STRENGTHS OF GAMMA-RAY TRANSITIONS IN $A = 45-90$ NUCLEI

P. M. ENDT

Fysisch Laboratorium, Rijksuniversiteit Utrecht
Princetonplein 5, 3508 TA Utrecht, The Netherlands

The present tables list the strengths (in Weisskopf units) of over 1200 gamma-ray transitions in $A = 45-90$ nuclei, classified according to character (electric or magnetic, multipolarity). It appears that $E1$, $M1$, and $M2$ transitions are weaker here than in the $A = 6-44$ region, whereas $E2$ transitions are slightly stronger. The following recommended upper limits for the $A = 45-90$ region can be deduced from the data: 0.01, 300, 100, and 100 W.u. for $E1$, $E2$, $E3$, and $E4$ and 3, 1, 10, and 30 W.u. for $M1$, $M2$, $M3$, and $M4$, respectively.

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INTRODUCTION

Scope

Gamma-ray strengths in the $A = 6-44$ region have been discussed extensively, the most recent review appearing in 1979.¹ The input data for this last paper (excitation energies, J^π values, branching and mixing ratios) could be taken predominantly from relatively recent A -chain reviews (the oldest dating from 1975) by Ajzenberg-Selove² and Endt and Van der Leun.³ An additional 30 papers supplied input information not yet quoted in the A -chain reviews. The main purpose of the γ -ray-strength reviews has been to arrive at recommended upper limits (RUL) for transitions of different characters (E or M , multipolarity, T -forbiddenness). These upper limits are an indispensable tool in nuclear spectroscopy for the exclusion of "impossible" J^π values.

In the present paper the discussion of γ -ray strengths has been extended to somewhat heavier nuclei, that is, the $A = 45\text{--}90$ region, which more or less covers the $1f_{7/2}$ shell. The A -chain reviews covering this region (Nuclear Data Sheets; hereafter to be quoted as NDS) are on the average not quite so recent (ranging from 1971 to 1979), which considerably

increased the amount of work involved in collecting the additional input data, not yet quoted in the A-chain reviews.

As to the γ -ray strengths, there are three notable differences between the $A = 6-44$ and $A = 45-90$ regions. First, isospin is of no importance in the latter. Most transitions listed here are of the normal T -allowed nonretarded type since they occur in nuclei with neutron excesses. In addition some nonretarded $E2$ transitions in even-even self-conjugate nuclei have been observed. The few transitions with known strengths from analog states are also of normal non-retarded type.

Second, almost all transitions listed occur between bound states. The number of transitions with known strengths from neutron resonances is quite small (about 10), but the main difference is that (p, γ) resonances have dropped out as a source of γ -ray strengths. At low proton energies where resonances can be resolved the proton width is too small to be measured by means of the (p, p_0) reaction; at higher energies the resonances are no longer resolved.

Third, the importance of internal conversion increases considerably with A . Of the about 1200

transitions listed 7% have conversion coefficients exceeding 0.10. In such cases, to calculate the strength of a given γ -transition from lifetime, branching, and conversion coefficient, one has to know the *total* branchings instead of just the *photon* branchings usually measured and given in the *A*-chain reviews. It proved a time-consuming task to convert the photon into total branchings, the more so because in some source papers it is not clear which of the two is reported.

Input Data

The criteria for the selection of transitions were the same as those used in Ref. 1. They are repeated below.

1. Transitions are included only if the error in the strength does not exceed 50%. The strength error is compounded quadratically from the errors in the input data. In some cases there is a strength error smaller than the error compounded from the listed input data. This may occur, for example, if the strength has been derived directly from an accurate $B(E2\uparrow)$ value which has also been used, with the aid of the measured ground-state branching and mixing ratios, to compute the lifetime.

2. Transitions are listed only when the character (*E* or *M*, multipolarity) has been determined unambiguously. This does not necessarily mean that, in addition, the J^π values of the initial and final states have to be known unambiguously; the character may have been determined, for example, from the measured conversion coefficient.

A summary of the bases for unambiguous J^π assignments is given in the introduction of each issue of NDS. Some additional rules are given in the introduction of Ref. 3. An unpleasant surprise to the present compiler was the large number of experimental papers on *fp*-shell nuclei in which J^π determinations are based on weak arguments. Most of the high-spin work with $(\alpha, xn\gamma)$ or $(HI, xn\gamma)$ reactions is of this type, but luckily there are also a few sound exceptions. In view of the large number of source papers in addition to the NDS, it proved impractical to discuss in detail (for example, in notes to the tables) why many published J^π values were not accepted.

3. Transitions which in principle can be mixed are generally listed only if the mixing ratio δ has been measured. Transitions with unknown δ are included, however, if it can be shown (by computing Γ_γ corresponding to the RUL for the admixture) that the admixture contributes less than 50% to the total Γ_γ . Such cases are indicated as $\delta = [0]$; they constitute well over 25% of the number listed.

It has been remarked already that the NDS forms the backbone for the retrieval of input data. It should also be said, however, that the format and presentation of the NDS are not particularly suited for the extraction of γ -ray information. For a given nucleus, data on branching and mixing ratios obtained from different reactions may be found in many tables and figures, often many pages apart. Gamma-ray intensities in different tables may be normalized in different ways. For most *A*-chains the calculation of "best" branchings and mixings is left to the reader.

Conversion coefficients have been calculated for $A < 30$ and $A \geq 30$ by means of the tables in Refs. 4 and 5, respectively.

The γ -ray strengths listed in Tables II through VIII are expressed in Weisskopf units,⁶ based on a nuclear-radius constant $r_0 = 1.20$ fm. The Weisskopf estimates Γ_w (in eV) are given below as a function of E_γ (in MeV) and *A*:

$$\Gamma_w(E1) = 6.8 \times 10^{-2} A^{2/3} E_\gamma^3,$$

$$\Gamma_w(E2) = 4.9 \times 10^{-8} A^{4/3} E_\gamma^5,$$

$$\Gamma_w(E3) = 2.3 \times 10^{-14} A^2 E_\gamma^7,$$

$$\Gamma_w(E4) = 6.8 \times 10^{-21} A^{8/3} E_\gamma^9,$$

$$\Gamma_w(E5) = 1.6 \times 10^{-27} A^{10/3} E_\gamma^{11},$$

$$\Gamma_w(M1) = 2.1 \times 10^{-2} E_\gamma^3,$$

$$\Gamma_w(M2) = 1.5 \times 10^{-8} A^{2/3} E_\gamma^5,$$

$$\Gamma_w(M3) = 6.8 \times 10^{-15} A^{4/3} E_\gamma^7,$$

$$\Gamma_w(M4) = 2.1 \times 10^{-21} A^2 E_\gamma^9.$$

The strengths of *E0* transitions (Table I) are expressed in Wilkinson units (Wi.u.). The definition of this unit and the derivation of the *E0* strength from the probability for $e^+ + e^-$ pair formation are indicated in Refs. 7 and 8, respectively.

In Fig. 1 the strength distributions for the most common transitions (*M1*, *E1*, and *E2*) are compared for the $A = 6-20$, 21-44, and 45-90 regions.

Strong Transitions and Recommended Upper Limits

In the present section the strongest transitions of each character are discussed. They determine the corresponding RUL value to a large extent.

For a discussion of a possible dependence of the strengths on *A*, the average strength is not a very good measure (as argued in Ref. 1). Instead we take (as in Ref. 1) the (logarithmic) average of the strongest transitions, defined as the strongest 10% of the group of transitions of given character.

Fig. 1. Strength histograms of $M1$, $E1$, and $E2$ γ -ray transitions for the $A = 6-20$, $21-44$, and $45-90$ regions. The logarithmic abscissa scale indicates the strength in Weisskopf units. For $E2$, the curves for the lower and middle A -regions differ so little that they could be replaced by a single histogram. The figure clearly shows a large decrease in strength with A for $E1$, a small decrease for $M1$, and a small increase for $E2$.

For the $A = 6-44$ region it has been shown¹ that the dependence of γ -ray strength on E_{xi} , if any, is very small. For the $A = 45-90$ region an investigation of possible E_{xi} dependence would be impractical, because the tabulated transitions originate mainly from the decay of low-lying bound states.

The RUL's for $A = 45-90$ discussed below are listed in Table IX, compared to those for $A = 6-20$ and $21-45$.

$E1$. In Ref. 1 it was shown (by comparing the $A = 6-20$ and $21-44$ regions) that $E1$ strengths show a marked decrease with A . It is clear from Fig. 1 that this trend continues up to $A = 90$. In fact $\langle S \rangle_{av}$, the average of the strongest 10%, amounts to 130, 9, and 0.9 mW.u. for the $A = 6-20$, $21-44$, and $45-90$ regions, respectively.

Of the 127 transitions there are only 2, of 1.1 ± 0.3 and 3.6 ± 1.2 mW.u., exceeding 1 mW.u. in strength. A RUL of 10 mW.u. is proposed, to be compared with values of 100 and 300 mW.u. for the $A = 21-44$ and $6-20$ regions, respectively.

$E2$. Whereas there is very little difference in $E2$ strength between the $A = 6-20$ and $21-44$ regions¹ (they are represented by a single histogram in Fig. 1),

one can note a small but definite increase for $A = 45-90$. The $\langle S \rangle_{av}$ (strongest 10%) increases from 25 W.u. for $A = 6-44$ to 55 W.u. Among the 515 $E2$ transitions listed there are 2 (with 160 ± 30 and 140 ± 20 W.u.) exceeding the RUL of 100 W.u. for $A = 6-44$. For $A = 45-90$ the RUL is set at 300 W.u.

The increase in $E2$ strength occurs in the upper half of the $A = 45-90$ region. There are only 21 transitions (out of 375) exceeding 32 W.u. in the $A = 45-67$ region, whereas there are 41 (out of 140) for $A = 68-90$.

The strongest transition (of 160 ± 30 W.u. in ^{72}Se) is of $0_2^+ \rightarrow 2_1^+$ type. Several such transitions in neighboring nuclei are also quite strong, for example, 53 ± 7 W.u. in ^{70}Ge , 77 ± 5 W.u. in ^{74}Se , 47 ± 18 W.u. in ^{76}Se . The large strengths are understandable, compared to $2^+ \rightarrow 0^+$ transitions, because the former are favored by the statistical factor $(2J_f + 1)/(2J_i + 1) = 5$. The very weakest of all $E2$ transitions in the $A = 6-90$ region, however (320 ± 20 μ W.u. in ^{58}Ni), is also of $0_2^+ \rightarrow 2_1^+$ type! The extreme weakness of this transition is largely explained by a simple shell model calculation⁹ with two valence neutrons in $2p_{3/2}$, $1f_{5/2}$, or $2p_{1/2}$ orbits.

Fig. 2. The number, as a function of A , of γ -ray transitions with known strength listed in Ref. 1 and the present tables.

Conclusions

About 1200 transitions are listed in the present tables covering the $A = 45-90$ region. This is certainly not much as compared to the 2400 transitions listed for the slightly narrower $A = 6-44$ region in Ref. 1. This comparison is illustrated in more detail in Fig. 2, in which the number of transitions listed in Ref. 1 and the present tables is plotted as a function of A . Because of the broadening of the valley of stable nuclides the number of nuclei for each A -value easily accessible for experiment certainly increases with A . On the other hand, as mentioned above, the contribution of (p, γ) resonance decay drops out above $A \approx 40$, but this explains only part of the difference. One should conclude that less experimental effort has been expended on the heavier nuclei. This applies in particular to $A = 70-90$ nuclei on which, apparently, nuclear spectroscopy has hardly begun. The very high point at $A = 31$ is explained by an unusually large contribution from $^{30}\text{Si}(p, \gamma)^{31}\text{P}$ resonance decay.

The present survey shows that $E1$ strengths drop sharply with A , with slower decreases for $M1$ and $M2$, and a small increase for $E2$. All this is explained by a decreasing single-particle character and an increasing collectivity of the states concerned.

References for Introduction

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$E3, E4$. The strengths of $E3$ and $E4$ transitions do not seem very different from those in the $A = 6-44$ region. There are 5 $E3$ transitions (out of 45) with strengths between 20 and 25 W.u. and the strongest $E4$ transition has 5.5 ± 1.1 W.u. (17 cases). In view of the poor statistics, however, it seems unjustified to set the RUL's for $E3$ and $E4$ at values lower than the value for $A = 6-44$ (100 W.u.).

$E0, E5$. The statistics are too meager to permit any conclusions as to A -dependence or RUL.

$M1$. The decrease of $M1$ strength with A noted in Ref. 1 seems to continue to higher A -values, although in a less pronounced way (see Fig. 1). The $\langle S \rangle_{av}$ values (strongest 10%) for $A = 6-20$, 21-44, and 45-90 are 3.5, 0.7, and 0.5 W.u., respectively.

There are 5 $A = 45-90$ $M1$ transitions in the range 1-3 W.u. (with the strongest, in ^{56}Fe , of 2.5 ± 0.4 W.u.). Consequently the RUL may be decreased from 10 W.u. for $A = 6-44$ to 3 W.u. for $A = 45-90$.

$M2$. The $M2$ strengths also decrease with A . Here we compare the average strengths of the strongest 50% to improve statistics. The values are $\langle S \rangle_{av} = 1.0, 0.5$, and 0.09 W.u. for $A = 6-20$, 21-44, and 45-90, respectively. The $A = 45-90$ RUL can be put at 1 W.u., to be compared to 3 W.u. for $A = 6-44$.

$M3$. There does not seem to be a good reason to change the RUL from that for $A = 6-44$ (10 W.u.). The strongest transition (out of 7) has 4.2 ± 0.1 W.u.

$M4$. Of the 8 transitions listed there are 4 of $\frac{1}{2}^- \rightarrow \frac{1}{2}^+$ and 3 of $\frac{1}{2}^+ \rightarrow \frac{1}{2}^-$ type. The strength averages of these $2p_{1/2} \rightarrow 1g_{9/2}$ groups differ by a factor 4.8, almost exactly equal to the statistical factor $(2J_f + 1)/(2J_i + 1) = 5$. The RUL may be put at 30 W.u.

EXPLANATION OF TABLES

The excitation energies of the initial and final states have been rounded off to 1 or 10 keV for E_x below or above 100 keV, respectively. For the calculation of the Weisskopf estimates for some low-energy transitions, however, it was necessary to use the full energy information available so as not to introduce unnecessary rounding-off errors.

The adopted mean lives generally are weighted averages of all measured values. To the errors of some published lifetimes derived from Doppler shift attenuation (DSA) measurements a 15% systematic error has been added quadratically. If the adopted lifetime results from DSA measurements only, an error of at least 10% was adopted (even if the error in the weighted average was smaller).

EL, ML	Electric (magnetic) transition of multipolarity L
E_{xi}, E_{xf}	Excitation energy of initial (final) state
J_i^π, J_f^π	Spin and parity of initial (final) state
$(\frac{1}{2}-\frac{5}{2})^+$	The possible J^π values are $\frac{1}{2}^+, \frac{3}{2}^+, \frac{5}{2}^+$
$(\frac{1}{2}-\frac{5}{2}^+)$	The possible J^π values are $\frac{1}{2}^\pm, \frac{3}{2}^\pm, \frac{5}{2}^+$
τ_m	Mean life
Γ_γ	Gamma-ray width
Γ_π	Width for $e^+ + e^-$ pair decay
Total branching (%)	Branching with conversion included. If the photon branching for the k th branch from a given level is denoted by b_k (normalized to $\sum_k b_k = 100$), the total branching for this branch amounts to $c_k = 100b_k(1 + \alpha_k)/\sum_l b_l(1 + \alpha_l)$, where α_k is the total conversion coefficient of branch k ; the photon width of branch k is then found as

$$\Gamma_{\gamma k} = 0.01\tau_m c_k \hbar^{-1} (1 + \alpha_k)^{-1}.$$

For a mixed branch with mixing ratio δ_k the photon widths of components 1 and 2 are given by

$$\Gamma_{\gamma k_1} = 0.01\tau_m c_k \hbar^{-1} (1 + \delta_k^2)^{-1} (1 + \alpha_k)^{-1},$$

$$\Gamma_{\gamma k_2} = \delta_k^2 \Gamma_{\gamma k_1},$$

respectively, with

$$\alpha_k = (\alpha_{k_1} + \delta_k^2 \alpha_{k_2}) (1 + \delta_k^2)^{-1},$$

where α_{k_1} and α_{k_2} are the conversion coefficients of the two components

δ	Mixing ratio
$\delta = 0$	The transition has to be unmixed because of the angular momentum addition rule (as for $J \rightarrow 0$ or $\frac{1}{2} \rightarrow \frac{1}{2}$ transitions)
$\delta \approx 0$	The (measured) value of δ is so small that the strength of the higher- L admixture can be neglected in the calculation of the strength of the lower- L main component
$\delta = [0]$	The transition (with δ not measured) can be assumed to be unmixed; even if the strength of the higher- L admixture were up to its RUL value, the corresponding decrease in strength of the lower- L main component would be below 50%.

