information 30.
8270				Additional information 31.
8296.1 10	3			J ^π : from $\gamma(\theta)$ 1997Br07 .
				Additional information 32.
8346.3 14		<28 fs		Additional information 33.
8407.0 14	2			J ^π : from $\gamma(\theta)$ 1997Br07 .
				Additional information 34.
8504 6				Additional information 35.
8690				E(level): from γ decay in 1997Br07 .
8729.3 6	3 ⁺			J ^π : from $\gamma(\theta)$ 1997Br07 , negative parity rejected because of $\beta(\text{M2}) > 35$ RUL for the 11670 γ decay to this level.
				Additional information 36.
8745.6 8	3			J ^π : from $\gamma(\theta)$ 1997Br07 .
				Additional information 37.
8861	2 ⁺			E(level): from γ decay in 1997Br07 .
9023				E(level): from γ decay in 1997Br07 .
9059 2				E(level): E(p)=200 2 (1993II01).
				Resonance Strength=4.8×10 ⁻⁷ eV 16 (1993II01).
9065				E(level): from γ decay in 1997Br07 .
9170 3				E(level): from (1991II01).
				Resonance Strength=0.037 meV<(1991II01).
9196				E(level): from (1995Ro22).
				Resonance Strength=0.061 meV<(1991II01).
9207.55 71	1 ⁺	0.36 eV 11	0.01	E(level): from 2006Tr03 .
				J ^π : from $\gamma(\theta)$ (1963Te01), $\gamma\gamma\theta$ (1962Ne10).
				E(level): E(p)=355 6 (1962Be39), 355 1 (1974Vi02), 355 1 (1991II01), 355 (1993II01).
				Resonance Strength=4.2 meV 7 (1991II01), 17 meV 2 (1975Ob02), 3 meV 1 (1972Co13).
				Additional information 38.
9235 2				E(level): E(p)=383 2 (1991II01).
				Resonance Strength=0.06 meV 12 (1991II01), 0.14 meV<(1964Sm03).
9253 1				E(level): E(p)=402 1 (1991II01).

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$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)** ^{32}S Levels (continued)

E(level) [†]	J ^π	T _{1/2}	S	Comments
9289.0 1	1 ⁺		0.11	Resonance Strength=0.45 meV 7 (1991II01). E(level): E(p)=440 6 (1962Be39), 439 1 (1974Vi02), 439 1 (1991II01). J ^π : from $\gamma(\theta)$ (1963Te01), $\gamma\gamma(\theta)$ (1962Ne10). Resonance Strength=25 meV 4 (1991II01), 130 meV 20 (1975Ob02), 250 meV 8 (1972Co13).
9388 1	2 ⁺		0.45	E(level): E(p)=540 6 (1962Be39), 541 1 (1974Vi02), 541 1 (1991II01). J ^π : from $\gamma(\theta)$ (1963Ch04), parity from $p\gamma\gamma(\theta)$ (1962Be39). T _{1/2} : >0.7 ps (1971Re15). Resonance Strength=120 meV 20 (1991II01), 510 meV 60 (1975Ob02), 1.0 eV 3 (1972Co13).
9463.3 10		<49 fs	0.03	E(level): E(p)=618.9 10 (1964Sm03), 619 1 (1991II01). Resonance Strength=1.1 meV 2 (1991II01), 6 meV 4 (1975Ob02), 6 meV 2 (1972Co13), 3 meV (1964Sm03).
9485.7 10	1 ⁻	8.2 eV 25	0.24 4	E(level): E(p)=642.1 10 (1964Sm03), 642 1 (1974Vi02). J ^π : from $\gamma(\theta)$ (1964Sm03). Resonance Strength=0.52 eV 8 absolute (1966En04), 0.25 eV 3 (1975Ob02), 0.52 eV 16 (1972Co13), 0.23 eV (1964Sm03).
9650.2 5	2 ⁺		1.00 15	E(level): E(p)=811.8 5 (1961An01), 811 1 (1974Vi02). J ^π : from $\gamma(\theta)$ and $\gamma\gamma\theta$ (1963Sp03). Additional information 39.
9659 1		2.4 eV 7	0.20	E(level): E(p)=821 1 (1974Vi02). Additional information 40.
9711.9 14		3.6 eV	0.13	E(level): E(p)=875.5 14 (1964Sm03). Additional information 41.
9724 1	2,3,4		0.08	E(level): E(p)=888 1 (1974Vi02). J ^π : from $\gamma(\theta)$ 1972Co13. Additional information 42.
9727.9 5				E(level): E(p)=892.0 5 (1961An01). Additional information 43.
9731 1			0.32	E(level): E(p)=895 1 (1974Vi02). Additional information 44.
9816.8 10			0.08	E(level): E(p)=983.8 10 (1972Co13), 983 1 (1974Vi02). Resonance Strength=0.18 eV 5 (1972Co13), 0.091 eV 15 (1975Ob02), 0.18 eV (1972Co13).
9827? 3				E(level): E(p)=994 3 (1975Ob02). 1997Br07 legitimately criticizes if this level truly exists. Resonance Strength=0.3 eV<(1975Ob02).
9848 1		0.100 keV 10	0.03	E(level): E(p)=1016 1 (1974Vi02). Additional information 45.
9883.3 5				E(level): E(p)=1052.5 5 (1961An01), 1053 1 (1974Vi02). Additional information 46.
9887.3 6		0.010 keV 5	0.50	E(level): E(p)=1056.5 6 (1972Co13). Resonance Strength=1.1 eV 3 (1972Co13), 0.55 eV 6 (1975Ob02), 1.1 eV (1972Co13).
9919.3 5		0.010 keV 5	0.17	E(level): E(p)=1089.6 6 (1972Co13), 1088.0 5 (1961An01), 1087 1 (1974Vi02). Resonance Strength=0.38 eV 12 (1972Co13), 0.19 eV 6 (1975Ob02), 0.38 eV (1972Co13). Additional information 47.
9946.6 5		0.150 keV 15	1.4	E(level): E(p)=1120.7 6 (1972Co13), 1116.2 5 (1961An01), 1117 1 (1974Vi02), 1117 1 (1972Le29). Resonance Strength=3.0 eV 10 (1972Co13), 1.04 eV 13 (1975Ob02), 1.7 eV 7 (1972Le29). Additional information 48.
9977.8 5	4		0.11 3	E(level): E(p)=1150.0 (1981He09) doublet only identified by 1981He09. Resonance Strength=3.9 eV 13 (1972Co13), 1.85 eV 22 (1975Bo22) undivided between 9977.8 and 9978.3. J ^π : from $\gamma(\theta)$ 1981He09.

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$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)** ^{32}S Levels (continued)

E(level) [†]	J ^π	T _{1/2}	S	Comments
9978.3 1	3		1.0 2	Additional information 49. E(level): E(p)=1150.5 6 (1972Co13), 1150.5 (1981He09), 1151 1 (1972Le29), 1146 1 (1972Le29), 1147.5 5 (1961An01). Resonance Strength=3.9 eV 13 (1972Co13), 1.85 eV 22 (1975Bo22) undivided between 9977.8 and 9978.3. J^π: from γ(θ) 1981He09.
9982.7 6	2	0.100 keV 10	0.68	Additional information 50. E(level): E(p)=1155.1 6 (1972Co13). J^π: from γ(θ) (1970Ho25). Resonance Strength=1.5 eV 5 (1972Co13), 0.66 eV 8 (1975Ob02).
10073.4 6	2 ⁻	1.50 keV 15		G.s. transition is considered one of the strongest M2 transitions known. E(level): E(p)=1251.4 6 (1972Co13), 1247 (1976Ve03), 1246.5 6 (1961An01), 1247.4 15 (1973Ve08), 1248 1 (1972Le29). J^π: from γ(θ) 1973Ve08. Resonance Strength=1.27 eV 16 (corrected value 1997Br07). Other: 11 eV 3 (1972Co13), 4.6 eV 6 (1975Ob02), 1.6 eV 2 (1986Zi08), 11.8 eV 24 (1973Ve08), 9.2 eV 37 (1972Le29).
10102.3 10	4 ⁽⁺⁾		0.11	Additional information 51. J^π: from γ(θ) 1997Br07. E(level): E(p)=1278.2 10 (1997Br07), 1279.1 15 (1973Ve08). Resonance Strength=0.25 eV 5 (1973Ve08).
10218.8 6	3 ⁺	0.010 keV 5	0.59	Additional information 52. E(level): E(p)=1400.1 6 (1972Co13), 1396.5 7 (1961An01), 1399.3 8 (1973Ve08), 1400 1 (1974Vi02), 1398 1 (1972Le29). Resonance Strength=1.3 eV 4 (1972Co13), 0.7 eV 2 (1975Ob02), 1.3 eV 3 (1973Ve08), 5.8 eV 23 (1972Le29).
10221.2 6	3 ⁻	0.056 keV 10	2.3	Additional information 53. J^π: from angular distribution and E3+M2 admixture of decay to 4961 (1⁺) level (1974Vi02). E(level): E(p)=1402.9 6 (1972Co13), 1398.7 7 (1961An01), 1401.9 15 (1973Ve08), 1402 1 (1974Vi02), 1401 1 (1972Le29). J^π: from γ(θ) 1973Ve08. Resonance Strength=5.0 eV 17 (1972Co13), 2.0 eV 6 (1975Ob02), 3.8 eV 8 (1973Ve08).
10225.0 16		0.18 keV 2		Additional information 54. E(level): E(p)=1405.1 15 (1973Ve08), 1404 1 (1972Le29) unclear. Resonance Strength=0.25 eV 10 (1973Ve08).
10230.3 6	1 ⁺	0.025 keV 3	0.91	E(level): E(p)=1411.4 6 (1972Co13), 1410.6 8 (1973Ve08), 1410 1 (1974Vi02), 1409 1 (1972Le29). J^π: from γ(θ) 1973Ve08, M2 strength for the transition to 5411 level would be 42 W.U. with negative parity which is greater than RUL. Resonance Strength=2.0 eV 7 (1972Co13), 0.5 eV 1 (1975Ob02), 1.0 eV 2 (1973Ve08), 1.5 eV 6 (1972Le29).
10256.1 7	4 ⁻	0.035 keV 4	5.0	E(level): E(p)=1438.3 7 (1972Co13), 1436.3 7 (1961An01), 1437.3 15 (1973Ve08), 1437 1 (1972Le29). J^π: from γ(θ) 1973Ve08. Resonance Strength=11 eV 3 (1972Co13), 4.8 eV 6 (1975Ob02), 8.3 eV 17 (1973Ve08), 20 eV 8 (1972Le29).
10286.3 7		0.16 keV 2	0.07	Additional information 55. E(level): E(p)=1468.6 7 (1961An01), 1469.0 15 (1973Ve08), 1468 1 (1972Le29).
10290.2 6	2	0.125 keV 13	1.1	Additional information 56. Resonance Strength=0.15 eV 3 (1973Ve08). E(level): E(p)=1473.1 6 (1972Co13), 1472.1 15 (1973Ve08), 1471 1 (1972Le29). J^π: from γ(θ) 1973Ve08. Resonance Strength=2.4 eV 7 (1972Co13), 1.2 eV 2 (1975Ob02), 1.5 eV 3 (1973Ve08), 2.4 eV 10 (1972Le29).

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$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)** ^{32}S Levels (continued)

E(level) [†]	J ^π	T _{1/2}	S	Comments
10292.0 15		0.07 keV 1	0.17	E(level): E(p)=1474.3 15 (1973Ve08), 1474 1 (1972Le29) unclear. Resonance Strength=0.38 eV 15 (1973Ve08).
10331.1 15		6.1 keV 7		E(level): E(p)=1514.7 15 (1973Ve08). Resonance Strength=0.8 eV 2 (1975Ob02), 2.2 eV 0.4 (1973Ve08).
10370.6 6		0.025 keV 3	4.1	E(level): E(p)=1556.6 6 (1972Co13), 1553.9 8 (1961An01), 1555.4 15 (1973Ve08), 1555 1 (1972Le29). Resonance Strength=9 eV 3 (1972Co13), 4.2 eV 5 (1975Ob02), 8.7 eV 17 (1973Ve08), 11 eV 4 (1972Le29). Additional information 57.
10396.7 6	4 ⁻	0.012 keV 2	3.6	E(level): E(p)=1582.9 6 (1972Co13), 1581.5 8 (1961An01), 1581.1 15 (1973Ve08), 1583 1 (1972Le29), 1585.2 15 (1973Ve08). J ^π : from γ(θ) 1973Ve08. Resonance Strength=8 eV 3 (1972Co13), 4.6 eV 6 (1975Ob02) 7.9 eV 16 (1973Ve08), 15.2 eV 60 (1972Le29). Additional information 58.
10507.9 10		0.010 keV 5	0.41	E(level): E(p)=1698.9 10 (1972Co13). Additional information 59. Resonance Strength=0.9 eV 3 (1972Co13), 0.70 eV 15 (1975Ob02).
10556.1? 10				E(level): E(p)=1746.9 10 (1972Co13). Resonance Strength=2.9 eV 10 (1972Co13) possibly due to $^{13}\text{C}(\text{p},\gamma)^{14}\text{N}$ contamination (1975Ob02), or $^{23}\text{Na}(\text{p},\gamma)$ (1997Br07). Level not observed in 1975Bo42.
10574.4 10	5 ⁺	0.015 keV 2	0.41	J ^π : from γ(θ) 1997Br07, parity from rejecting L=5 as a result of strong centrifugal barrier. E(level): E(p)=1764.2 10 (1972Co13). Additional information 60. Resonance Strength=0.9 eV 3 (1972Co13).
10603.8 10		0.15 keV 2	0.50	E(level): E(p)=1796.1 10 (1972Co13). Resonance Strength=1.1 eV 4 (1972Co13). Additional information 61.
10636.4 10				E(level): E(p)=1891.5 10 (1972Co13), 1891 3 (1973Ko28).
10696.1 10		0.18 keV 2	1.0	Resonance Strength=2.2 eV 7 (1972Co13), 23 eV 2 (1965Sp05).
10700.5 10		21 keV 4	1.1	E(level): E(p)=1896.0 10 (1972Co13). Resonance Strength=2.5 eV 8 (1972Co13). Additional information 62.
10705.3 10				J ^π : from γ(θ) 1997Br07.
10756.7 10	3 ⁽⁺⁾	0.05 keV 1		E(level): E(p)=1954.0 10 (1972Co13). Resonance Strength=6.4 19 (1997Br07). Additional information 63. Resonance Strength=7 eV 2 (1972Co13).
10778.8 10		0.62 keV 7		E(level): E(p)=1977.1 10 (1972Co13), 1975 2 (1973Ko28). Additional information 64. Resonance Strength=6.7 eV 20 (1997Br07), 3.9 eV 13 (1972Co13).
10783.8 10		0.75 keV 8		E(level): E(p)=1983.6 10 (1972Co13). Additional information 65. Resonance Strength=9.3 eV 31 (1997Br07), 8 eV 3 (1972Co13).
10784.5 10		0.60 keV 6		Additional information 66. Resonance Strength=0.64 eV 19 (1997Br07).
10791.3 10		0.17 keV 2	2.4	E(level): E(p)=1990.9 10 (1972Co13). Additional information 67. Resonance Strength=5.3 eV 17 (1972Co13).
10825.4 10		22 keV 4		Resonance Strength=11.2 eV 33 (1997Br07). Additional information 68.
10827.0 10		0.32 keV 3	6.8	E(level): E(p)=2026.6 10 (1972Co13), 2023 2 (1973Ko28) unclear. Resonance Strength=15 eV 5 (1972Co13), 11 eV 2 (1965Sp05).
10915 2				E(level): E(p)=2118 2 (1973Ko28).

Continued on next page (footnotes at end of table)

$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)** ^{32}S Levels (continued)

E(level) [†]	J ^π	Comments
10933.7 10	3	J ^π : from $\gamma(\theta)$ 1997Br07. Resonance Strength=6.2 eV 19 (1997Br07). Additional information 69.
11009.9 10	4 ⁺	J ^π : from $\gamma(\theta)$ 1997Br07, negative parity rejected on $\beta(\text{M2}) > \text{RUL}$ for 11010→6666 keV transition. Resonance Strength=5.4 16 (1997Br07). Additional information 70.
11092.3 10	3	J ^π : from $\gamma(\theta)$ 1997Br07. Resonance Strength=4.9 eV 15 (1997Br07). Additional information 71.
11114 2		E(level): E(p)=2323 2 (1973Ko28).
11123 1		Resonance Strength=10.9 eV 33 (1997Br07). Additional information 72.
11131 2		E(level): E(p)=2341 2 (1973Ko28).
11139.8 10		Resonance Strength=27 eV 8(1997Br07). Additional information 73.
11235.5 10	3	J ^π : from $\gamma(\theta)$ 1997Br07. Resonance Strength=3.8 eV 11 (1997Br07). Additional information 74.
11253.9 10	3	J ^π : from $\gamma(\theta)$ 1997Br07. Resonance Strength=4.4 eV 13 (1997Br07). Additional information 75.
11332.8 10		Additional information 76.
11474.6 10	3	J ^π : from $\gamma(\theta)$ 1997Br07. Resonance Strength=15.2 45 (1997Br07). Additional information 77.
11485.8 10		Additional information 78.
11589.7 10		Resonance Strength=3.1 eV 19 (1997Br07). Additional information 79.
11602.4 10		Additional information 80.
11637.1 10		Resonance Strength=15.1 eV 50 (1997Br07). Additional information 81.
11669.6 10	5 ⁺	J ^π : from $\gamma(\theta)$ 1997Br07, parity from rejecting L=5 as a result of strong centrifugal barrier. Resonance Strength=6.1 18 (1997Br07). Additional information 82.
11696.7 10	5 ⁺	J ^π : from $\gamma(\theta)$ 1997Br07, parity from rejecting L=5 as a result of strong centrifugal barrier. Resonance Strength=2.5 7 (1997Br07). Additional information 83.
11758.8 10		Resonance Strength=5.5 eV 16 (1997Br07). Additional information 84.
11940.1 10	3	J ^π : from $\gamma(\theta)$ 1997Br07. Resonance Strength=3.8 eV 11 (1997Br07). Additional information 85.
12043.9 10		Additional information 86.
12044.19 28	2,3,4	E(level): E(p)=3283 3 (1973Ve06).
12047.96 28	0 ⁺	J ^π : from $\gamma(\theta)$ 1973Ve06, E(level): from 2006Tr03. Additional information 87. E(level): E(p)=3289 3 (1973Ve06). J ^π : from $\gamma(\theta)$ 1973Ve06.

[†] Values for levels up to 10756 keV are from primary γ transitions. Resonance energy levels are derived E(p)(cm)+ S(p), where S(p)=8863.78 keV 21 (2003Au03).

$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)**

$\gamma(^{32}\text{S})$								
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Mult.&	$\delta^\&$	Comments
2230.5	2 ⁺	2231.7 10	100	0	0 ⁺			E_γ : from (1971In02). Additional information 88. $A_2=+0.18$ 8, $A_2=+0.12$ 4, $A_4=+0.27$, $A_2=+0.32$ 3, $A_4=+0.65$, $A_2=+0.26$ (1969Pi10), $\gamma\gamma(\theta)$: $A_2=-0.16$ 15, $A_4=+0.99$ 17, $A_2=+0.17$ 9, $A_4=0.00$ 10 (1963Sp03), $A_2=+0.081$ 27, $A_4=-0.098$ 27 (1970Fo13).
3776.0		1548.8 15	100	2230.5	2 ⁺			E_γ : from (1971In02). Additional information 89.
4281.2	2 ⁺	3777.2 503.7 2052.6 15	<10 <0.4 13.0 5	0 3776.0 2230.5	0 ⁺ 2 ⁺	M1+E2	-29 17	Additional information 90. Additional information 91. E_γ : from (1971In02). Additional information 92. $A_2=+0.33$, $A_4=+0.74$ (1971In02), $A_2=-0.31$ 7, $A_4=+0.01$ (1969Pi10). δ : 29 17 (1971In02). E_γ : from (1971In02). $A_2=+0.33$ 8, $A_4=-0.12$ 10 (1997Br07), $A_2=+0.37$ 3, $A_4=-0.22$ 4 (1997Br07), $A_2=+0.41$ 2, $A_4=-0.30$ 3 (1997Br07), $A_2=+0.41$ 6, $A_4=-0.32$ 6 (1997Br07), ; $A_2=+0.6$ 2, $A_4=-0.83$ (1969Pi10). Additional information 93. Additional information 94.
4459.1	4 ⁺	681.4 2229.4 12	<0.3 100	3776.0 2230.5	2 ⁺	E2		E_γ : from (1971In02). Additional information 95. $A_2=+0.52$ 13, $A_4=-0.39$ 12 (1971In02), $A_2=+0.34$ 1, $A_4=-0.12$ 1 (1997Br07), $A_2=+0.49$ 4, $A_4=-0.08$ (1969Pi10). Mult., δ : 1997Br07.
4695.3	1 ⁺	4458.4 414.1 917.8 2466.0 15	<1 <0.6 <0.4 61 1	0 4281.2 3776.0 2230.5	0 ⁺ 2 ⁺ 2 ⁺	M1+E2	-0.08 10	Additional information 96. Additional information 97. Additional information 98. E_γ : from (1971In02). Additional information 99. $A_2=-0.38$ 9, 0.14 9 (1974Vi02), $A_2=-0.33$ (1969Pi10). Mult., δ : from (1974Vi02). E_γ : from (1971In02). Additional information 100. $A_2=-0.36$ (1969Pi10). Additional information 101. Additional information 102.
5006.2	3 ⁻	724.8 1228.4 2776.2 12	<0.1 <0.4 96.6 @ 4	4281.2 3776.0 2230.5	2 ⁺ 2 ⁺	E1(+M2)	0.00 5	E_γ : from (1971In02). $A_2=-0.28$ 0.03, $A_4=-0.06$ 34 (1969Pi10), $A_2=-0.17$ 3, $A_4=-0.03$ 3 (1973Ve08), $A_2=-0.18$ 4, $A_4=-0.07$ 4 (1973Ve08), $A_2=-0.23$ 3, $A_4=-0.02$ 3 (1976Ve03), $A_2=-0.23$ 1, $A_4=-0.02$ 1 (1976Ve03), $A_2=-0.30$ 2, $A_4=0.00$ 2 (1997Br07). Mult., δ : 0.00 5 (1997Br07), 0.00 2 (1976Ve03), +0.03 2 (1973Ve08). Additional information 103. Additional information 104. Additional information 105. Additional information 106.
5412.6	3 ⁺	5005.4 406.2 716.9	3.4 4 <2 <1	0 5006.2 4695.3	0 ⁺ 3 ⁻ 1 ⁺	E3		

Continued on next page (footnotes at end of table)

$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)**

$\gamma(^{32}\text{S})$ (continued)								
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Mult.&	$\delta^\&$	Comments
5412.6	3^+	953.3	<1	4459.1	4^+			Additional information 107.
		1131.0	<6	4281.2	2^+			Additional information 108.
		1634.6	<20 [#]	3776.0				Additional information 109.
		3181.8	100	2230.5	2^+	M1+E2	+7.6 19	$A_2=+0.07$ 4, $A_4=+0.08$ 4 (1969Pi10), $A_2=-0.12$ 6, $A_4=+0.07$ 7 (1976Ve03), $A_2=+0.32$ 4, $A_4=+0.22$ 4 (1976Ve03), $A_2=+0.17$ 5, $A_4=+0.12$ 6 (1976Ve03), $A_2=+0.38$ 3, $A_4=+0.28$ 4 (1997Br07), $A_2=+0.24$ 2, $A_4=-0.02$ 2 (1997Br07), $A_2=+0.28$ 3, $A_4=+0.05$ 4 (1997Br07), $A_2=+0.24$ 3, $A_4=+0.39$ (1969Pi10). Mult., δ : 7.1 -14+24 (1997Br07). Additional information 110. Additional information 111.
5546.2	2^+	5411.4	<5	0	0^+			
		541.2	<0.4	5006.2	3^-			
		851.9	<1	4695.3	1^+			
		1088.3	<2	4459.1	4^+			
		1265.9	<1	4281.2	2^+			
		1769.6	<1	3776.0				
		3318.5	60.0 15	2230.5	2^+	E2+M1	-5.2 21	E_γ : from (1971In02). $A_2=+0.06$ 5, $A_4=-0.02$ 3 (1997Br07), $A_2=-0.19$ 6, $A_4=-0.27$ (1969Pi10). Mult., δ : -6.3 -11+32 (1997Br07). Additional information 112. $A_2=+0.50$ 1, $A_4=-0.35$ 2 (1981He09), $A_2=+0.55$ 4, $A_4=-0.80$ (1969Pi10). Additional information 113.
5797.6		5546.4	40.0 15	0	0^+			
		791.3	<1	5006.2	3^-			
		1102.0	<1	4695.3	1^+			
		1338.3	<1.5	4459.1	4^+			
		1516.0	<1	4281.2	2^+			
		2019.7	<1.5	3776.0				
		3566.8	<5	2230.5	2^+			Additional information 114.
		5796.4	100	0	0^+			Additional information 115.
6222.9	2^-	811.3	<0.2	5412.6	3^+			$A_2=-0.33$ 5 (1969Pi10), $A_2=+0.30$ 5 (1969Pi10).
		1217.5	3 2	5006.2	3^-			Additional information 116.
		1528.1	<0.5	4695.3	1^+			
		1764.5	<0.6	4459.1	4^+			
		1942.2	<1.5	4281.2	2^+			
		2445.8	<0.8	3776.0				
		3993.0 20	97 2	2230.5	2^+	E1+M2	-0.07 3	E_γ : from (1971In02). $A_2=+0.100$ 4, $A_4=0.001$ 4 (1969Pi10), $A_2=+0.21$ 2, $A_4=-0.04$ 2 (1973Ve08), $A_2=+0.23$ 2, $A_4=-0.09$ 3 (1973Ve08), $A_2=+0.14$ 1, $A_4=-0.01$ 1 (1976Ve03), $A_2=+0.29$ 2, $A_4=+0.16$ (1969Pi10). Mult., δ : from 1976Ve03. Additional information 117. Additional information 118.
		6222.4	<1.5	0	0^+			
		4179	100	2230.5	2^+			$A_2=+0.17$ 9, $A_4=-0.15$ 9 (1976Ve03), $A_2=+0.32$ 3, $A_4=-0.18$ 4 (1997Br07), $A_2=+0.45$ 9, $A_4=-0.26$ 2 (1997Br07), $A_2=-0.31$ 5, $A_4=+0.09$ 6 (1997Br07), $A_2=+0.30$ (1969Pi10). Mult., δ : ± 0.28 14 if 3^- or -0.13 11 if 4^+ (1976Ve03).

Continued on next page (footnotes at end of table)

$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)** $\gamma(^{32}\text{S})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Mult.&	$\delta^\&$	Comments
Additional information 119. I $_\gamma$: from 1974Vi02. Additional information 120. Mult., δ : 0.0 5 (1976Ve03). A $_2$ =+0.29 2, A $_4$ =+0.14 2 (1972Co13) weighted average of 3 measurements, A $_2$ =+0.49 4, A $_4$ =+0.22 4 (1969Pi10), A $_2$ =+0.27 2, A $_4$ =+0.25 2 (1973Ve08), A $_2$ =+0.28 3, A $_4$ =+0.18 3 (1973Ve08), A $_2$ =+0.32 1, A $_4$ =+0.21 1 (1976Ve03), A $_2$ =+0.31 1, A $_4$ =+0.22 1 (1976Ve03), A $_2$ =+0.53 3, A $_4$ =+0.26 5 (1997Br07). Mult., δ : from 1997Br07. Additional information 121. A $_2$ =+0.31 3, A $_4$ =-0.09 4 (1972Co13) weighted average of 3 measurements, A $_2$ =+0.56 2, A $_4$ =-0.03 2 (1969Pi10), A $_2$ =+0.25 2, A $_4$ =+0.07 3 (1973Ve08), A $_2$ =+0.23 4, A $_4$ =-0.03 4 (1973Ve08), A $_2$ =+0.35 1, A $_4$ =-0.03 1 (1976Ve03), A $_2$ =+0.35 2, A $_4$ =-0.02 2 (1976Ve03). Mult., δ : from 1976Ve03. Additional information 122. A $_2$ =+0.05 5, A $_4$ =-0.30 5 (1976Ve03), A $_2$ =+0.02 3, A $_4$ =-0.28 3 (1976Ve03). Mult., δ : from (1976Ve03). Additional information 123.								
6621.7	4 ⁻	1209.1	<0.9	5412.6	3 ⁺	E1		
		1615.2	73 1	5006.2	3 ⁻	E2+M1	2.9 8	
		1925.9	<0.3	4695.3	1 ⁺			
		2162.2	24.0 7	4459.1	4 ⁺	E1+M2	-0.06 2	
		2339.9	<0.2	4281.2	2 ⁺			
		2843.5	<0.6	3776.0				
		4390.6	3.0 3	2230.5	2 ⁺	M2+E3	-0.41 8	
6666.1	2 ⁺	6620.0	<0.3	0	0 ⁺			
		1253.3	<1	5412.6	3 ⁺			
		1659.5	<4	5006.2	3 ⁻			
		1970.2	14 2	4695.3	1 ⁺			
		2206.5	<3	4459.1	4 ⁺			
		2384.2	<7	4281.2	2 ⁺			
		2887.9 20	49 5	3776.0				
		4434.8	37 4	2230.5	2 ⁺			
		6664.3	<3	0	0 ⁺			
6761.6	2,3	1349.1	<3	5412.6	3 ⁺			
		1755.3	74 30	5006.2	3 ⁻			
		2066.0	<8	4695.3	1 ⁺			
		2302.3	24 10	4459.1	4 ⁺	D+Q	-0.6	
		2480.0	<3	4281.2	2 ⁺			
		2983.6	<4	3776.0				
		4530.6	<7	2230.5	2 ⁺			
6851.5	4 ⁺	6760.1	2 1	0	0 ⁺			
		1439.9	10 5	5412.6	3 ⁺			
		1846.1	<13	5006.2	3 ⁻			
		2156.7	<5	4695.3	1 ⁺			
		2393.1	10 5	4459.1	4 ⁺			
		2570.8	80 10	4281.2	2 ⁺	E2		

Continued on next page (footnotes at end of table)

$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)** $\gamma(^{32}\text{S})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Mult. &	$\delta^\&$	Comments
								$A_4 = -0.33$ 2 (1981He09). Mult., δ : 0.04 3 (1981He09), -0.09 9 if 4^+ and -0.50 12 if 3^- (1976Ve03). Additional information 133.
6851.5	4^+	3074.4	<8	3776.0				
		4621.4	<7	2230.5	2^+			Additional information 134.
		6850.8	<8	0	0^+			Additional information 135.
7001.44	1	1589.0	<1	5412.6	3^+			
		1995.1	<2	5006.2	3^-			
		2305.8	<1	4695.3	1^+			
		2542.1	<2	4459.1	4^+			
		2719.8	<2	4281.2	2^+			Additional information 136.
		3223.4	10 5	3776.0				Additional information 137.
		4770.49 33	100	2230.5	2^+			E_γ : from 2006Tr03. $A_2 = +0.02$ 2, $A_4 = -0.04$ 2 (1973Ve08). Additional information 138. Additional information 139.
7115.3	2^+	6999.8	<2	0	0^+			
		1702.8	<0.5	5412.6	3^+			
		2109.0	<1	5006.2	3^-			
		2419.6	9 1	4695.3	1^+			Additional information 140.
		2656.0	<1	4459.1	4^+			
		2833.6	3 1	4281.2	2^+			I_γ : early 1965Sp05 study found significant intensity for this γ -ray but subsequent experiments all agree on only a small amount of intensity. Additional information 141. Additional information 142.
		3337.2	3 2	3776.0				
		4884.2	86 2	2230.5	2^+	M1+E2	-0.38 3	$A_2 = +0.28$ 5, $A_4 = -0.11$ 6 (1973Ve08), $A_2 = +0.38$ 3, $A_4 = +0.02$ 3 (1976Ve03), $A_2 = +0.27$ 3, $A_4 = -0.10$ 4 (1981He09), $A_2 = +0.33$ 4, $A_4 = -0.13$ 5 (1974Vi02). Mult., δ : from 1973Ve08, agrees with 1981He09. Additional information 143. Additional information 144.
7190.1	1^+	7113.6	2.0 5	0	0^+			
		2183.7	<28	5006.2	3^-			
		2494.4	<25	4695.3	1^+			
		2730.7	<54	4459.1	4^+			
		2908.4	<35	4281.2	2^+			
		3412.0	<55	3776.0				
		4959.0	59 12	2230.5	2^+			Additional information 145.
		7188.4	41 12	0	0^+			I_γ : 1974Vi02 disagrees with both 1975Bo42 and 1972Co13. I_γ : 1974Vi02 disagrees with both 1975Bo42 and 1972Co13. Additional information 146.
7350.0	$3^{(+)}$	2654.2	100	4695.3	1^+			$A_2 = +0.42$ 6, $A_4 = -0.13$ 7 (1997Br07). I_γ : recent results from 1998Ka31 find only 59 15 of the intensity of the decay in this γ , this level may decay by unknown branches. Additional information 147.
7434		3150	20 10	4281.2	2^+			I_γ : 20 10 (1974Vi02), 40 (1965Sp05).
		5203	20 10	2230.5	2^+			I_γ : 20 10 (1974Vi02).
		7432	60 15	0	0^+			I_γ : 60 15 (1974Vi02), 60 (1965Sp05).
7483.9	2^+	2071.4	<10	5412.6	3^+			
		2477.5	<9	5006.2	3^-			
		2788.1	<6	4695.3	1^+			
		3024.5	<14	4459.1	4^+			

Continued on next page (footnotes at end of table)

$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)** $\gamma(^{32}\text{S})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Mult. &	Comments
7483.9	2 ⁺	3202.2	<13	4281.2	2 ⁺		Additional information 148.
		3705.7	<15	3776.0			Additional information 149.
		5252.7	<7	2230.5	2 ⁺		Additional information 150.
		7482.0	100	0	0 ⁺	E2	$A_2=+0.44$ 4, $A_4=-0.44$ 5 (1981He09). Additional information 151.
7535.7		2123.1	<10	5412.6	3 ⁺		
		2529.3	<5	5006.2	3 ⁻		
		2839.9	100	4695.3	1 ⁺		Additional information 152.
		3076.3	<6	4459.1	4 ⁺		
		3253.9	<8	4281.2	2 ⁺		
		3757.5	<11	3776.0			
		5304.5	<14	2230.5	2 ⁺		Additional information 153.
		7533.8	<7	0	0 ⁺		Additional information 154.
7567		2154		5412.6	3 ⁺		E_γ : from 1997Br07. $A_2=+0.45$ 5, $A_4=-0.09$ 7 (1997Br07). Additional information 155.
7637.0		3355.2	100	4281.2	2 ⁺		
7701.44	3	2288.9	<50	5412.6	3 ⁺		
		2695.0	<50	5006.2	3 ⁻		
		3005.6	<50	4695.3	1 ⁺		
		3242.0	<50	4459.1	4 ⁺		
		3419.6	<70	4281.2	2 ⁺		Additional information 156.
		3923.2	<45	3776.0			
		5470.1	100	2230.5	2 ⁺		$A_2=-0.37$ 7, $A_4=-0.04$ 9 (1997Br07). Mult., δ : +0.05 3 or 2.5 7 (1997Br07). Additional information 157.
7882.9	4 ⁺	7699.5	<60	0	0 ⁺		Additional information 158.
		2335.3	11 5	5546.2	2 ⁺		Additional information 159.
		2876.4	14 5	5006.2	3 ⁻		Additional information 160.
		5651.5	75 5	2230.5	2 ⁺		$A_2=+0.41$ 2, $A_4=-0.07$ 3 (1997Br07). Additional information 161.
7921.0		x	10 10				Additional information 162.
							I_γ : unknown or missing γ -branching of <20% from Table 32i in 1998En04 evaluation, implied from γ -branching ratio of >80% in Table 1 of 1997Br07.
7950.1	4 ⁻	5689.6	90 10	2230.5	2 ⁺		I_γ : from 80>(1997Br07). Additional information 163.
		2537.5	40 10	5412.6	3 ⁺		$A_2=-0.15$ 2, $A_4=+0.18$ 2 (1976Ve03), $A_2=-0.13$ 8, $A_4=+0.29$ 9 (1976Ve03). Mult., δ : 10 3 (1976Ve03). Additional information 164.
		2943.6	60 7	5006.2	3 ⁻		Additional information 165.
		3254.2	<3	4695.3	1 ⁺		Additional information 166.
		3490.6	<8	4459.1	4 ⁺		Additional information 167.
		3668.2	<10	4281.2	2 ⁺		Additional information 168.
		4171.8	<2	3776.0			Additional information 169.
		5718.7	<4	2230.5	2 ⁺		Additional information 170.
		7948.0	<0.5	0	0 ⁺		Additional information 171.
7974.9	3	x	31				I_γ : unknown or missing γ -branching from Table 32i in 1998En04 evaluation and Table 1 in 1997Br07 (listed as 21%). Additional information 172.
		2968.4	19 5	5006.2	3 ⁻		Additional information 173.
		5743.4	50 5	2230.5	2 ⁺		Additional information 174.
8125.32		2712.7	<4	5412.6	3 ⁺		Additional information 175.
		3118.8	<2	5006.2	3 ⁻		Additional information 176.
		3429.4	<4	4695.3	1 ⁺		Additional information 177.
		3665.8	<4	4459.1	4 ⁺		Additional information 178.
		3843.4	<3	4281.2	2 ⁺		

Continued on next page (footnotes at end of table)

$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)** $\gamma(^{32}\text{S})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Mult. &	Comments
8125.32		4347.0	<10	3776.0			Additional information 179.
		5894.32 28	15 5	2230.5	2 ⁺		E_γ : from 2006Tr03.
		8124.12 24	85 5	0	0 ⁺		Additional information 180.
							E_γ : from 2006Tr03.
							Additional information 181.
8191.1	4	2643.4	30 6	5546.2	2 ⁺		$A_2=+0.42$ 6, $A_4=-0.2$ 8 (1997Br07).
		2778.4	24 5	5412.6	3 ⁺		Additional information 182.
							$A_2=-0.47$ 9, $A_4=+0.20$ 13 (1997Br07).
							Mult., δ : +0.03 8 or 2.9 7 (1997Br07).
							Additional information 183.
		3731.5	28 6	4459.1	4 ⁺		$A_2=+0.51$ 9, $A_4=-0.18$ 14 (1997Br07).
							Mult., δ : -2.2 +160-10 (1997Br07).
							Additional information 184.
8296.1	3	3909.1	18 3	4281.2	2 ⁺		Additional information 185.
		x	19				Additional information 186.
							I_γ : unknown or missing γ -branching from Table 32i in
							1998En04 evaluation and Table 1 in 1997Br07.
		4014.1	27 9	4281.2	2 ⁺		Additional information 187.
		6064.5	54 9	2230.5	2 ⁺		Additional information 188.
8407.0	2	x	30				Additional information 189.
							I_γ : unknown or missing γ -branching from Table 32i in
							1998En04 evaluation and Table 1 in 1997Br07.
		3711.0	10 2	4695.3	1 ⁺		Additional information 190.
		4125.0	9 2	4281.2	2 ⁺		Additional information 191.
		4628.1	51 5	3776.0			Additional information 192.
8504		6273	100	2230.5	2 ⁺		I_γ : from 1965Sp05.
8729.3	3 ⁺	x	56				Additional information 193.
							I_γ : unknown or missing γ -branching from Table 32i in
							1998En04 evaluation and Table 1 in 1997Br07 (where
							54% is listed).
		1876.7	10 2	6851.5	4 ⁺		Additional information 194.
		2107.6	16 3	6621.7	4 ⁻		Additional information 195.
		3316.5	18 3	5412.6	3 ⁺		Additional information 196.
8745.6	3	1893.0	12 5	6851.5	4 ⁺		Additional information 197.
		2123.9	34 5	6621.7	4 ⁻		Additional information 198.
		2335.4	40 5	6410	1,2,3,4		Additional information 199.
		3197.8	8 4	5546.2	2 ⁺		Additional information 200.
		3332.8	7 3	5412.6	3 ⁺		Additional information 201.
9207.55	1 ⁺	911.4	<1	8296.1	3		Additional information 202.
		1324.6	<1	7882.9	4 ⁺		Additional information 203.
		2017.31	2.8 7	7190.1	1 ⁺		Additional information 204.
		2983.6	9.1 8	6222.9	2 ⁻		Additional information 205.
		3409.7	6.2 12	5797.6			Additional information 206.
		3659.7	7.1 11	5546.2	2 ⁺		Additional information 207.
		4747.6	3.0 6	4459.1	4 ⁺		Additional information 208.
		4925.5	2.1 6	4281.2	2 ⁺		Additional information 209.
		5428.9	4.1 6	3776.0			Additional information 210.
		6975.6	34.1 20	2230.5	2 ⁺		Additional information 211.
		9206.1 7	34.5 20	0	0 ⁺	M1	E_γ : from 2006Tr03.
							Additional information 212.
							Mult., δ : +0.14 5 from 1963Te01.
9235		4538.8	17 8	4695.3	1 ⁺		Additional information 213.
		5456.3	47 12	3776.0			Additional information 214.
		7003.1	36 9	2230.5	2 ⁺		Additional information 215.
9253		2587.0	8.9 16	6666.1	2 ⁺		Additional information 216.
		3029.0	6.0 11	6222.9	2 ⁻		Additional information 217.

Continued on next page (footnotes at end of table)

$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)** $\gamma(^{32}\text{S})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Mult. &	$\delta^\&$	Comments
9253		3705.1	4.3 13	5546.2	2 ⁺			Additional information 218.
		3840.1	5.2 14	5412.6	3 ⁺			Additional information 219.
		4246.3	14.0 21	5006.2	3 ⁻			Additional information 220.
		4556.8	24.5 23	4695.3	1 ⁺			Additional information 221.
		4971.0	5.6 13	4281.2	2 ⁺			Additional information 222.
		7021.0	32 3	2230.5	2 ⁺			Additional information 223.
9289.0	1 ⁺	785	4 1	8504				Additional information 224.
		1163.6	<1	8125.32				Additional information 225.
		1753.2	5.6 5	7535.7				Additional information 226.
		2173.5	15.6 9	7115.3	2 ⁺			Additional information 227.
		2287.4	1.0 2	7001.44	1			Additional information 228.
		2623.0	<0.4	6666.1	2 ⁺			Additional information 229.
		2667.3	<0.4	6621.7	4 ⁻			Additional information 230.
		3065.0	2.5 3	6222.9	2 ⁻			Additional information 231.
		3491.1	1.1 2	5797.6				Additional information 232.
		3741.1	<1.4	5546.2	2 ⁺			Additional information 233.
		3876.1	<0.9	5412.6	3 ⁺			Additional information 234.
		4282.2	<1.1	5006.2	3 ⁻			Additional information 235.
		4592.8	15.6 9	4695.3	1 ⁺			Additional information 236.
		4829.1	<0.7	4459.1	4 ⁺			Additional information 237.
								$A_2=-0.48$ 7, $A_4=+0.11$ 11 (1962Ne10).
								Mult., δ : from 1962Ne10.
		5006.8	<1.1	4281.2	2 ⁺			Additional information 238.
		5510.3	<0.8	3776.0				Additional information 239.
		7057.0	18.7 9	2230.5	2 ⁺	M1(+E2)	0.01 1	Additional information 240.
								$A_2=-0.04$ 3 (1962Be39), $A_2=-0.31$ 5, $A_4=-0.09$ 8 (1962Ne10).
								Mult., δ : 1962Ne10.
		9286.1	39.9 17	0	0 ⁺			Additional information 241.
								$A_2=-0.02$ 2, $A_4=+0.04$ 5 (1962Be39), $A_2=-0.09$ 2, $A_4=+0.04$ 4 (1963Te01).
								Mult., δ : from 1963Te01.
9388	2 ⁺	1262.6	1.3 1	8125.32				Additional information 242.
		2626.2	<0.4	6761.6	2,3			Additional information 243.
		2722.0	<0.4	6666.1	2 ⁺			Additional information 244.
		2766.2	1.3 3	6621.7	4 ⁻			Additional information 245.
		3164.0	15.9 7	6222.9	2 ⁻			Additional information 246.
		3590.1	1.9 3	5797.6				Additional information 247.
		3840.1	1.7 3	5546.2	2 ⁺			Additional information 248.
		3975.1	0.9 1	5412.6	3 ⁺			Additional information 249.
		4381.2	7.8 4	5006.2	3 ⁻			Additional information 250.
		4691.8	2.0 2	4695.3	1 ⁺			Additional information 251.
		4928.1	<0.6	4459.1	4 ⁺			Additional information 252.
		5105.7	1.9 2	4281.2	2 ⁺			Additional information 253.
		5609.2	<0.5	3776.0				Additional information 254.
		7156.0	62.6 23	2230.5	2 ⁺			Additional information 255.
								$A_2=+0.35$ 2, $A_4=+0.042$ 28 (1962Be39).
		9385.0	2.5 1	0	0 ⁺			Additional information 256.
9463.3		2347.8	5.4 15	7115.3	2 ⁺			Additional information 257.
		4767.0	21 3	4695.3	1 ⁺			Additional information 258.
		5684.5	4.7 13	3776.0				Additional information 259.
		7231.2	26 3	2230.5	2 ⁺			Additional information 260.
		9460.3	42 3	0	0 ⁺			Additional information 261.
9485.7	1 ⁻	1360	3	8125.32				E_γ, I_γ : from 1963Sp03.
		2370.2	<8.3	7115.3	2 ⁺			Additional information 262.
		2860	7	6621.7	4 ⁻			E_γ, I_γ : from 1963Sp03.

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$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)** $\gamma(^{32}\text{S})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Comments
9485.7	1^-	3261.6	<2.4	6222.9	2^-	Additional information 263.
		3687.7	3.6 8	5797.6		Additional information 264.
		3937.8	<2	5546.2	2^+	Additional information 265.
		4072.7	<1.4	5412.6	3^+	Additional information 266.
		4478.8	3.1 7	5006.2	3^-	Additional information 267.
		4789.4	<3	4695.3	1^+	Additional information 268.
		5025.8	<0.8	4459.1	4^+	Additional information 269.
		5203.4	8 1	4281.2	2^+	Additional information 270.
		5706.9	<1.8	3776.0		Additional information 271.
		7253.6	<2.3	2230.5	2^+	Additional information 272.
9650.2	2^+	9482.7	85 7	0	0^+	Additional information 273.
						$A_2=+0.20$ (1963Sp03), $A_2=-0.273$ 15 (1964Sm03).
						I_γ : from 1963Sp03.
						$A_2=+0.15$ 8, $A_4=+0.50$ 9 (1963Sp03).
		3426.1	<0.6	6222.9	2^-	Additional information 274.
		3852.2	<0.8	5797.6		Additional information 275.
		4102.2	<0.5	5546.2	2^+	Additional information 276.
		4237.2	1.7 4	5412.6	3^+	Additional information 277.
		4643.3	<0.6	5006.2	3^-	Additional information 278.
		4953.9	40 3	4695.3	1^+	Additional information 279.
9659		5190.2	<1.2	4459.1	4^+	Additional information 280.
		5367.8	<0.4	4281.2	2^+	Additional information 281.
		5871.3	<0.4	3776.0		Additional information 282.
		7418.1	58 5	2230.5	2^+	Additional information 283.
						$A_2=+0.35$ 4 (1963Sp03), $\gamma\gamma(\theta)$: $A_2=-0.37$ 13, $A_4=+0.27$ 13 (1963Sp03).
		9647.1	0.4 2	0	0^+	Additional information 284.
		2174.9	0.3 1	7483.9	2^+	Additional information 285.
		2468.7	2.1 9	7190.1	1^+	Additional information 286.
		3434.9	<0.3	6222.9	2^-	Additional information 287.
		3861.0	<0.7	5797.6		Additional information 288.
9711.9		4111.0	2.2 3	5546.2	2^+	Additional information 289.
		4246.0	<0.2	5412.6	3^+	Additional information 290.
		4652.1	<0.3	5006.2	3^-	Additional information 291.
		4962.7	2.3 1	4695.3	1^+	Additional information 292.
		5199.0	<0.4	4459.1	4^+	Additional information 293.
		5376.6	<0.2	4281.2	2^+	Additional information 294.
		5880.1	1.8 3	3776.0		Additional information 295.
		7426.8	10 1	2230.5	2^+	Additional information 296.
		9655.9	81 8	0	0^+	Additional information 297.
		1586.5	2.9 7	8125.32		Additional information 298.
9724	2,3,4	2596.4	3.1 5	7115.3	2^+	Additional information 299.
		2710.2	3.1 5	7001.44	1	Additional information 300.
		3487.8	<1.7	6222.9	2^-	Additional information 301.
		3913.9	3.6 9	5797.6		Additional information 302.
		4163.9	<1.8	5546.2	2^+	Additional information 303.
		4298.9	<1.3	5412.6	3^+	Additional information 304.
		4705.0	2.1 1	5006.2	3^-	Additional information 305.
		5015.6	26 2	4695.3	1^+	Additional information 306.
		5251.9	1.2 5	4459.1	4^+	Additional information 307.
		5429.5	2.8 8	4281.2	2^+	Additional information 308.
9724	2,3,4	5933.0	6.4 2	3776.0		Additional information 309.
		7479.7	43 7	2230.5	2^+	Additional information 310.
		9708.7	6.6 7	0	0^+	Additional information 311.
		1773.8	<0.7	7950.1	4^-	Additional information 312.
		2022.9	1.0 5	7701.44	3	Additional information 313.
		2188.1	<0.4	7535.7		Additional information 314.