α_{tot}	Total conversion coefficient ($\alpha_K + \alpha_L + \dots$); for a mixed transition the (measurable) quantity $\alpha = (\alpha_1 + \alpha_2 \delta^2) \times (1 + \delta^2)^{-1}$, where α_1 and α_2 are the conversion coefficients of the two components, is listed
$\Gamma_{\text{w}}(\text{EL}),$ $\Gamma_{\text{w}}(\text{ML})$	Weisskopf estimates for EL, ML transitions as given under Input Data
$\Gamma_{\text{wi}}(\text{E0})$	Wilkinson estimate for E0 transitions as given in Ref. 6.
S	Strength of a transition in Weisskopf units ($S = \Gamma_{\gamma}/\Gamma_{\text{w}}$) or (for E0 transitions) in Wilkinson units ($S = \Gamma_{\pi}/\Gamma_{\text{wi}}$)
$R = r_0 A^{1/3}$	Nuclear radius ($r_0 = 1.20 \text{ fm}$)
μ_{N}	Nuclear magneton
$B(\text{EL}\downarrow) = \left\{ 4\pi \left(\frac{L+3}{3} \right)^2 \right\}^{-1} e^2 R^{2L} \Gamma_{\gamma}/\Gamma_{\text{w}} (e^2 fm^{2L});$	
$B(\text{EL}\uparrow) = \frac{(2J+1)}{(2J_0+1)} B(\text{EL}\downarrow),$	
where J and J_0 are the spins of the excited state and the ground state, respectively. This definition and the following one for $B(\text{ML}\downarrow)$ were inadvertently listed without the curly brackets in Ref. 1	
$B(\text{ML}\downarrow) = \left\{ \frac{\pi}{10} \left(\frac{L+3}{3} \right)^2 \right\}^{-1} \mu_{\text{N}}^2 R^{2L-2} \Gamma_{\gamma}/\Gamma_{\text{w}} (\mu_{\text{N}}^2 fm^{2L-2});$	
$B(\text{ML}\uparrow) = \frac{(2J+1)}{(2J_0+1)} B(\text{ML}\downarrow)$	
RUL	Recommended upper limit of γ -ray strength in Weisskopf units

TABLE I. Strengths of $E0$ Transitions between 0^+ States
See page 552 for Explanation of Tables

Nucleus	$E_{xi} \rightarrow E_{xf}$ (MeV)	τ_m	Total branching (%)	$\Gamma_\pi + ce$ (eV)	I_{conv}/I_π	S (W.U.)
^{48}Ca	4.28 ± 0	321 ± 16 ps	22.5 ± 0.8	$(4.6 \pm 0.3) (-7)$		$(3.5 \pm 0.2) (-2)$
^{70}Ge	1.22 ± 0	4.6 ± 0.6 ns	1.4	$(2.0 \pm 0.3) (-8)$	30	$(3.6 \pm 1.8) (-2)$
^{72}Ge	0.69 ± 0	603 ± 9 ns	100	$(1.1 \pm 0.1) (-9)$	∞	$(3.2 \pm 0.1) (-2)$
^{72}Se	0.86 ± 0	27 ± 2 ns	27 ± 12	$(7 \pm 3) (-8)$	∞	$(1.6 \pm 0.7) (-1)$
^{90}Zr	1.76 ± 0	89 ± 4 ns	100	$(7.4 \pm 0.4) (-8)$	2.4	$(2.4 \pm 0.1) (-2)$

TABLE II. Strengths of $E1$ Transitions
See page 552 for Explanation of Tables

Nucleus	$E_{xi} \rightarrow E_{xf}$ (MeV)	$J_i^\pi \rightarrow J_f^\pi$	τ_m or τ_γ	Total branching (%)	δ	α_{tot}	S (W.u.)	Remarks
^{45}Sc	0.38 $\rightarrow$ 0.012	$3/2^- \rightarrow 3/2^+$	61 ± 5 ps	91.7 ± 0.3	≈ 0		$(2.3 \pm 0.2)(-4)$	
	0.54 $\rightarrow$ 0	$5/2^+ \rightarrow 7/2^-$	8.1 ± 2.3 ps	41.3 ± 0.5	≈ 0		$(2.6 \pm 0.7)(-4)$	
	0.72 $\rightarrow$ 0.012	$5/2^- \rightarrow 3/2^+$	320 ± 25 fs	3.5 ± 0.5	[0]		$(2.3 \pm 0.3)(-4)$	
	0.94 $\rightarrow$ 0.38	$1/2^+ \rightarrow 3/2^-$	10.5 ± 0.7 ps	17.3 ± 0.6	[0]		$(7.1 \pm 0.6)(-5)$	
	0.97 $\rightarrow$ 0	$7/2^+ \rightarrow 7/2^-$	2.7 ± 0.3 ps	58.3 ± 0.3	≈ 0		$(1.8 \pm 0.2)(-4)$	
	1.43 $\rightarrow$ 0	$9/2^+ \rightarrow 7/2^-$	7.6 ± 0.3 ps	11.9 ± 1.3	≈ 0		$(4.1 \pm 0.5)(-6)$	
	1.80 $\rightarrow$ 0	$5/2^+ \rightarrow 7/2^-$	150 ± 50 fs	12.0 ± 1.2	[0]		$(1.1 \pm 0.4)(-4)$	
^{45}Ti	0.33 $\rightarrow$ 0.037	$3/2^+ \rightarrow 3/2^-$	1.59 ± 0.02 ns	100	≈ 0		$(2.0 \pm 0.1)(-5)$	
	0.74 $\rightarrow$ 0.037	$5/2^+ \rightarrow 3/2^-$	15.1 ± 2.5 ps	8 ± 1	≈ 0		$(1.2 \pm 0.3)(-5)$	
	1.23 $\rightarrow$ 0	$7/2^+ \rightarrow 7/2^-$	4.0 ± 0.9 ps	5.1 ± 1.0	[0]		$(5.2 \pm 1.6)(-6)$	
	$\rightarrow$ 0.040	$\rightarrow 5/2^-$		5.7 ± 1.0	[0]		$(6.5 \pm 1.9)(-6)$	
^{46}Sc	1.12 $\rightarrow$ 0.28	$4^- \rightarrow 5^+$	1.6 ± 0.3 ps	13	[0]		$(1.0 \pm 0.2)(-4)$	
	$\rightarrow$ 0.77	$\rightarrow (5)^+$		1.9	[0]		$(2.1 \pm 0.4)(-4)$	
^{46}Ti	3.06 $\rightarrow$ 2.01	$3^- \rightarrow 4^+$	10 ± 3 ps	100	≈ 0		$(7 \pm 2)(-5)$	
	3.17 $\rightarrow$ 0	$1^- \rightarrow 0^+$	34 ± 10 fs	41 ± 5	0		$(2.9 \pm 0.9)(-4)$	
	$\rightarrow$ 0.89	$\rightarrow 2^+$		59 ± 5	[0]		$(1.1 \pm 0.3)(-3)$	
^{47}Sc	1.30 $\rightarrow$ 0.77	$5/2^- \rightarrow 3/2^+$	90 ± 35 fs	0.18 ± 0.05	[0]		$(1.0 \pm 0.4)(-4)$	
	1.40 $\rightarrow$ 0	$5/2^+ \rightarrow 7/2^-$	1.4 ± 0.4 ps	69 ± 3	≈ 0		$(1.3 \pm 0.4)(-4)$	
	$\rightarrow$ 0.81	$\rightarrow 3/2^-$		8 ± 2	[0]		$(2.1 \pm 0.8)(-4)$	
	2.00 $\rightarrow$ 0.81	$3/2^+ \rightarrow 3/2^-$	580 ± 120 fs	57 ± 13	≈ 0		$(4.4 \pm 1.4)(-4)$	
	$\rightarrow$ 1.30	$\rightarrow 5/2^-$		28 ± 8	[0]		$(1.0 \pm 0.4)(-3)$	
^{47}Ti	2.26 $\rightarrow$ 0	$5/2^+ \rightarrow 5/2^-$	1.1 ± 0.4 ps	85	[0]		$(5.0 \pm 1.8)(-5)$	
	$\rightarrow$ 0.16	$\rightarrow 7/2^-$		15	[0]		$(1.1 \pm 0.4)(-5)$	
^{47}V	0.26 $\rightarrow$ 0	$3/2^+ \rightarrow 3/2^-$	84 ± 9 ps	87 ± 1	[0]		$(4.4 \pm 0.5)(-4)$	
	$\rightarrow$ 0.088	$\rightarrow 5/2^-$		13 ± 1	[0]		$(2.3 \pm 0.3)(-4)$	
^{48}Ca	4.51 $\rightarrow$ 3.83	$3^- \rightarrow 2^+$	13 ± 2 ps	73 ± 2	[0]		$(1.3 \pm 0.3)(-4)$	
^{48}V	0.52 $\rightarrow$ 0.31	$1^- \rightarrow 2^+$	3.91 ± 0.09 ns	67 ± 4	≈ 0		$(1.4 \pm 0.1)(-5)$	
	$\rightarrow$ 0.42	$\rightarrow 1^+$		33 ± 4	≈ 0		$(6.1 \pm 0.7)(-5)$	
	1.10 $\rightarrow$ 0	$4^- \rightarrow 4^+$	6.5 ± 0.3 ps	100	≈ 0		$(8.4 \pm 0.4)(-5)$	
^{49}V	0.75 $\rightarrow$ 0.091	$3/2^+ \rightarrow 5/2^-$	7.6 ± 0.9 ps	44.6 ± 0.6	≈ 0		$(1.5 \pm 0.2)(-4)$	
	$\rightarrow$ 0.15	$\rightarrow 3/2^-$		55.4 ± 0.6	≈ 0		$(2.4 \pm 0.3)(-4)$	
	1.14 $\rightarrow$ 0	$5/2^+ \rightarrow 7/2^-$	1.9 ± 0.7 ps	51.8 ± 1.3	≈ 0		$(1.2 \pm 0.4)(-4)$	
	$\rightarrow$ 0.091	$\rightarrow 5/2^-$		26.4 ± 0.9	≈ 0		$(8 \pm 3)(-5)$	
	$\rightarrow$ 0.15	$\rightarrow 3/2^-$		16.6 ± 1.5	≈ 0		$(6 \pm 2)(-5)$	
	1.60 $\rightarrow$ 0	$7/2^+ \rightarrow 7/2^-$	680 ± 250 fs	25.3 ± 0.6	[0]		$(6 \pm 2)(-5)$	
	$\rightarrow$ 0.091	$\rightarrow 5/2^-$		58.9 ± 1.3	[0]		$(1.8 \pm 0.7)(-4)$	
	1.65 $\rightarrow$ 0.15	$1/2^+ \rightarrow 3/2^-$	3.2 ± 1.1 ps	69 ± 2	[0]		$(4.6 \pm 1.6)(-5)$	
	1.99 $\rightarrow$ 0.091	$3/2^+ \rightarrow 5/2^-$	190 ± 65 fs	24 ± 1	[0]		$(1.3 \pm 0.4)(-4)$	
	$\rightarrow$ 0.15	$\rightarrow 3/2^-$		39 ± 2	≈ 0		$(2.4 \pm 0.8)(-4)$	
	2.39 $\rightarrow$ 0	$5/2^+ \rightarrow 7/2^-$	82 ± 26 fs	7 ± 1	[0]		$(4.5 \pm 1.4)(-5)$	
	$\rightarrow$ 0.091	$\rightarrow 5/2^-$		17 ± 1	[0]		$(1.2 \pm 0.4)(-4)$	
	2.81 $\rightarrow$ 0	$5/2^+ \rightarrow 7/2^-$	455 ± 75 fs	65 ± 11	[0]		$(4.7 \pm 1.1)(-5)$	
^{51}V	2.68 $\rightarrow$ 0.93	$3/2^+ \rightarrow 3/2^-$	900 ± 200 fs	100	≈ 0		$(1.5 \pm 0.3)(-4)$	
^{51}Cr	2.76 $\rightarrow$ 0.75	$1/2^+ \rightarrow 3/2^-$	110 ± 20 fs	100	[0]		$(7.2 \pm 1.4)(-4)$	
	3.00 $\rightarrow$ 0.75	$3/2^+ \rightarrow 3/2^-$	475 ± 60 fs	45 ± 3	[0]		$(5.9 \pm 0.8)(-5)$	
	$\rightarrow$ 2.00	$\rightarrow 5/2^-$		55 ± 3	≈ 0		$(8.2 \pm 1.0)(-4)$	
^{52}Cr	4.56 $\rightarrow$ 3.77	$3^- \rightarrow 2^+$	390 ± 130 fs	≈ 100	[0]		$(3.6 \pm 1.2)(-3)$	
^{53}Mn	2.71 $\rightarrow$ 1.29	$1/2^+ \rightarrow 3/2^-$	1.15 ± 0.35 ps	100	[0]		$(2.1 \pm 0.6)(-4)$	
^{53}Fe	2.97 $\rightarrow$ 0.74	$1/2^+ \rightarrow 3/2^-$	112 ± 23 fs	100	[0]		$(5.3 \pm 1.1)(-4)$	
^{54}Fe	4.78 $\rightarrow$ 1.41	$3^- \rightarrow 2^+$	48 ± 16 fs	54 ± 7	≈ 0		$(2.0 \pm 0.7)(-4)$	
	$\rightarrow$ 2.54	$\rightarrow 4^+$		17 ± 4	[0]		$(1.9 \pm 0.8)(-4)$	
	$\rightarrow$ 3.30	$\rightarrow 4^+$		18 ± 4	[0]		$(8 \pm 3)(-4)$	
^{59}Fe	1.52 $\rightarrow$ 1.02	$9/2^+ \rightarrow 7/2^-$	210 ± 40 ps	100	[0]		$(2.4 \pm 0.5)(-5)$	
^{59}Cu	3.04 $\rightarrow$ 1.40	$9/2^+ \rightarrow 7/2^-$	1.15 ± 0.50 ps	74 ± 2	[0]		$(9 \pm 4)(-5)$	
^{62}Ni	3.76 $\rightarrow$ 1.77	$3^- \rightarrow 2^+$	235 ± 45 fs	55 ± 11	[0]		$(8 \pm 2)(-5)$	

TABLE II. Strengths of $E1$ Transitions

See page 552 for Explanation of Tables

Nucleus	$E_{x1} \rightarrow E_{xf}$ (MeV)	$J_i^\pi \rightarrow J_f^\pi$	τ_m or τ_γ	Total branching (%)	δ	α_{tot}	S (W.u.)	Remarks
^{62}Ni	3.76 $\rightarrow$ 2.30	$3^- \rightarrow 2^+$	235 ± 45 fs	45 ± 11	[0]		$(3.9 \pm 1.2)(-4)$	
	7.65 $\rightarrow$ 0	$1^- \rightarrow 0^+$	1.37 ± 0.14 fs	63	0		$(6.3 \pm 0.6)(-4)$	
	+ 1.17	$\rightarrow 2^+$		4.1	[0]		$(6.8 \pm 0.7)(-5)$	
	+ 2.05	$\rightarrow 0^+$		16.4	0		$(4.2 \pm 0.2)(-4)$	
	+ 3.16	$\rightarrow 2^+$		1.7	[0]		$(8.4 \pm 0.8)(-5)$	
	+ 3.27	$\rightarrow (1,2)^+$		2.2	[0]		$(1.2 \pm 0.1)(-4)$	
	+ 3.37	$\rightarrow (1,2)^+$		2.1	[0]		$(1.2 \pm 0.1)(-4)$	
	+ 3.52	$\rightarrow 2^+$		1.5	[0]		$(9.6 \pm 1.0)(-5)$	
	+ 3.85	$\rightarrow 2^+$		0.4	[0]		$(3.3 \pm 0.8)(-5)$	
	+ 3.86	$\rightarrow (1,2)^+$		2.1	[0]		$(1.7 \pm 0.2)(-4)$	
	+ 3.97	$\rightarrow 2^+$		3.1	[0]		$(2.9 \pm 0.3)(-4)$	
	+ 4.06	$\rightarrow (1,2)^+$		2.1	[0]		$(2.0 \pm 0.2)(-4)$	
	+ 4.23	$\rightarrow 0^+$		1.2	0		$(1.4 \pm 0.2)(-4)$	
^{62}Cu	2.29 $\rightarrow$ 1.37	$6^- \rightarrow 5^+$	23.3 ± 1.9 ps	98.8	≈ 0		$(3.4 \pm 0.3)(-5)$	
^{63}Zn	1.70 $\rightarrow$ 1.07	$9/2^+ \rightarrow 7/2^-$	46 ± 6 ps	85 ± 1	[0]		$(4.5 \pm 0.6)(-5)$	
	+ 1.21	$\rightarrow 7/2^-$		15 ± 1	≈ 0		$(1.7 \pm 0.2)(-5)$	
^{64}Cu	7.917 $\rightarrow$ 0.16	$2^- \rightarrow 2^+$	520 ± 40 meV	16.9 ± 0.6	[0]		$(1.7 \pm 0.2)(-4)$	$E_n = 0.58$ keV
	+ 0.28	$\rightarrow 2^+$		6.3 ± 0.5	[0]		$(6.8 \pm 0.6)(-5)$	
	+ 0.61	$\rightarrow 2^+$		1.5 ± 0.4	[0]		$(1.8 \pm 0.5)(-5)$	
	7.918 $\rightarrow$ 0.28	$1^- \rightarrow 2^+$	570 ± 70 meV	3.2 ± 1.4	[0]		$(3.8 \pm 1.7)(-5)$	$E_n = 2.06$ keV
	+ 0.61	$\rightarrow 2^+$		4.1 ± 1.0	[0]		$(5.5 \pm 1.4)(-5)$	
	7.919 $\rightarrow$ 0	$2^- \rightarrow 1^+$	580 ± 50 meV	5.3 ± 1.0	[0]		$(5.7 \pm 1.1)(-5)$	$E_n = 2.66$ keV
	+ 0.34	$\rightarrow 1^+$		2.4 ± 0.7	[0]		$(2.9 \pm 0.9)(-5)$	
	+ 0.36	$\rightarrow 3^+$		5.2 ± 0.9	[0]		$(6.4 \pm 1.0)(-5)$	
	+ 0.61	$\rightarrow 2^+$		1.9 ± 0.9	[0]		$(2.6 \pm 1.2)(-5)$	
^{64}Zn	3.00 $\rightarrow$ 0.99	$3^- \rightarrow 2^+$	115 ± 30 fs	≈ 100	≈ 0		$(6.5 \pm 1.7)(-4)$	
^{65}Zn	1.07 $\rightarrow$ 0.86	$9/2^+ \rightarrow 7/2^-$	830 ± 40 ps	95 ± 1	≈ 0		$(8.3 \pm 0.4)(-5)$	
^{67}Zn	1.68 $\rightarrow$ 0.093	$1/2^+ \rightarrow 1/2^-$	210 ± 45 fs	43 ± 3	0		$(3.0 \pm 0.7)(-4)$	
	+ 0.39	$\rightarrow 3/2^-$		57 ± 3	[0]		$(7.4 \pm 1.6)(-4)$	
^{67}Ga	2.86 $\rightarrow$ 2.07	$11/2^- \rightarrow 9/2^+$	1.25 ± 0.30 ps	31.6 ± 1.4	≈ 0		$(3.0 \pm 0.7)(-4)$	
^{68}Zn	2.75 $\rightarrow$ 1.08	$3^- \rightarrow 2^+$	600 ± 200 fs	92.9 ± 0.5	[0]		$(1.9 \pm 0.6)(-4)$	
	+ 2.34	$\rightarrow 2^+$		7.1 ± 0.5	[0]		$(1.0 \pm 0.3)(-3)$	
^{69}Ge	0.86 $\rightarrow$ 0.40	$7/2^- \rightarrow 9/2^+$	3.1 ± 0.5 ps	1.3 ± 0.6	[0]		$(2.5 \pm 1.2)(-5)$	
	1.60 $\rightarrow$ 0	$5/2^+ \rightarrow 5/2^-$	750 ± 250 fs	26 ± 2	≈ 0		$(4.9 \pm 1.6)(-5)$	
	+ 0.37	$\rightarrow 3/2^-$		19 ± 2	≈ 0		$(8 \pm 3)(-5)$	
	3.75 $\rightarrow$ 2.76	$17/2^- \rightarrow 15/2^+$	9.4 ± 0.8 ps	59 ± 2	≈ 0		$(3.7 \pm 0.3)(-5)$	
^{71}Ga	1.49 $\rightarrow$ 1.11	$(7/2, 9/2)^+ \rightarrow 7/2^-$	220 ± 20 ps	99	[0]		$(4.4 \pm 0.4)(-5)$	
	+ 1.40	$\rightarrow (5/2, 7/2)^-$		0.067 ± 0.007	[0]		$(1.7 \pm 0.2)(-6)$	
^{72}Ge	2.51 $\rightarrow$ 0.83	$3^- \rightarrow 2^+$	35 ± 7 ps	8.5 ± 0.3	[0]		$(2.6 \pm 0.6)(-7)$	
	+ 1.46	$\rightarrow 2^+$		59.2 ± 0.7	$+0.31 \pm 0.05$		$(7.4 \pm 1.5)(-6)$	
	+ 1.73	$\rightarrow 4^+$		28.0 ± 0.7	[0]		$(9 \pm 2)(-6)$	
	+ 2.06	$\rightarrow 3^+$		1.3 ± 0.2	[0]		$(2.7 \pm 0.7)(-6)$	
	+ 2.40	$\rightarrow 2^+$		0.9 ± 0.4	[0]		$(1.0 \pm 0.5)(-4)$	
^{72}As	0.046 $\rightarrow$ 0	$1^+ \rightarrow 2^-$	16.4 ± 0.3 ns	100	[0]	0.70	$(2.1 \pm 0.1)(-4)$	
	0.21 $\rightarrow$ 0	$(1-3)^+ \rightarrow 2^-$	115 ± 3 ns	41 ± 5	≈ 0		$(2.1 \pm 0.2)(-7)$	
	0.31 $\rightarrow$ 0.21	$(0-4)^- \rightarrow (1-3)^+$	24 ± 4 ns	71	≈ 0	0.10	$(1.7 \pm 0.3)(-5)$	
^{75}As	0.40 $\rightarrow$ 0	$5/2^+ \rightarrow 3/2^-$	2.5 ± 0.1 ns	12.1 ± 0.6	[0]		$(4.1 \pm 0.2)(-7)$	
	+ 0.27	$\rightarrow 3/2^-$		62.8 ± 1.0	[0]	0.03	$(5.1 \pm 0.2)(-5)$	
	+ 0.28	$\rightarrow 5/2^-$		18.7 ± 0.7	[0]	0.05	$(2.2 \pm 0.1)(-5)$	
^{75}Se	0.29 $\rightarrow$ 0	$3/2^- \rightarrow 5/2^+$	1.9 ± 0.2 ns	100	≈ 0		$(1.2 \pm 0.2)(-5)$	
^{75}Br	0.13 $\rightarrow$ 0	$(1/2-5/2)^+ \rightarrow 3/2^-$	8.1 ± 0.6 ns	100	≈ 0	0.04	$(2.9 \pm 0.2)(-5)$	
^{76}As	0.046 $\rightarrow$ 0	$(1,2)^+ \rightarrow 2^-$	2.78 ± 0.09 μ s	100	[0]	0.78	$(1.1 \pm 0.1)(-6)$	
^{76}Se	2.43 $\rightarrow$ 1.22	$3^- \rightarrow 2^+$	16.5 ± 2.0 ps	86.5 ± 0.3	[0]		$(1.6 \pm 0.2)(-5)$	
	+ 2.03	$\rightarrow (2-4)^+$		1.2 ± 0.1	[0]		$(6.1 \pm 0.9)(-6)$	
	+ 2.13	$\rightarrow (2,3)^+$		0.45 ± 0.05	[0]		$(5.4 \pm 0.9)(-6)$	