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$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)** $\gamma(^{32}\text{S})$ (continued)

$E_i(\text{level})$	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Comments
9724	2608.5	<0.5	7115.3	2 ⁺	Additional information 315.
	2962.1	5.1 2	6761.6	2,3	Additional information 316.
	3102.2	41 3	6621.7	4 ⁻	Additional information 317.
					$A_2=+0.32$ 6, $A_4=-0.11$ 8 (1972Co13).
	3499.9	13.0 14	6222.9	2 ⁻	Additional information 318.
	3926.0	<0.4	5797.6		Additional information 319.
	4176.0	<0.8	5546.2	2 ⁺	Additional information 320.
	4311.0	<0.9	5412.6	3 ⁺	Additional information 321.
	4717.1	39 3	5006.2	3 ⁻	Additional information 322.
					$A_2=+0.64$ 15, $A_4=+0.11$ 18 (1972Co13).
	5027.7	<0.9	4695.3	1 ⁺	Additional information 323.
	5264.0	<0.7	4459.1	4 ⁺	Additional information 324.
	5441.6	<0.9	4281.2	2 ⁺	Additional information 325.
	5945.1	<1.2	3776.0		Additional information 326.
	7491.8	0.8 2	2230.5	2 ⁺	Additional information 327.
	9720.8	<0.4	0	0 ⁺	Additional information 328.
9731	1605.6	4.2 6	8125.32		Additional information 329.
	1780.8	1.2 3	7950.1	4 ⁻	Additional information 330.
	2029.9	<0.6	7701.44	3	Additional information 331.
	2615.5	2	7115.3	2 ⁺	Additional information 332.
	3109.2	<0.3	6621.7	4 ⁻	Additional information 333.
	3506.9	20 2	6222.9	2 ⁻	Additional information 334.
	3933.0	20 2	5797.6		Additional information 335.
	4183.0	1.0 5	5546.2	2 ⁺	Additional information 336.
	4318.0	<1.4	5412.6	3 ⁺	Additional information 337.
	4724.1	3.0 15	5006.2	3 ⁻	Additional information 338.
	5034.6	5.2 9	4695.3	1 ⁺	Additional information 339.
	5271.0	<0.5	4459.1	4 ⁺	Additional information 340.
	5448.6	22 2	4281.2	2 ⁺	Additional information 341.
	5952.1	<0.8	3776.0		Additional information 342.
	7498.8	19 2	2230.5	2 ⁺	Additional information 343.
	9727.8	4.0 5	0	0 ⁺	Additional information 344.
9816.8	2701.3	8.6 6	7115.3	2 ⁺	Additional information 345.
	3195.0	<0.6	6621.7	4 ⁻	Additional information 346.
	3592.7	5.6 7	6222.9	2 ⁻	Additional information 347.
	4018.8	2.7 3	5797.6		Additional information 348.
	4268.8	<0.7	5546.2	2 ⁺	Additional information 349.
	4403.7	<1.5	5412.6	3 ⁺	Additional information 350.
	4809.8	50 3	5006.2	3 ⁻	Additional information 351.
	5120.4	<0.9	4695.3	1 ⁺	Additional information 352.
	5356.7	1.7 4	4459.1	4 ⁺	Additional information 353.
	5534.4	10 2	4281.2	2 ⁺	Additional information 354.
	6037.9	<0.8	3776.0		Additional information 355.
	7584.6	20 2	2230.5	2 ⁺	Additional information 356.
	9813.6	0.7 2	0	0 ⁺	Additional information 357.
9848	2732.4	27 2	7115.3	2 ⁺	Additional information 358.
	3181.9	<1.4	6666.1	2 ⁺	Additional information 359.
	3226.2	<0.5	6621.7	4 ⁻	Additional information 360.
	3623.9	<2.2	6222.9	2 ⁻	Additional information 361.
	4049.9	5.7 1	5797.6		Additional information 362.
	4300.0	<0.9	5546.2	2 ⁺	Additional information 363.
	4434.9	<1.7	5412.6	3 ⁺	Additional information 364.
	4841.0	<1	5006.2	3 ⁻	Additional information 365.
	5151.6	2.4 5	4695.3	1 ⁺	Additional information 366.
	5387.9	<1.3	4459.1	4 ⁺	Additional information 367.
	5565.6	1.8 6	4281.2	2 ⁺	Additional information 368.

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$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)** $\gamma(^{32}\text{S})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Comments
9848		6069.1	<0.5	3776.0		Additional information 369.
		7615.8	51 4	2230.5	2 ⁺	Additional information 370.
		9844.7	10 1	0	0 ⁺	Additional information 371.
9887.3		2771.7	45 6	7115.3	2 ⁺	Additional information 372.
		2885.6	24 3	7001.44	1	Additional information 373.
		3221.2	3.6 4	6666.1	2 ⁺	Additional information 374.
		3663.1	<0.5	6222.9	2 ⁻	Additional information 375.
		4089.2	<0.3	5797.6		Additional information 376.
		4339.3	11 1	5546.2	2 ⁺	Additional information 377.
		4474.2	<1.2	5412.6	3 ⁺	Additional information 378.
		4880.3	<7	5006.2	3 ⁻	Additional information 379.
		5190.9	5.0 1	4695.3	1 ⁺	Additional information 380.
		5427.2	0.2 1	4459.1	4 ⁺	Additional information 381.
		5604.8	3.8 5	4281.2	2 ⁺	Additional information 382.
		6108.3	<0.6	3776.0		Additional information 383.
		7655.0	10 1	2230.5	2 ⁺	Additional information 384.
		9884.0	1.7 2	0	0 ⁺	Additional information 385.
9919.3		2383.4	0.8 4	7535.7		Additional information 386.
		2435.2	2.9 3	7483.9	2 ⁺	Additional information 387.
		2803.7	9 1	7115.3	2 ⁺	Additional information 388.
		3066.6	7.4 1	6851.5	4 ⁺	Additional information 389.
		3253.1	<5	6666.1	2 ⁺	Additional information 390.
		3297.4	<1.1	6621.7	4 ⁻	Additional information 391.
		3695.1	<2.3	6222.9	2 ⁻	Additional information 392.
		4121.2	<1.3	5797.6		Additional information 393.
		4371.3	35 3	5546.2	2 ⁺	Additional information 394.
		4506.2	2.7 1	5412.6	3 ⁺	Additional information 395.
		4912.3	<1.1	5006.2	3 ⁻	Additional information 396.
		5222.9	<11	4695.3	1 ⁺	Additional information 397.
		5459.2	<1.4	4459.1	4 ⁺	Additional information 398.
		5636.8	1.2 7	4281.2	2 ⁺	Additional information 399.
		6140.3	<1.3	3776.0		Additional information 400.
		7687.0	41 4	2230.5	2 ⁺	Additional information 401.
		9916.0	<1.1	0	0 ⁺	Additional information 402.
9946.6		1821.2	7.8 6	8125.32		$A_2=+0.29$ 4, $A_4=+0.09$ 4 (1977Ko07). Mult., δ : +0.10 6 (1977Ko07). Additional information 403.
		2831.0	1.5 2	7115.3	2 ⁺	Additional information 404.
		2944.9	0.4 1	7001.44	1	Additional information 405.
		3324.7	<0.5	6621.7	4 ⁻	Additional information 406.
		3722.4	<0.4	6222.9	2 ⁻	Additional information 407.
		4148.5	<0.3	5797.6		Additional information 408.
		4398.6	<0.8	5546.2	2 ⁺	Additional information 409.
		4533.5	<0.3	5412.6	3 ⁺	Additional information 410.
		4939.6	<0.3	5006.2	3 ⁻	Additional information 411.
		5250.2	1.5 3	4695.3	1 ⁺	Additional information 412.
		5486.5	<1	4459.1	4 ⁺	Additional information 413.
		5664.1	2.2 3	4281.2	2 ⁺	Additional information 414.
		6167.6	2.8 6	3776.0		Additional information 415.
		7714.3	8.1 9	2230.5	2 ⁺	$A_2=+0.76$ 10, $A_4=-0.16$ 10 (1977Ko07), $A_2=+0.22$ (1963Sp03). Mult., δ : +0.7 1 (1977Ko07). Additional information 416.
		9943.3	76 7	0	0 ⁺	$A_2=+0.03$ 16, $A_4=+0.21$ 17 (1977Ko07), $A_2=-0.17$ 2 (1963Sp03). Mult., δ : 0 (1977Ko07). Additional information 417.
9977.8	4	3356.4	25 3	6621.7	4 ⁻	$A_2=+0.61$ 4, $A_4=-0.24$ 6 (1981He09).

Continued on next page (footnotes at end of table)

$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)** $\gamma(^{32}\text{S})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Comments
						Mult., δ : -0.5 2 (1981He09). I $_\gamma$: from (1981He09). Additional information 418.
9977.8	4	3754.1	26 3	6222.9	2 ⁻	A ₂ =+0.42 5, A ₄ =-0.43 5 (1981He09). Mult., δ : 0.04 5 (1981He09). I $_\gamma$: from (1981He09). Additional information 419.
		4971.3	49 4	5006.2	3 ⁻	A ₂ =-0.71 2, A ₄ =+0.46 3 (1981He09). Mult., δ : 2.4 2 (1981He09). I $_\gamma$: from (1981He09). Additional information 420.
9978.3	3	1634.2	0.8 2	8346.3		A ₂ =-0.42 7, A ₄ =+0.57 1 (1981He09). Mult., δ : 3.4 4 (1981He09). I $_\gamma$: from (1981He09).
		2276.9 ^a		7701.44	3	E $_\gamma$: only 1963Sp03 have seen this transition after extensive studies by other groups it is unlikely to be correctly placed.
		2494.2	4.0 4	7483.9	2 ⁺	A ₂ =+0.22 5, A ₄ =0.00 2 (1963Sp03). A ₂ =-0.33 2, A ₄ =-0.03 3 (1981He09). Mult., δ : 0.00 2 (1981He09). Additional information 421.
		2628.3	3	7350.0	3 ⁽⁺⁾	I $_\gamma$: from (1981He09). Additional information 422.
		2862.7	4.9 5	7115.3	2 ⁺	I $_\gamma$: from (1972Le29), doublet unresolved. A ₂ =-0.23 2, A ₄ =+0.03 3 (1981He09). Mult., δ : -0.05 2 (1981He09). I $_\gamma$: from (1981He09). Additional information 423.
		2976.2	1.3 2	7001.44	1	A ₂ =+0.34 5, A ₄ =-0.11 7 (1981He09). Mult., δ : 0.1 1 (1981He09). I $_\gamma$: from (1981He09).
		3125.6	7.2 7	6851.5	4 ⁺	A ₂ =-0.22 2, A ₄ =-0.04 2 (1981He09). Mult., δ : -0.05 2 (1981He09). Additional information 424.
		3312.1	<0.6	6666.1	2 ⁺	I $_\gamma$: from (1981He09). Additional information 425.
		3356.4	3.5 3	6621.7	4 ⁻	I $_\gamma$: from (1975Bo42), doublet unresolved. A ₂ =+0.61 4, A ₄ =-0.24 6 (1981He09). Mult., δ : -0.5 2 (1981He09). Additional information 426.
		4180.2	1.1 3	5797.6		Additional information 427.
		4430.2	31 3	5546.2	2 ⁺	I $_\gamma$: from (1975Bo42), doublet unresolved. A ₂ =-0.34 4, A ₄ =+0.04 4 (1977Ko07), A ₂ =-0.45 1, A ₄ =0.00 1 (1981He09). Mult., δ : 0.06 3 (1981He09), -5.3 18 (1977Ko07). Additional information 428.
		4565.2	6.6 6	5412.6	3 ⁺	I $_\gamma$: from (1981He09). A ₂ =-0.03 1, A ₄ =-0.13 2 (1981He09). Mult., δ : 0.49 4 (1981He09). Additional information 429.
		5281.9	<0.4	4695.3	1 ⁺	I $_\gamma$: from (1981He09). Additional information 430.
		5518.2	7.7 8	4459.1	4 ⁺	A ₂ =+0.29 2, A ₄ =-0.08 3 (1981He09). Mult., δ : 0.34 4 (1981He09). Additional information 431.
		5695.8	<1	4281.2	2 ⁺	I $_\gamma$: from (1981He09). Additional information 432.
						I $_\gamma$: from (1975Bo42), doublet unresolved.

Continued on next page (footnotes at end of table)

$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)** $\gamma(^{32}\text{S})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Comments
9978.3	3	6199.3	<0.9	3776.0		Additional information 433.
		7746.0	37 3	2230.5	2 ⁺	I_γ : from (1975Bo42), doublet unresolved. $A_2=0.00$ 4, $A_4=+0.10$ 4 (1977Ko07), $A_2=+0.09$ 1, $A_4=+0.01$ 1 (1981He09), $A_2=+0.18$ 6, $A_4=-0.10$ 7 (1970Ho25), $\gamma\gamma(\theta)$: $A_2=+0.20$ 9, $A_4=+0.1$ 10 (1963Sp03). Mult., δ : -0.22 2 (1981He09), +0.1 1 (1977Ko07). I_γ : from (1981He09). Additional information 434.
		9975.0	0.3	0	0 ⁺	I_γ : from 1972Co13, doublet unresolved. Additional information 435.
9982.7	2	2867.1	0.8 3	7115.3	2 ⁺	Additional information 436.
		2981.0	1.8 5	7001.44	1	Additional information 437.
		3130.0	0.8 2	6851.5	4 ⁺	Additional information 438.
		3360.8	1.2 4	6621.7	4 ⁻	Additional information 439.
		3758.5	<1.1	6222.9	2 ⁻	Additional information 440.
		4184.6	<0.9	5797.6		Additional information 441.
		4434.6	9.4 9	5546.2	2 ⁺	Additional information 442.
		4569.6	<1	5412.6	3 ⁺	Additional information 443.
		4975.7	<1	5006.2	3 ⁻	Additional information 444.
		5286.3	21 2	4695.3	1 ⁺	Additional information 445.
		5522.6	<0.9	4459.1	4 ⁺	Additional information 446.
		5700.2	1.6 5	4281.2	2 ⁺	Additional information 447.
		6203.7	<0.6	3776.0		Additional information 448.
		7750.4	62 6	2230.5	2 ⁺	$A_2=+0.28$ 6, $A_4=+0.14$ 9 (1970Ho25). Additional information 449.
10073.4	2 ⁻	9979.4	0.7 1	0	0 ⁺	Additional information 450.
		1569.3	0.2 1	8504		Additional information 451.
		1777.2	0.4 2	8296.1	3	Additional information 452.
		1948.0	0.3 1	8125.32		Additional information 453.
		2372.2	0.3 1	7701.44	3	Additional information 454.
		2957.8	0.7 3	7115.3	2 ⁺	Additional information 455.
		3407.2	<0.7	6666.1	2 ⁺	Additional information 456.
		3451.5	<0.7	6621.7	4 ⁻	Additional information 457.
		3849.2	49 2	6222.9	2 ⁻	$A_2=+0.24$ 2, $A_4=+0.044$ 14 (1969Pi10); $A_2=+0.35$ 3, $A_4=-0.06$ 3 (1973Ve08), $A_2=+0.33$ 3, $A_4=0.00$ 3 (1976Ve03). Mult., δ : 0.02 (1976Ve03), -0.02 2 (1973Ve08). Additional information 458.
		4275.3	<1.5	5797.6		Additional information 459.
		4525.3	<0.7	5546.2	2 ⁺	Additional information 460.
		4660.3	4.3 3	5412.6	3 ⁺	$A_2=-0.17$ 9, $A_4=-0.05$ 10 (1969Pi10), $A_2=-0.11$ 2, $A_4=+0.03$ 2 (1976Ve03). Mult., δ : 0.00 (1976Ve03). Additional information 461.
		5066.3	13.8 7	5006.2	3 ⁻	$A_2=-0.13$ 2, $A_4=+0.042$ 27 (1969Pi10), $A_2=-0.02$ 3, $A_4=-0.06$ 3 (1973Ve08), $A_2=-0.03$ 1, $A_4=0.00$ 1 (1976Ve03). Mult., δ : 0.06 (1976Ve03), 0.08 5 (1973Ve08). Additional information 462.
		5376.9	0.7 1	4695.3	1 ⁺	Additional information 463.
		5613.2	<0.5	4459.1	4 ⁺	Additional information 464.
		5790.9	1.5 1	4281.2	2 ⁺	$A_2=+0.29$ 8, $A_4=+0.01$ 8 (1976Ve03). Mult., δ : 0.05 (1976Ve03). Additional information 465.
		6294.4	<0.4	3776.0		Additional information 466.
		7841.0	29.6 15	2230.5	2 ⁺	$A_2=+0.28$ 3, $A_4=+0.015$ 34 (1969Pi10); $A_2=+0.43$ 2, $A_4=-0.04$ 3 (1973Ve08), $A_2=+0.36$ 2, $A_4=-0.01$ 2 (1976Ve03). Mult., δ : -0.02 (1976Ve03), -0.10 2 (1973Ve08). Additional information 467.

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$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)** $\gamma(^{32}\text{S})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Mult.&	$\delta^\&$	Comments
10073.4	2^-	10070.0	1.7 1	0	0^+	M2		$A_2=+0.52$ 13, $A_4=0.00$ 13 (1969Pi10), $A_2=+0.50$ 3, $A_4=-0.07$ 4 (1973Ve08), $A_2=+0.43$ 1, $A_4=-0.02$ 1 (1976Ve03). Additional information 468. Additional information 469. Additional information 470.
10102.3	$4^{(+)}$	4689.3 5095.4 5642.2	7.0 6 21.1 6 19.8 6	5412.6 5006.2 4459.1	3^+ 3^- 4^+			$A_2=-0.15$ 7, $A_4=-0.29$ 9 (1997Br07). Mult., δ : -7.1 +8-10 (1997Br07). Additional information 471.
		5820.1	9.7 5	4281.2	2^+			$A_2=+0.64$ 1, $A_4=-0.45$ 2 (1997Br07). Additional information 472.
10218.8	3^+	7870.0 2734.6 3028.4 3103.2 3552.6 3596.9 3994.6 4420.6 4670.7 4805.6 5211.7 5522.3 5758.6 5936.2 6439.7 7986.4	42.4 9 1.1 2 0.5 1 41 3 0.7 2 <0.6 <0.7 <0.6 6.8 7 2.9 3 4.9 7 19 2 5.3 5 6.8 6 <0.7 12 1	2230.5 7483.9 7190.1 7115.3 6666.1 6621.7 6222.9 5797.6 5546.2 5412.6 5006.2 4695.3 4459.1 4281.2 3776.0 2230.5	2^+ 2^+ 1^+ 2^+ 2^+ 4^- 2^- 2^+ 2^+ 3^+ 3^- 1^+ 4^+ 2^+ 2^+ 2^+			Additional information 473. Additional information 474. Additional information 475. Additional information 476. Additional information 477. Additional information 478. Additional information 479. Additional information 480. Additional information 481. Additional information 482. Additional information 483. Additional information 484. Additional information 485. Additional information 486. Additional information 487. Additional information 488.
10221.2	3^-	10215.3 2737.0 3105.6	1.6 2 <0.4 2.0 15	0 7483.9 7115.3	0^+ 2^+ 2^+	E1+M2	+0.233 17	Additional information 489. Additional information 490. $A_2=-0.20$ 3, $A_4=0.00$ 3 (1973Ve08), $A_2=-0.25$ 1, $A_4=-0.04$ 1 (1976Ve03), $A_2=-0.28$ 4, $A_4=-0.05$ 4 (1974Vi02). Mult., δ : from 1974Vi02. Additional information 491. Additional information 492. Additional information 493. Additional information 494. Additional information 495. Additional information 496. Additional information 497. $A_2=+0.37$ 5, $A_4=-0.03$ 5 (1973Ve08), $A_2=+0.39$ 1, $A_4=+0.01$ 1 (1976Ve03). Mult., δ : 0.02 (1976Ve03), 0.02 5 (1973Ve08). Additional information 498. Additional information 499.
		3555.0 3599.3 3997.0 4423.0 4673.1 4808.0 5214.1	0.7 2 <0.6 <0.6 <0.8 <1 0.4 2 62 5	6666.1 6621.7 6222.9 5797.6 5546.2 5412.6 5006.2	2^+ 4^- 2^- 2^+ 2^+ 3^+ 3^-			$A_2=+0.52$ 7, $A_4=-0.27$ 9 (1973Ve08), $A_2=+0.51$ 7, $A_4=-0.26$ 9 (1976Ve03), $A_2=+0.43$ 6, $A_4=-0.28$ 7 (1974Vi02). Mult., δ : from (1974Vi02). Mult., δ : -0.02 (1976Ve03), -0.04 6 (1973Ve08), 0.22 7 (1974Vi02). $A_2=-0.03$ 2, $A_4=-0.04$ 2 (1973Ve08). Mult., δ : 0.07 1 (1973Ve08). Additional information 500. Additional information 501.
		5524.7	<1	4695.3	1^+	E3+M2	-0.22 7	$A_2=-0.67$ 11, $A_4=+0.09$ 10 (1974Vi02). Mult., δ : -0.65 5 or -6.76 1.7 (1974Vi02).
		5761.0	21 2	4459.1	4^+			
		5938.6	<1	4281.2	2^+			

Continued on next page (footnotes at end of table)

$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)** $\gamma(^{32}\text{S})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Mult.&	$\delta^\&$	Comments
10221.2	3^-	6442.1 7988.8	<0.2 14 1	3776.0 2230.5	2^+	E1+M2	-0.70 5	Additional information 502. $A_2=-0.76$ 8, $A_4=+0.09$ 6 (1973Ve08), $A_2=-0.19$ 2, $A_4=-0.01$ 1 (1973Ve08), $A_2=-0.83$ 9, $A_4=+0.12$ 9 (1974Vi02). Mult., δ : from 1974Vi02.
10230.3	1^+	10217.7 2694.4 3039.9 3114.7 3228.5	0.3 2 5.4 7 0.9 2 3.2 10 47 3	0 7535.7 7190.1 7115.3 7001.44	0^+ 1^+ 2^+ 1			Additional information 503. Additional information 504. Additional information 505. Additional information 506. Additional information 507. $A_2=-0.05$ 3, $A_4=-0.03$ 3 (1973Ve08). Mult., δ : 0.21< δ <4.7 (1973Ve08). Additional information 508. Additional information 509. Additional information 510. Additional information 511. Additional information 512. Additional information 513. Additional information 514. Additional information 515. Additional information 516. Additional information 517. Additional information 518. Additional information 519. $A_2=+0.04$ 2, $A_4=-0.03$ 2 (1973Ve08). Additional information 520. Additional information 521. Additional information 522. $A_2=-0.08$ 3, $A_4=+0.03$ 2 (1973Ve08). Additional information 523.
		3377.5 3468.3 3564.1 3608.4 4006.1 4432.1 4682.2 4817.1 5223.2 5533.8 5770.1 5947.7	<1 <1.1 <1 <0.9 4.2 9 <1 2.5 5 3.2 3 <1.4 4.3 6 <1 11 1	6851.5 6761.6 6666.1 6621.7 6222.9 5797.6 5546.2 5412.6 5006.2 4695.3 4459.1 4281.2	4^+ 2,3 2^+ 4^- 2^- 2^+ 3^+ 3^- 1^+ 4^+ 2^+			Additional information 524. Additional information 525. Additional information 526. Additional information 527. $A_2=-0.25$ 3, $A_4=+0.01$ 3 (1976Ve03). Additional information 528. $A_2=+0.66$ 3, $A_4=+0.03$ 3 (1969Pi10), $A_2=+0.42$ 3, $A_4=-0.01$ 4 (1973Ve08), $A_2=+0.46$ 1, $A_4=-0.02$ 1 (1976Ve03). Mult., δ : -0.02 (1976Ve03), 0.03 2 (1973Ve08), -0.9 3 (1972Co13). Additional information 529. $A_2=+0.42$ 2, $A_4=-0.08$ 4 (1972Co13). $A_2=+0.55$ 3, $A_4=0.00$ 4 (1976Ve03). Mult., δ : -0.50 (1976Ve03). Additional information 530. Additional information 531. Additional information 532.
10256.1	4^-	2305.8	5.6 6	7950.1	4^-			$A_2=-0.31$ 1, $A_4=-0.03$ 1 (1976Ve03). Mult., δ : 0.18 (1976Ve03). Additional information 524. Additional information 525. Additional information 526. Additional information 527. $A_2=-0.25$ 3, $A_4=+0.01$ 3 (1976Ve03). Additional information 528. $A_2=+0.66$ 3, $A_4=+0.03$ 3 (1969Pi10), $A_2=+0.42$ 3, $A_4=-0.01$ 4 (1973Ve08), $A_2=+0.46$ 1, $A_4=-0.02$ 1 (1976Ve03). Mult., δ : -0.02 (1976Ve03), 0.03 2 (1973Ve08), -0.9 3 (1972Co13). Additional information 529. $A_2=+0.42$ 2, $A_4=-0.08$ 4 (1972Co13). $A_2=+0.55$ 3, $A_4=0.00$ 4 (1976Ve03). Mult., δ : -0.50 (1976Ve03). Additional information 530. Additional information 531. Additional information 532.
		2554.9 2906.1 3406.1 3494.1	<0.3	7701.44 7350.0 6851.5 6761.6	3 $3^{(+)}$ 4^+ 2,3			$A_2=-0.25$ 3, $A_4=+0.01$ 3 (1976Ve03). Additional information 528. $A_2=+0.66$ 3, $A_4=+0.03$ 3 (1969Pi10), $A_2=+0.42$ 3, $A_4=-0.01$ 4 (1973Ve08), $A_2=+0.46$ 1, $A_4=-0.02$ 1 (1976Ve03). Mult., δ : -0.02 (1976Ve03), 0.03 2 (1973Ve08), -0.9 3 (1972Co13). Additional information 529. $A_2=+0.42$ 2, $A_4=-0.08$ 4 (1972Co13). $A_2=+0.55$ 3, $A_4=0.00$ 4 (1976Ve03). Mult., δ : -0.50 (1976Ve03). Additional information 530. Additional information 531. Additional information 532.
		3634.2	76 5	6621.7	4^-	M1+E2	-0.9 3	$A_2=+0.31$ 1, $A_4=-0.03$ 1 (1976Ve03). Mult., δ : 0.18 (1976Ve03). Additional information 524. Additional information 525. Additional information 526. Additional information 527. $A_2=-0.25$ 3, $A_4=+0.01$ 3 (1976Ve03). Additional information 528. $A_2=+0.66$ 3, $A_4=+0.03$ 3 (1969Pi10), $A_2=+0.42$ 3, $A_4=-0.01$ 4 (1973Ve08), $A_2=+0.46$ 1, $A_4=-0.02$ 1 (1976Ve03). Mult., δ : -0.02 (1976Ve03), 0.03 2 (1973Ve08), -0.9 3 (1972Co13). Additional information 529. $A_2=+0.42$ 2, $A_4=-0.08$ 4 (1972Co13). $A_2=+0.55$ 3, $A_4=0.00$ 4 (1976Ve03). Mult., δ : -0.50 (1976Ve03). Additional information 530. Additional information 531. Additional information 532.
		3845.6	0.5 2	6410	1,2,3,4			$A_2=+0.31$ 1, $A_4=-0.03$ 1 (1976Ve03). Mult., δ : 0.18 (1976Ve03). Additional information 524. Additional information 525. Additional information 526. Additional information 527. $A_2=-0.25$ 3, $A_4=+0.01$ 3 (1976Ve03). Additional information 528. $A_2=+0.66$ 3, $A_4=+0.03$ 3 (1969Pi10), $A_2=+0.42$ 3, $A_4=-0.01$ 4 (1973Ve08), $A_2=+0.46$ 1, $A_4=-0.02$ 1 (1976Ve03). Mult., δ : -0.02 (1976Ve03), 0.03 2 (1973Ve08), -0.9 3 (1972Co13). Additional information 529. $A_2=+0.42$ 2, $A_4=-0.08$ 4 (1972Co13). $A_2=+0.55$ 3, $A_4=0.00$ 4 (1976Ve03). Mult., δ : -0.50 (1976Ve03). Additional information 530. Additional information 531. Additional information 532.
		4708.0 4842.9 5249.0	<0.3 <0.2 4.7 5	5546.2 5412.6 5006.2	2^+ 3^+ 3^-	M1+E2	+0.2 1	$A_2=-0.31$ 4, $A_4=-0.22$ 4 (1969Pi10), $A_2=-0.51$ 11, $A_4=-0.03$ 14 (1972Co13), $A_2=-0.54$ 8, $A_4=+0.04$ 8 (1973Ve08), $A_2=-0.52$ 2, $A_4=0.00$ 2 (1976Ve03). Mult., δ : 0.11 (1976Ve03), 0.15 3 (1973Ve08), 0.2 1 or 2.2 5 (1972Co13). Additional information 533.