TABLE II. Strengths of $E1$ Transitions
See page 552 for Explanation of Tables

Nucleus	$E_{xi} \rightarrow E_{xf}$ (MeV)	$J_i^\pi \rightarrow J_f^\pi$	τ_m or r_γ	Total branching (%)	δ	α_{tot}	S (W.U.)	Remarks
^{76}Br	0.25 $\rightarrow$ 0	$(0-2)^+ \rightarrow 1^-$	3.14 ± 0.13 ns	100	≈ 0		$(1.1 \pm 0.1)(-5)$	
	0.36 $\rightarrow$ 0	$1^+ \rightarrow 1^-$	580 ± 140 ps	46 ± 4	[0]		$(4.6 \pm 1.0)(-6)$	
	$\rightarrow 0.045$	$\rightarrow (0-2)^-$		35 ± 4	≈ 0		$(5.1 \pm 1.4)(-6)$	
^{77}As	0.63 $\rightarrow$ 0	$5/2^+ \rightarrow 3/2^-$	108 ± 22 ps	18 ± 2	≈ 0		$(3.6 \pm 0.8)(-6)$	
	$\rightarrow 0.22$	$\rightarrow 3/2^-$		50 ± 4	≈ 0		$(3.5 \pm 0.7)(-5)$	
^{77}Se	0.25 $\rightarrow$ 0.16	$5/2^- \rightarrow 7/2^+$	13.4 ± 0.6 ns	30.0 ± 1.1	≈ 0		$(1.8 \pm 0.1)(-5)$	
	0.44 $\rightarrow$ 0.16	$5/2^- \rightarrow 7/2^+$	33 ± 3 ps	1.4 ± 0.5	[0]		$(1.0 \pm 0.4)(-5)$	
^{77}Br	0.13 $\rightarrow$ 0	$5/2^+ \rightarrow 3/2^-$	13.4 ± 0.4 ns	≈ 100	≈ 0	0.04	$(1.7 \pm 0.1)(-5)$	
	0.28 $\rightarrow$ 0	$(3/2, 5/2)^+ \rightarrow 3/2^-$	130 ± 30 ps	8 ± 2	≈ 0		$(1.5 \pm 0.5)(-5)$	
^{77}Kr	0.067 $\rightarrow$ 0	$3/2^- \rightarrow 5/2^+$	170 ± 17 ns	100	[0]	0.29	$(8.1 \pm 0.8)(-6)$	
^{78}Kr	2.75 $\rightarrow$ 1.12	$5^- \rightarrow 4^+$	2.3 ± 0.3 ps	100	[0]		$(5.7 \pm 0.8)(-5)$	
	3.29 $\rightarrow$ 1.98	$7^- \rightarrow 6^+$	2.9 ± 0.3 ps	54 ± 3	[0]		$(4.4 \pm 0.5)(-5)$	
^{79}Br	0.76 $\rightarrow$ 0.21	$7/2^- \rightarrow 9/2^+$	1.7 ± 0.3 ps	3.6 ± 0.4	[0]		$(6.4 \pm 1.3)(-5)$	
^{80}Br	0.037 $\rightarrow$ 0	$2^- \rightarrow 1^+$	10.6 ± 1.3 ns	100	≈ 0	1.56	$(3.8 \pm 0.1)(-4)$	
^{88}Sr	2.73 $\rightarrow$ 1.84	$3^- \rightarrow 2^+$	1.18 ± 0.11 ps	99.31 ± 0.05	[0]		$(5.8 \pm 0.6)(-4)$	
^{89}Y	2.22 $\rightarrow$ 1.51	$5/2^+ \rightarrow 3/2^-$	500 ± 200 fs	30	[0]		$(8 \pm 3)(-4)$	
^{89}Zr	1.63 $\rightarrow$ 1.10	$5/2^+ \rightarrow 3/2^-$	580 ± 90 fs	13 ± 2	[0]		$(7.3 \pm 1.6)(-4)$	
^{90}Zr	2.75 $\rightarrow$ 2.19	$3^- \rightarrow 2^+$	8.3 ± 2.6 ps	93 ± 2	[0]		$(3.1 \pm 1.0)(-4)$	

TABLE III. Strengths of $E2$ Transitions
See page 552 for Explanation of Tables

Nucleus	$E_{x_i} \rightarrow E_{x_f}$ (MeV)	$J_i^\pi \rightarrow J_f^\pi$	τ_m or Γ_γ	Total branching (%)	δ	α_{tot}	S (W.u.)	Remarks
^{45}Sc	0.38 $\rightarrow$ 0	$3/2^- \rightarrow 7/2^-$	61 ± 5 ps	8.3 ± 0.3	≈ 0		$(1.5 \pm 0.2)(+1)$	
	0.54 $\rightarrow$ 0.012	$5/2^+ \rightarrow 3/2^+$	8.1 ± 2.3 ps	58.7 ± 0.5	$+0.70 \pm 0.15$		$(5 \pm 2)(+1)$	
	0.72 $\rightarrow$ 0	$5/2^- \rightarrow 7/2^-$		from B(E2)			$(8.9 \pm 0.7)(0)$	
	0.97 $\rightarrow$ 0.012	$7/2^+ \rightarrow 3/2^+$	2.7 ± 0.3 ps	31.3 ± 0.5	≈ 0		$(1.2 \pm 0.1)(+1)$	
	1.07 $\rightarrow$ 0	$3/2^- \rightarrow 7/2^-$		from B(E2)			$(8.4 \pm 0.8)(0)$	
	1.24 $\rightarrow$ 0	$11/2^- \rightarrow 7/2^-$	2.6 ± 0.3 ps	100	≈ 0		$(1.1 \pm 0.1)(+1)$	
	1.43 $\rightarrow$ 0.54	$9/2^+ \rightarrow 5/2^+$	7.6 ± 0.3 ps	69.9 ± 1.7	≈ 0		$(1.4 \pm 0.1)(+1)$	
	$\rightarrow$ 0.97	$\rightarrow 7/2^+$		18.2 ± 1.4	$+0.28 \pm 0.07$		$(7 \pm 3)(0)$	
	1.66 $\rightarrow$ 0	$9/2^- \rightarrow 7/2^-$	146 ± 13 fs	79 ± 3	-0.45 ± 0.04		$(5.9 \pm 1.0)(0)$	
	2.03 $\rightarrow$ 0.97	$11/2^+ \rightarrow 7/2^+$	1.6 ± 0.7 ps	83 ± 2	≈ 0		$(3.2 \pm 1.4)(+1)$	
^{45}Ti	2.56 $\rightarrow$ 1.43	$13/2^+ \rightarrow 9/2^+$	2.0 ± 0.7 ps	57 ± 6	≈ 0		$(1.2 \pm 0.4)(+1)$	
	0.037 $\rightarrow$ 0	$3/2^- \rightarrow 7/2^-$	4.5 ± 0.4 μ s	100	[0]	16	$(1.7 \pm 0.2)(+1)$	
	0.74 $\rightarrow$ 0.33	$5/2^+ \rightarrow 3/2^+$	15.1 ± 2.5 ps	92 ± 1	-0.40 ± 0.03		$(6.1 \pm 1.3)(+1)$	
	1.23 $\rightarrow$ 0.33	$7/2^+ \rightarrow 3/2^+$	4.0 ± 0.9 ps	52 ± 2	≈ 0		$(1.9 \pm 0.4)(+1)$	
	$\rightarrow$ 0.74	$\rightarrow 5/2^+$		37 ± 2	-0.28 ± 0.03		$(2.1 \pm 0.6)(+1)$	
	1.35 $\rightarrow$ 0	$9/2^- \rightarrow 7/2^-$	148 ± 15 fs	90 ± 2	$+0.46 \pm 0.08$		$(2.0 \pm 0.6)(+1)$	
	$\rightarrow$ 0.040	$\rightarrow 5/2^-$		10 ± 2	[0]		$(1.5 \pm 0.3)(+1)$	
	1.47 $\rightarrow$ 0	$11/2^- \rightarrow 7/2^-$	690 ± 90 fs	100	≈ 0		$(1.8 \pm 0.2)(+1)$	
	1.35 $\rightarrow$ 0	$2^+ \rightarrow 0^+$	5.2 ± 0.4 ps	100	0		$(3.4 \pm 0.3)(0)$	
^{46}Ca	1.12 $\rightarrow$ 0.29	$4^- \rightarrow 2^-$	1.6 ± 0.3 ps	13	[0]		$(1.7 \pm 0.3)(+1)$	
^{46}Sc	0.89 $\rightarrow$ 0	$2^+ \rightarrow 0^+$	8.2 ± 0.4 ps	100	0		$(1.8 \pm 0.1)(+1)$	
^{46}Ti	2.01 $\rightarrow$ 0.89	$4^+ \rightarrow 2^+$	2.6 ± 0.3 ps	100	[0]		$(1.8 \pm 0.2)(+1)$	
	2.61 $\rightarrow$ 0.89	$0^+ \rightarrow 2^+$	110 ± 30 fs	100	0		$(4.1 \pm 1.1)(+1)$	
	3.30 $\rightarrow$ 2.01	$6^+ \rightarrow 4^+$	1.6 ± 0.2 ps	100	[0]		$(1.4 \pm 0.2)(+1)$	
^{47}Sc	1.15 $\rightarrow$ 0	$11/2^- \rightarrow 7/2^-$	4.5 ± 1.6 ps	100	[0]		$(9 \pm 3)(0)$	
^{47}Ti	0.16 $\rightarrow$ 0	$7/2^- \rightarrow 5/2^-$	301 ± 9 ps	100	$+0.030 \pm 0.007$		$(2.3 \pm 1.1)(0)$	
	1.25 $\rightarrow$ 0.16	$9/2^- \rightarrow 7/2^-$	210 ± 20 fs	88 ± 6	$+0.29 \pm 0.03$		$(1.6 \pm 0.4)(+1)$	
	1.55 $\rightarrow$ 0	$3/2^- \rightarrow 5/2^-$	2.3 ± 0.7 ps	43 ± 5	-0.46 ± 0.09		$(2.9 \pm 1.3)(-1)$	
	$\rightarrow$ 0.16	$\rightarrow 7/2^-$		57 ± 5	[0]		$(3.8 \pm 1.2)(0)$	
^{47}V	1.27 $\rightarrow$ 0.09	$9/2^- \rightarrow 5/2^-$	430 ± 65 fs	18 ± 2	≈ 0		$(1.4 \pm 0.3)(+1)$	
	$\rightarrow$ 0.15	$\rightarrow 7/2^-$		82 ± 2	-0.43 ± 0.06		$(1.3 \pm 0.4)(+1)$	
	1.30 $\rightarrow$ 0.15	$11/2^- \rightarrow 7/2^-$	2.0 ± 0.9 ps	100	≈ 0		$(2.0 \pm 0.9)(+1)$	
^{48}Ca	3.83 $\rightarrow$ 0	$2^+ \rightarrow 0^+$	42 ± 5 fs	100	0		$(2.2 \pm 0.3)(0)$	
^{48}Ti	0.98 $\rightarrow$ 0	$2^+ \rightarrow 0^+$	6.4 ± 0.3 ps	100	0		$(1.3 \pm 0.1)(+1)$	
	2.30 $\rightarrow$ 0.98	$4^+ \rightarrow 2^+$	630 ± 80 fs	100	[0]		$(3.1 \pm 0.4)(+1)$	
	2.42 $\rightarrow$ 0	$2^+ \rightarrow 0^+$	38 ± 5 fs	5.0 ± 0.8	0		$(1.2 \pm 0.2)(0)$	
	3.33 $\rightarrow$ 2.30	$6^+ \rightarrow 4^+$	12.8 ± 1.2 ps	100	[0]		$(5.2 \pm 0.5)(0)$	
^{48}V	0.31 $\rightarrow$ 0	$2^+ \rightarrow 4^+$	10.23 ± 0.04 ns	100	[0]		$(2.6 \pm 0.1)(0)$	
	0.43 $\rightarrow$ 0	$5^+ \rightarrow 4^+$	8.80 ± 0.14 ps	100	$+0.13 \pm 0.03$		$(1.0 \pm 0.4)(+1)$	
	0.63 $\rightarrow$ 0	$6^+ \rightarrow 4^+$	111 ± 9 ps	55 ± 8	[0]		$(3.9 \pm 0.6)(0)$	
	$\rightarrow$ 0.43	$\rightarrow 5^+$		45 ± 8	$+0.14 \pm 0.02$		$(1.9 \pm 0.7)(+1)$	
^{48}Cr	1.06 $\rightarrow$ 0.52	$3^- \rightarrow 1^-$	6.6 ± 1.7 ps	8 ± 2	≈ 0		$(2.0 \pm 0.7)(+1)$	
	0.75 $\rightarrow$ 0	$2^+ \rightarrow 0^+$	10.6 ± 1.0 ps	100	0		$(3.3 \pm 0.3)(+1)$	
	1.86 $\rightarrow$ 0.75	$4^+ \rightarrow 2^+$	1.9 ± 0.5 ps	100	[0]		$(2.4 \pm 0.6)(+1)$	
^{49}Ti	1.38 $\rightarrow$ 0	$3/2^- \rightarrow 7/2^-$		from B(E2)			$(3.2 \pm 0.4)(0)$	
^{49}V	0.15 $\rightarrow$ 0	$3/2^- \rightarrow 7/2^-$	28.8 ± 0.3 ns	65.0 ± 0.3	[0]	0.08	$(1.9 \pm 0.1)(+1)$	
	1.02 $\rightarrow$ 0	$11/2^- \rightarrow 7/2^-$	4.8 ± 0.9 ps	100	≈ 0		$(1.4 \pm 0.3)(+1)$	
	1.16 $\rightarrow$ 0	$9/2^- \rightarrow 7/2^-$	1.6 ± 0.4 ps	74.7 ± 0.7	-0.70 ± 0.07		$(5.4 \pm 1.4)(0)$	
	$\rightarrow$ 0.091	$\rightarrow 5/2^-$		25.3 ± 0.7	≈ 0		$(8 \pm 2)(0)$	
	1.51 $\rightarrow$ 0.15	$5/2^- \rightarrow 3/2^-$	45 ± 19 fs	56.3 ± 0.8	$+0.57 \pm 0.05$		$(5 \pm 2)(+1)$	
	1.60 $\rightarrow$ 0.75	$7/2^+ \rightarrow 3/2^+$	680 ± 250 fs	8.0 ± 0.8	[0]		$(2.0 \pm 0.7)(+1)$	
	2.26 $\rightarrow$ 1.02	$15/2^- \rightarrow 11/2^-$	930 ± 410 fs	100	≈ 0		$(2.7 \pm 1.2)(+1)$	
	0.27 $\rightarrow$ 0	$7/2^- \rightarrow 5/2^-$	19 ± 4 ps	100	$+0.115 \pm 0.011$		$(3.5 \pm 1.0)(+1)$	
^{49}Cr	1.08 $\rightarrow$ 0	$9/2^- \rightarrow 5/2^-$	220 ± 40 fs	5.9 ± 1.0	[0]		$(1.4 \pm 0.3)(+1)$	
	$\rightarrow$ 0.27	$\rightarrow 7/2^-$		94.1 ± 1.0	$+0.21 \pm 0.03$		$(3.8 \pm 1.2)(+1)$	