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$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)** $\gamma(^{32}\text{S})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Mult. &	$\delta^\&$	Comments
10256.1	4 ⁻	5559.6 5795.9	<0.1 9.7 7	4695.3 4459.1	1 ⁺ 4 ⁺	E1+M2	-0.9 3	Additional information 534. A ₂ =+0.61 6, A ₄ =+0.01 6 (1969Pi10), A ₂ =+0.43 2, A ₄ =-0.07 3 (1972Co13), A ₂ =+0.51 9, A ₄ =-0.02 1 (1973Ve08), A ₂ =+0.46 1, A ₄ =-0.03 1 (1976Ve03). Mult., δ : -0.03 (1976Ve03), -0.07 13 (1973Ve08), -0.9 3 (1972Co13). Additional information 535. Additional information 536. Additional information 537. A ₂ =+0.44 2, A ₄ =-0.25 2 (1976Ve03). Mult., δ : 0.02 (1976Ve03). Additional information 538. Additional information 539. Additional information 540. Additional information 541. Additional information 542. Additional information 543. Additional information 544.
		5973.5 6477.0 8023.6	<0.2 <0.1 0.9 1	4281.2 3776.0 2230.5	2 ⁺ 2 ⁺			
10286.3		10252.6 5279.2 5826.1 8053.8 10282.8	<0.3 74 15 11 7	0 5006.2 4459.1 2230.5 0	0 ⁺ 3 ⁻ 4 ⁺ 2 ⁺ 0 ⁺			Additional information 545. Additional information 546.
10290.2	2	2164.7 2806.0 3288.4 3624.0 3668.2 4065.9	3.4 10 <2.3 1.5 1.8 9 <1.4 29 2	8125.32 7483.9 7001.44 6666.1 6621.7 6222.9	2 ⁺ 2 ⁺ 1 2 ⁺ 4 ⁻ 2 ⁻			A ₂ =+0.22 2, A ₄ =-0.05 2 (1973Ve08). Mult., δ : 0.10 4 (1973Ve08). Additional information 547. Additional information 548. Additional information 549. Additional information 550. A ₂ =+0.16 2, A ₄ =-0.10 3 (1973Ve08). Mult., δ : 0.29 6 (1973Ve08). Additional information 551.
		4492.0 4742.0 4877.0 5283.1	2.4 8 <1.7 2.2 8 24 1	5797.6 5546.2 5412.6 5006.2	 2 ⁺ 3 ⁺ 3 ⁻			
		5593.7 5830.0 6007.6 6511.1 8057.7	<1 <3 2.8 4 <1.5 35 4	4695.3 4459.1 4281.2 3776.0 2230.5	1 ⁺ 4 ⁺ 2 ⁺ 2 ⁺			Additional information 552. A ₂ =+0.42 4, A ₄ =-0.09 5 (1973Ve08). Mult., δ : -0.11 4 (1973Ve08). Additional information 553. Additional information 554. Additional information 555.
10331.1		10286.6 2205.6 3329.3 3569.1 3664.8 3709.1 4106.8 4532.9 4782.9 4917.9 5323.9 5634.5 5870.8 6048.5 6552.0 8098.6	4.0 4 5 1 <2.1 <2.9 <2.2 <2.6 <2.5 <3.4 <11 <2.6 <1.3 12 1 <1.3 <0.8 <2.3 68 6	0 8125.32 7001.44 6761.6 6666.1 6621.7 6222.9 5797.6 5546.2 5412.6 5006.2 4695.3 4459.1 4281.2 3776.0 2230.5	0 ⁺ 1 2,3 2 ⁺ 4 ⁻ 2 ⁻ 2 ⁺ 3 ⁺ 3 ⁻ 1 ⁺ 4 ⁺ 2 ⁺ 2 ⁺			Additional information 556. Additional information 557.
10370.6		10327.5 2886.4	15 2 2.6 9	0 7483.9	0 ⁺ 2 ⁺			Additional information 558. Additional information 559. Additional information 560.

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$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)**

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	$\gamma(^{32}\text{S})$ (continued)		Comments
						Mult.&	$\delta^\&$	
10370.6		3020.3 ^a	0.3	7350.0	3 ⁽⁺⁾			Additional information 561.
		3180.2	1.2 9	7190.1	1 ⁺			Additional information 562.
		3368.8	0.20 7	7001.44	1			Additional information 563.
		3517.8	<0.6	6851.5	4 ⁺			Additional information 564.
		3704.3	14 1	6666.1	2 ⁺			$A_2=+0.44$ 3, $A_4=-0.057$ 32 (1977Ko07).
								Mult., δ : +0.72 26 (1977Ko07).
								Additional information 565.
		3748.6	<0.6	6621.7	4 ⁻			Additional information 566.
		4146.3	2.0 3	6222.9	2 ⁻			Additional information 567.
		4572.4	<0.6	5797.6				Additional information 568.
		4822.4	2.7 3	5546.2	2 ⁺			Additional information 569.
		4957.4	12 1	5412.6	3 ⁺			$A_2=+0.14$ 9, $A_4=+0.009$ 10 (1977Ko07).
								Mult., δ : +2.8 5 (1977Ko07).
								Additional information 570.
		5363.4	2.3 2	5006.2	3 ⁻			Additional information 571.
		5674.0	9.2 7	4695.3	1 ⁺			$A_2=-0.28$ 4, $A_4=-0.17$ 4 (1977Ko07).
								Mult., δ : -0.10 10 (1977Ko07).
								Additional information 572.
		5910.3	<0.3	4459.1	4 ⁺			Additional information 573.
		6088.0	40 3	4281.2	2 ⁺			$A_2=+0.54$ 3, $A_4=-0.088$ 3 (1977Ko07).
								Mult., δ : -0.08 2 (1977Ko07).
								Additional information 574.
		6591.4	0.6 2	3776.0				Additional information 575.
		8138.1	12 1	2230.5	2 ⁺			$A_2=+0.48$ 4, $A_4=-0.024$ 4 (1977Ko07).
								Mult., δ : -0.08 3 (1977Ko07).
10396.7	4 ⁻	10367.0	1.0 2	0	0 ⁺			Additional information 576.
		2271.2	0.8 5	8125.32				Additional information 577.
		2421.6	<0.4	7974.9	3			Additional information 578.
		2446.4	3.9 4	7950.1	4 ⁻			Additional information 579.
								$A_2=+0.41$ 6, $A_4=-0.02$ 7 (1976Ve03).
								Mult., δ : 0.05 (1976Ve03).
								Additional information 580.
		2695.5	<0.3	7701.44	3			Additional information 581.
		2829.4	0.3 6	7567				Additional information 582.
		3029.3	0.70 11	7367				Additional information 583.
		3394.9	0.30 7	7001.44	1			Additional information 584.
		3543.9	1.3 5	6851.5	4 ⁺			$A_2=+0.57$ 9, $A_4=-0.03$ 10 (1976Ve03).
								Mult., δ : -0.3 (1976Ve03).
								Additional information 585.
		3634.7	2.2 17	6761.6	2,3			$A_2=-0.07$ 5, $A_4=+0.01$ 6 (1976Ve03).
								Mult., δ : 0.55 (1976Ve03).
								Additional information 586.
		3774.7	82 5	6621.7	4 ⁻	M1+E2	+0.9 3	$A_2=+0.38$ 4, $A_4=-0.04$ 5 (1973Ve08), $A_2=+0.39$ 1, $A_4=-0.09$ 2 (1972Co13), $A_2=+0.41$ 1, $A_4=-0.01$ 1 (1976Ve03).
								Mult., δ : 0.05 (1976Ve03), 0.05 4 (1973Ve08), -0.9 3 (1972Co13).
								Additional information 587.
		3986.2	0.5 2	6410	1,2,3,4			Additional information 588.
		4172.4	<2	6222.9	2 ⁻			Additional information 589.
		4598.5	0.30 6	5797.6				Additional information 590.
		4848.5	<0.5	5546.2	2 ⁺			Additional information 591.
		4983.5	0.10 3	5412.6	3 ⁺			Additional information 592.
		5389.5	6.4 5	5006.2	3 ⁻	M1+E2	+0.2 1	$A_2=+0.04$ 5, $A_4=+0.02$ 9 (1973Ve08), $A_2=+0.04$ 3, $A_4=-0.07$ 3 (1972Co13), $A_2=+0.06$ 1,

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$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)** $\gamma(^{32}\text{S})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Comments
10396.7	4^-	5700.1	<0.3	4695.3	1^+	$A_4 = -0.03$ 1 (1976Ve03). Mult., δ : -0.19 (1976Ve03), -0.21 4 (1973Ve08), -0.2 1 (1972Co13). Additional information 593.
		5936.4	1.4 4	4459.1	4^+	Additional information 594. $A_2 = +0.43$ 3, $A_4 = -0.02$ 3 (1976Ve03), $A_2 = +0.39$ 10, $A_4 = -0.16$ 12 (1972Co13). Mult., δ : 0.02 (1976Ve03). Additional information 595.
		6114.0	1.8 5	4281.2	2^+	Additional information 596.
		6617.5	0.30 19	3776.0		Additional information 597.
		8164.2	0.8 3	2230.5	2^+	$A_2 = +0.36$ 5, $A_4 = -0.12$ 5 (1976Ve03). Mult., δ : 0.00 (1976Ve03). Additional information 598.
		10393.1	<0.9	0	0^+	Additional information 599.
		3317.4	3.8 4	7190.1	1^+	Additional information 600.
		3392.2	49.4 9	7115.3	2^+	Additional information 601.
		3506.0	<4	7001.44	1	Additional information 602.
		3655.1	<1.5	6851.5	4^+	Additional information 603.
10507.9		3745.8	<1.5	6761.6	2,3	Additional information 604.
		3841.6	1.5 3	6666.1	2^+	Additional information 605.
		3885.9	<1.5	6621.7	4^-	Additional information 606.
		4283.6	<7.3	6222.9	2^-	Additional information 607.
		4709.7	2.0 2	5797.6		Additional information 608.
		4959.7	2.7 5	5546.2	2^+	Additional information 609.
		5094.6	6.9 3	5412.6	3^+	Additional information 610.
		5500.8	1.1 2	5006.2	3^-	Additional information 611.
		5811.3	0.8 2	4695.3	1^+	Additional information 612.
		6047.6	<1.4	4459.1	4^+	Additional information 613.
		6225.2	6.7 4	4281.2	2^+	Additional information 614.
		6728.7	<2.5	3776.0		Additional information 615.
		8275.3	20.6 5	2230.5	2^+	Additional information 616.
		10504.2	5.3 8	0	0^+	Additional information 617.
		8323.5	60	2230.5	2^+	Additional information 618.
		10552.4	40	0	0^+	Additional information 619.
		10574.4	5 ⁺	2304.2	2.1 2	8270 Additional information 620.
		3224.1	3.7 3	7350.0	3 ⁽⁺⁾	Additional information 621.
		3812.3	3.3 3	6761.6	2,3	Additional information 622.
10556.1?		3952.4	2.4 3	6621.7	4^-	Additional information 623.
		4163.8	1.5 4	6410	1,2,3,4	Additional information 624.
		5161.1	28.7 5	5412.6	3^+	$A_2 = +0.43$ 3, $A_4 = -0.23$ 5 (1997Br07). Additional information 625.
		6114.0	54.7 9	4459.1	4^+	Additional information 626.
		8341.8	44	2230.5	2^+	Additional information 627.
		10570.7	7	0	0^+	Additional information 628.
		2478.3	3	8125.32		Additional information 629.
		3488.1	10	7115.3	2^+	Additional information 630.
		4805.5	5	5797.6		Additional information 631.
		5055.5	39	5546.2	2^+	Additional information 632.
10603.8		5190.5	10	5412.6	3^+	Additional information 633.
		5596.6	8	5006.2	3^-	Additional information 634.
		8371.1	6	2230.5	2^+	Additional information 635.
		10600.0	19	0	0^+	Additional information 636.
		10636.4	2686.1	16.0 8	7950.1	4^- Additional information 637.
		2934.7	3.9 6	7701.44	3	
		3874.3	9.4 9	6761.6	2,3	Additional information 638.
		4014.4	70.6 15	6621.7	4^-	Additional information 639.
		10696.1	2994.4	0.5	7701.44	3 Additional information 640.

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$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13** (continued) $\gamma(^{32}\text{S})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Comments
10696.1		3160.1	0.5	7535.7		Additional information 641.
		4897.8	3	5797.6		Additional information 642.
		5147.8	2	5546.2	2 ⁺	Additional information 643.
		5688.9	3	5006.2	3 ⁻	Additional information 644.
		5999.4	2	4695.3	1 ⁺	Additional information 645.
		6235.7	1	4459.1	4 ⁺	Additional information 646.
		6413.5	10	4281.2	2 ⁺	Additional information 647.
		6916.8	3	3776.0		Additional information 648.
		8463.4	5	2230.5	2 ⁺	Additional information 649.
		10692.3	70	0	0 ⁺	Additional information 650.
10700.5		4902.2	4	5797.6		Additional information 651.
		6003.8	3	4695.3	1 ⁺	Additional information 652.
		6921.2	4	3776.0		
		8467.8	5	2230.5	2 ⁺	Additional information 653.
		10696.7	84	0	0 ⁺	Additional information 654.
10705.3		3003.6	8.7 9	7701.44	3	Additional information 655.
		3943.2	31.1 15	6761.6	2,3	Additional information 656.
		4083.2	52.1 17	6621.7	4 ⁻	Additional information 657.
		6244.9	8.1 20	4459.1	4 ⁺	Additional information 658.
10756.7	3 ⁽⁺⁾	1691.6	0.7 2	9065		Additional information 659.
		2027.3	1.0 3	8729.3	3 ⁺	Additional information 660.
		3054.9	2.0 2	7701.44	3	Additional information 661.
		3406.3	3.5 2	7350.0	3 ⁽⁺⁾	Additional information 662.
		3641.0	1.5 2	7115.3	2 ⁺	Additional information 663.
		3903.8	3.1 2	6851.5	4 ⁺	Additional information 664.
		4092.4	2	6666.1	2 ⁺	Additional information 665.
		4134.6	1.3 3	6621.7	4 ⁻	Additional information 666.
		5208.4	18.0 6	5546.2	2 ⁺	$A_2=-0.20$ 9, $A_4=-0.03$ 8 (1977Ko07), $A_2=-0.02$ 5, $A_4=+0.08$ 7 (1997Br07).
						Mult., δ : -0.19 4 (1997Br07), +0.86 11 (1977Ko07).
						Additional information 667.
		5343.3	7.6 4	5412.6	3 ⁺	$A_2=+0.23$ 7, $A_4=0.00$ 10 (1977Ko07).
						Mult., δ : +0.48 12 (1977Ko07).
						Additional information 668.
		6296.3	56.7 9	4459.1	4 ⁺	$A_2=-0.19$ 4, $A_4=+0.04$ 4 (1977Ko07), $A_2=+0.03$ 3, $A_4=-0.02$ 3 (1997Br07).
						Mult., δ : 0.12 9 (1997Br07), -0.45 15 (1977Ko07).
						Additional information 669.
		6474.1	3.5 2	4281.2	2 ⁺	Additional information 670.
		8524.0	1.1 2	2230.5	2 ⁺	Additional information 671.
10778.8		1755.7	1.2 1	9023		Additional information 672.
		2803.6	2.1 2	7974.9	3	Additional information 673.
		3294.5	0.8 1	7483.9	2 ⁺	Additional information 674.
		3428.4	0.3 1	7350.0	3 ⁽⁺⁾	Additional information 675.
		3776.9	12.9 3	7001.44	1	Additional information 676.
		4112.4	1.6 2	6666.1	2 ⁺	Additional information 677.
		4980.5	0.6 1	5797.6		Additional information 678.
		5230.5	0.6 1	5546.2	2 ⁺	Additional information 679.
		5365.4	7.1 2	5412.6	3 ⁺	Additional information 680.
		6082.1	4.5 2	4695.3	1 ⁺	Additional information 681.
		6496.2	16.7 3	4281.2	2 ⁺	Additional information 682.
		8546.0	42.9 9	2230.5	2 ⁺	Additional information 683.
		10774.9	8.3 2	0	0 ⁺	Additional information 684.
10783.8		2862.5	1.3 1	7921.0		Additional information 685.
		3146.5	0.7 1	7637.0		Additional information 686.
		3781.9	1.6 1	7001.44	1	I_γ : 1973Ko28 report significantly more intensity (4x) than 1997Br07 for

Continued on next page (footnotes at end of table)

$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)** $\gamma(^{32}\text{S})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Comments
this transition.						
10783.8		4117.4	1.9 1	6666.1	2 ⁺	Additional information 687.
		4373.2	1.5	6410	1,2,3,4	Additional information 688.
		5235.5	11.9 3	5546.2	2 ⁺	Additional information 689.
		5777.8	0.5	5006.2	3 ⁻	Additional information 690.
		6087.1	10.4 4	4695.3	1 ⁺	Additional information 691.
		6323.4	(1)	4459.1	4 ⁺	Additional information 692.
		6501.2	3.7 2	4281.2	2 ⁺	Additional information 693.
		7004.5	1.7 2	3776.0		Additional information 694.
		8551.0	14.7 4	2230.5	2 ⁺	Additional information 695.
		10779.9	51.7 6	0	0 ⁺	Additional information 696.
10784.5		6087.8	100	4695.3	1 ⁺	Additional information 697.
10791.3		3600.8	1.9 1	7190.1	1 ⁺	Additional information 698.
		3675.5	4.0 1	7115.3	2 ⁺	Additional information 699.
		3789.4	4.6 1	7001.44	1	Additional information 700.
		4993.0	0.6 1	5797.6		Additional information 701.
		5243.0	1.8 2	5546.2	2 ⁺	Additional information 702.
		5377.9	4.2 2	5412.6	3 ⁺	Additional information 703.
		5784.1	9.2 3	5006.2	3 ⁻	Additional information 704.
		6094.6	3.3 3	4695.3	1 ⁺	Additional information 705.
		6508.7	7.1 4	4281.2	2 ⁺	Additional information 706.
		8558.5	46.1 5	2230.5	2 ⁺	Additional information 707.
10825.4		10787.4	17.2 4	0	0 ⁺	Additional information 708.
		3823.5	4.3 3	7001.44	1	Additional information 709.
		5027.1 ^a	6	5797.6		Additional information 710.
						Additional information 711.
						E_γ, I_γ : seen by 1970Fo13 but not subsequently seen by the much more detailed study of 1997Br07.
		5277.1	5.5 12	5546.2	2 ⁺	Additional information 712.
		5412.0	4.9 12	5412.6	3 ⁺	Additional information 713.
		5818.2	9.4 17	5006.2	3 ⁻	Additional information 714.
		6542.8	25.3 22	4281.2	2 ⁺	Additional information 715.
		8592.6	32.1 28	2230.5	2 ⁺	Additional information 716.
10827.0		10821.5	18.6 27	0	0 ⁺	Additional information 717.
						I_γ : 1970Fo13 report most of the intensity from this γ but did not see several other transitions seen in 1997Br07.
		3711.2	1	7115.3	2 ⁺	Additional information 718.
		4161	2	6666.1	2 ⁺	Additional information 719.
		4202	1.5	6621.7	4 ⁻	Additional information 720.
		5028.7	3	5797.6		Additional information 721.
		5281	2	5546.2	2 ⁺	Additional information 722.
		5413.6	3	5412.6	3 ⁺	Additional information 723.
		5819.8	6	5006.2	3 ⁻	Additional information 724.
		6130.2	2	4695.3	1 ⁺	Additional information 725.
10915		6544.4	22	4281.2	2 ⁺	Additional information 726.
		7047.6	2	3776.0		Additional information 727.
		8594.2	37	2230.5	2 ⁺	Additional information 728.
		10823.1	24	0	0 ⁺	Additional information 729.
		8685	29	2230.5	2 ⁺	I_γ : unidentified intensity of 7 (1973Ko28).
						Additional information 730.
		10911	64	0	0 ⁺	Additional information 731.
		1221.7	2.3 1	9711.9		Additional information 732.
		3449.4	2.4 2	7483.9	2 ⁺	Additional information 733.
		3583.3	9.5 2	7350.0	3 ⁽⁺⁾	$A_2=+0.40$ 5, $A_4=+0.02$ 7 (1997Br07).
10933.7	3					Mult., δ : +0.02 11 (1997Br07).
						Additional information 734.