TABLE III. Strengths of $E2$ Transitions
See page 552 for Explanation of Tables

Nucleus	$E_{xi} \rightarrow E_{xf}$ (MeV)	$J_i^\pi \rightarrow J_f^\pi$	τ_m or Γ_γ	Total branching (%)	δ	α_{tot}	S (W.u.)	Remarks
^{49}Cr	1.56 $\pm$ 0.27	11/2 ⁻ $\rightarrow$ 7/2 ⁻	530 $\pm$ 80 fs	49 $\pm$ 2	$\approx$ 0		(1.9 $\pm$ 0.3)(+1)	
	1.74 $\pm$ 0.27	3/2 ⁻ $\rightarrow$ 7/2 ⁻	1.6 $\pm$ 0.4 ps	29 $\pm$ 2	$\approx$ 0		(2.0 $\pm$ 0.5)(0)	
	2.50 $\pm$ 1.08	13/2 ⁻ $\rightarrow$ 9/2 ⁻	230 $\pm$ 50 fs	10 $\pm$ 3	[0]		(5 $\pm$ 2)(0)	
	2.61 $\pm$ 0.27	3/2 ⁻ $\rightarrow$ 7/2 ⁻	65 $\pm$ 20 fs	59 $\pm$ 2	$\approx$ 0		(1.0 $\pm$ 0.3)(+1)	
	3.19 $\pm$ 1.56	15/2 ⁻ $\rightarrow$ 11/2 ⁻	400 $\pm$ 90 fs	52 $\pm$ 5	[0]		(8.4 $\pm$ 1.9)(0)	
^{50}Ti	1.55 $\pm$ 0	2 ⁺ $\rightarrow$ 0 ⁺	1.41 $\pm$ 0.10 ps	100	0		(5.8 $\pm$ 0.4)(0)	
	2.67 $\pm$ 1.55	4 ⁺ $\rightarrow$ 2 ⁺	7.6 $\pm$ 1.6 ps	100	[0]		(5.4 $\pm$ 1.1)(0)	
^{50}V	[1.49 $\pm$ 0.39	1 ⁺ $\rightarrow$ 2 ⁺	65 $\pm$ 8 fs	88 $\pm$ 5	+0.58 $\pm$ 0.03		(1.5 $\pm$ 0.2)(+2)]	a)
	1.52 $\pm$ 0.39	2 ⁺ $\rightarrow$ 2 ⁺	210 $\pm$ 20 fs	82 $\pm$ 2	+0.06 $\pm$ 0.01		(5.6 $\pm$ 1.9)(0)	
^{50}Cr	0.78 $\pm$ 0	2 ⁺ $\rightarrow$ 0 ⁺	13.1 $\pm$ 0.6 ps	100	0		(1.9 $\pm$ 0.1)(+1)	
	1.88 $\pm$ 0.78	4 ⁺ $\rightarrow$ 2 ⁺	3.2 $\pm$ 0.4 ps	100	[0]		(1.4 $\pm$ 0.2)(+1)	
	2.92 $\pm$ 0	2 ⁺ $\rightarrow$ 0 ⁺	13.5 $\pm$ 2.0 fs	8 $\pm$ 2	0		(2.0 $\pm$ 0.6)(0)	
	3.16 $\pm$ 1.88	6 ⁺ $\rightarrow$ 4 ⁺	1.7 $\pm$ 0.4 ps	100	[0]		(1.3 $\pm$ 0.3)(+1)	
	3.32 $\pm$ 0.78	4 ⁺ $\rightarrow$ 2 ⁺	140 $\pm$ 35 fs	0.9 $\pm$ 0.2	[0]		(4.4 $\pm$ 1.5)(-2)	
^{51}V	0.32 $\pm$ 0	5/2 ⁻ $\rightarrow$ 7/2 ⁻	265 $\pm$ 7 ps	100	-0.42 $\pm$ 0.02		(1.2 $\pm$ 0.1)(+1)	
	0.93 $\pm$ 0	3/2 ⁻ $\rightarrow$ 7/2 ⁻	11.2 $\pm$ 1.2 ps	84.0 $\pm$ 0.5	$\approx$ 0		(7.5 $\pm$ 0.8)(0)	
	$\rightarrow$ 0.32	$\rightarrow$ 5/2 ⁻		16.0 $\pm$ 0.5	-6.8 $\pm$ 0.7		(1.2 $\pm$ 0.1)(+1)	
	1.61 $\pm$ 0	11/2 ⁻ $\rightarrow$ 7/2 ⁻	760 $\pm$ 70 fs	100	[0]		(8.5 $\pm$ 0.8)(0)	
	1.81 $\pm$ 0	9/2 ⁻ $\rightarrow$ 7/2 ⁻	810 $\pm$ 110 fs	75 $\pm$ 2	-3.8 $\pm$ 0.7		(3.1 $\pm$ 0.4)(0)	
	$\rightarrow$ 0.32	$\rightarrow$ 5/2 ⁻		25 $\pm$ 2	$\approx$ 0		(3.0 $\pm$ 0.4)(0)	
	2.41 $\pm$ 0	3/2 ⁻ $\rightarrow$ 7/2 ⁻	27 $\pm$ 9 fs	19 $\pm$ 3	$\approx$ 0		(6 $\pm$ 2)(0)	
	2.70 $\pm$ 1.61	15/2 ⁻ $\rightarrow$ 11/2 ⁻	7.9 $\pm$ 0.6 ps	100	$\approx$ 0		(5.8 $\pm$ 0.4)(0)	
	0.75 $\pm$ 0	3/2 ⁻ $\rightarrow$ 7/2 ⁻	10.6 $\pm$ 0.4 ns	100	[0]		(2.8 $\pm$ 0.1)(-2)	
	1.16 $\pm$ 0	9/2 ⁻ $\rightarrow$ 7/2 ⁻	100 $\pm$ 15 fs	100	+0.17 $\pm$ 0.02		(1.0 $\pm$ 0.3)(+1)	
^{51}Cr	1.48 $\pm$ 0	11/2 ⁻ $\rightarrow$ 7/2 ⁻	740 $\pm$ 150 fs	51.9 $\pm$ 1.1	$\approx$ 0		(7.0 $\pm$ 1.4)(0)	
	1.56 $\pm$ 0.75	7/2 ⁻ $\rightarrow$ 3/2 ⁻	6.0 $\pm$ 2.0 ps	79.4 $\pm$ 0.3	$\approx$ 0		(2.7 $\pm$ 0.9)(+1)	
	1.90 $\pm$ 0	3/2 ⁻ $\rightarrow$ 7/2 ⁻	450 $\pm$ 60 fs	78 $\pm$ 2	[0]		(5.0 $\pm$ 0.7)(0)	
	2.38 $\pm$ 1.35	9/2 ⁻ $\rightarrow$ 5/2 ⁻	600 $\pm$ 180 fs	26 $\pm$ 3	$\approx$ 0		(2.6 $\pm$ 0.8)(+1)	
	0.24 $\pm$ 0	7/2 ⁻ $\rightarrow$ 5/2 ⁻	20 $\pm$ 3 ps	100	-0.103 $\pm$ 0.011		(5.0 $\pm$ 1.2)(+1)	
	1.14 $\pm$ 0	9/2 ⁻ $\rightarrow$ 5/2 ⁻	360 $\pm$ 100 fs	13 $\pm$ 2	[0]		(1.3 $\pm$ 0.4)(+1)	
	$\rightarrow$ 0.24	$\rightarrow$ 7/2 ⁻		87 $\pm$ 2	-0.32 $\pm$ 0.02		(2.7 $\pm$ 0.8)(+1)	
^{52}Cr	1.49 $\pm$ 0.24	11/2 ⁻ $\rightarrow$ 7/2 ⁻	720 $\pm$ 170 fs	65 $\pm$ 3	[0]		(2.1 $\pm$ 0.5)(+1)	
	1.43 $\pm$ 0	2 ⁺ $\rightarrow$ 0 ⁺	1.02 $\pm$ 0.04 ps	100	0		(1.1 $\pm$ 0.1)(+1)	
	2.37 $\pm$ 1.43	4 ⁺ $\rightarrow$ 2 ⁺	1.4 $\pm$ 0.3 ps	100	[0]		(6.7 $\pm$ 1.4)(+1)	
	2.77 $\pm$ 1.43	4 ⁺ $\rightarrow$ 2 ⁺	3.7 $\pm$ 0.9 ps	90 $\pm$ 1	[0]		(3.9 $\pm$ 1.0)(0)	
	2.96 $\pm$ 0	2 ⁺ $\rightarrow$ 0 ⁺	600 $\pm$ 110 fs	4.2 $\pm$ 1.7	0		(2.1 $\pm$ 0.9)(-2)	
	$\rightarrow$ 1.43	$\rightarrow$ 2 ⁺		95.8 $\pm$ 1.7	+6.25 $\pm$ 0.15		(1.3 $\pm$ 0.2)(+1)	
	3.11 $\pm$ 2.37	6 ⁺ $\rightarrow$ 4 ⁺	60 $\pm$ 2 ps	98.8 $\pm$ 0.2	[0]		(5.1 $\pm$ 0.2)(0)	
	$\rightarrow$ 2.77	$\rightarrow$ 4 ⁺		1.2 $\pm$ 0.2	[0]		(3.1 $\pm$ 0.5)(0)	
	3.16 $\pm$ 0	2 ⁺ $\rightarrow$ 0 ⁺	120 $\pm$ 40 fs	11 $\pm$ 2	0		(2.0 $\pm$ 0.7)(-1)	
	3.42 $\pm$ 1.43	4 ⁺ $\rightarrow$ 2 ⁺	460 $\pm$ 90 fs	5.5 $\pm$ 1.5	[0]		(2.7 $\pm$ 0.9)(-2)	
	3.77 $\pm$ 0	2 ⁺ $\rightarrow$ 0 ⁺	13 $\pm$ 6 fs	20 $\pm$ 4	0		(1.4 $\pm$ 0.7)(-1)	
^{53}Cr	4.75 $\pm$ 3.11	8 ⁺ $\rightarrow$ 6 ⁺	920 $\pm$ 300 fs	100	[0]		(7 $\pm$ 2)(0)	
	0.56 $\pm$ 0	1/2 ⁻ $\rightarrow$ 3/2 ⁻		from B(E2)			(1.6 $\pm$ 0.1)(+1)	
	1.01 $\pm$ 0	5/2 ⁻ $\rightarrow$ 3/2 ⁻	1.1 $\pm$ 0.2 ps	99.57	-0.36 $\pm$ 0.02		(6.5 $\pm$ 1.0)(0)	
	$\rightarrow$ 0.56	$\rightarrow$ 1/2 ⁻		0.43	[0]		(1.4 $\pm$ 0.3)(+1)	
	1.29 $\pm$ 0	7/2 ⁻ $\rightarrow$ 3/2 ⁻		from B(E2)			(1.1 $\pm$ 0.1)(+1)	
	1.54 $\pm$ 0	7/2 ⁻ $\rightarrow$ 3/2 ⁻	31.2 $\pm$ 2.5 fs	11 $\pm$ 2	[0]		(2.7 $\pm$ 0.5)(-2)	
	2.17 $\pm$ 1.29	11/2 ⁻ $\rightarrow$ 7/2 ⁻	13.3 $\pm$ 1.8 ps	100	[0]		(1.9 $\pm$ 0.3)(+1)	
	2.32 $\pm$ 0	3/2 ⁻ $\rightarrow$ 3/2 ⁻		from B(E2)			(1.0 $\pm$ 0.1)(+1)	
^{53}Mn	0.38 $\pm$ 0	5/2 ⁻ $\rightarrow$ 7/2 ⁻	169 $\pm$ 9 ps	100	-0.55 $\pm$ 0.02		(1.2 $\pm$ 0.1)(+1)	
	1.29 $\pm$ 0	3/2 ⁻ $\rightarrow$ 7/2 ⁻	760 $\pm$ 100 fs	56 $\pm$ 3	[0]		(1.4 $\pm$ 0.2)(+1)	
	$\rightarrow$ 0.38	$\rightarrow$ 5/2 ⁻		44 $\pm$ 3	-0.167 $\pm$ 0.019		(1.7 $\pm$ 0.4)(0)	
	1.44 $\pm$ 0	11/2 ⁻ $\rightarrow$ 7/2 ⁻	760 $\pm$ 135 fs	100	[0]		(1.4 $\pm$ 0.2)(+1)	
	1.62 $\pm$ 0	9/2 ⁻ $\rightarrow$ 7/2 ⁻	610 $\pm$ 75 fs	89.0 $\pm$ 1.1	-2.9 $\pm$ 0.3		(7.9 $\pm$ 1.1)(0)	

TABLE III. Strengths of $E2$ Transitions

See page 552 for Explanation of Tables

Nucleus	$E_{xi} \rightarrow E_{xf}$ (MeV)	$J_i^\pi \rightarrow J_f^\pi$	τ_m or Γ_γ	Total branching (%)	δ	a_{tot}	S (W.u.)	Remarks
^{53}Mn	1.62 $\rightarrow$ 0.38	$9/2^- \rightarrow 5/2^-$	610 ± 75 fs	11.0 ± 1.1	[0]		$(4.1 \pm 0.7)(0)$	
	2.27 $\rightarrow$ 0	$5/2^- \rightarrow 7/2^-$	360 ± 55 fs	77 ± 2	-0.18 ± 0.04		$(7 \pm 3)(-2)$	
	$\rightarrow$ 0.38	$\rightarrow 5/2^-$		23 ± 2	$+0.9 \pm 0.3$		$(8 \pm 3)(-1)$	
	2.41 $\rightarrow$ 0	$3/2^- \rightarrow 7/2^-$	180 ± 35 fs	38 ± 6	[0]		$(1.7 \pm 0.4)(0)$	
	2.69 $\rightarrow$ 1.44	$15/2^- \rightarrow 11/2^-$	3.9 ± 0.6 ps	100	[0]		$(5.6 \pm 0.9)(0)$	
^{53}Fe	2.88 $\rightarrow$ 0	$3/2^- \rightarrow 7/2^-$	90 ± 35 fs	15	[0]		$(6 \pm 2)(-1)$	
	0.74 $\rightarrow$ 0	$3/2^- \rightarrow 7/2^-$	92 ± 2 ns	100	≈ 0		$(3.3 \pm 0.1)(-3)$	
	1.42 $\rightarrow$ 0.74	$5/2^- \rightarrow 3/2^-$	4.0 ± 1.0 ps	76 ± 2	-0.36 ± 0.02		$(1.0 \pm 0.3)(+1)$	
	$\rightarrow$ 0.77	$\rightarrow 1/2^-$		24 ± 2	≈ 0		$(3.5 \pm 0.9)(+1)$	
	2.04 $\rightarrow$ 0	$3/2^- \rightarrow 7/2^-$	340 ± 70 fs	100	[0]		$(5.6 \pm 1.2)(0)$	
^{54}Cr	2.34 $\rightarrow$ 0	$11/2^- \rightarrow 7/2^-$	76 ± 17 fs	14 ± 2	[0]		$(1.8 \pm 0.4)(0)$	
	$\rightarrow$ 1.33	$\rightarrow 9/2^-$		86 ± 2	$+0.11 \pm 0.02$		$(9 \pm 4)(0)$	
	0.83 $\rightarrow$ 0	$2^+ \rightarrow 0^+$	11.8 ± 0.7 ps	100	0		$(1.4 \pm 0.1)(+1)$	
	0.37 $\rightarrow$ 0.16	$5^+ \rightarrow 4^+$	9.7 ± 1.2 ps	100	-0.038 ± 0.003		$(2.3 \pm 0.5)(+1)$	
	1.78 $\rightarrow$ 0.37	$7^+ \rightarrow 5^+$	1.05 ± 0.28 ps	100	≈ 0		$(1.1 \pm 0.3)(+1)$	
^{54}Mn	1.41 $\rightarrow$ 0	$2^+ \rightarrow 0^+$	1.42 ± 0.04 ps	100	0		$(8.3 \pm 0.2)(0)$	
	2.95 $\rightarrow$ 2.54	$6^+ \rightarrow 4^+$	1.76 ± 0.03 ns	100	[0]		$(3.1 \pm 0.1)(0)$	
	2.96 $\rightarrow$ 0	$2^+ \rightarrow 0^+$	75 ± 12 fs	55 ± 3	0		$(2.1 \pm 0.3)(0)$	
	3.17 $\rightarrow$ 0	$2^+ \rightarrow 0^+$	230 ± 50 fs	81 ± 3	0		$(7.2 \pm 1.5)(-1)$	
	3.83 $\rightarrow$ 1.41	$4^+ \rightarrow 2^+$	91 ± 20 fs	91 ± 3	[0]		$(7.9 \pm 1.7)(0)$	
^{54}Fe	4.07 $\rightarrow$ 1.41	$3^+ \rightarrow 2^+$	84 ± 25 fs	92 ± 3	-1.9 ± 0.5		$(3.4 \pm 1.6)(0)$	
	4.26 $\rightarrow$ 1.41	$4^+ \rightarrow 2^+$	120 ± 30 fs	21 ± 6	[0]		$(6 \pm 2)(-1)$	
	4.95 $\rightarrow$ 1.41	$4^+ \rightarrow 2^+$	42 ± 14 fs	35 ± 6	[0]		$(1.0 \pm 0.4)(0)$	
	$\rightarrow$ 2.54	$\rightarrow 4^+$		55 ± 5	$+0.36 \pm 0.03$		$(1.2 \pm 0.4)(0)$	
	$\rightarrow$ 2.95	$\rightarrow 6^+$		10 ± 3	[0]		$(5 \pm 2)(-1)$	
^{55}Mn	0.13 $\rightarrow$ 0	$7/2^- \rightarrow 5/2^-$	373 ± 12 ps	100	-0.07 ± 0.01	0.02	$(2.2 \pm 0.6)(+1)$	
	1.53 $\rightarrow$ 0	$3/2^- \rightarrow 5/2^-$	71 ± 14 fs	96 ± 1	-0.22 ± 0.04		$(4.3 \pm 1.7)(0)$	
	$\rightarrow$ 0.13	$\rightarrow 7/2^-$		4 ± 1	[0]		$(7 \pm 2)(0)$	
	0.93 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	1.3 ± 0.4 ps	98.7 ± 0.4	-0.34 ± 0.02		$(7 \pm 2)(0)$	
	$\rightarrow$ 0.41	$\rightarrow 1/2^-$		1.3 ± 0.4	[0]		$(1.7 \pm 0.7)(+1)$	
^{55}Fe	1.32 $\rightarrow$ 0	$7/2^- \rightarrow 3/2^-$	17 ± 6 ps	95 ± 1	[0]		$(9 \pm 3)(-1)$	
	1.41 $\rightarrow$ 0	$7/2^- \rightarrow 3/2^-$	58 ± 4 ps	42 ± 3	[0]		$(8.4 \pm 0.9)(-2)$	
	2.14 $\rightarrow$ 0.41	$5/2^- \rightarrow 1/2^-$	55 ± 14 fs	3 ± 1	[0]		$(2.2 \pm 0.8)(0)$	
	2.58 $\rightarrow$ 0.41	$5/2^- \rightarrow 1/2^-$	66 ± 9 fs	7 ± 2	[0]		$(1.5 \pm 0.5)(0)$	
	2.16 $\rightarrow$ 0	$3/2^- \rightarrow 7/2^-$	137 ± 14 fs	100	[0]		$(9.9 \pm 1.0)(0)$	
^{55}Co	2.56 $\rightarrow$ 0	$3/2^- \rightarrow 7/2^-$	600 ± 80 fs	100	[0]		$(9.6 \pm 1.3)(-1)$	
	0.11 $\rightarrow$ 0	$1^+ \rightarrow 3^+$	7.3 ± 0.2 ns	0.42	[0]	0.33	$(1.6 \pm 0.1)(0)$	
	0.34 $\rightarrow$ 0	$5^+ \rightarrow 3^+$	2.9 ± 0.2 ns	42 ± 5	[0]		$(2.1 \pm 0.3)(0)$	
	0.85 $\rightarrow$ 0	$2^+ \rightarrow 0^+$	8.9 ± 0.4 ps	100	0		$(1.6 \pm 0.1)(+1)$	
	2.09 $\rightarrow$ 0.85	$4^+ \rightarrow 2^+$	950 ± 270 fs	≈ 100	[0]		$(2.2 \pm 0.6)(+1)$	
^{56}Mn	2.66 $\rightarrow$ 0	$2^+ \rightarrow 0^+$	40 ± 10 fs	2.3 ± 0.1	0		$(2.7 \pm 0.7)(-1)$	
	$\rightarrow$ 0.85	$\rightarrow 2^+$		97.7 ± 0.1	$+0.185 \pm 0.015$		$(2.6 \pm 0.8)(0)$	
	2.94 $\rightarrow$ 0.85	$0^+ \rightarrow 2^+$	220 ± 100 fs	100	0		$(7 \pm 3)(0)$	
	2.96 $\rightarrow$ 0	$2^+ \rightarrow 0^+$	39 ± 12 fs	2.1 ± 0.1	0		$(1.6 \pm 0.5)(-1)$	
	$\rightarrow$ 0.85	$\rightarrow 2^+$		97.9 ± 0.1	-0.249 ± 0.009		$(2.2 \pm 0.7)(0)$	
^{56}Fe	3.12 $\rightarrow$ 0.85	$4^+ \rightarrow 2^+$	110 ± 50 fs	0.8 ± 0.1	[0]		$(7 \pm 3)(-2)$	
	3.37 $\rightarrow$ 0	$2^+ \rightarrow 0^+$	26 ± 10 fs	1.5 ± 0.1	0		$(8 \pm 3)(-2)$	
	3.76 $\rightarrow$ 2.09	$6^+ \rightarrow 4^+$	190 ± 30 fs	23 ± 2	[0]		$(5.8 \pm 1.1)(-0)$	
	3.86 $\rightarrow$ 0	$2^+ \rightarrow 0^+$	64 ± 20 fs	8	0		$(9 \pm 3)(-2)$	
	0.97 $\rightarrow$ 0	$2^+ \rightarrow 4^+$	160 ± 40 fs	0.30 ± 0.05	[0]		$(1.4 \pm 0.6)(0)$	
^{56}Co	1.45 $\rightarrow$ 0.97	$0^+ \rightarrow 2^+$	2.28 ± 0.09 ns	100	0		$(1.1 \pm 0.1)(0)$	
	1.72 $\rightarrow$ 0.16	$1^+ \rightarrow 3^+$	540 ± 200 fs	13.8 ± 0.6	[0]		$(1.7 \pm 0.6)(0)$	
	4.18 $\rightarrow$ 2.28	$9^+ \rightarrow 7^+$	590 ± 60 fs	73 ± 1	[0]		$(3.1 \pm 0.3)(0)$	
	2.70 $\rightarrow$ 0	$2^+ \rightarrow 0^+$	76 ± 37 fs	100	0		$(6 \pm 3)(0)$	
	0.014 $\rightarrow$ 0	$3/2^- \rightarrow 1/2^-$	142 ± 12 ns	100	$(2.4 \pm 0.2) \times 10^{-3}$	8.2	$(3.6 \pm 0.6)(-1)$	