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$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)** $\gamma(^{32}\text{S})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Comments
10933.7	3	3817.9	1.9 2	7115.3	2 ⁺	Additional information 735.
		4080.7	20.9 3	6851.5	4 ⁺	$A_2=-0.10$ 4, $A_4=-0.01$ 5 (1997Br07). Mult., δ : 0.03 0.07 (1997Br07). Additional information 736.
		4523.0	7.1 2	6410	1,2,3,4	Additional information 737.
		5385.3	4.7 2	5546.2	2 ⁺	Additional information 738.
		5520.3	4.2 2	5412.6	3 ⁺	Additional information 739.
		6473.2	7.3 3	4459.1	4 ⁺	Additional information 740.
		6651.0	31.2 3	4281.2	2 ⁺	$A_2=-0.45$ 5, $A_4=-0.05$ 6 (1997Br07). Mult., δ : 0.00 0.06 (1997Br07). Additional information 741.
		8700.9	2.4 4	2230.5	2 ⁺	Additional information 742.
11009.9	4 ⁺	10929.7	<1	0	0 ⁺	Additional information 743.
		2739.6	0.7 1	8270		Additional information 744.
		3059.5	0.3 1	7950.1	4 ⁻	Additional information 745.
		3126.7	2.1 1	7882.9	4 ⁺	$A_2=+0.66$ 1, $A_4=-0.17$ 8 (1997Br07). Mult., δ : $-0.62 < \delta < 0$ (1997Br07). Additional information 746.
		3308.1	1.1 1	7701.44	3	Additional information 747.
		3525.6	0.4 1	7483.9	2 ⁺	Additional information 748.
		3575.3 ^a	12	7434		Additional information 749.
						E_γ, I_γ : seen by 1970Fo13 but not subsequently seen by the much more detailed study of 1997Br07.
		3659.5	1.2 1	7350.0	3 ⁽⁺⁾	Additional information 750.
		3894.1	0.5 1	7115.3	2 ⁺	Additional information 751.
		4247.7	0.5 1	6761.6	2,3	Additional information 752.
		4343.5	1.4 1	6666.1	2 ⁺	Additional information 753.
		4387.8	0.3 1	6621.7	4 ⁻	Additional information 754.
		4599.2	7.9 1	6410	1,2,3,4	$A_2=+0.58$ 4, $A_4=-0.11$ 5 (1997Br07). Mult., δ : $-1.0 < \delta < 0$ (1997Br07). Additional information 755.
		5596.4	1.5 1	5412.6	3 ⁺	Additional information 756.
		6002.6	18.2 3	5006.2	3 ⁻	$A_2=-0.53$ 4, $A_4=+0.05$ 6 (1997Br07). Mult., δ : 0.12 6 (1997Br07). Additional information 757.
		6549.4	48.0 5	4459.1	4 ⁺	$A_2=+0.57$ 1, $A_4=-0.11$ 2 (1997Br07). Mult., δ : $-0.73 < \delta < 0$ (1997Br07). Additional information 758.
		6727.2	11.3 2	4281.2	2 ⁺	Additional information 759.
11092.3	3	8777.0	4.3 1	2230.5	2 ⁺	Additional information 760.
		2795.9	5.4 2	8296.1	3	$A_2=+0.75$ 6, $A_4=-0.08$ 9 (1997Br07). Mult., δ : +0.47 24 (1997Br07). Additional information 761.
		2900.9	0.7 2	8191.1	4	Additional information 762.
		3117.1	3.1 1	7974.9	3	$A_2=+0.45$ 9, $A_4=+0.09$ 2 (1997Br07). Mult., δ : $-0.00 +7-29$ (1997Br07). Additional information 763.
		3141.9	4.3 2	7950.1	4 ⁻	Additional information 764.
		3390.5	12.1 3	7701.44	3	$A_2=+0.53$ 4, $A_4=-13$ 6 (1997Br07). Mult., δ : $-1.0 < \delta < 0$ (1997Br07). Additional information 765.
		4330.1	0.7 4	6761.6	2,3	Additional information 766.
		4470.1	23.4 4	6621.7	4 ⁻	$A_2=-0.07$ 3, $A_4=0.00$ 5 (1997Br07). Mult., δ : 0.05 5 (1997Br07). Additional information 767.
		4867.8	12.9 4	6222.9	2 ⁻	Additional information 768.

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$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)** $\gamma(^{32}\text{S})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Comments
11092.3	3	6085.0	20.0 6	5006.2	3 ⁻	Additional information 769.
		6631.7	14.8 6	4459.1	4 ⁺	Additional information 770.
		6809.5	2.4 4	4281.2	2 ⁺	Additional information 771.
		8859.4 ^a		2230.5	2 ⁺	E_γ, I_γ : seen by 1970Fo13, attributing their highest intensity (33) to this transition but not subsequently seen by the much more detailed study of 1997Br07.
		11088.2 ^a		0	0 ⁺	E_γ, I_γ : seen by 1970Fo13 but not subsequently seen by the much more detailed study of 1997Br07.
11114		4490 1		6621.7	4 ⁻	Additional information 772.
		6109 3		5006.2	3 ⁻	Additional information 773.
		8881 10		2230.5	2 ⁺	Additional information 774.
		11113 86		0	0 ⁺	Additional information 775.
11123		2432.8 ^a	8	8690		@B@0@0@@@ @B@0@1@@@@776 detailed study of 1997Br07.
		4121.0	6.4 2	7001.44	1	
		6426.1	4.7 2	4695.3	1 ⁺	Additional information 777.
		7343.5	6.7 2	3776.0		Additional information 778.
		8890.0	10.1 3	2230.5	2 ⁺	Additional information 779.
		11118.9	70.0 5	0	0 ⁺	Additional information 780.
11139.8		3603.7	0.4 1	7535.7		
		3946.4	1	7190.1	1 ⁺	Additional information 781.
		4137.8	0.6 1	7001.44	1	
		4915.3	0.4 1	6222.9	2 ⁻	
		5589.9	<0.5	5546.2	2 ⁺	Additional information 782.
		6442.9	2.3 2	4695.3	1 ⁺	Additional information 783.
		7360.3	1.8 2	3776.0		
		8906.8	9.2 6	2230.5	2 ⁺	Additional information 784.
		11135.6	84.8 7	0	0 ⁺	Additional information 785.
11235.5	3	2545.3	1.4 1	8690		
		3044.1	3.1 1	8191.1	4	
		3533.6	1.5 1	7701.44	3	
		4824.7	2.0 2	6410	1,2,3,4	
		5687.0	1.3 2	5546.2	2 ⁺	
		5822.0	3.4 2	5412.6	3 ⁺	
		6774.9	3.1 2	4459.1	4 ⁺	
		6952.7	36.8 6	4281.2	2 ⁺	$A_2=-0.41$ 4, $A_4=-0.05$ 8 (1997Br07). Mult., δ : 0.02 4 (1997Br07).
		9002.5	47.5 6	2230.5	2 ⁺	
11253.9	3	2392.7	0.9 1	8861	2 ⁺	
		2524.4	0.8 1	8729.3	3 ⁺	
		2563.7	2.4 1	8690		
		2846.6	2.7 1	8407.0	2	$A_2=-0.32$ 9, $A_4=-0.06$ 9 (1997Br07). Mult., δ : 0.00 3 (1997Br07).
		2957.5	0.4 1	8296.1	3	
		3062.5	4.8 1	8191.1	4	
		3303.4	1.8 1	7950.1	4 ⁻	
		3552.0	0.8 1	7701.44	3	
		4400.9	1.2 1	6851.5	4 ⁺	
		4587.4	1.9 1	6666.1	2 ⁺	
		4843.1	1.6 1	6410	1,2,3,4	
		5705.4	1.1 1	5546.2	2 ⁺	
		5840.4	1.2 1	5412.6	3 ⁺	
		6246.5	4.7 2	5006.2	3 ⁻	
		6557.0	1.1 1	4695.3	1 ⁺	
		6971.1	5.6 2	4281.2	2 ⁺	$A_2=-0.15$ 9, $A_4=-0.06$ 1 (1997Br07). Mult., δ : -0.09 3 (1997Br07).
		9020.9	65.7 5	2230.5	2 ⁺	

Continued on next page (footnotes at end of table)

$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)** $\gamma(^{32}\text{S})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Comments
11332.8		1673.7	9.2 9	9659		
		3207.1	14.6 7	8125.32		
		4216.9	6.5 8	7115.3	2 ⁺	
		4330.7	1.9 8	7001.44	1	
		4922.0	8.1 9	6410	1,2,3,4	
		6325.4	5.9 9	5006.2	3 ⁻	
		6635.8	5.0 9	4695.3	1 ⁺	
		7049.9	17.8 12	4281.2	2 ⁺	
		11328.5	31.1 2	0	0 ⁺	
11474.6	3	2728.8	3.7 1	8745.6	3	$A_2=+0.45$ 3, $A_4=-0.06$ 3 (1997Br07). Mult., δ : +0.00 5 or -1.0 1 (1997Br07).
		2745.0	3.7 1	8729.3	3 ⁺	$A_2=+0.44$ 3, $A_4=-0.10$ 3 (1997Br07). Mult., δ : +0.02 1 or -1.10 12 (1997Br07).
		4621.5	1.2 1	6851.5	4 ⁺	
		4808.0	1.9 1	6666.1	2 ⁺	$A_2=-0.28$ 7, $A_4=-0.02$ 8 (1997Br07). Mult., δ : -0.03 6 (1997Br07).
		4852.3	1.7 1	6621.7	4 ⁻	
		5063.7	0.4 1	6410	1,2,3,4	
		5250.0	0.7 1	6222.9	2 ⁻	
		5926.0	1.0 1	5546.2	2 ⁺	
		6061.0	6.7 1	5412.6	3 ⁺	$A_2=+0.42$ 7, $A_4=-11$ 4 (1997Br07). Mult., δ : +0.07 4 (1997Br07). Additional information 786. Additional information 787. Additional information 788.
		7013.8	4.7 1	4459.1	4 ⁺	
11485.8		7191.7	74.2 4	4281.2	2 ⁺	
		3360.1	23 4	8125.32		
		6478.3	34 6	5006.2	3 ⁻	
		7706.1	42 5	3776.0		
11589.7		3182.4	1.7 1	8407.0	2	
		4473.7	9.8 3	7115.3	2 ⁺	
		4923.1	0.4 2	6666.1	2 ⁺	
		5178.8	0.3 2	6410	1,2,3,4	
		6582.1	2.9 3	5006.2	3 ⁻	
		6892.6	0.7 2	4695.3	1 ⁺	
		7128.9	6.9 4	4459.1	4 ⁺	
		7306.7	21.5 4	4281.2	2 ⁺	
		7810.0	3.2 3	3776.0		
		9356.5	14.5 5	2230.5	2 ⁺	
		11585.2	38.0 7	0	0 ⁺	
11602.4		4066.1	5.4 7	7535.7		
		4411.6	14.3 7	7190.1	1 ⁺	
		6053.8	17.0 9	5546.2	2 ⁺	
		6594.8	20.3 10	5006.2	3 ⁻	
		6905.3	45.0 14	4695.3	1 ⁺	
11637.1		3290.4	0.7 1	8346.3		
		3715.6	0.5 1	7921.0		
		4152.6	0.4 1	7483.9	2 ⁺	
		4202.5	0.2 1	7434		
		4446.3	0.4 1	7190.1	1 ⁺	
		4634.9	0.7 1	7001.44	1	
		4970.5	0.6 1	6666.1	2 ⁺	
		5412.4	0.5 1	6222.9	2 ⁻	
		5838.5	0.6 1	5797.6		
		6088.5	3.1 1	5546.2	2 ⁺	
		6940.0	1.9 1	4695.3	1 ⁺	
		7857.3	1.1 1	3776.0		

Continued on next page (footnotes at end of table)

$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13** (continued) $\gamma(^{32}\text{S})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Comments
11637.1		9403.8	2.4 2	2230.5	2 ⁺	
		11632.6	87.4 5	0	0 ⁺	
11669.6	5 ⁺	2940.0	0.4 1	8729.3	3 ⁺	
		3322.9	3.9 2	8346.3		
		3478.1	9.6 2	8191.1	4	$A_2=-0.35$ 3, $A_4=-0.06$ 4 (1997Br07). Mult., δ : +0.03 3 (1997Br07). Additional information 789.
		4102.0	13.5 2	7567		$A_2=+0.48$ 2, $A_4=-0.03$ 2 (1997Br07). Mult., δ : 0.00 9 (1997Br07).
		4907.2	0.4 1	6761.6	2,3	
		5258.7	63.0 4	6410	1,2,3,4	$A_2=-0.09$ 1, $A_4=-0.01$ 1 (1997Br07). Mult., δ : -0.12 4 (1997Br07). Additional information 790.
		7208.8	9.1 2	4459.1	4 ⁺	$A_2=-0.26$ 4, $A_4=-0.04$ 4 (1997Br07). Mult., δ : -0.03 3 (1997Br07).
11696.7	5 ⁺	3350.0	4.0 1	8346.3		
		3505.2	6.1 1	8191.1	4	$A_2=-0.31$ 5, $A_4=+0.09$ 6 (1997Br07). Mult., δ : -0.02 4 (1997Br07).
		4129.1	8.8 2	7567		
		4346.1	1.0 1	7350.0	3 ⁽⁺⁾	
		5074.3	0.9 2	6621.7	4 ⁻	
		5285.8	60.1 4	6410	1,2,3,4	$A_2=-1.01$ 2, $A_4=+0.17$ 2 (1997Br07). Mult., δ : +0.4 4 (1997Br07).
		7235.8	19.2 2	4459.1	4 ⁺	
11758.8		3462.3	7.7 2	8296.1	3	
		3808.2	7.8 6	7950.1	4 ⁻	
		4996.4	55.0 6	6761.6	2,3	
		5136.4	27.2 5	6621.7	4 ⁻	
		6751.2	2.4 4	5006.2	3 ⁻	
11940.1	3	3532.7	0.5 1	8407.0	2	
		3989.5	2.3 1	7950.1	4 ⁻	
		5086.8	0.8 1	6851.5	4 ⁺	
		5317.7	5.6 2	6621.7	4 ⁻	
		5715.3	2.2 1	6222.9	2 ⁻	
		6391.3	7.7 3	5546.2	2 ⁺	$A_2=-0.23$ 8, $A_4=+0.11$ 9 (1997Br07). Mult., δ : -0.09 7 (1997Br07).
		6526.3	9.9 2	5412.6	3 ⁺	$A_2=+0.52$ 5, $A_4=+0.05$ 7 (1997Br07). Mult., δ : -0.16 12 (1997Br07).
		7479.1	35.6 4	4459.1	4 ⁺	$A_2=-0.1$ 3, $A_4=-0.06$ 4 (1997Br07). Mult., δ : +0.02 3 (1997Br07).
		7656.9	17.8 2	4281.2	2 ⁺	
		9706.6	17.6 3	2230.5	2 ⁺	
12043.9		4093.2	2.5 4	7950.1	4 ⁻	
		5281.4	14.9 8	6761.6	2,3	
		5421.4	2.1 4	6621.7	4 ⁻	
		7036.1	78.6 10	5006.2	3 ⁻	
		7582.9	2.0 3	4459.1	4 ⁺	
12044.19	2,3,4	7036.33	99	5006.2	3 ⁻	Additional information 791. $A_2=+0.284$ 11 (1973Ve06).
		9812.1	1	2230.5	2 ⁺	Additional information 792.
12047.96	0 ⁺	2840.32 14	9.4 7	9207.55	1 ⁺	Additional information 793.
		3922.37 15	84.3 9	8125.32		Additional information 794.
		5046.1 4	6.3 7	7001.44	1	Additional information 795.
		9816 ^a	≤ 0.25	2230.5	2 ⁺	Additional information 796.

Continued on next page (footnotes at end of table)

$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13 (continued)**

$\gamma(^{32}\text{S})$ (continued)

[†] From level-energy difference with recoil correction removed, if otherwise noted it is a direct measurement.

[‡] Below 10757 keV from [1975Bo42](#), above 10757 keV from [1997Br07](#), unless otherwise noted.

From [1972Co13](#).

@ From [1976Ve03](#).

& [Additional information 797](#).

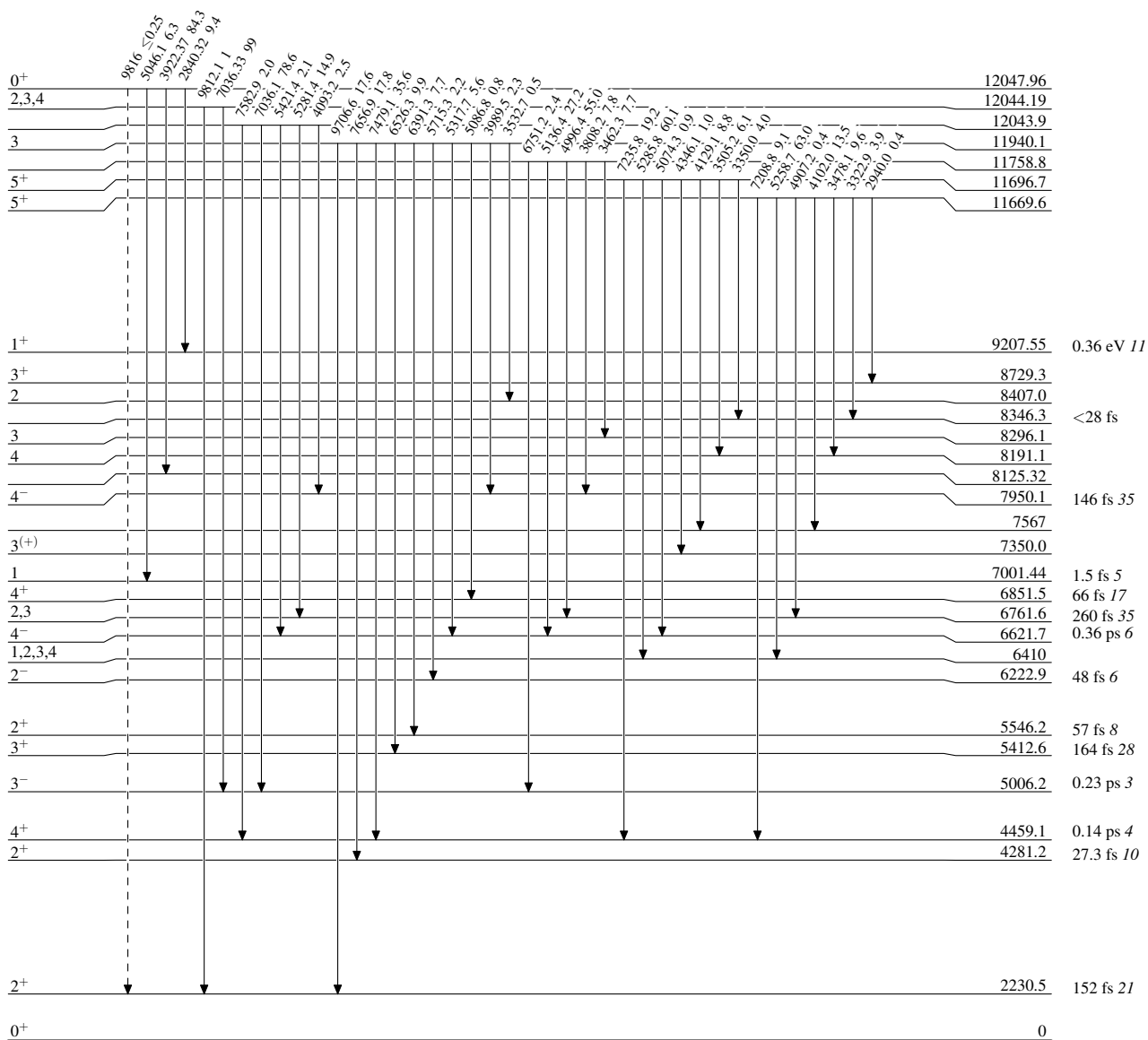
^a Placement of transition in the level scheme is uncertain.

$^{31}\text{P}(\text{p},\gamma)$ 1997Br07,1975Bo42,1972Co13

Legend

Level Scheme

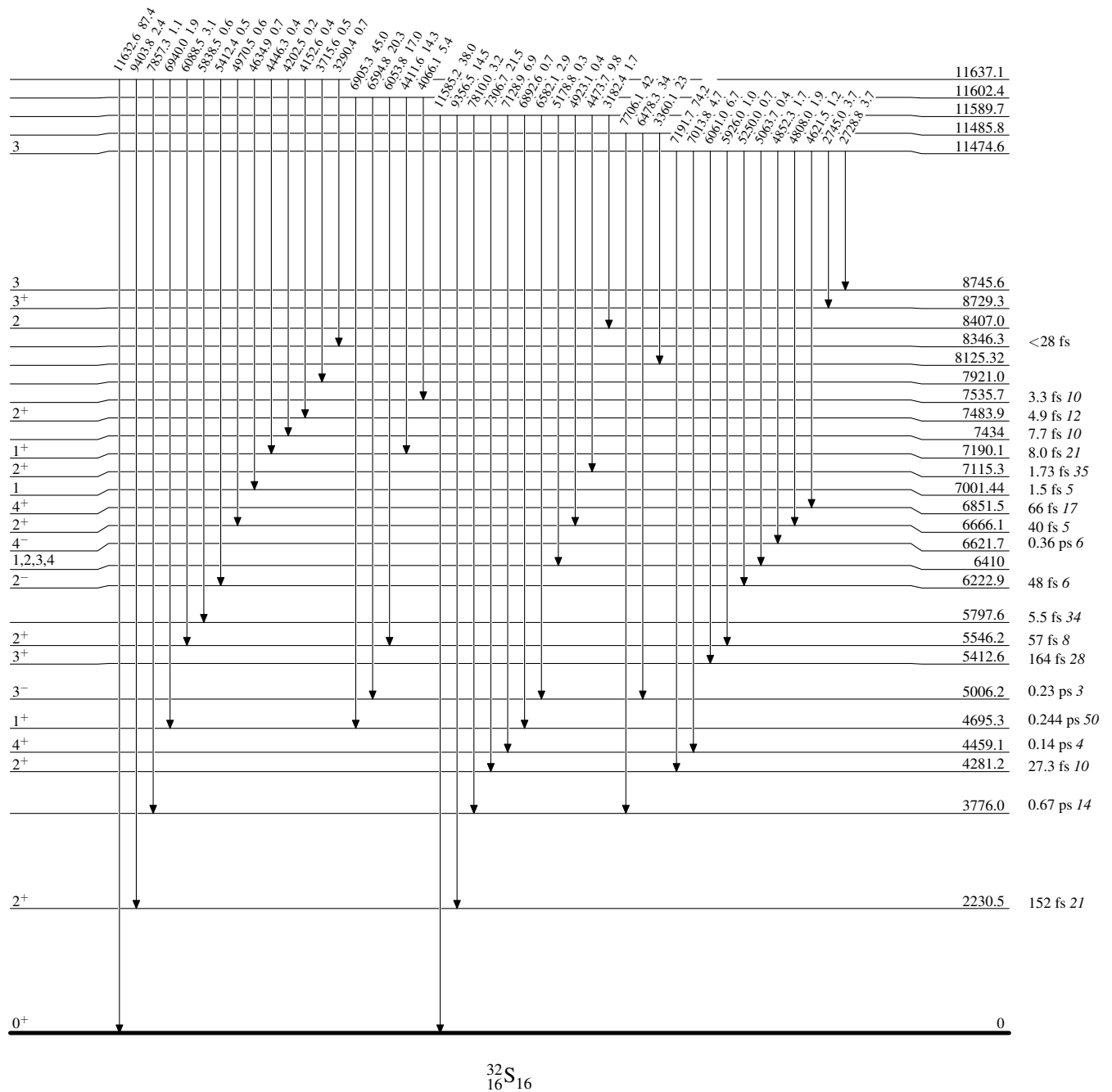
Intensities: % photon branching from each level

-----► γ Decay (Uncertain) $^{32}_{16}\text{S}$

$^{31}\text{P}(\text{p},\gamma)$ 1997Br07,1975Bo42,1972Co13

Level Scheme (continued)

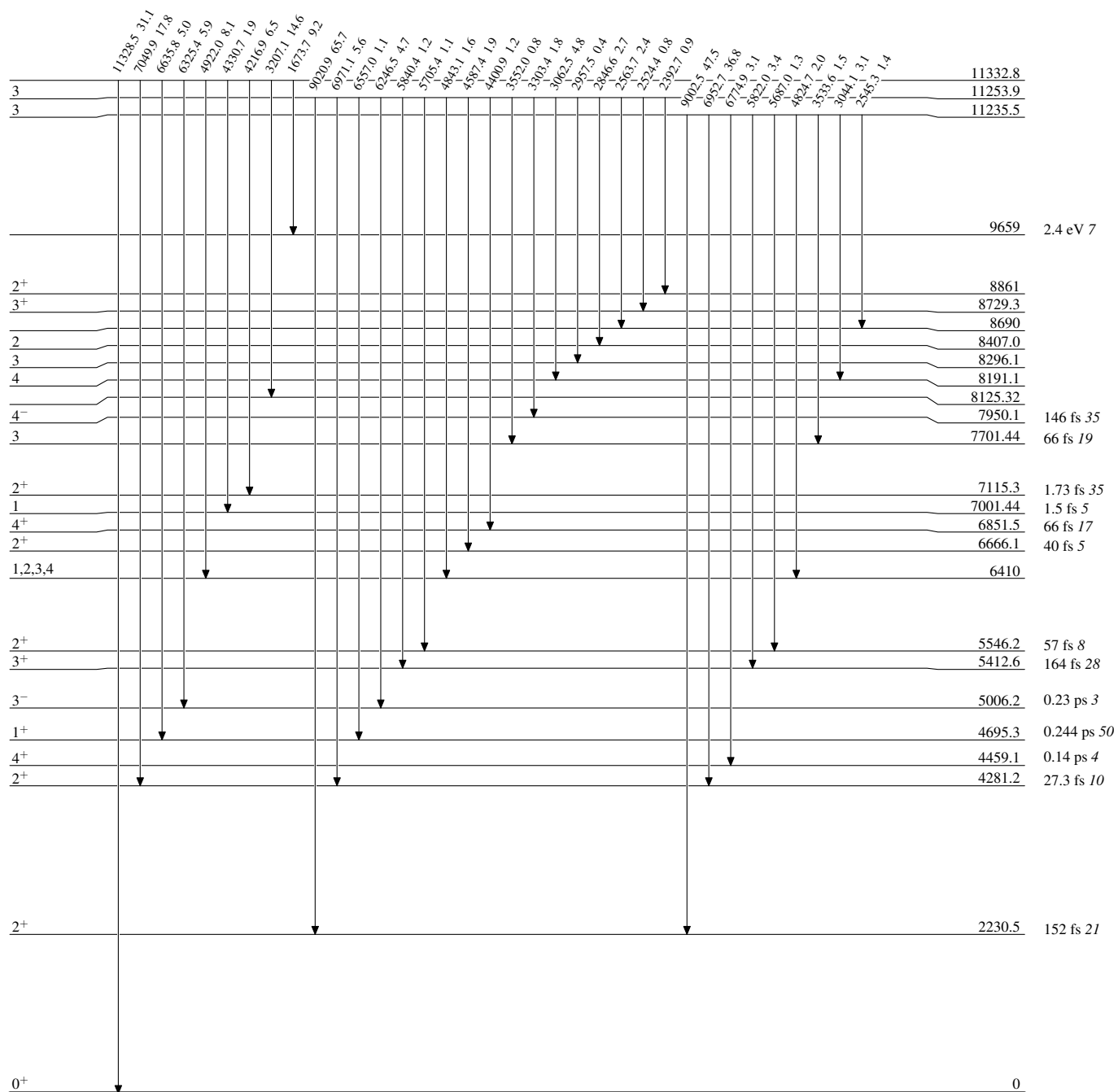
Intensities: % photon branching from each level