TABLE III. Strengths of E2 Transitions
See page 552 for Explanation of Tables

Nucleus	$E_{Xi} \rightarrow E_{Xf}$ (MeV)	$J_i^\pi \rightarrow J_f^\pi$	τ_m or Γ_γ	Total branching (%)	δ	α_{tot}	S (W.u.)	Remarks
^{57}Fe	0.14 $\pm$ 0	$5/2^- \rightarrow 1/2^-$	12.4 $\pm$ 0.4 ns	12.3 $\pm$ 0.2	[0]	0.15	(1.1 $\pm$ 0.1)(+1)	
	$\rightarrow$ 0.014	$\rightarrow 3/2^-$		87.7 $\pm$ 0.2	-0.120 $\pm$ 0.001	0.02	(2.2 $\pm$ 0.1)(0)	
	0.37 $\pm$ 0	$3/2^- \rightarrow 1/2^-$		from B(E2)			(5.8 $\pm$ 0.7)(+1)	
	0.71 $\pm$ 0	$5/2^- \rightarrow 1/2^-$	4.2 $\pm$ 0.7 ps	3.5 $\pm$ 0.5	[0]		(2.9 $\pm$ 0.6)(0)	
	$\rightarrow$ 0.014	$\rightarrow 3/2^-$		84.4 $\pm$ 0.8	+0.465 $\pm$ 0.008		(1.4 $\pm$ 0.2)(+1)	
	$\rightarrow$ 0.14	$\rightarrow 5/2^-$		9.9 $\pm$ 0.6	-0.097 $\pm$ 0.008		(2.2 $\pm$ 0.5)(0)	
	$\rightarrow$ 0.37	$\rightarrow 3/2^-$		2.2 $\pm$ 0.3	-0.083 $\pm$ 0.005		(4.9 $\pm$ 1.2)(-1)	
^{57}Co	7.65 $\pm$ 0.14	$1/2^- \rightarrow 5/2^-$	600 $\pm$ 100 meV	2.5 $\pm$ 0.5	[0]		(5.8 $\pm$ 1.5)(-2)	$E_n=1.15$ keV
	1.22 $\pm$ 0	$9/2^- \rightarrow 7/2^-$	76 $\pm$ 10 fs	100	-0.26 $\pm$ 0.01		(1.9 $\pm$ 0.3)(+1)	
	1.38 $\pm$ 0	$3/2^- \rightarrow 7/2^-$	27 $\pm$ 6 ps	100	[0]		(4.5 $\pm$ 1.0)(-1)	
	1.69 $\pm$ 0	$11/2^- \rightarrow 7/2^-$	350 $\pm$ 35 fs	46 $\pm$ 2	[0]		(5.8 $\pm$ 0.6)(0)	
	$\rightarrow$ 1.22	$\rightarrow 9/2^-$		54 $\pm$ 2	-0.08 $\pm$ 0.01		(2.6 $\pm$ 0.7)(+1)	
	2.31 $\pm$ 1.22	$7/2^- \rightarrow 9/2^-$	290 $\pm$ 60 fs	70 $\pm$ 2	-0.13 $\pm$ 0.02		(1.6 $\pm$ 0.4)(0)	
	$\rightarrow$ 1.38	$\rightarrow 3/2^-$		20 $\pm$ 3	[0]		(6 $\pm$ 2)(+1)	
^{57}Ni	0.77 $\pm$ 0	$5/2^- \rightarrow 3/2^-$	4.6 $\pm$ 0.6 ps	100	-0.23 $\pm$ 0.02		(2.5 $\pm$ 0.5)(0)	
	2.58 $\pm$ 0	$7/2^- \rightarrow 3/2^-$	68 $\pm$ 9 fs	100	[0]		(7.9 $\pm$ 1.0)(0)	
^{58}Fe	0.81 $\pm$ 0	$2^+ \rightarrow 0^+$	11.7 $\pm$ 2.3 ps	100	0		(1.5 $\pm$ 0.3)(+1)	
	1.67 $\pm$ 0	$2^+ \rightarrow 0^+$	2.3 $\pm$ 0.6 ps	44 $\pm$ 1	0		(9 $\pm$ 2)(-1)	
	$\rightarrow$ 0.81	$\rightarrow 2^+$		56 $\pm$ 1	+0.69 $\pm$ 0.05		(9 $\pm$ 2)(0)	
	2.08 $\pm$ 0.81	$4^+ \rightarrow 2^+$	440 $\pm$ 110 fs	100	[0]		(4.1 $\pm$ 1.0)(+1)	
	2.60 $\pm$ 0.81	$4^+ \rightarrow 2^+$	540 $\pm$ 100 fs	30.1 $\pm$ 0.9	[0]		(1.8 $\pm$ 0.3)(0)	
	$\rightarrow$ 1.67	$\rightarrow 2^+$		17.7 $\pm$ 0.6	[0]		(2.8 $\pm$ 0.5)(+1)	
	2.78 $\pm$ 0.81	$1^+ \rightarrow 2^+$	265 $\pm$ 40 fs	48 $\pm$ 3	+0.17 $\pm$ 0.04		(1.0 $\pm$ 0.4)(-1)	
^{58}Ni	$\rightarrow$ 1.67	$\rightarrow 2^+$		22.2 $\pm$ 1.3	+0.18 $\pm$ 0.03		(9 $\pm$ 4)(-1)	
	1.45 $\pm$ 0	$2^+ \rightarrow 0^+$	920 $\pm$ 26 fs	100	0		(1.0 $\pm$ 0.1)(+1)	
	2.78 $\pm$ 0	$2^+ \rightarrow 0^+$	580 $\pm$ 160 fs	4.1 $\pm$ 0.3	0		(2.5 $\pm$ 0.7)(-2)	
	$\rightarrow$ 1.45	$\rightarrow 2^+$		95.9 $\pm$ 0.3	+1.18 $\pm$ 0.15		(1.4 $\pm$ 0.4)(+1)	
	2.94 $\pm$ 1.45	$0^+ \rightarrow 2^+$	2.90 $\pm$ 0.10 ns	11.4 $\pm$ 0.7	0		(3.2 $\pm$ 0.2)(-4)	
	$\rightarrow$ 2.78	$\rightarrow 2^+$		10.6 $\pm$ 1.1	0	0.08	(1.6 $\pm$ 0.2)(+1)	
	3.04 $\pm$ 0	$2^+ \rightarrow 0^+$	72 $\pm$ 7 fs	42 $\pm$ 2	0		(1.3 $\pm$ 0.1)(0)	
	$\rightarrow$ 1.45	$\rightarrow 2^+$		57 $\pm$ 2	-0.21 $\pm$ 0.03		(2.0 $\pm$ 0.6)(0)	
	3.26 $\pm$ 0	$2^+ \rightarrow 0^+$	42 $\pm$ 4 fs	63 $\pm$ 2	0		(2.4 $\pm$ 0.2)(0)	
	$\rightarrow$ 1.45	$\rightarrow 2^+$		37 $\pm$ 2	-0.46 $\pm$ 0.13		(5 $\pm$ 2)(0)	
^{59}Co	3.53 $\pm$ 1.45	$0^+ \rightarrow 2^+$	260 $\pm$ 70 fs	100	0		(5.9 $\pm$ 1.6)(0)	
	3.90 $\pm$ 0	$2^+ \rightarrow 0^+$	33 $\pm$ 4 fs	24 $\pm$ 2	0		(5.3 $\pm$ 0.8)(-1)	
	1.10 $\pm$ 0	$3/2^- \rightarrow 7/2^-$	4.9 $\pm$ 0.8 ps	100	[0]		(7.6 $\pm$ 1.2)(0)	
	1.19 $\pm$ 0	$9/2^- \rightarrow 7/2^-$		from B(E2)			(1.6 $\pm$ 0.3)(+1)	
	1.29 $\pm$ 0	$3/2^- \rightarrow 7/2^-$	790 $\pm$ 40 fs	93.3 $\pm$ 0.4	[0]		(2.0 $\pm$ 0.1)(+1)	
	[$\rightarrow$ 1.10	$\rightarrow 3/2^-$		6.7 $\pm$ 0.4	-0.17 $\pm$ 0.03		(5.0 $\pm$ 1.8)(+2)]	b)
	1.46 $\pm$ 0	$11/2^- \rightarrow 7/2^-$	1.6 $\pm$ 0.2 ps	95 $\pm$ 1	[0]		(5.3 $\pm$ 0.7)(0)	
^{59}Ni	1.75 $\pm$ 0	$7/2^- \rightarrow 7/2^-$		from B(E2)			(2.1 $\pm$ 0.7)(0)	
	1.19 $\pm$ 0	$5/2^- \rightarrow 3/2^-$	400 $\pm$ 45 fs	89 $\pm$ 5	+0.56 $\pm$ 0.17		(1.6 $\pm$ 0.7)(+1)	
	1.34 $\pm$ 0	$7/2^- \rightarrow 3/2^-$	1.45 $\pm$ 0.26 ps	29 $\pm$ 1	$\approx$ 0		(2.7 $\pm$ 0.5)(0)	
	$\rightarrow$ 0.34	$\rightarrow 5/2^-$		71 $\pm$ 1	-4.8 $\pm$ 0.9		(2.8 $\pm$ 0.5)(+1)	
	1.77 $\pm$ 0.34	$9/2^- \rightarrow 5/2^-$	820 $\pm$ 100 fs	93	$\approx$ 0		(1.1 $\pm$ 0.1)(+1)	
	1.95 $\pm$ 0	$7/2^- \rightarrow 3/2^-$	200 $\pm$ 60 fs	72 $\pm$ 3	[0]		(7 $\pm$ 2)(0)	
	2.71 $\pm$ 1.34	$11/2^- \rightarrow 7/2^-$	500 $\pm$ 60 fs	90	$\approx$ 0		(2.2 $\pm$ 0.3)(+1)	
^{59}Cu	$\rightarrow$ 1.77	$\rightarrow 9/2^-$		10	+0.95 $\pm$ 0.39		(8 $\pm$ 3)(0)	
	1.40 $\pm$ 0	$7/2^- \rightarrow 3/2^-$	580 $\pm$ 250 fs	91 $\pm$ 2	$\approx$ 0		(1.7 $\pm$ 0.7)(+1)	
^{60}Fe	2.27 $\pm$ 0.49	$3/2^- \rightarrow 5/2^-$	320 $\pm$ 140 fs	46 $\pm$ 5	-1.9 $\pm$ 0.7		(3.7 $\pm$ 1.8)(0)	
	0.82 $\pm$ 0	$2^+ \rightarrow 0^+$	11.6 $\pm$ 2.2 ps	100	0		(1.3 $\pm$ 0.2)(+1)	
^{60}Ni	2.11 $\pm$ 0.82	$4^+ \rightarrow 2^+$	1.2 $\pm$ 0.3 ps	100	[0]		(1.3 $\pm$ 0.3)(+1)	
	1.33 $\pm$ 0	$2^+ \rightarrow 0^+$	1.05 $\pm$ 0.01 ps	100	0		(1.3 $\pm$ 0.1)(+1)	
	2.16 $\pm$ 0	$2^+ \rightarrow 0^+$	770 $\pm$ 150 fs	13.3 $\pm$ 0.8	0		(2.1 $\pm$ 0.4)(-1)	
	$\rightarrow$ 1.33	$\rightarrow 2^+$		86.7 $\pm$ 0.8	-0.82 $\pm$ 0.15		(7 $\pm$ 2)(+1)	

TABLE III. Strengths of $E2$ Transitions
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Nucleus	$E_{x_i} \rightarrow E_{x_f}$ (MeV)	$J_i^\pi \rightarrow J_f^\pi$	τ_m or τ_γ	Total branching (%)	δ	α_{tot}	S (W.u.)	Remarks
^{60}Ni	$2.51 \rightarrow 1.33$	$4^+ \rightarrow 2^+$	4.7 ± 0.7 ps	≈ 100	[0]		$(5.3 \pm 0.8)(0)$	
	$\rightarrow 2.16$	$\rightarrow 2^+$		$(7.6 \pm 0.5) \times 10^{-3}$	[0]		$(1.8 \pm 0.3)(-1)$	
	$3.19 \rightarrow 1.33$	$3^+ \rightarrow 2^+$	200 ± 50 fs	32.0 ± 1.6	-0.106 ± 0.023		$(5 \pm 2)(-2)$	
	$\rightarrow 2.16$	$\rightarrow 2^+$		42 ± 2	-0.42 ± 0.03		$(1.6 \pm 0.4)(+1)$	
^{61}Ni	$3.39 \rightarrow 0$	$2^+ \rightarrow 0^+$	180 ± 50 fs	6 ± 2	0		$(4.4 \pm 1.9)(-2)$	
	$0.067 \rightarrow 0$	$5/2^- \rightarrow 3/2^-$		from B(E2)			$(3.2 \pm 0.3)(-1)$	
	$0.28 \rightarrow 0$	$1/2^- \rightarrow 3/2^-$		from B(E2)			$(1.7 \pm 0.2)(0)$	
	$0.66 \rightarrow 0$	$1/2^- \rightarrow 3/2^-$	25 ± 6 ps	from B(E2)			$(1.2 \pm 0.1)(+1)$	
	$\rightarrow 0.067$	$\rightarrow 5/2^-$		8 ± 1	[0]		$(2.5 \pm 0.7)(0)$	
	$0.91 \rightarrow 0$	$5/2^- \rightarrow 3/2^-$	1.6 ± 0.5 ps	from B(E2)			$(6.1 \pm 0.9)(-1)$	
	$\rightarrow 0.067$	$\rightarrow 5/2^-$		19 ± 2	-1.83 ± 0.20		$(1.2 \pm 0.4)(+1)$	
	$1.02 \rightarrow 0$	$7/2^- \rightarrow 3/2^-$	6.8 ± 1.0 ps	25 ± 1	≈ 0		$(1.8 \pm 0.3)(0)$	
	$\rightarrow 0.067$	$\rightarrow 5/2^-$		75 ± 1	-2.46 ± 0.16		$(6.9 \pm 1.0)(0)$	
	$1.10 \rightarrow 0$	$3/2^- \rightarrow 3/2^-$		from B(E2)			$(9 \pm 2)(-1)$	
	$1.13 \rightarrow 0$	$5/2^- \rightarrow 3/2^-$		from B(E2)			$(7.4 \pm 0.8)(0)$	
	$1.19 \rightarrow 0$	$3/2^- \rightarrow 3/2^-$		from B(E2)			$(2.6 \pm 0.4)(0)$	
	$1.45 \rightarrow 0$	$7/2^- \rightarrow 3/2^-$	1.20 ± 0.34 ps	75 ± 3	[0]		$(5.5 \pm 1.6)(0)$	
	$\rightarrow 0.067$	$\rightarrow 5/2^-$		25 ± 3	-2.7 ± 0.4		$(2.0 \pm 0.6)(0)$	
	$1.81 \rightarrow 0.067$	$9/2^- \rightarrow 5/2^-$	1.60 ± 0.34 ps	89 ± 2	≈ 0		$(2.0 \pm 0.4)(0)$	
	$\rightarrow 1.02$	$\rightarrow 7/2^-$		11 ± 2	-0.97 ± 0.18		$(6 \pm 2)(0)$	
	$1.99 \rightarrow 0.067$	$9/2^- \rightarrow 5/2^-$	900 ± 250 fs	57 ± 3	≈ 0		$(1.4 \pm 0.4)(0)$	
	$\rightarrow 0.91$	$\rightarrow 5/2^-$		18 ± 2	≈ 0		$(8 \pm 2)(0)$	
	$2.00 \rightarrow 0$	$5/2^- \rightarrow 3/2^-$	60 ± 12 fs	68 ± 2	$+0.27 \pm 0.06$		$(1.3 \pm 0.6)(0)$	
	$2.41 \rightarrow 0.067$	$9/2^- \rightarrow 5/2^-$	280 ± 45 fs	62 ± 3	≈ 0		$(1.8 \pm 0.3)(0)$	
	$\rightarrow 1.13$	$\rightarrow 5/2^-$		12 ± 2	≈ 0		$(7.3 \pm 1.7)(0)$	
	$3.30 \rightarrow 2.12$	$11/2^+ \rightarrow 9/2^+$	870 ± 230 fs	100	-0.63 ± 0.08		$(8 \pm 2)(0)$	
	$3.44 \rightarrow 2.12$	$13/2^+ \rightarrow 9/2^+$	1.4 ± 0.5 ps	100	≈ 0		$(1.0 \pm 0.4)(+1)$	
^{61}Cu	$0.97 \rightarrow 0$	$5/2^- \rightarrow 3/2^-$	1.00 ± 0.17 ps	99.1 ± 0.1	$+0.33 \pm 0.02$		$(6.3 \pm 1.3)(0)$	
	$\rightarrow 0.48$	$\rightarrow 1/2^-$		0.9 ± 0.1	[0]		$(1.8 \pm 0.4)(+1)$	
	$1.31 \rightarrow 0$	$7/2^- \rightarrow 3/2^-$	760 ± 120 fs	93.8 ± 0.2	≈ 0		$(1.8 \pm 0.3)(+1)$	
	$1.39 \rightarrow 0$	$5/2^- \rightarrow 3/2^-$	1.2 ± 0.2 ps	85.3 ± 0.7	$+3.54 \pm 0.14$		$(6.5 \pm 1.1)(0)$	
	$\rightarrow 0.48$	$\rightarrow 1/2^-$		11.9 ± 0.6	[0]		$(9.0 \pm 1.5)(0)$	
	$1.90 \rightarrow 0$	$5/2^- \rightarrow 3/2^-$	260 ± 40 fs	36.3 ± 1.9	-0.69 ± 0.08		$(1.0 \pm 0.2)(0)$	
	$\rightarrow 0.97$	$\rightarrow 5/2^-$		41.6 ± 1.3	$+0.18 \pm 0.03$		$(4.1 \pm 1.5)(0)$	
	$2.20 \rightarrow 0.48$	$5/2^- \rightarrow 1/2^-$	250 ± 40 fs	23.1 ± 1.4	[0]		$(3.5 \pm 0.6)(0)$	
	$2.30 \rightarrow 0.97$	$9/2^- \rightarrow 5/2^-$	2.6 ± 0.7 ps	12.5 ± 0.7	[0]		$(6.5 \pm 1.8)(-1)$	
	$\rightarrow 1.31$	$\rightarrow 7/2^-$		34.2 ± 1.1	$+0.17 \pm 0.03$		$(2.0 \pm 0.9)(-1)$	
	$\rightarrow 1.39$	$\rightarrow 5/2^-$		25.8 ± 0.8	≈ 0		$(9 \pm 2)(-1)$	
	$\rightarrow 1.73$	$\rightarrow 7/2^-$		19.9 ± 0.6	-0.56 ± 0.04		$(1.7 \pm 0.5)(+1)$	
	$2.34 \rightarrow 0.97$	$9/2^- \rightarrow 5/2^-$	620 ± 90 fs	75 ± 2	≈ 0		$(1.4 \pm 0.2)(+1)$	
	$\rightarrow 1.39$	$\rightarrow 5/2^-$		1.2 ± 0.2	[0]		$(1.4 \pm 0.3)(0)$	
	$2.40 \rightarrow 0.97$	$7/2^- \rightarrow 5/2^-$	175 ± 25 fs	58.2 ± 1.0	$+0.16 \pm 0.02$		$(8 \pm 2)(-1)$	
	$2.61 \rightarrow 1.94$	$9/2^- \rightarrow 7/2^-$	410 ± 60 fs	30.1 ± 0.5	-0.25 ± 0.04		$(1.8 \pm 0.6)(+1)$	
	$2.73 \rightarrow 0.97$	$7/2^- \rightarrow 5/2^-$	330 ± 50 fs	60 ± 12	$+1.6 \pm 0.3$		$(4.3 \pm 1.2)(0)$	
^{62}Ni	$1.17 \rightarrow 0$	$2^+ \rightarrow 0^+$	2.09 ± 0.03 ps	100	0		$(1.2 \pm 0.1)(+1)$	
	$2.30 \rightarrow 0$	$2^+ \rightarrow 0^+$	950 ± 170 fs	57 ± 4	0		$(5.1 \pm 0.9)(-1)$	
	$\rightarrow 1.17$	$\rightarrow 2^+$		43 ± 4	-3.19 ± 0.11		$(1.2 \pm 0.2)(+1)$	
	$2.34 \rightarrow 1.17$	$4^+ \rightarrow 2^+$	1.2 ± 0.3 ps	≈ 100	[0]		$(2.1 \pm 0.5)(+1)$	
	$3.06 \rightarrow 0$	$2^+ \rightarrow 0^+$	3.3 ± 1.5 ps	11 ± 2	0		$(7 \pm 3)(-3)$	
	$\rightarrow 2.34$	$\rightarrow 4^+$		16 ± 3	[0]		$(1.3 \pm 0.6)(+1)$	
	$3.18 \rightarrow 1.17$	$4^+ \rightarrow 2^+$	1.05 ± 0.25 ps	93 ± 2	[0]		$(1.5 \pm 0.4)(0)$	
	$\rightarrow 2.30$	$\rightarrow 2^+$		7 ± 2	[0]		$(7 \pm 2)(0)$	
	$3.26 \rightarrow 0$	$2^+ \rightarrow 0^+$	1.03 ± 0.28 ps	2.9 ± 0.7	0		$(6 \pm 2)(-3)$	
	$3.28 \rightarrow 1.17$	$4^+ \rightarrow 2^+$	280 ± 40 fs	100	[0]		$(4.7 \pm 0.7)(0)$	
	$3.52 \rightarrow 0$	$2^+ \rightarrow 0^+$	290 ± 55 fs	5.3 ± 1.8	0		$(1.8 \pm 0.7)(-2)$	