$^{31}\text{P}(\text{p},\gamma)$ 1997Br07,1975Bo42,1972Co13

Level Scheme (continued)

Intensities: % photon branching from each level

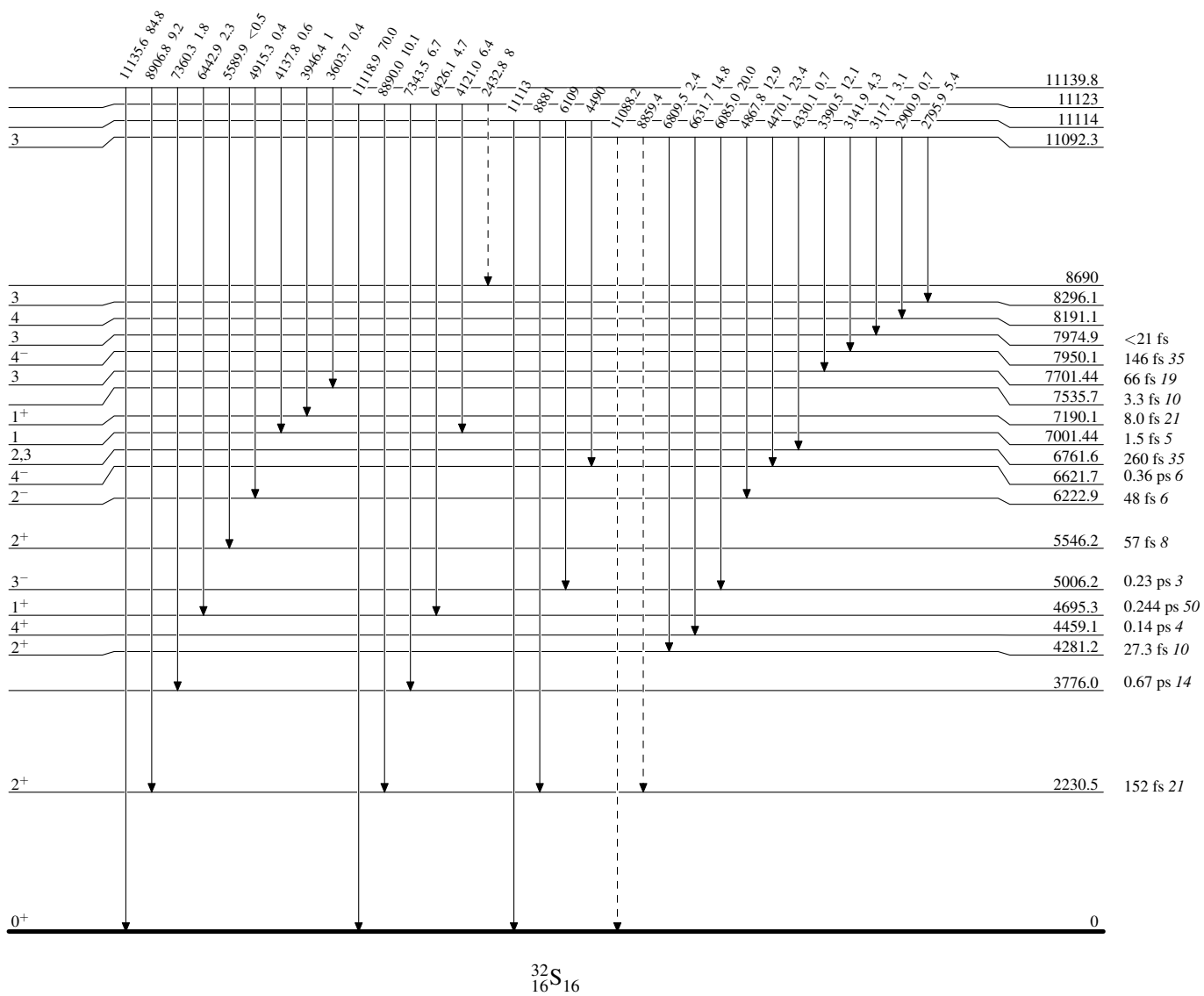


$^{31}\text{P}(\text{p},\gamma)$ 1997Br07,1975Bo42,1972Co13

Legend

Level Scheme (continued)

Intensities: % photon branching from each level

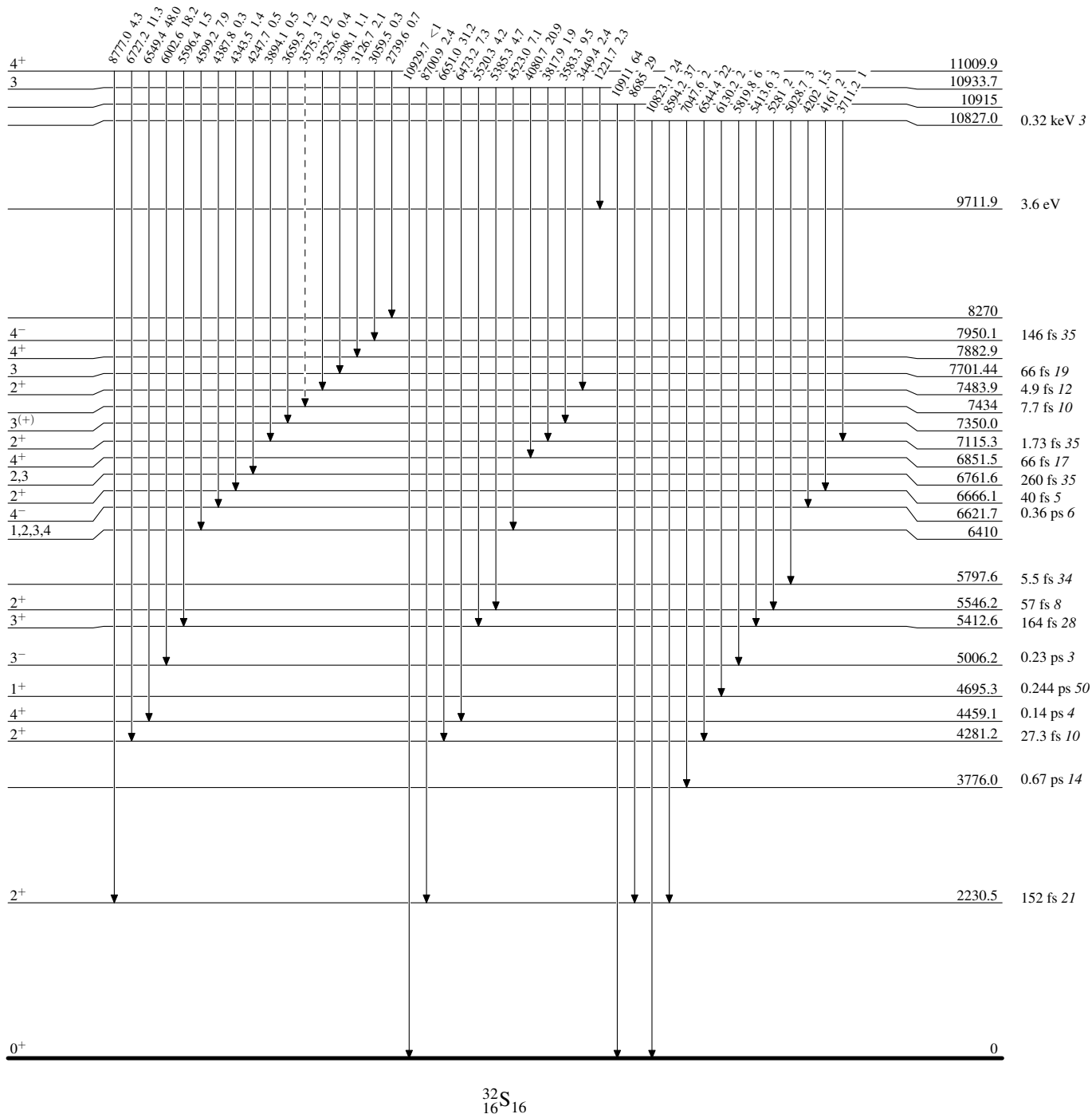
-----► γ Decay (Uncertain) $^{32}_{16}\text{S}$

$^{31}\text{P}(\text{p},\gamma)$ 1997Br07,1975Bo42,1972Co13

Legend

Level Scheme (continued)

Intensities: % photon branching from each level

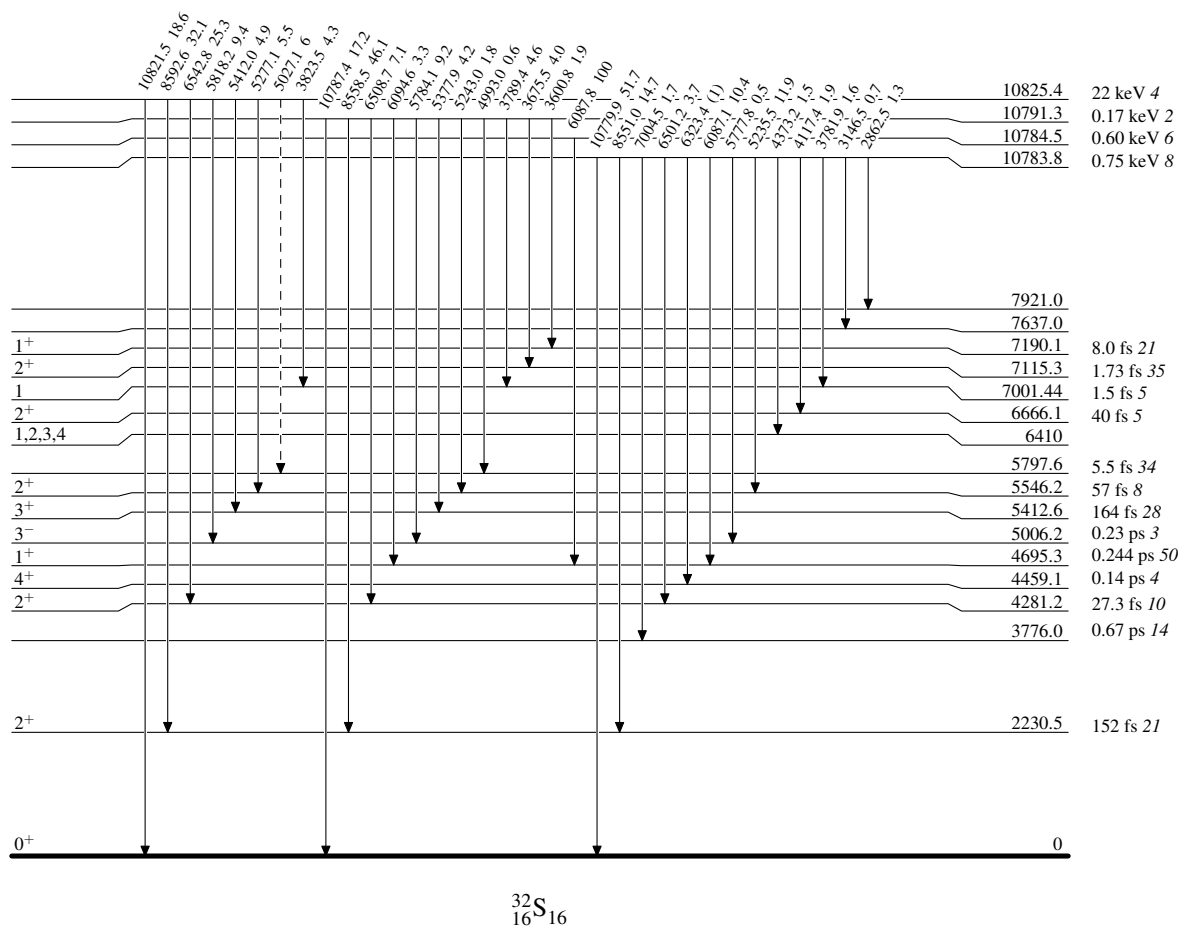
-----► γ Decay (Uncertain)

$^{31}\text{P}(\text{p},\gamma)$ 1997Br07,1975Bo42,1972Co13

Legend

Level Scheme (continued)

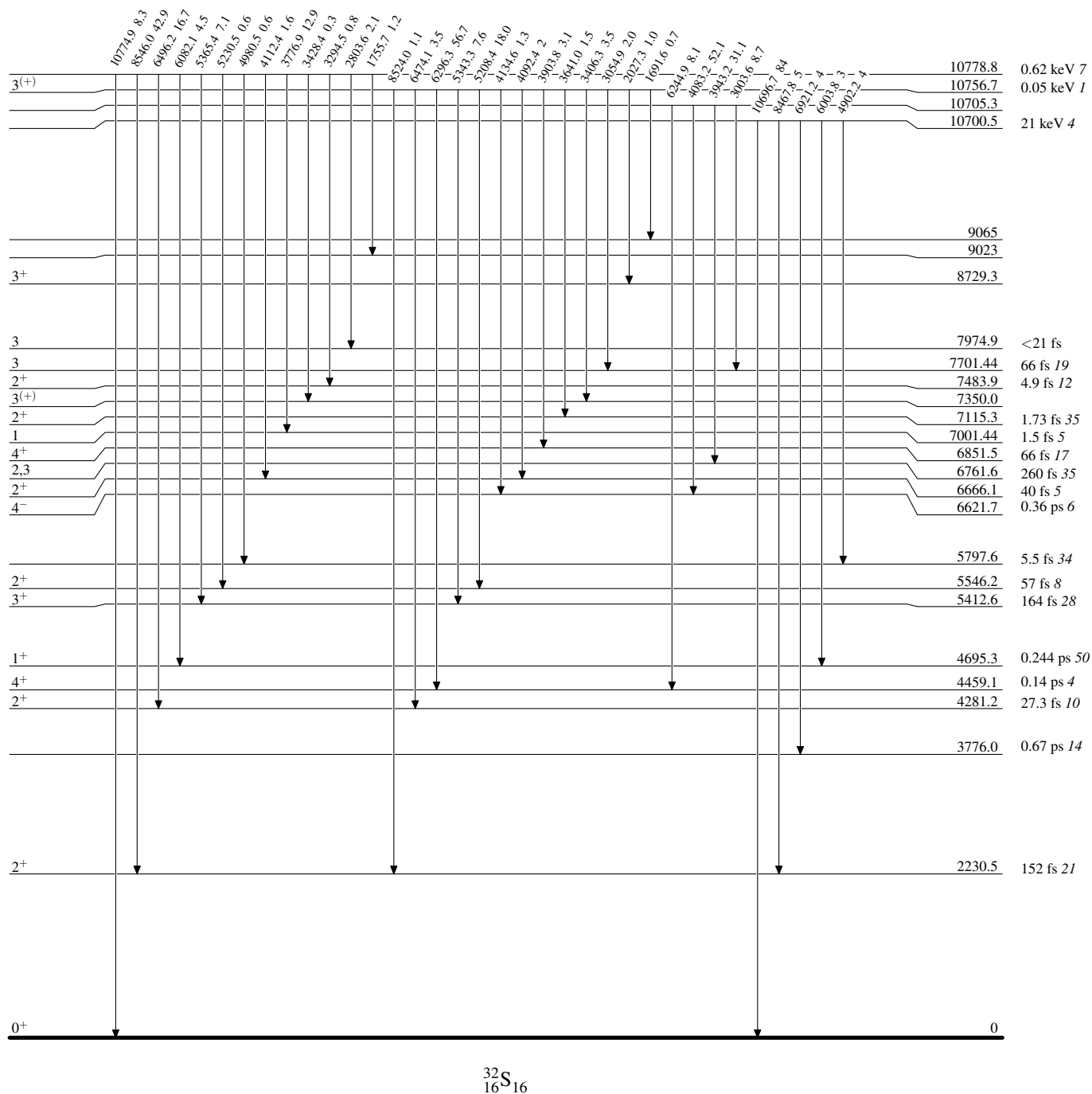
Intensities: % photon branching from each level

-----► γ Decay (Uncertain) $^{32}_{16}\text{S}_{16}$

$^{31}\text{P}(\text{p},\gamma)$ 1997Br07,1975Bo42,1972Co13

Level Scheme (continued)

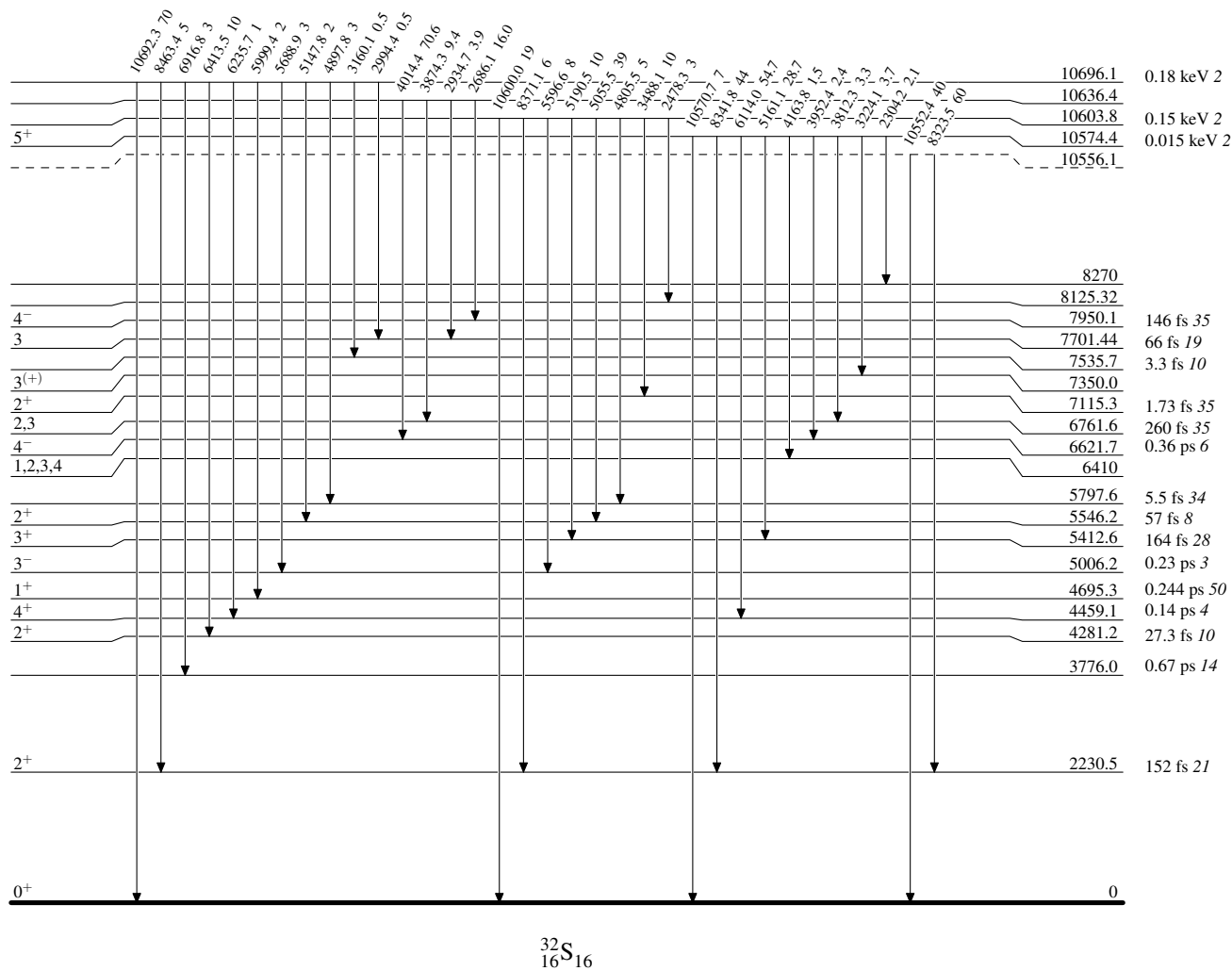
Intensities: % photon branching from each level



$^{31}\text{P}(\text{p},\gamma)$ 1997Br07,1975Bo42,1972Co13

Level Scheme (continued)

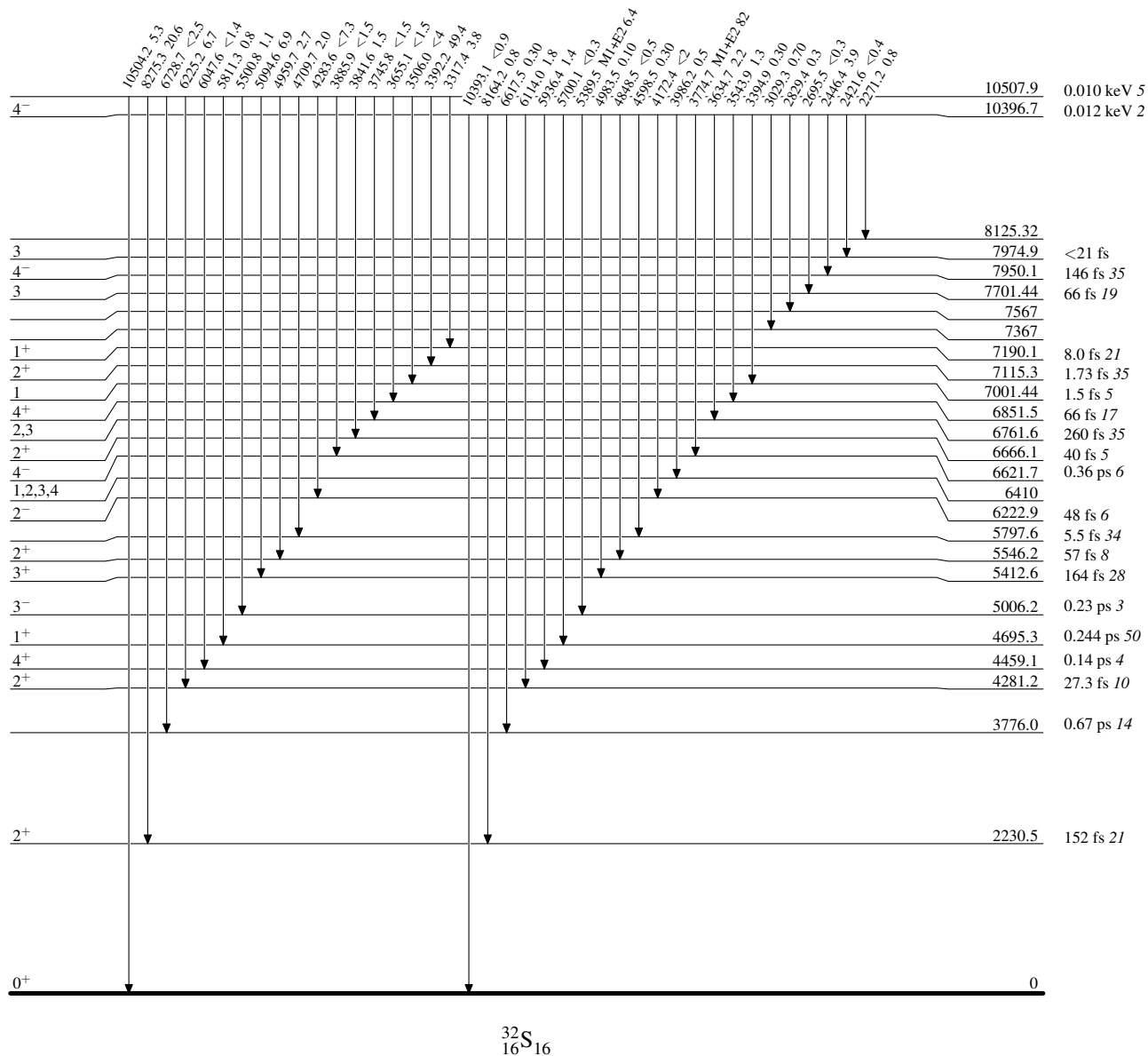
Intensities: % photon branching from each level



$^{31}\text{P}(\text{p},\gamma)$ 1997Br07,1975Bo42,1972Co13

Level Scheme (continued)

Intensities: % photon branching from each level

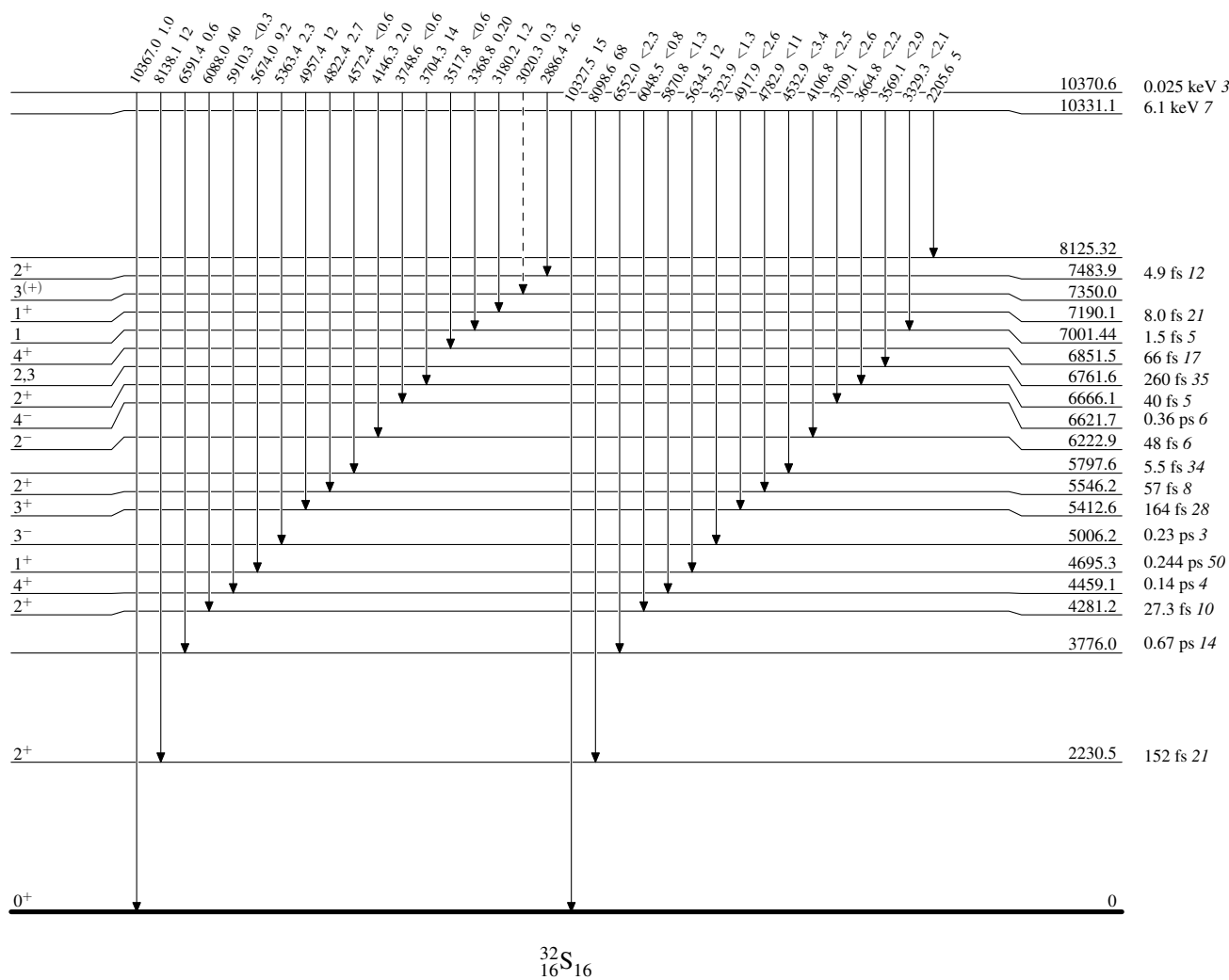
 $^{32}_{16}\text{S}$

$^{31}\text{P}(\text{p},\gamma)$ 1997Br07,1975Bo42,1972Co13

Legend

Level Scheme (continued)

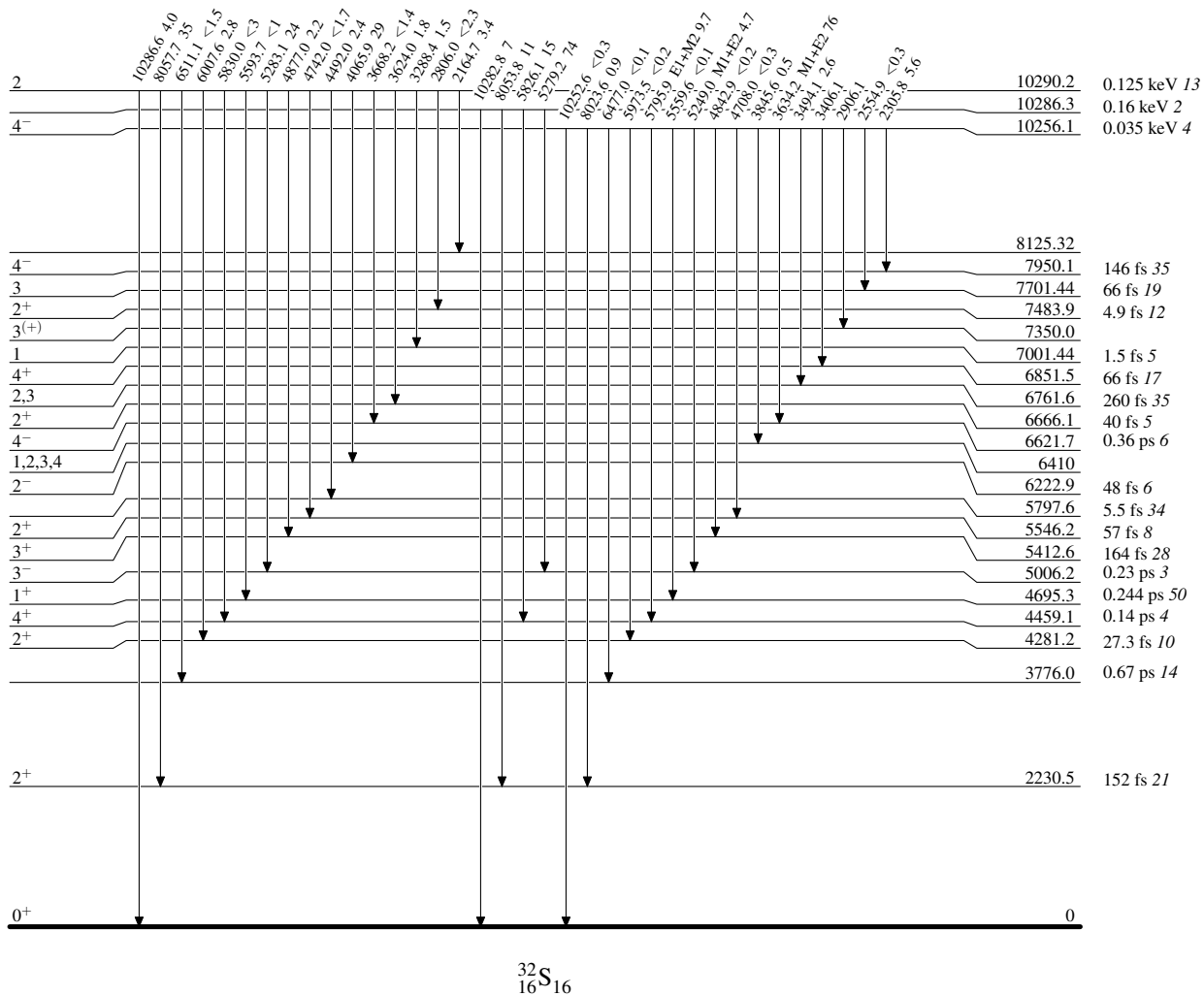
Intensities: % photon branching from each level

-----► γ Decay (Uncertain)

$^{31}\text{P}(\text{p},\gamma)$ 1997Br07,1975Bo42,1972Co13

Level Scheme (continued)

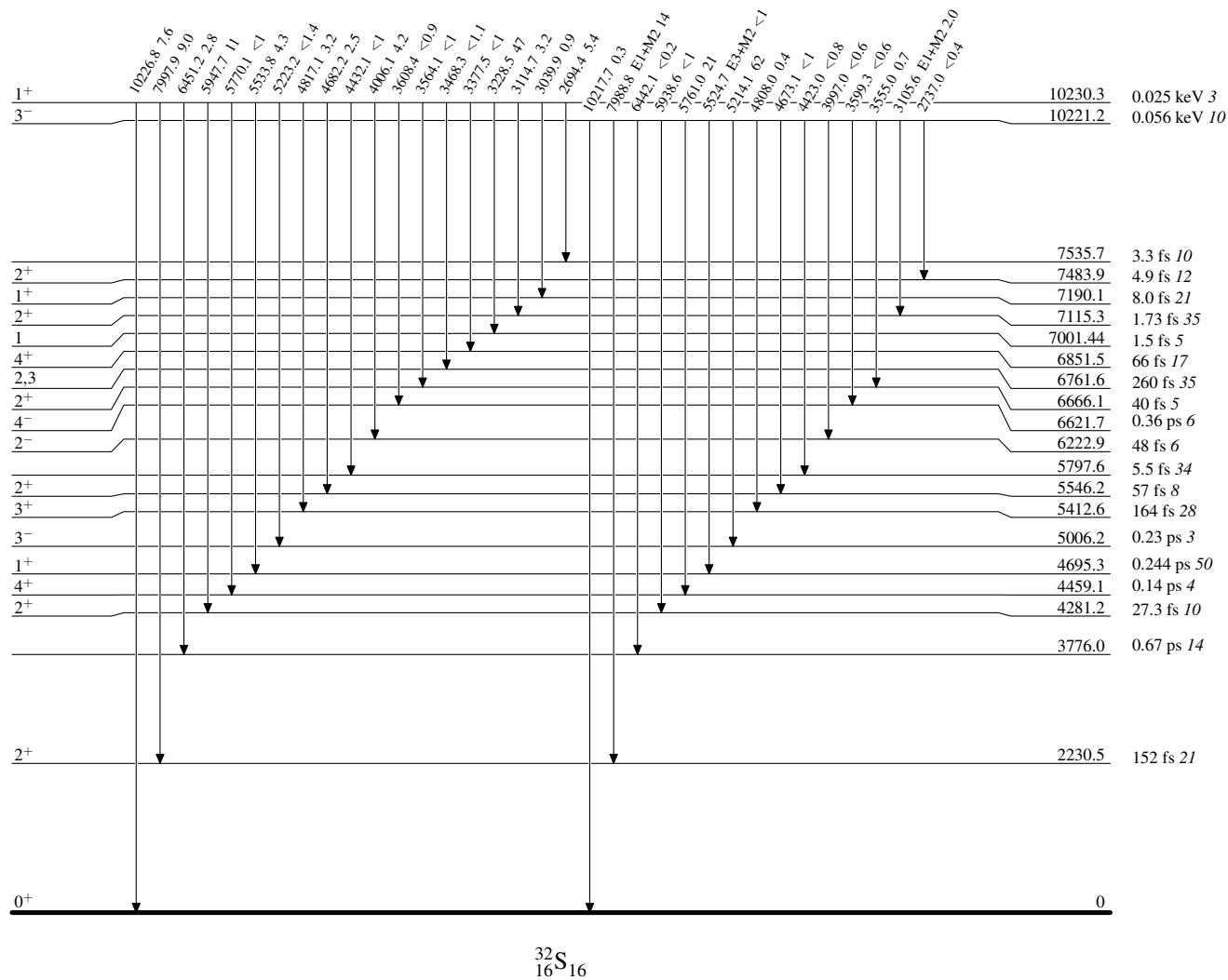
Intensities: % photon branching from each level



$^{31}\text{P}(\text{p},\gamma)$ 1997Br07,1975Bo42,1972Co13

Level Scheme (continued)

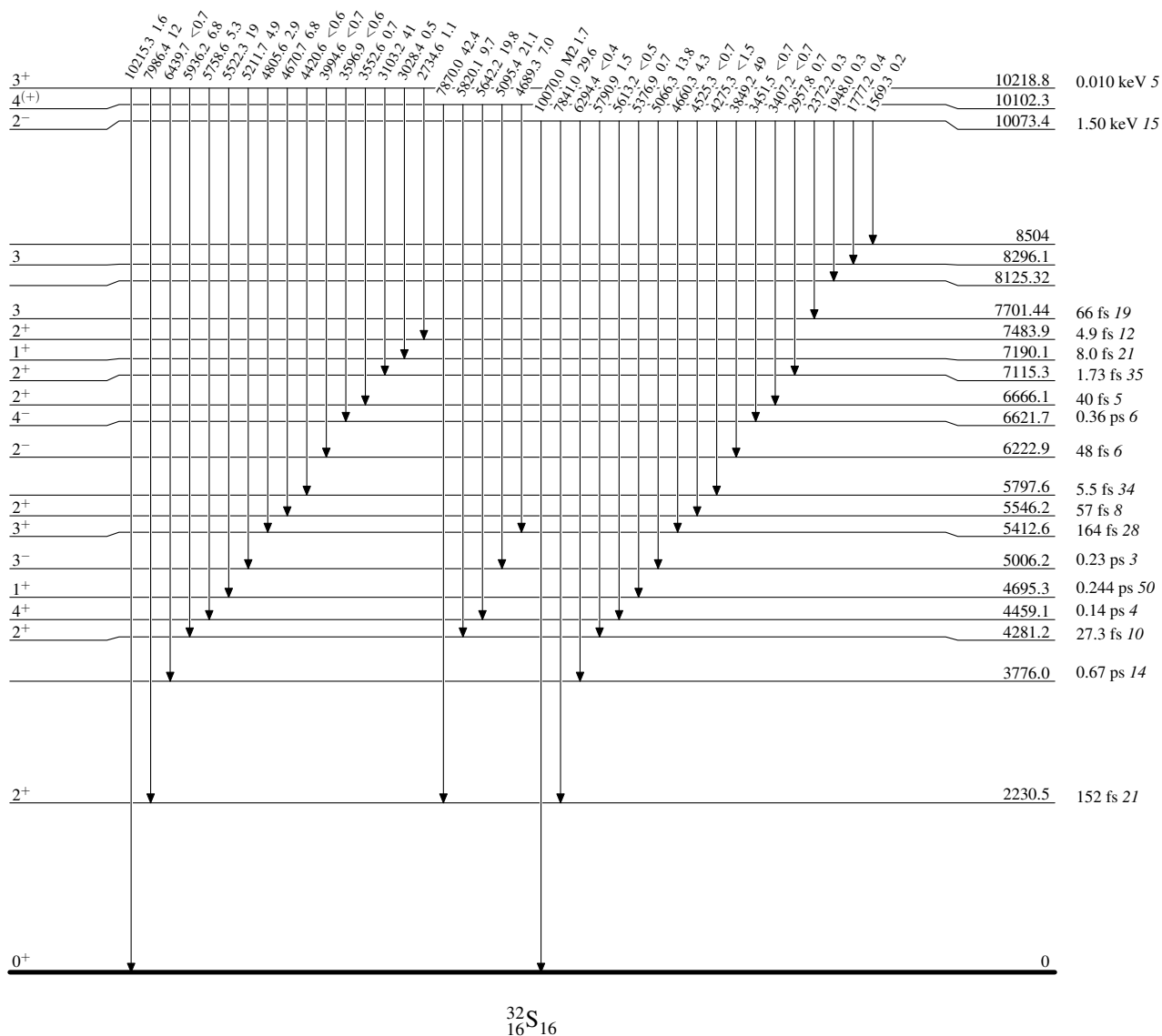
Intensities: % photon branching from each level



$^{31}\text{P}(\text{p},\gamma)$ 1997Br07,1975Bo42,1972Co13

Level Scheme (continued)

Intensities: % photon branching from each level

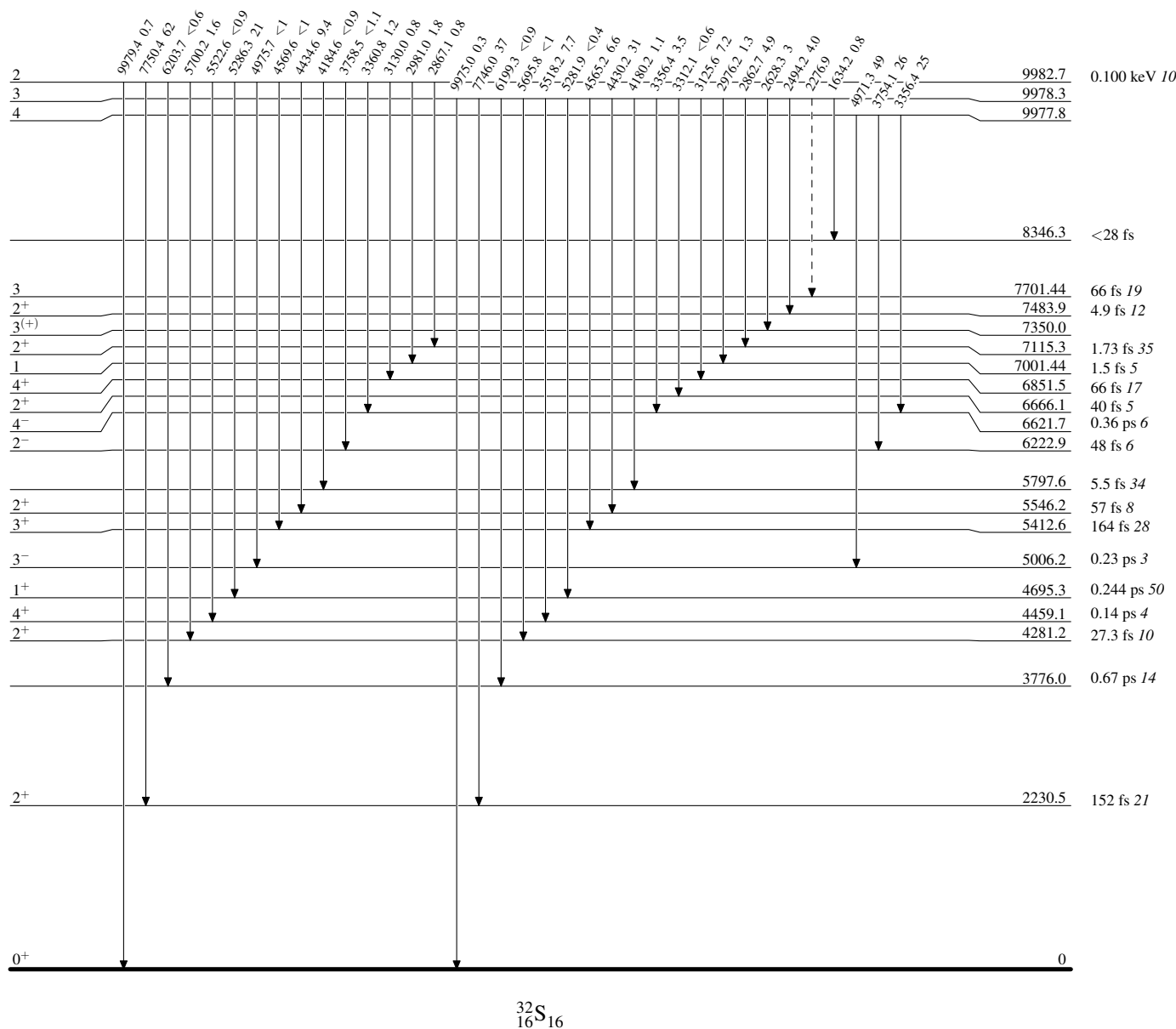


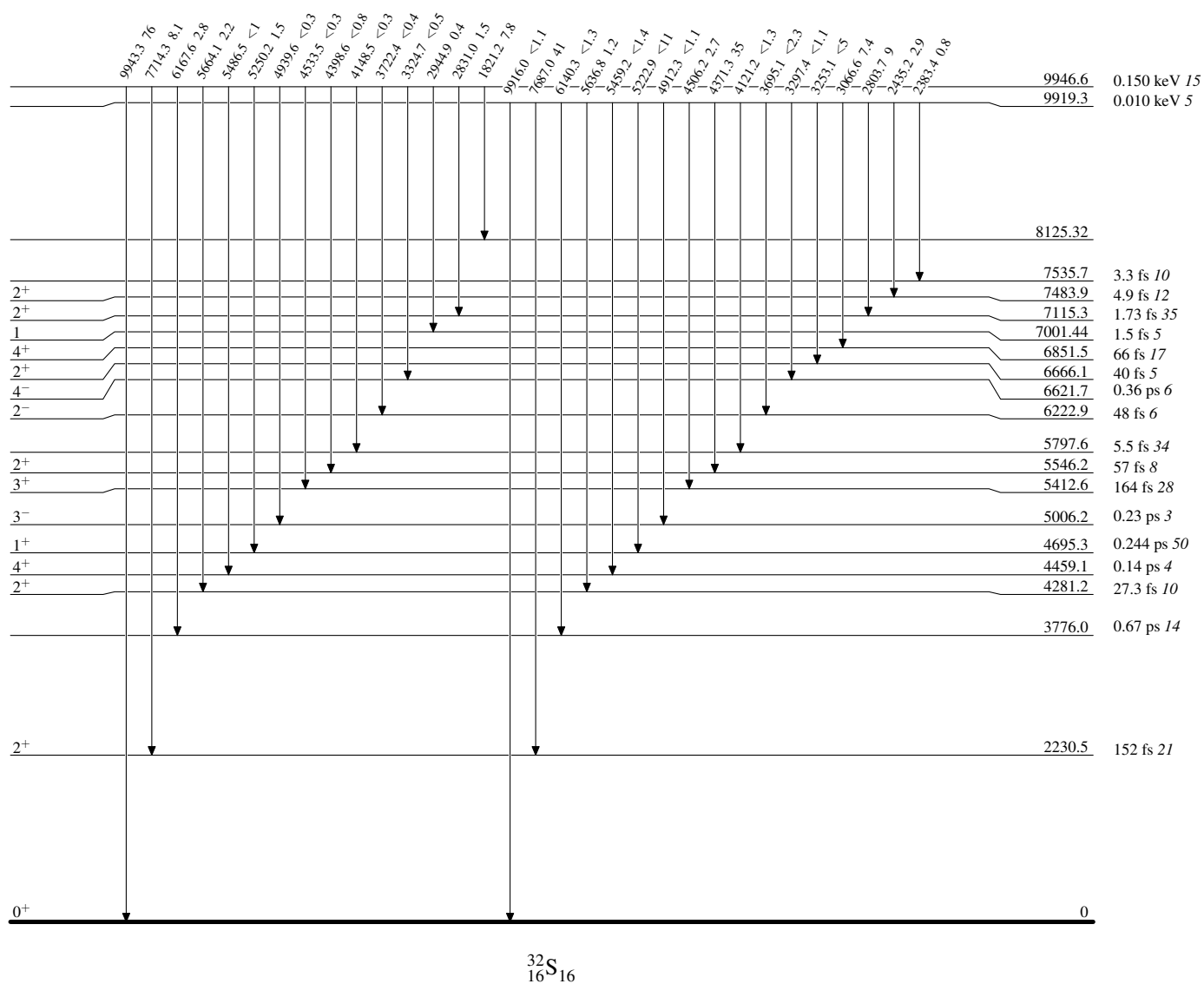
$^{31}\text{P}(\text{p},\gamma)$ 1997Br07,1975Bo42,1972Co13

Legend

Level Scheme (continued)

Intensities: % photon branching from each level

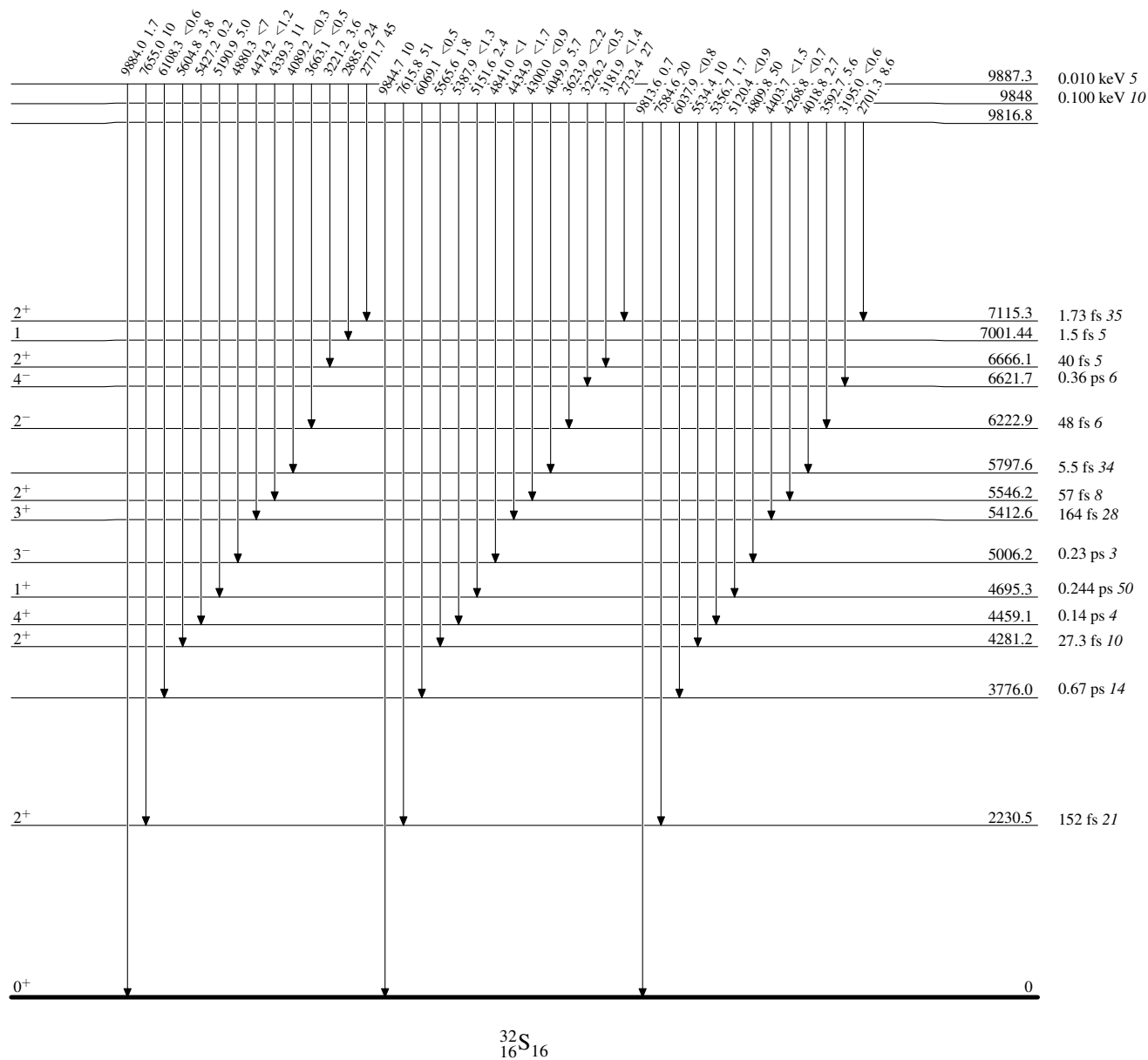
-----► γ Decay (Uncertain)