TABLE III. Strengths of $E2$ Transitions
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Nucleus	$E_{x_i} \rightarrow E_{x_f}$ (MeV)	$J_i^\pi \rightarrow J_f^\pi$	τ_m or Γ_γ	Total branching (%)	δ	α_{tot}	S (W.u.)	Remarks
^{62}Ni	3.52 ± 1.17 $\rightarrow 2.05$	$2^+ \rightarrow 2^+$ $\rightarrow 0^+$	290 ± 55 fs	80 ± 2 8.0 ± 1.8	-0.44 ± 0.09 0		$(3.4 \pm 1.3)(-1)$ $(2.2 \pm 0.6)(0)$	
^{62}Cu	3.97 ± 0 0.39 ± 0.041 $\rightarrow 0.24$	$2^+ \rightarrow 0^+$ $4^+ \rightarrow 2^+$ $\rightarrow 2^+$	160 ± 50 fs 16.0 ± 0.3 ns	37 ± 6 95.8 4.2	0 [0] [0]	0.13	$(1.3 \pm 0.5)(-1)$ $(6.2 \pm 0.2)(-1)$ $(1.8 \pm 0.4)(0)$	
^{63}Ni	0.087 ± 0	$5/2^- \rightarrow 1/2^-$	2.38 ± 0.06 μ s	100	[0]	0.99	$(2.3 \pm 0.1)(0)$	
^{63}Cu	0.67 ± 0 0.96 ± 0 1.33 ± 0 $\rightarrow 0.96$ 1.41 ± 0 $\rightarrow 0.67$ 1.86 ± 0 2.09 ± 0 $\rightarrow 0.96$ 2.21 ± 0.96 $\rightarrow 1.33$ 2.41 ± 0 2.54 ± 0.67 2.68 ± 1.33	$1/2^- \rightarrow 3/2^-$ $5/2^- \rightarrow 3/2^-$ $7/2^- \rightarrow 3/2^-$ $\rightarrow 5/2^-$ $5/2^- \rightarrow 3/2^-$ $\rightarrow 1/2^-$ $7/2^- \rightarrow 3/2^-$ $7/2^- \rightarrow 3/2^-$ $\rightarrow 5/2^-$ $9/2^- \rightarrow 5/2^-$ $\rightarrow 7/2^-$ $7/2^- \rightarrow 3/2^-$ $5/2^- \rightarrow 1/2^-$ $11/2^- \rightarrow 7/2^-$	300 ± 20 fs 850 ± 40 fs 780 ± 60 fs 15.8 ± 0.4 1.6 ± 0.3 ps 850 ± 130 fs 535 ± 120 fs 47 ± 2 43 ± 2 57 ± 2 180 ± 40 fs 310 ± 60 fs 840 ± 220 fs	100 100 84.2 ± 0.4 15.8 ± 0.4 72.2 ± 0.8 6.2 ± 0.4 57 ± 2 9.7 ± 0.8 47 ± 2 43 ± 2 57 ± 2 3.8 ± 1.2 7.5 ± 0.9 70 ± 2	$+0.12 \pm 0.01$ $+0.49 \pm 0.04$ ≈ 0 $+0.11 \pm 0.02$ -0.62 ± 0.05 ≈ 0 ≈ 0 ≈ 0 -1.1 ± 0.2 ≈ 0 $+0.26 \pm 0.04$ [0] [0] ≈ 0		$(1.9 \pm 0.3)(+1)$ $(1.5 \pm 0.2)(+1)$ $(1.4 \pm 0.1)(+1)$ $(1.8 \pm 0.3)(+1)$ $(1.2 \pm 0.3)(0)$ $(9 \pm 2)(0)$ $(1.6 \pm 0.3)(0)$ $(2.5 \pm 0.6)(-1)$ $(1.4 \pm 0.4)(+1)$ $(1.7 \pm 0.4)(+1)$ $(9 \pm 3)(0)$ $(1.4 \pm 0.5)(-1)$ $(5.8 \pm 1.1)(-1)$ $(1.0 \pm 0.3)(+1)$	
^{63}Zn	1.44 ± 0.19 1.66 ± 0 $\rightarrow 0.19$ 1.86 ± 0.65 2.16 ± 0.25 2.25 ± 0.65 $\rightarrow 1.07$ 2.59 ± 1.70 2.83 ± 1.70 2.94 ± 1.44 4.50 ± 4.16	$9/2^- \rightarrow 5/2^-$ $7/2^- \rightarrow 3/2^-$ $\rightarrow 5/2^-$ $9/2^- \rightarrow 5/2^-$ $3/2^- \rightarrow 1/2^-$ $9/2^- \rightarrow 5/2^-$ $\rightarrow 7/2^-$ $13/2^+ \rightarrow 9/2^+$ $11/2^+ \rightarrow 9/2^+$ $13/2^+ \rightarrow 9/2^+$ $17/2^+ \rightarrow 13/2^+$	1.0 ± 0.3 ps 335 ± 90 fs 75 ± 1 710 ± 230 fs 260 ± 70 fs 150 ± 40 fs 71 ± 2 5.1 ± 0.4 ps 420 ± 130 fs 310 ± 90 fs 6.1 ± 0.6 ns	100 25 ± 1 75 ± 1 70 ± 3 90 ± 1 29 ± 2 71 ± 2 100 100 100 100	≈ 0 ≈ 0 -0.18 ± 0.03 ≈ 0 $+2.3 \pm 0.2$ ≈ 0 -0.9 ± 0.2 ≈ 0 -0.7 ± 0.1 ≈ 0 ≈ 0		$(1.8 \pm 0.6)(+1)$ $(3.2 \pm 0.9)(0)$ $(5 \pm 2)(-1)$ $(2.0 \pm 0.6)(+1)$ $(6.2 \pm 1.7)(0)$ $(1.0 \pm 0.3)(+1)$ $(5.0 \pm 1.8)(+1)$ $(1.9 \pm 0.2)(0)$ $(2.3 \pm 0.8)(+1)$ $(2.3 \pm 0.7)(+1)$ $(1.9 \pm 0.2)(0)$	
^{64}Ni	1.35 ± 0	$2^+ \rightarrow 0^+$		from B(E2)			$(8.6 \pm 0.5)(0)$	
^{64}Zn	0.99 ± 0 1.80 ± 0 $\rightarrow 0.99$ 1.91 ± 0.99 2.31 ± 0.99 3.01 ± 0 3.08 ± 0.99 $\rightarrow 2.31$ 3.99 ± 2.31 4.24 ± 2.74	$2^+ \rightarrow 0^+$ $2^+ \rightarrow 0^+$ $\rightarrow 2^+$ $0^+ \rightarrow 2^+$ $4^+ \rightarrow 2^+$ $2^+ \rightarrow 0^+$ $4^+ \rightarrow 2^+$ $\rightarrow 4^+$ $6^+ \rightarrow 4^+$ $6^+ \rightarrow 4^+$	2.65 ± 0.10 ps 3.0 ± 0.4 ps 3.4 ± 1.2 ps 420 ± 120 fs 115 ± 30 fs 610 ± 160 fs 47 ± 3 175 ± 50 fs 190 ± 60 fs	100 25 ± 2 75 ± 2 100 ≈ 100 26 ± 3 53 ± 3 47 ± 3 100 100	0 0 $+3.3 \pm 0.7$ 0 [0] 0 [0] $+0.54 \pm 0.12$ [0] [0]		$(2.1 \pm 0.1)(+1)$ $(2.1 \pm 0.3)(-1)$ $(3.4 \pm 0.5)(+1)$ $(2.3 \pm 0.8)(+1)$ $(3.1 \pm 0.9)(+1)$ $(4.8 \pm 1.4)(-1)$ $(1.1 \pm 0.3)(0)$ $(3.3 \pm 1.4)(+1)$ $(2.3 \pm 0.7)(+1)$ $(3.6 \pm 1.1)(+1)$	
^{65}Ni	0.064 ± 0	$1/2^- \rightarrow 5/2^-$	105 ± 7 μ s	100	[0]	3.1	$(1.5 \pm 0.1)(-1)$	
^{65}Cu	0.77 ± 0 1.12 ± 0 $\rightarrow 0.77$ 1.48 ± 0 1.62 ± 0.77 $\rightarrow 1.12$	$1/2^- \rightarrow 3/2^-$ $5/2^- \rightarrow 3/2^-$ $\rightarrow 1/2^-$ $7/2^- \rightarrow 3/2^-$ $5/2^- \rightarrow 1/2^-$ $\rightarrow 5/2^-$	380 ± 25 fs 380 ± 25 fs 380 ± 25 fs 475 ± 5 fs 1.3 ± 0.3 ps 35 ± 2	from B(E2) ≈ 100 $(6.0 \pm 0.6) \times 10^{-3}$ 84.0 ± 0.6 8 ± 1 35 ± 2	$+0.44 \pm 0.02$ [0] [0] [0] [0] -0.20 ± 0.02		$(1.3 \pm 0.1)(+1)$ $(1.3 \pm 0.1)(+1)$ $(2.0 \pm 0.2)(0)$ $(1.3 \pm 0.1)(+1)$ $(7.1 \pm 1.9)(0)$ $(1.7 \pm 0.5)(+1)$	
^{65}Zn	0.054 ± 0 0.77 ± 0.054 $\rightarrow 0.12$ 0.87 ± 0 0.91 ± 0 $\rightarrow 0.054$	$1/2^- \rightarrow 5/2^-$ $5/2^- \rightarrow 1/2^-$ $\rightarrow 3/2^-$ $1/2^- \rightarrow 5/2^-$ $3/2^- \rightarrow 5/2^-$ $\rightarrow 1/2^-$	2.28 ± 0.06 μ s 1.9 ± 0.8 ps 33 ± 1 800 ± 300 fs 2.1 ± 0.5 ps 22 ± 1	100 11 ± 1 33 ± 1 1.4 ± 0.3 48 ± 1 22 ± 1	[0] [0] $+0.43 \pm 0.04$ [0] -0.25 ± 0.04 $+0.96 \pm 0.20$	6.9	$(6.2 \pm 0.2)(0)$ $(1.2 \pm 0.5)(+1)$ $(1.2 \pm 0.5)(0)$ $(1.8 \pm 0.3)(0)$ $(1.1 \pm 0.5)(0)$ $(5.5 \pm 1.8)(0)$	

TABLE III. Strengths of $E2$ Transitions
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Nucleus	$E_{xi} \rightarrow E_{xf}$ (MeV)	$J_i^\pi \rightarrow J_f^\pi$	τ_m or Γ_γ	Total branching (%)	δ	α_{tot}	S (W.u.)	Remarks
^{65}Zn	1.05 $\rightarrow$ 0.054	$5/2^- \rightarrow 1/2^-$	520 $\pm$ 100 fs	1.8 $\pm$ 0.3	[0]		(1.8 $\pm$ 0.5)(0)	
	$\rightarrow$ 0.12	$\rightarrow 3/2^-$		63 $\pm$ 2	+0.43 $\pm$ 0.04		(1.1 $\pm$ 0.3)(+1)	
	1.25 $\rightarrow$ 0.12	$7/2^- \rightarrow 3/2^-$	2.3 $\pm$ 0.8 ps	20 $\pm$ 2	[0]		(2.4 $\pm$ 0.9)(0)	
	$\rightarrow$ 0.21	$\rightarrow 3/2^-$		44 $\pm$ 2	[0]		(8 $\pm$ 3)(0)	
	1.47 $\rightarrow$ 0.12	$3/2^- \rightarrow 3/2^-$	210 $\pm$ 60 fs	67	-2.1 $\pm$ 0.3		(3.0 $\pm$ 0.9)(+1)	
	1.58 $\rightarrow$ 0.054	$3/2^- \rightarrow 1/2^-$	250 $\pm$ 30 fs	29 $\pm$ 2	+2.5 $\pm$ 0.3		(6.1 $\pm$ 0.7)(0)	
	1.59 $\rightarrow$ 0	$7/2^- \rightarrow 5/2^-$	220 $\pm$ 70 fs	68 $\pm$ 2	-0.31 $\pm$ 0.02		(1.4 $\pm$ 0.5)(0)	
	$\rightarrow$ 0.12	$\rightarrow 3/2^-$		22 $\pm$ 2	[0]		(7 $\pm$ 2)(0)	
	$\rightarrow$ 0.77	$\rightarrow 5/2^-$		10 $\pm$ 1	+0.23 $\pm$ 0.03		(2.2 $\pm$ 0.9)(0)	
	1.96 $\rightarrow$ 1.07	$7/2^+ \rightarrow 9/2^+$	600 $\pm$ 290 fs	79 $\pm$ 1	+0.27 $\pm$ 0.01		(8 $\pm$ 3)(0)	
^{66}Zn	$\rightarrow$ 1.37	$\rightarrow 5/2^+$		21 $\pm$ 1	-0.11 $\pm$ 0.01		(2.7 $\pm$ 1.3)(0)	
	2.14 $\rightarrow$ 1.07	$11/2^+ \rightarrow 9/2^+$	960 $\pm$ 100 fs	100	-0.67 $\pm$ 0.05		(1.2 $\pm$ 0.2)(+1)	
	1.04 $\rightarrow$ 0	$2^+ \rightarrow 0^+$	2.28 $\pm$ 0.09 ps	100	0		(1.8 $\pm$ 0.1)(+1)	
	1.87 $\rightarrow$ 0	$2^+ \rightarrow 0^+$		from B(E2)			(5.7 $\pm$ 0.8)(-2)	
^{67}Zn	2.78 $\rightarrow$ 0	$2^+ \rightarrow 0^+$	420 $\pm$ 100 fs	77 $\pm$ 2	0		(5.5 $\pm$ 1.3)(-1)	
	0.093 $\rightarrow$ 0	$1/2^- \rightarrow 5/2^-$	13.1 $\pm$ 0.2 μ s	100	[0]	0.87	(2.9 $\pm$ 0.1)(-1)	
	0.18 $\rightarrow$ 0	$3/2^- \rightarrow 5/2^-$	1.49 $\pm$ 0.02 ns	86.7 $\pm$ 0.2	-0.39 $\pm$ 0.02	0.02	(1.7 $\pm$ 0.1)(+1)	
	0.39 $\rightarrow$ 0	$3/2^- \rightarrow 5/2^-$		from B(E2)			(4.6 $\pm$ 0.4)(-1)	
	0.81 $\rightarrow$ 0	$7/2^- \rightarrow 5/2^-$	9 $\pm$ 2 ps	from B(E2)			(1.4 $\pm$ 0.1)(+1)	
	$\rightarrow$ 0.18	$\rightarrow 3/2^-$		9 $\pm$ 1	[0]		(5.0 $\pm$ 1.2)(0)	
	0.89 $\rightarrow$ 0	$5/2^- \rightarrow 5/2^-$		from B(E2)			(5.8 $\pm$ 0.4)(0)	
	1.36 $\rightarrow$ 0.39	$5/2^- \rightarrow 3/2^-$	260 $\pm$ 55 fs	37 $\pm$ 3	+0.31 $\pm$ 0.06		(7 $\pm$ 3)(0)	
	$\rightarrow$ 0.89	$\rightarrow 5/2^-$		8 $\pm$ 1	+0.37 $\pm$ 0.05		(8 $\pm$ 3)(+1)	
	1.52 $\rightarrow$ 0	$9/2^- \rightarrow 5/2^-$	330 $\pm$ 65 fs	92 $\pm$ 3	$\approx$ 0		(1.7 $\pm$ 0.3)(+1)	
^{67}Ga	1.60 $\rightarrow$ 0.60	$7/2^+ \rightarrow 9/2^+$	200 $\pm$ 35 fs	80 $\pm$ 3	+0.28 $\pm$ 0.03		(1.4 $\pm$ 0.4)(+1)	
	1.80 $\rightarrow$ 0	$7/2^- \rightarrow 5/2^-$	170 $\pm$ 30 fs	31 $\pm$ 3	+0.38 $\pm$ 0.08		(6 $\pm$ 2)(-1)	
	$\rightarrow$ 0.18	$\rightarrow 3/2^-$		24 $\pm$ 3	[0]		(6.2 $\pm$ 1.3)(0)	
	$\rightarrow$ 0.39	$\rightarrow 3/2^-$		18 $\pm$ 3	[0]		(9 $\pm$ 2)(0)	
	1.88 $\rightarrow$ 0.39	$5/2^- \rightarrow 3/2^-$	190 $\pm$ 35 fs	21 $\pm$ 2	+0.8 $\pm$ 0.2		(2.8 $\pm$ 1.0)(0)	
	0.36 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	70 $\pm$ 7 ps	100	+0.07 $\pm$ 0.01		(5.8 $\pm$ 1.8)(-1)	
	0.83 $\rightarrow$ 0	$3/2^- \rightarrow 3/2^-$	250 $\pm$ 40 fs	86.9 $\pm$ 1.2	+0.16 $\pm$ 0.03		(1.1 $\pm$ 0.4)(+1)	
	$\rightarrow$ 0.17	$\rightarrow 1/2^-$		9.4 $\pm$ 1.2	+0.36 $\pm$ 0.09		(1.7 $\pm$ 0.8)(+1)	
	0.91 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	360 $\pm$ 95 fs	95.5 $\pm$ 0.5	-0.33 $\pm$ 0.02		(2.1 $\pm$ 0.6)(+1)	
	$\rightarrow$ 0.17	$\rightarrow 1/2^-$		2.1 $\pm$ 0.3	$\approx$ 0		(1.3 $\pm$ 0.4)(+1)	
^{68}Zn	1.20 $\rightarrow$ 0	$7/2^- \rightarrow 3/2^-$	1.5 $\pm$ 0.5 ps	75 $\pm$ 2	$\approx$ 0		(1.0 $\pm$ 0.3)(+1)	
	$\rightarrow$ 0.36	$\rightarrow 5/2^-$		25 $\pm$ 2	+2.3 $\pm$ 0.1		(1.8 $\pm$ 0.6)(+1)	
	1.41 $\rightarrow$ 0	$7/2^- \rightarrow 3/2^-$	900 $\pm$ 300 fs	55 $\pm$ 2	$\approx$ 0		(5.4 $\pm$ 1.8)(0)	
	$\rightarrow$ 0.36	$\rightarrow 5/2^-$		35 $\pm$ 2	+1.7 $\pm$ 0.2		(1.1 $\pm$ 0.4)(+1)	
	$\rightarrow$ 0.91	$\rightarrow 5/2^-$		10.5 $\pm$ 0.9	+0.11 $\pm$ 0.02		(2.2 $\pm$ 0.8)(0)	
	1.52 $\rightarrow$ 0.36	$9/2^- \rightarrow 5/2^-$	1.6 $\pm$ 0.7 ps	100	$\approx$ 0		(1.4 $\pm$ 0.6)(+1)	
	1.55 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	230 $\pm$ 35 fs	43 $\pm$ 3	-0.42 $\pm$ 0.04		(1.5 $\pm$ 0.3)(0)	
	$\rightarrow$ 0.36	$\rightarrow 5/2^-$		57 $\pm$ 3	+0.65 $\pm$ 0.03		(1.5 $\pm$ 0.2)(+1)	
	1.64 $\rightarrow$ 0.17	$3/2^- \rightarrow 1/2^-$	165 $\pm$ 25 fs	53 $\pm$ 2	+0.16 $\pm$ 0.02		(5.0 $\pm$ 1.4)(-1)	
	2.26 $\rightarrow$ 0.91	$9/2^- \rightarrow 5/2^-$	980 $\pm$ 250 fs	49.6 $\pm$ 1.4	$\approx$ 0		(5.6 $\pm$ 1.4)(0)	
^{68}Ge	$\rightarrow$ 1.20	$\rightarrow 7/2^-$		50.4 $\pm$ 1.4	+2.4 $\pm$ 0.2		(1.6 $\pm$ 0.4)(+1)	
	2.86 $\rightarrow$ 1.52	$11/2^- \rightarrow 9/2^-$	1.25 $\pm$ 0.30 ps	68.4 $\pm$ 1.4	+2.5 $\pm$ 0.2		(5.3 $\pm$ 1.3)(0)	
	3.03 $\rightarrow$ 2.07	$13/2^+ \rightarrow 9/2^+$	6.5 $\pm$ 0.6 ps	100	$\approx$ 0		(9.3 $\pm$ 0.9)(0)	
	1.08 $\rightarrow$ 0	$2^+ \rightarrow 0^+$		from B(E2)			(1.5 $\pm$ 0.1)(+1)	
^{69}Ga	1.88 $\rightarrow$ 0	$2^+ \rightarrow 0^+$	2.2 $\pm$ 0.4 ps	61 $\pm$ 2	0		(5.6 $\pm$ 0.8)(-1)	
	$\rightarrow$ 1.08	$\rightarrow 2^+$		39 $\pm$ 2	+1.46 $\pm$ 0.14		(1.7 $\pm$ 0.4)(+1)	
	$\rightarrow$ 1.66	$\rightarrow 0^+$		(2.6 $\pm$ 1.0) $\times 10^{-2}$	0		(9 $\pm$ 4)(+1)	
	1.02 $\rightarrow$ 0	$2^+ \rightarrow 0^+$	5.8 $\pm$ 1.0 ps	100	0		(6.7 $\pm$ 1.2)(0)	
^{69}Ge	2.27 $\rightarrow$ 1.02	$4^+ \rightarrow 2^+$	1.3 $\pm$ 0.3 ps	100	[0]		(1.2 $\pm$ 0.3)(+1)	
	0.32 $\rightarrow$ 0	$1/2^- \rightarrow 3/2^-$		from B(E2)			(7.8 $\pm$ 1.2)(0)	
^{69}Ga	0.57 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	19 $\pm$ 3 ps	from B(E2)			(3.4 $\pm$ 0.5)(-1)	

TABLE III. Strengths of $E2$ Transitions
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Nucleus	$E_{xi} \rightarrow E_{xf}$ (MeV)	$J_i^\pi \rightarrow J_f^\pi$	τ_m or τ_γ	Total branching (%)	δ	a_{tot}	S (W.u.)	Remarks
^{69}Ga	0.57 ± 0.32	$5/2^- \rightarrow 1/2^-$	19 ± 3 ps	0.16 ± 0.05	[0]		$(3.7 \pm 1.3)(0)$	
	0.87 ± 0	$3/2^- \rightarrow 3/2^-$		from B(E2)			$(5.1 \pm 0.8)(0)$	
	1.03 ± 0	$1/2^- \rightarrow 3/2^-$		from B(E2)			$(4.4 \pm 0.9)(0)$	
	1.11 ± 0	$5/2^- \rightarrow 3/2^-$	290 ± 30 fs	from B(E2)			$(1.0 \pm 0.2)(+1)$	
	± 0.32	$\rightarrow 1/2^-$		1.2 ± 0.1	[0]		$(6.2 \pm 0.8)(0)$	
	1.34 ± 0	$7/2^- \rightarrow 3/2^-$	1.18 ± 0.16 ps	93.7 ± 0.6	≈ 0		$(8.7 \pm 1.2)(0)$	
	± 0.57	$\rightarrow 5/2^-$		6.3 ± 0.6	$+0.68 \pm 0.10$		$(1.9 \pm 0.5)(0)$	
	1.49 ± 0	$7/2^- \rightarrow 3/2^-$	2.9 ± 1.2 ps	51 ± 6	≈ 0		$(1.1 \pm 0.4)(0)$	
	± 0.57	$\rightarrow 5/2^-$		35 ± 8	-2.54 ± 0.10		$(8 \pm 3)(0)$	
^{69}Ge	0.087 ± 0	$1/2^- \rightarrow 5/2^-$	7.4 ± 0.4 μs	100	≈ 0	1.3	$(5.6 \pm 0.3)(-1)$	
	0.23 ± 0	$3/2^- \rightarrow 5/2^-$	252 ± 17 ps	69 ± 1	-0.27 ± 0.04		$(1.3 \pm 0.4)(+1)$	
	$[0.81 \pm 0.40]$	$5/2^+ \rightarrow 9/2^+$	1.5 ± 0.2 ps	18 ± 1	≈ 0		$(4.9 \pm 0.7)(+2)$	c)
	0.86 ± 0	$7/2^- \rightarrow 5/2^-$	3.1 ± 0.5 ps	94.4 ± 0.8	-2.4 ± 0.3		$(2.6 \pm 0.4)(+1)$	
	± 0.23	$\rightarrow 3/2^-$		4.3 ± 0.4	≈ 0		$(6.6 \pm 1.2)(0)$	
	0.93 ± 0.087	$5/2^- \rightarrow 1/2^-$	2.2 ± 1.0 ps	18.7 ± 0.9	≈ 0		$(1.0 \pm 0.4)(+1)$	
	1.35 ± 0.40	$11/2^+ \rightarrow 9/2^+$	810 ± 110 fs	100	-0.6 ± 0.1		$(2.0 \pm 0.6)(+1)$	
	1.41 ± 0.40	$13/2^+ \rightarrow 9/2^+$	1.5 ± 0.2 ps	100	≈ 0		$(3.0 \pm 0.4)(+1)$	
	1.42 ± 0	$5/2^- \rightarrow 5/2^-$	1.4 ± 0.6 ps	64 ± 3	$+0.65 \pm 0.10$		$(1.1 \pm 0.5)(0)$	
	1.48 ± 0.23	$7/2^- \rightarrow 3/2^-$	430 ± 120 fs	7 ± 2	[0]		$(2.4 \pm 1.0)(0)$	
	± 0.37	$\rightarrow 3/2^-$		29 ± 2	≈ 0		$(1.9 \pm 0.5)(+1)$	
^{70}Zn	0.88 ± 0	$2^+ \rightarrow 0^+$	4.6 ± 0.4 ps	100	0		$(1.9 \pm 0.2)(+1)$	
	1.76 ± 0	$2^+ \rightarrow 0^+$		from B(E2)			$(5.8 \pm 1.5)(-1)$	
^{70}Ga	0.88 ± 0.69	$4^- \rightarrow 2^-$	32.8 ± 0.7 ns	100	≈ 0	0.07	$(5.8 \pm 0.1)(0)$	
^{70}Ge	1.04 ± 0	$2^+ \rightarrow 0^+$	1.83 ± 0.04 ps	100	0		$(2.1 \pm 0.1)(+1)$	
	1.22 ± 1.04	$0^+ \rightarrow 2^+$	4.6 ± 0.6 ns	98.6	0	0.11	$(5.3 \pm 0.7)(+1)$	
	1.71 ± 0	$2^+ \rightarrow 0^+$	5 ± 2 ps	44.7 ± 0.4	0		$(2.9 \pm 1.2)(-1)$	
	± 1.04	$\rightarrow 2^+$		52.9 ± 0.5	$+1.0 \pm 0.2$		$(1.8 \pm 0.8)(+1)$	
	± 1.22	$\rightarrow 0^+$		0.77 ± 0.15	0		$(2.5 \pm 1.1)(0)$	
	3.30 ± 2.15	$6^+ \rightarrow 4^+$	700 ± 150 fs	100	[0]		$(3.3 \pm 0.7)(+1)$	
	4.43 ± 3.30	$8^+ \rightarrow 6^+$	1.10 ± 0.25 ps	100	[0]		$(2.5 \pm 0.6)(+1)$	
^{70}As	0.032 ± 0	$2^+ \rightarrow 4^+$	138 ± 4 μs	100	[0]	51	$(2.0 \pm 0.1)(-1)$	
^{71}Ga	0.51 ± 0	$3/2^- \rightarrow 3/2^-$		from B(E2)			$(4.6 \pm 0.8)(0)$	
	0.96 ± 0	$5/2^- \rightarrow 3/2^-$	2.1 ± 0.3 ps	from B(E2)			$(1.2 \pm 0.2)(+1)$	
	± 0.39	$\rightarrow 1/2^-$		2.0 ± 0.2	[0]		$(7.0 \pm 1.2)(0)$	
^{71}Ge	0.17 ± 0	$5/2^- \rightarrow 1/2^-$	114 ± 3 ns	100	≈ 0	0.09	$(2.6 \pm 0.1)(0)$	
^{72}Ge	0.83 ± 0	$2^+ \rightarrow 0^+$	24 ± 2 ps	≈ 100	0		$(4.8 \pm 0.4)(0)$	
	± 0.69	$\rightarrow 0^+$		0.015 ± 0.001	0	0.23	$(3.8 \pm 0.5)(0)$	
	1.46 ± 0	$2^+ \rightarrow 0^+$	4.0 ± 1.0 ps	12.3 ± 0.3	0		$(2.1 \pm 0.5)(-1)$	
	± 0.69	$\rightarrow 0^+$		0.15 ± 0.03	0		$(6 \pm 2)(-2)$	
	± 0.83	$\rightarrow 2^+$		87.6 ± 0.3	$+10.3 \pm 1.3$		$(9 \pm 2)(+1)$	
^{72}As	0.21 ± 0.046	$(1-3)^+ \rightarrow 1^+$	115 ± 3 ns	59 ± 5	≈ 0	0.16	$(1.5 \pm 0.2)(0)$	
	0.31 ± 0	$(0-4)^- \rightarrow 2^-$	24 ± 4 ns	29	≈ 0		$(1.9 \pm 0.3)(-1)$	
^{72}Se	0.86 ± 0	$2^+ \rightarrow 0^+$	4.8 ± 0.5 ps	100	0		$(2.0 \pm 0.2)(+1)$	
	0.94 ± 0.86	$0^+ \rightarrow 2^+$	27 ± 2 ns	73 ± 12	0	2.2	$(1.6 \pm 0.3)(+2)$	d)
	1.32 ± 0	$2^+ \rightarrow 0^+$	13 ± 3 ps	51 ± 2	0		$(4.4 \pm 1.0)(-1)$	
	± 0.86	$\rightarrow 2^+$		39 ± 2	-4.6 ± 1.5		$(2.0 \pm 0.4)(+1)$	
	± 0.94	$\rightarrow 0^+$		10 ± 2	0		$(4.4 \pm 1.3)(+1)$	
	1.64 ± 0.86	$(1-4)^+ \rightarrow 2^+$	3.6 ± 0.8 ps	100	≈ 0		$(4.4 \pm 1.0)(+1)$	
	2.47 ± 1.64	$(1-6)^+ \rightarrow (1-4)^+$	2.4 ± 0.3 ps	100	≈ 0		$(4.7 \pm 0.5)(+1)$	
^{73}Ge	0.013 ± 0	$5/2^+ \rightarrow 9/2^+$	4.25 ± 0.07 μs	100	≈ 0	1100	$(2.5 \pm 0.1)(+1)$	
^{74}Ge	0.60 ± 0	$2^+ \rightarrow 0^+$	16.6 ± 1.6 ps	100	0		$(3.2 \pm 0.3)(+1)$	
	1.20 ± 0	$2^+ \rightarrow 0^+$	7.8 ± 1.1 ps	32 ± 1	0		$(7.1 \pm 1.0)(-1)$	
	± 0.60	$\rightarrow 2^+$		68 ± 1	-3.3 ± 0.2		$(4.3 \pm 0.6)(+1)$	
^{74}Se	0.63 ± 0	$2^+ \rightarrow 0^+$	10.7 ± 0.4 ps	100	0		$(4.0 \pm 0.2)(+1)$	
	0.85 ± 0.63	$0^+ \rightarrow 2^+$	1.08 ± 0.07 ns	≈ 100	0	0.04	$(7.7 \pm 0.5)(+1)$	