$^{31}\text{P}(\text{p},\gamma)$ 1997Br07,1975Bo42,1972Co13

Level Scheme (continued)

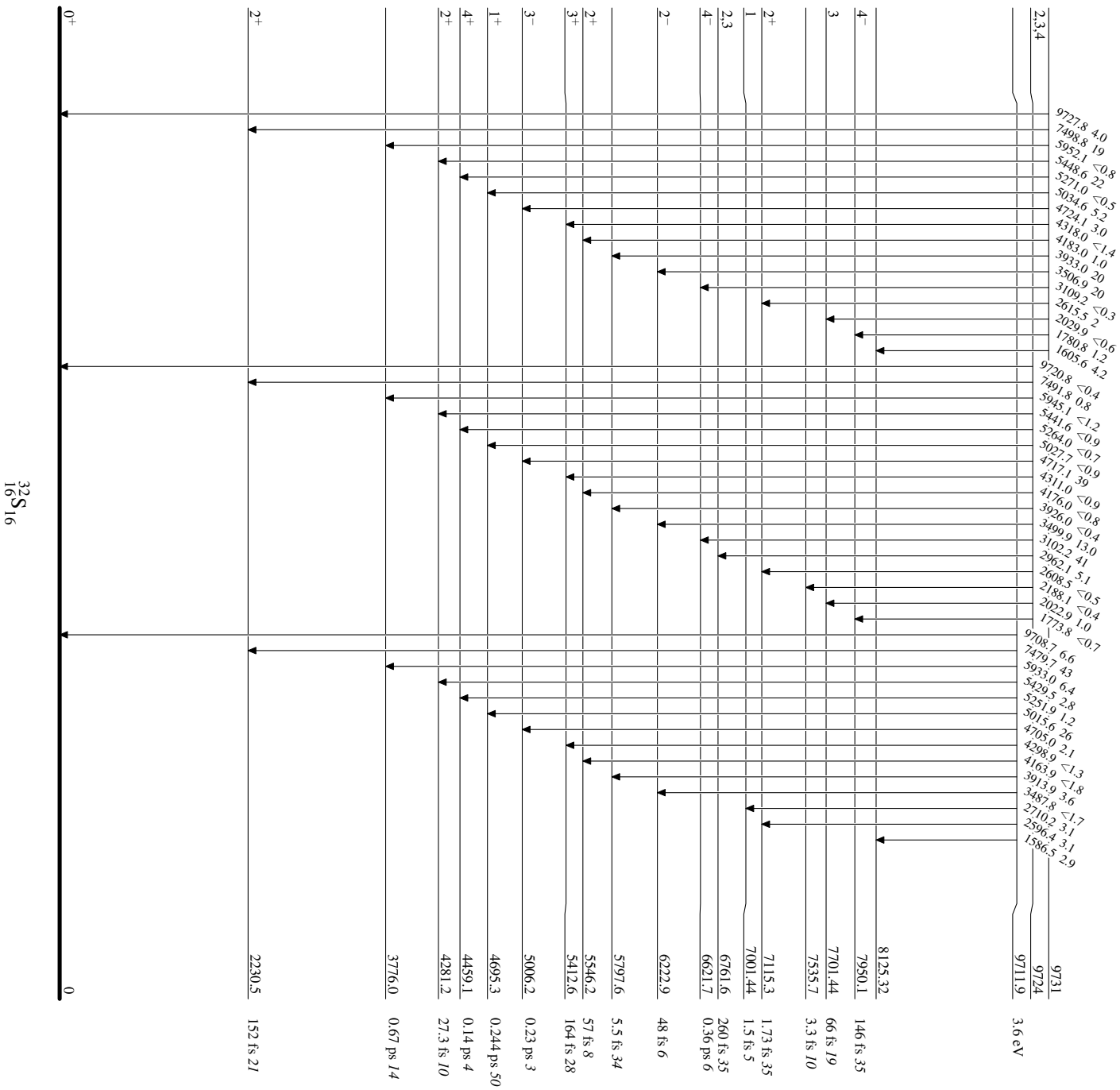
Intensities: % photon branching from each level



³¹P(p,γ) 1997Br07,1975Bo42,1972Co13

Level Scheme (continued)

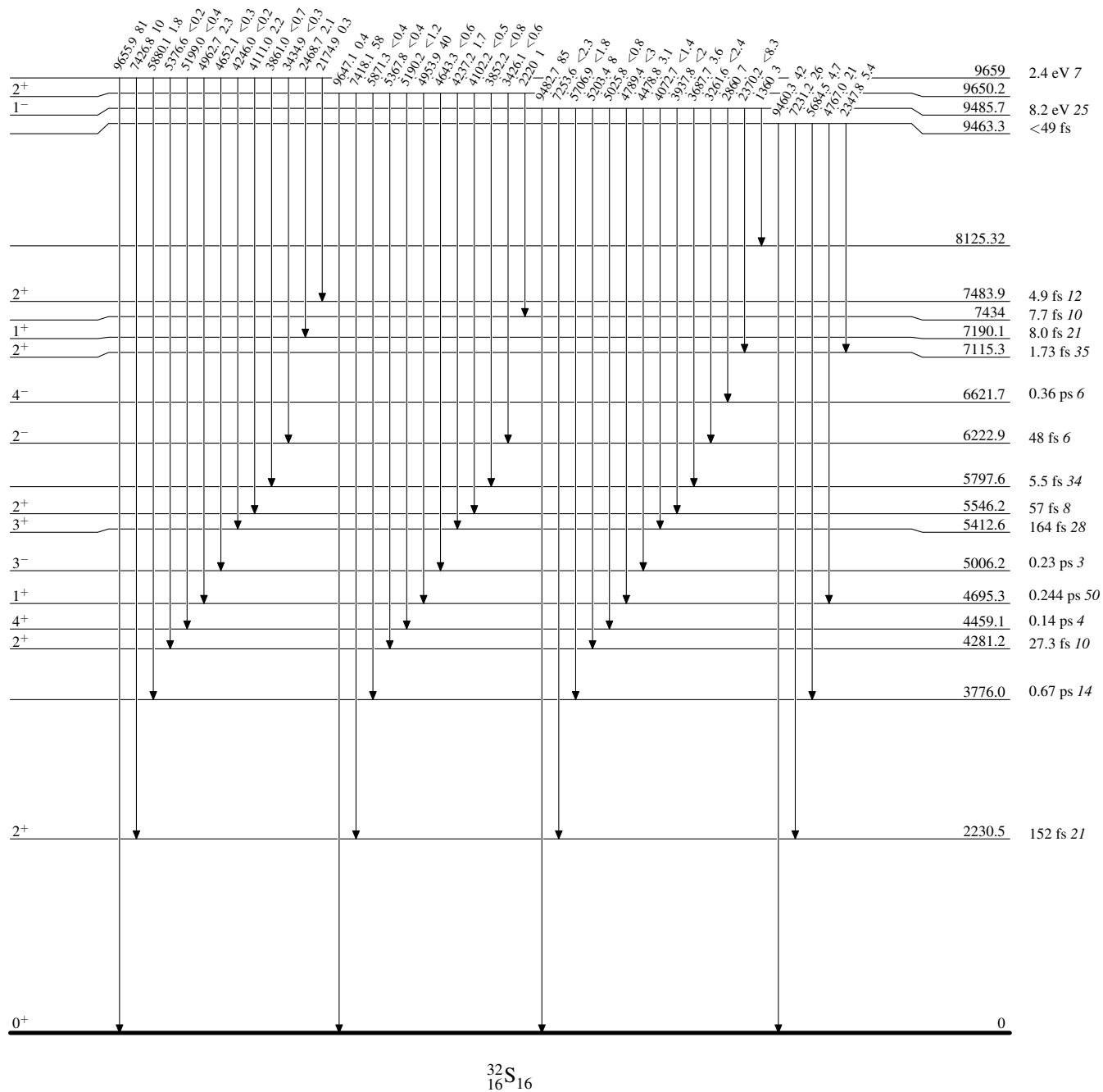
Intensities: % photon branching from each level



$^{31}\text{P}(\text{p},\gamma)$ 1997Br07,1975Bo42,1972Co13

Level Scheme (continued)

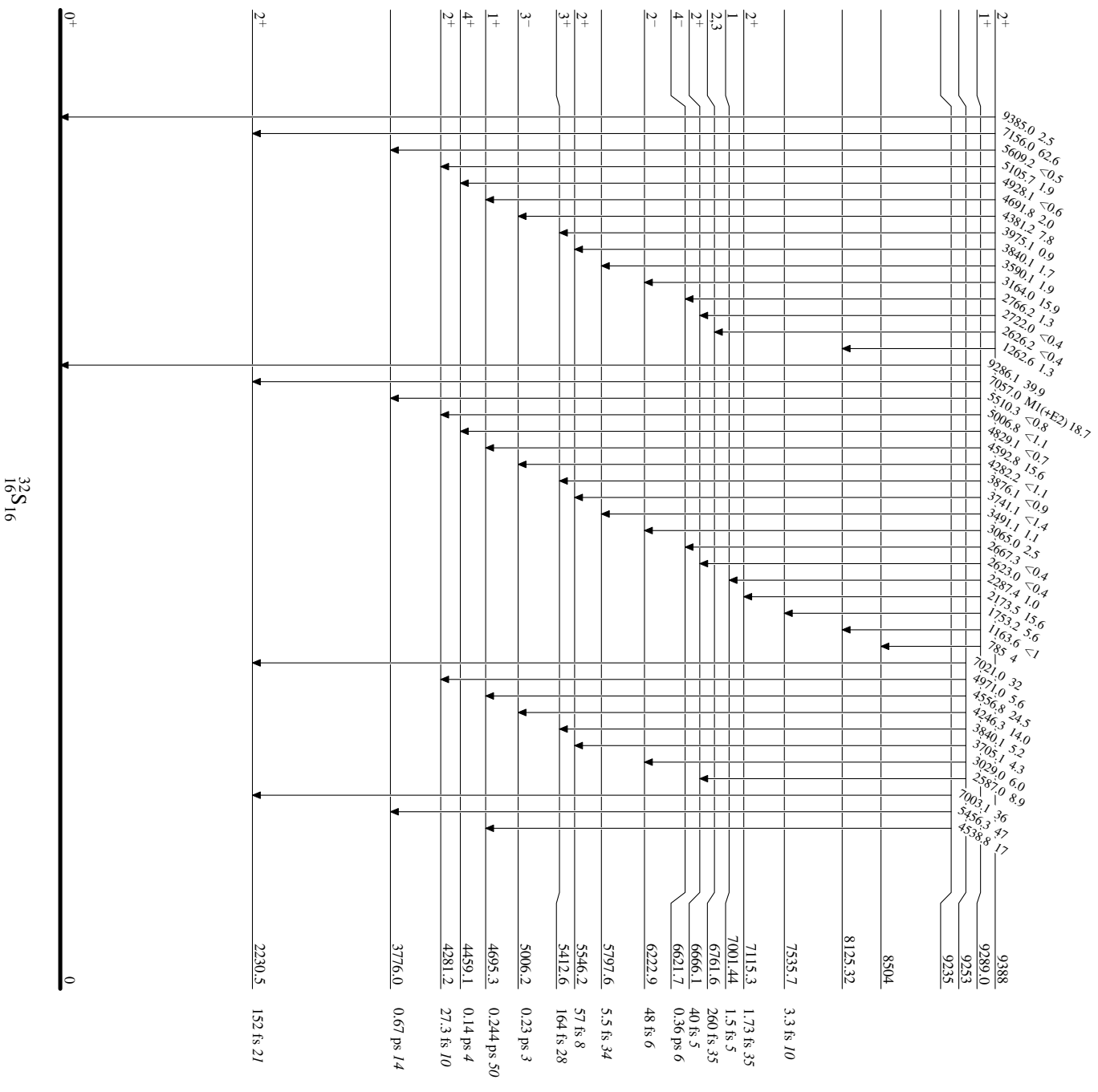
Intensities: % photon branching from each level



³¹P(p,γ) 1997Br07,1975Bo42,1972Co13

Level Scheme (continued)

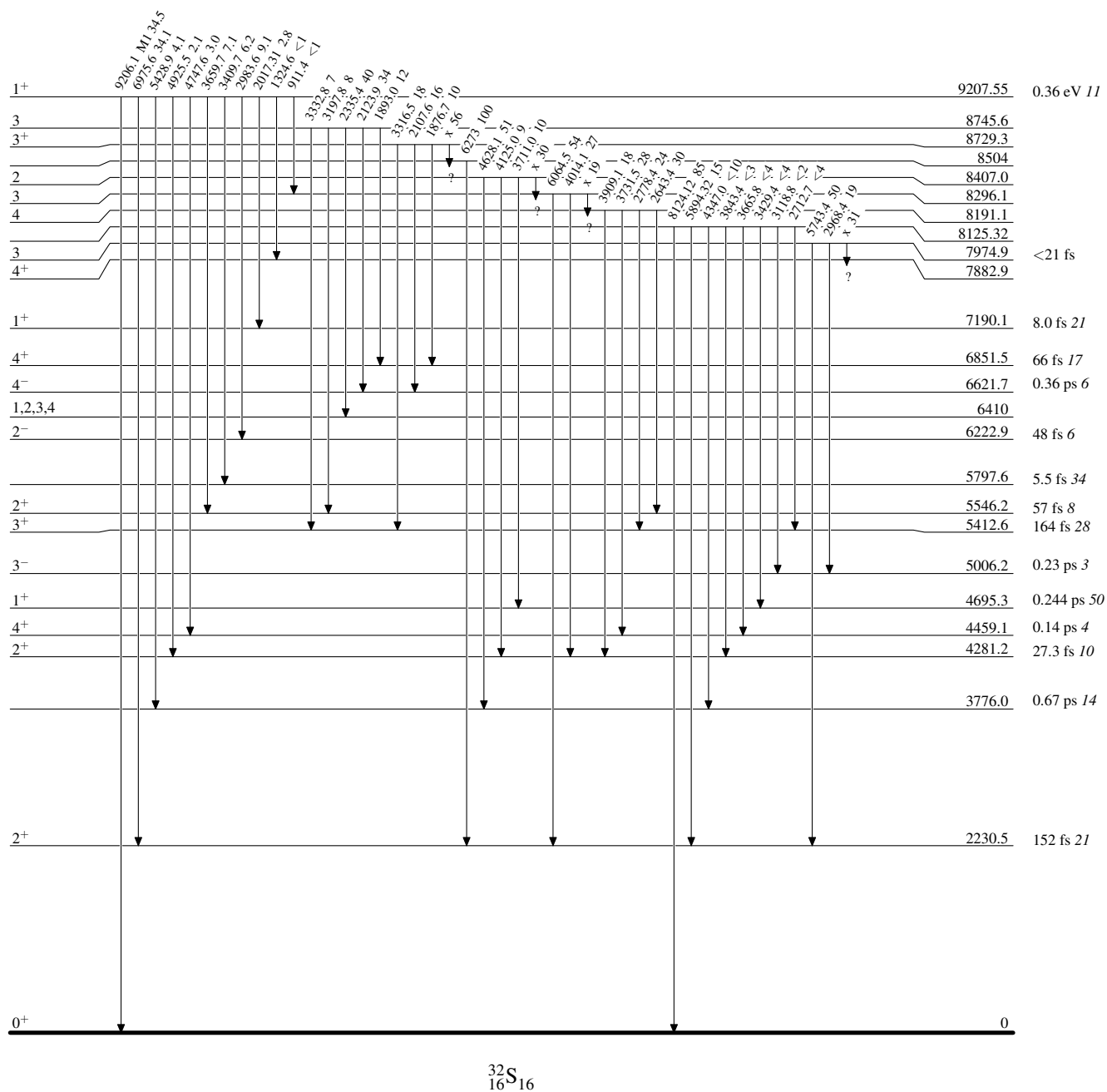
Intensities: % photon branching from each level



$^{31}\text{P}(\text{p},\gamma)$ 1997Br07,1975Bo42,1972Co13

Level Scheme (continued)

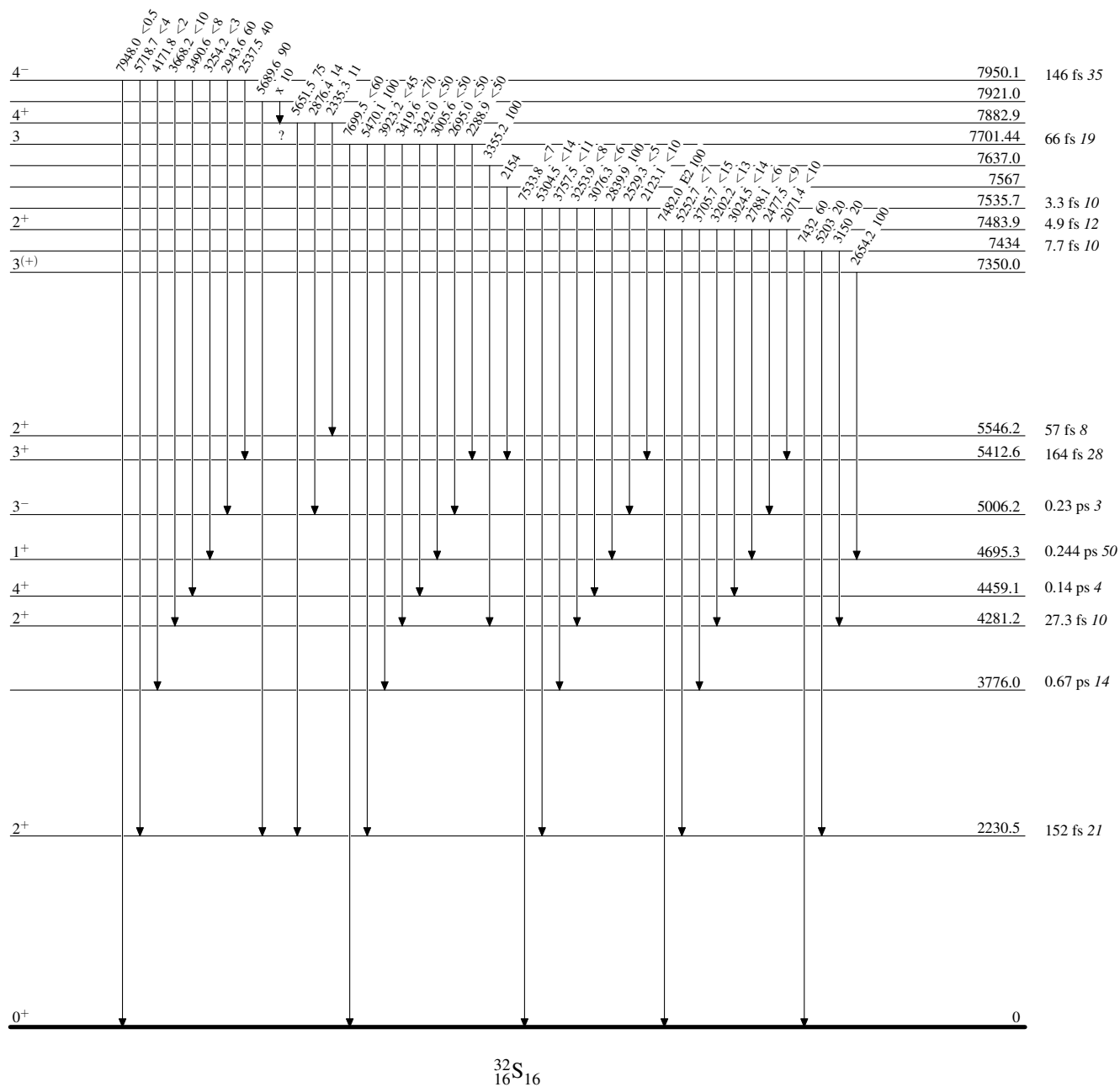
Intensities: % photon branching from each level



$^{31}\text{P}(\text{p},\gamma)$ 1997Br07,1975Bo42,1972Co13

Level Scheme (continued)

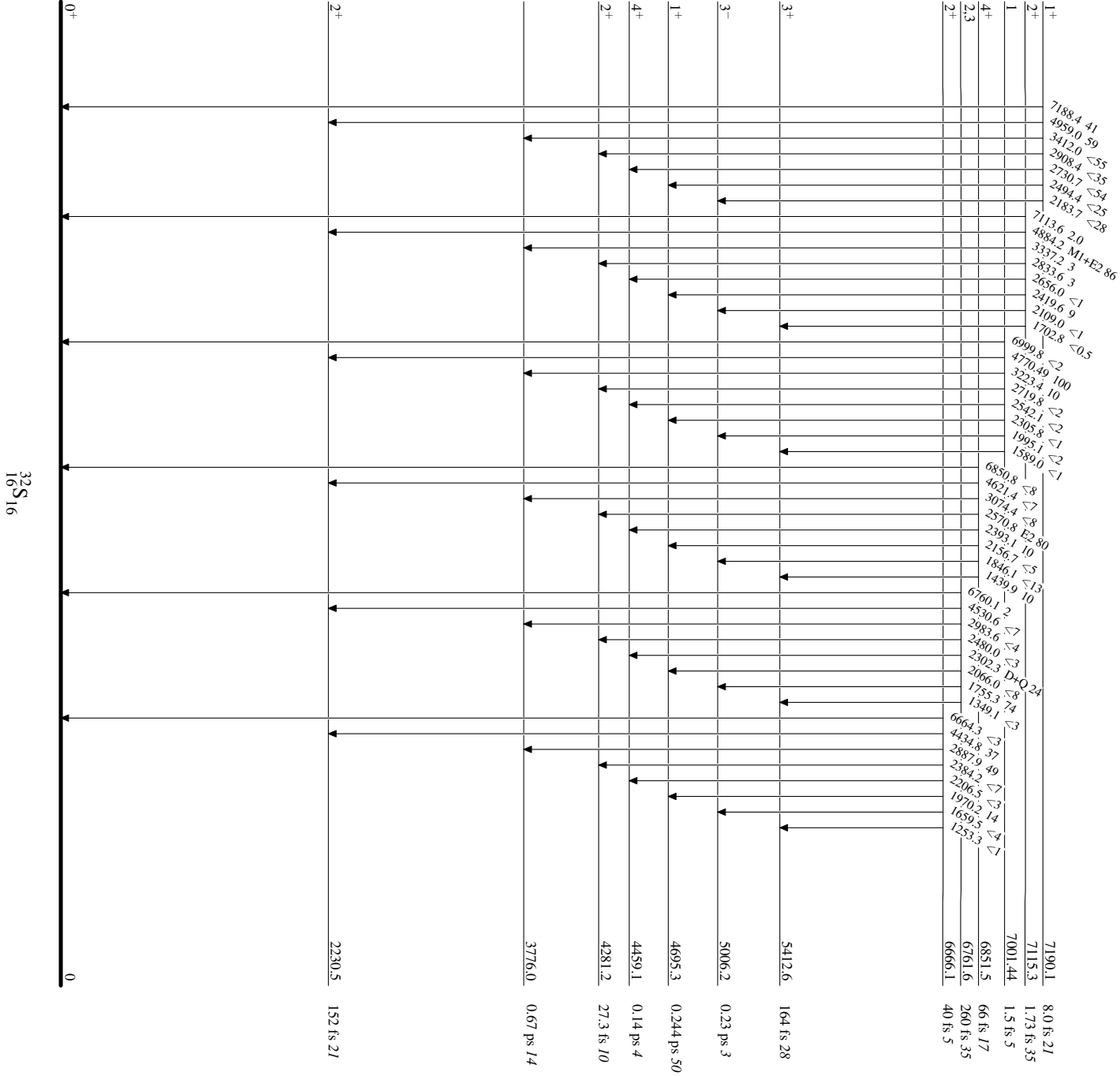
Intensities: % photon branching from each level



³¹P(p,γ) **1997Br07,1975Bo42,1972Co13**

Level Scheme (continued)

Intensities: % photon branching from each level



$^{31}\text{P}(\text{p},\gamma)$ **1997Br07,1975Bo42,1972Co13**

Level Scheme (continued)

Intensities: % photon branching from each level