TABLE III. Strengths of $E2$ Transitions
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Nucleus	$E_{xi} \rightarrow E_{xf}$ (MeV)	$J_i^\pi \rightarrow J_f^\pi$	τ_m or τ_γ	Total branching (%)	δ	α_{tot}	S (W.u.)	Remarks
^{74}Se	$1.27 \rightarrow 0$ $\rightarrow 0.63$	$2^+ \rightarrow 0^+$ $\rightarrow 2^+$	4.8 ± 0.6 ps	31 ± 3 69 ± 3	0 $+2.6 \pm 0.2$		$(8.4 \pm 1.4)(-1)$ $(4.9 \pm 0.6)(+1)$	
	$1.36 \rightarrow 0.63$	$4^+ \rightarrow 2^+$	2.7 ± 0.1 ps	100	≈ 0		$(9.5 \pm 0.4)(+1)$	
	$2.23 \rightarrow 1.36$	$6^+ \rightarrow 4^+$	2.4 ± 0.3 ps	100	≈ 0		$(3.6 \pm 0.5)(+1)$	
^{75}As	$0.20 \rightarrow 0$	$1/2^- \rightarrow 3/2^-$	1.25 ± 0.04 ns	100	$\pm 0.44 \pm 0.02$		$(1.8 \pm 0.2)(+1)$	
	$0.27 \rightarrow 0$	$3/2^- \rightarrow 3/2^-$	17.0 ± 1.0 ps	97.57 ± 0.06	$+0.045 \pm 0.006$		$(3.7 \pm 1.0)(-1)$	
	[$\rightarrow 0.20$]	$\rightarrow 1/2^-$		2.43 ± 0.06	-0.19 ± 0.02	0.51	$(1.1 \pm 0.2)(+3)$	e)
	$0.28 \rightarrow 0$	$5/2^- \rightarrow 3/2^-$	400 ± 14 ps	100	$+0.36 \pm 0.03$		$(7.1 \pm 1.0)(0)$	
	[$\rightarrow 0.20$]	$\rightarrow 1/2^-$		0.090 ± 0.015	[0]	1.7	$(1.0 \pm 0.2)(+2)$	f)
	$0.40 \rightarrow 0.30$	$5/2^+ \rightarrow 9/2^+$	2.5 ± 0.1 ns	6.4 ± 0.4	[0]	0.88	$(6.4 \pm 0.5)(+1)$	
	$0.57 \rightarrow 0$	$5/2^- \rightarrow 3/2^-$		from B(E2)			$(2.6 \pm 0.3)(+1)$	
	$0.82 \rightarrow 0$	$7/2^- \rightarrow 3/2^-$	3.6 ± 0.4 ps	86.3 ± 1.3	[0]		$(2.7 \pm 0.3)(+1)$	
^{75}Se	[$0.11 \rightarrow 0$]	$7/2^+ \rightarrow 5/2^+$	1.00 ± 0.17 ns	100	$+0.35 \pm 0.06$	0.14	$(2.4 \pm 0.8)(+2)$	g)
	$0.13 \rightarrow 0$	$9/2^+ \rightarrow 5/2^+$	7.6 ± 0.9 ns	37 ± 8	≈ 0	0.29	$(3.7 \pm 0.9)(+1)$	
^{76}Ge	$0.56 \rightarrow 0$	$2^+ \rightarrow 0^+$	26.2 ± 0.2 ps	100	0		$(2.9 \pm 0.1)(+1)$	
	$1.11 \rightarrow 0$	$2^+ \rightarrow 0^+$	13.1 ± 1.4 ps	38 ± 4	0		$(7.2 \pm 0.9)(-1)$	
	$\rightarrow 0.56$	$\rightarrow 2^+$		62 ± 4	-3.4 ± 0.4		$(3.4 \pm 0.4)(+1)$	
^{76}Se	$0.56 \rightarrow 0$	$2^+ \rightarrow 0^+$	17.8 ± 0.4 ps	100	0		$(4.3 \pm 0.1)(+1)$	
	$1.12 \rightarrow 0.56$	$0^+ \rightarrow 2^+$	16 ± 6 ps	100	0		$(4.7 \pm 1.8)(+1)$	
	$1.22 \rightarrow 0$	$2^+ \rightarrow 0^+$	4.9 ± 0.3 ps	39 ± 2	0		$(1.2 \pm 0.1)(0)$	
	$\rightarrow 0.56$	$\rightarrow 2^+$		61 ± 2	-5.2 ± 0.2		$(4.0 \pm 0.3)(+1)$	
	$1.33 \rightarrow 0.56$	$4^+ \rightarrow 2^+$	2.20 ± 0.07 ps	100	[0]		$(7.0 \pm 0.2)(+1)$	
^{77}As	$0.26 \rightarrow 0$	$5/2^- \rightarrow 3/2^-$	500 ± 30 ps	100	$+0.32 \pm 0.01$		$(5.8 \pm 0.5)(0)$	
	$0.63 \rightarrow 0.48$	$5/2^+ \rightarrow 9/2^+$	108 ± 22 ps	2.1 ± 0.2	[0]	0.18	$(7.1 \pm 1.6)(+1)$	
^{77}Se	$0.24 \rightarrow 0$	$3/2^- \rightarrow 1/2^-$	39 ± 10 ps	99.90 ± 0.05	-0.18 ± 0.02		$(4.1 \pm 1.4)(+1)$	
	$0.25 \rightarrow 0$	$5/2^- \rightarrow 1/2^-$	13.4 ± 0.6 ns	70.0 ± 1.1	[0]		$(2.2 \pm 0.1)(0)$	
	$0.44 \rightarrow 0$	$5/2^- \rightarrow 1/2^-$	33 ± 3 ps	53 ± 2	≈ 0		$(4.0 \pm 0.4)(+1)$	
^{78}Se	$0.61 \rightarrow 0$	$2^+ \rightarrow 0^+$		from B(E2)			$(3.3 \pm 0.1)(+1)$	
	$1.31 \rightarrow 0$	$2^+ \rightarrow 0^+$	3.9 ± 0.4 ps	41.0 ± 1.3	0		$(1.1 \pm 0.1)(0)$	
	$\rightarrow 0.61$	$\rightarrow 2^+$		59.0 ± 1.3	-2.7 ± 0.8		$(3.3 \pm 0.4)(+1)$	
^{78}Kr	$0.46 \rightarrow 0$	$2^+ \rightarrow 0^+$	33 ± 2 ps	100	0		$(6.2 \pm 0.4)(+1)$	
	$1.12 \rightarrow 0.46$	$4^+ \rightarrow 2^+$	3.6 ± 0.3 ps	100	[0]		$(9.0 \pm 0.8)(+1)$	
	$1.15 \rightarrow 0$	$2^+ \rightarrow 0^+$	5.8 ± 0.5 ps	34 ± 4	0		$(1.2 \pm 0.2)(0)$	
	$1.56 \rightarrow 0.46$	$3^+ \rightarrow 2^+$	6.4 ± 0.5 ps	85 ± 3	$+5 \pm 2$		$(3.2 \pm 0.3)(0)$	
	$\rightarrow 1.12$	$\rightarrow 4^+$		15 ± 3	$+11 \pm 2$		$(5.7 \pm 1.2)(+1)$	
	$1.87 \rightarrow 1.15$	$4^+ \rightarrow 2^+$	1.9 ± 0.3 ps	58 ± 8	[0]		$(6.3 \pm 1.3)(+1)$	
	$1.98 \rightarrow 1.12$	$6^+ \rightarrow 4^+$	900 ± 150 fs	100	[0]		$(9.5 \pm 1.6)(+1)$	
	$2.30 \rightarrow 1.56$	$5^+ \rightarrow 3^+$	1.8 ± 0.4 ps	70 ± 3	[0]		$(7.0 \pm 1.6)(+1)$	
	$2.99 \rightarrow 1.98$	$8^+ \rightarrow 6^+$	450 ± 60 fs	100	[0]		$(8.5 \pm 1.1)(+1)$	
	$3.29 \rightarrow 2.75$	$7^- \rightarrow 5^-$	2.9 ± 0.3 ps	46 ± 3	[0]		$(1.4 \pm 0.2)(+2)$	
^{79}Br	$0.22 \rightarrow 0$	$5/2^- \rightarrow 3/2^-$		from B(E2)			$(1.3 \pm 0.1)(+1)$	
	$0.31 \rightarrow 0$	$1/2^- \rightarrow 3/2^-$		from B(E2)			$(2.0 \pm 0.4)(+1)$	
	$0.40 \rightarrow 0$	$3/2^- \rightarrow 3/2^-$		from B(E2)			$(1.6 \pm 0.3)(0)$	
	$0.52 \rightarrow 0$	$5/2^- \rightarrow 3/2^-$		from B(E2)			$(3.2 \pm 0.3)(+1)$	
	$0.61 \rightarrow 0$	$3/2^- \rightarrow 3/2^-$	2.9 ± 0.3 ps	from B(E2)			$(7.6 \pm 1.2)(0)$	
	$\rightarrow 0.22$	$\rightarrow 5/2^-$		12.6 ± 1.6	$+0.19 \pm 0.02$		$(4.8 \pm 1.2)(0)$	
	$0.76 \rightarrow 0$	$7/2^- \rightarrow 3/2^-$	1.7 ± 0.3 ps	34 ± 2	[0]		$(3.1 \pm 0.6)(+1)$	
^{79}Kr	$0.15 \rightarrow 0$	$(1/2-7/2)^- \rightarrow (1/2, 3/2)^-$	113 ± 2 ns	100	≈ 0	0.22	$(4.2 \pm 0.1)(-1)$	
^{80}Se	$0.67 \rightarrow 0$	$2^+ \rightarrow 0^+$		from B(E2)			$(2.5 \pm 0.1)(+1)$	
	$1.45 \rightarrow 0$	$2^+ \rightarrow 0^+$	1.5 ± 0.3 ps	56 ± 6	0		$(2.3 \pm 0.5)(0)$	
	$\rightarrow 0.67$	$\rightarrow 2^+$		44 ± 6	$+5 \pm 4$		$(3.8 \pm 1.0)(+1)$	
^{80}Kr	$0.62 \rightarrow 0$	$2^+ \rightarrow 0^+$	12.7 ± 0.7 ps	100	0		$(3.4 \pm 0.2)(+1)$	
^{81}Br	$0.28 \rightarrow 0$	$5/2^- \rightarrow 3/2^-$	12 ± 5 ps	100	-0.09 ± 0.02		$(1.6 \pm 0.1)(+1)$	
	$0.57 \rightarrow 0$	$3/2^- \rightarrow 3/2^-$		from B(E2)			$(1.2 \pm 0.1)(0)$	
	$0.84 \rightarrow 0$	$7/2^- \rightarrow 3/2^-$	920 ± 220 fs	13 ± 4	[0]		$(1.3 \pm 0.5)(+1)$	

TABLE III. Strengths of $E2$ Transitions
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Nucleus	$E_{xi} \rightarrow E_{xf}$ (MeV)	$J_i^\pi \rightarrow J_f^\pi$	τ_m or Γ_γ	Total branching (%)	δ	α_{tot}	S (W.u.)	Remarks
^{81}Br	$0.84 \rightarrow 0.28$	$7/2^- \rightarrow 5/2^-$	920 ± 220 fs	87 ± 4	-0.193 ± 0.012		$(2.4 \pm 0.6)(+1)$	
^{82}Se	$0.66 \rightarrow 0$	$2^+ \rightarrow 0^+$		from B(E2)			$(1.7 \pm 0.1)(+1)$	
^{82}Kr	$0.78 \rightarrow 0$	$2^+ \rightarrow 0^+$	6.9 ± 1.2 ps	100	0		$(1.9 \pm 0.3)(+1)$	
^{84}Kr	$0.88 \rightarrow 0$	$2^+ \rightarrow 0^+$	4.6 ± 0.7 ps	100	0		$(1.5 \pm 0.2)(+1)$	
^{84}Sr	$0.79 \rightarrow 0$	$2^+ \rightarrow 0^+$	4.2 ± 1.3 ps	100	0		$(2.8 \pm 0.9)(+1)$	
^{85}Rb	$0.15 \rightarrow 0$	$3/2^- \rightarrow 5/2^-$		from B(E2)			$(2.2 \pm 0.2)(0)$	
	$0.28 \rightarrow 0$	$1/2^- \rightarrow 5/2^-$	420 ± 90 ps	4.5 ± 0.9	[0]		$(2.2 \pm 0.2)(0)$	
	$0.73 \rightarrow 0$	$3/2^- \rightarrow 3/2^-$	6.4 ± 0.7 ps	64 ± 3	$+0.8 \pm 0.2$		$(7 \pm 2)(0)$	
	$0.87 \rightarrow 0$	$3/2^- \rightarrow 1/2^-$	3.8 ± 0.3 ps	99	$\approx \infty$		$(1.9 \pm 0.2)(+1)$	
^{86}Sr	$1.08 \rightarrow 0$	$2^+ \rightarrow 0^+$		from B(E2)			$(1.0 \pm 0.2)(+1)$	
^{86}Y	$0.24 \rightarrow 0$	$2^- \rightarrow 4^-$	42 ± 3 ns	100	≈ 0		$(1.0 \pm 0.1)(0)$	
^{86}Zr	$0.75 \rightarrow 0$	$2^+ \rightarrow 0^+$	10.6 ± 2.0 ps	100	0		$(1.4 \pm 0.3)(+1)$	
^{87}Rb	$0.40 \rightarrow 0$	$5/2^- \rightarrow 3/2^-$		from B(E2)			$(1.6 \pm 0.2)(0)$	
^{88}Sr	$1.84 \rightarrow 0$	$2^+ \rightarrow 0^+$	210 ± 20 fs	100	0		$(7.7 \pm 0.8)(0)$	
^{89}Y	$1.51 \rightarrow 0$	$3/2^- \rightarrow 1/2^-$		from B(E2)			$(2.8 \pm 0.4)(0)$	
	$1.74 \rightarrow 0$	$5/2^- \rightarrow 1/2^-$		from B(E2)			$(2.8 \pm 0.2)(0)$	
	$2.22 \rightarrow 0.91$	$5/2^+ \rightarrow 9/2^+$	500 ± 200 fs	70	[0]		$(1.2 \pm 0.5)(+1)$	
^{89}Zr	$1.63 \rightarrow 0$	$5/2^+ \rightarrow 9/2^+$	580 ± 90 fs	87 ± 2	[0]		$(4.4 \pm 0.7)(0)$	
	$1.83 \rightarrow 0$	$5/2^+ \rightarrow 9/2^+$	810 ± 170 fs	91 ± 5	[0]		$(1.8 \pm 0.4)(0)$	
	$2.10 \rightarrow 1.10$	$5/2^- \rightarrow 3/2^-$	110 ± 20 fs	75 ± 3	$+3.5 \pm 0.5$		$(6.7 \pm 1.3)(+1)$	
^{90}Y	$0.20 \rightarrow 0$	$3^- \rightarrow 2^-$	361 ± 10 ps	100	-0.28 ± 0.06		$(2.0 \pm 0.8)(+1)$	
^{90}Zr	$2.19 \rightarrow 0$	$2^+ \rightarrow 0^+$		from B(E2)			$(5.5 \pm 0.5)(0)$	
	$3.31 \rightarrow 0$	$2^+ \rightarrow 0^+$		from B(E2)			$(5.6 \pm 1.5)(-1)$	
	$3.59 \rightarrow 3.45$	$8^+ \rightarrow 6^+$	195 ± 5 ns	98.68 ± 0.09	≈ 0	0.31	$(2.3 \pm 0.1)(0)$	
	$3.84 \rightarrow 0$	$2^+ \rightarrow 0^+$		from B(E2)			$(1.7 \pm 0.3)(0)$	
^{90}Nb	$0.12 \rightarrow 0$	$6^+ \rightarrow 8^+$	91 ± 3 μ s	100	≈ 0	0.54	$(8.8 \pm 0.3)(-3)$	

- a) The large mixing ratio results from (p,n γ) work in $^{74}\text{To}10$. Analogous work in $^{74}\text{Ri}13$ is perfectly compatible with $\delta = 0$.
- b) The mixing ratio $\delta = -0.17 \pm 0.03$ is the average of six measured values with large spread; one should conclude to $\delta \approx 0$.
- c) One has to conclude that the 0.81 MeV level (decaying to $3/2^-$, $5/2^-$ and $9/2^+$ states) is a doublet as already suggested in $^{72}\text{Hs}01$. The $J^\pi = 5/2^+$ assignment would also lead to an impossibly strong M2 component in the γ_0 transition (see Table VII).
- d) See discussion in text.
- e) The mixing ratio for this weak branch obtained from $^{75}\text{Ge}(\beta^- \gamma)$ γ - γ angular correlation work (see A = 75 compilation) must be doubted; $\delta \approx 0$ seems more realistic.
- f) The branching ratio for this weak branch is suspect (see A = 75 compilation).
- g) The mixing ratio has been derived from the (very small) measured conversion coefficient ($^{74}\text{Su}03$). A value $\delta = +0.21 \pm 0.13$ is derived from an (α ,n γ) angular distribution measurement ($^{76}\text{Sa}07$); one should conclude to $\delta \approx 0$.

TABLE IV. Strengths of E3 Transitions

See page 552 for Explanation of Tables

Nucleus	$E_{x1} \rightarrow E_{xf}$ (MeV)	$J_1^\pi \rightarrow J_f^\pi$	τ_m	Total branching (%)	δ	α_{tot}	S (W.u.)	Remarks
⁴⁶ Sc	0.14 $\rightarrow$ 0	1 ⁻ $\rightarrow$ 4 ⁺	27 $\pm$ 7 s	100	[0]	0.61	(2.7 $\pm$ 0.7)(-1)	
⁴⁸ Ca	4.51 $\rightarrow$ 0	3 ⁻ $\rightarrow$ 0 ⁺	13 $\pm$ 2 ps	27 $\pm$ 2	0		(6.7 $\pm$ 1.0)(0)	
⁴⁹ Sc	2.23 $\rightarrow$ 0	1/2 ⁺ $\rightarrow$ 7/2 ⁻	43.1 $\pm$ 1.6 ns	100	[0]		(1.0 $\pm$ 0.1)(0)	
⁵² Cr	4.56 $\rightarrow$ 0	3 ⁻ $\rightarrow$ 0 ⁺		from B(E3)			(6.1 $\pm$ 0.3)(0)	
⁵⁸ Fe	3.86 $\rightarrow$ 0	3 ⁻ $\rightarrow$ 0 ⁺		from B(E3)			(9.9 $\pm$ 0.9)(0)	
⁵⁸ Ni	4.47 $\rightarrow$ 0	3 ⁻ $\rightarrow$ 0 ⁺		from B(E3)			(1.6 $\pm$ 0.3)(+1)	
⁶⁰ Ni	4.05 $\rightarrow$ 0	3 ⁻ $\rightarrow$ 0 ⁺		from B(E3)			(1.1 $\pm$ 0.2)(+1)	
⁶² Ni	3.76 $\rightarrow$ 0	3 ⁻ $\rightarrow$ 0 ⁺		from B(E3)			(1.3 $\pm$ 0.1)(+1)	
⁶⁵ Zn	1.07 $\rightarrow$ 0	9/2 ⁺ $\rightarrow$ 5/2 ⁻	830 $\pm$ 40 ps	5 $\pm$ 1	+0.13 $\pm$ 0.02		(4.2 $\pm$ 1.5)(0)	
⁶⁶ Zn	2.83 $\rightarrow$ 0	3 ⁻ $\rightarrow$ 0 ⁺		from B(E3)			(2.3 $\pm$ 0.5)(+1)	
⁶⁸ Zn	2.75 $\rightarrow$ 0	3 ⁻ $\rightarrow$ 0 ⁺		from B(E3)			(2.0 $\pm$ 0.4)(+1)	
⁷² Ge	2.51 $\rightarrow$ 0	3 ⁻ $\rightarrow$ 0 ⁺	35 $\pm$ 7 ps	2.1 $\pm$ 0.2	0		(5.3 $\pm$ 1.0)(0)	
⁷³ Se	0.026 $\rightarrow$ 0	(1/2-5/2) ⁻ $\rightarrow$ (7/2,9/2) ⁺	56 $\pm$ 3 min	73 $\pm$ 7	$\approx$ 0	5300	(3.8 $\pm$ 0.4)(-2)	
⁷⁴ Se	2.35 $\rightarrow$ 0	3 ⁻ $\rightarrow$ 0 ⁺		from B(E3)			(9 $\pm$ 2)(0)	
⁷⁵ Ge	0.14 $\rightarrow$ 0	7/2 ⁺ $\rightarrow$ 1/2 ⁻	69.7 $\pm$ 0.3 s	$\approx$ 100	$\approx$ 0	1.4	(2.8 $\pm$ 0.1)(-2)	
⁷⁵ As	0.30 $\rightarrow$ 0	9/2 ⁺ $\rightarrow$ 3/2 ⁻	25.30 $\pm$ 0.11 ms	8 $\pm$ 2	[0]	0.05	(6.3 $\pm$ 1.6)(-2)	
	[$\rightarrow$ 0.28	$\rightarrow$ 5/2 ⁻		92 $\pm$ 2	-0.18 $\pm$ 0.02	5600	(3.8 $\pm$ 0.8)(+3)]	a)
⁷⁶ Se	2.43 $\rightarrow$ 0	3 ⁻ $\rightarrow$ 0 ⁺	16.5 $\pm$ 2.0 ps	2.1 $\pm$ 0.2	0		(1.7 $\pm$ 0.2)(+1)	
⁷⁷ Ge	0.16 $\rightarrow$ 0	1/2 ⁻ $\rightarrow$ 7/2 ⁺	78 $\pm$ 2 s	21 $\pm$ 2	$\approx$ 0	0.86	(3.4 $\pm$ 0.3)(-3)	
⁷⁷ As	0.48 $\rightarrow$ 0	9/2 ⁺ $\rightarrow$ 3/2 ⁻	167 $\pm$ 6 μ s	3.3 $\pm$ 0.3	[0]		(2.2 $\pm$ 0.2)(-1)	
	$\rightarrow$ 0.26	$\rightarrow$ 5/2 ⁻		96.7 $\pm$ 0.3	-0.100 $\pm$ 0.007	0.08	(1.4 $\pm$ 0.2)(+1)	
⁷⁷ Se	0.16 $\rightarrow$ 0	7/2 ⁺ $\rightarrow$ 1/2 ⁻	25.2 $\pm$ 1.4 s	100	$\approx$ 0	0.86	(4.6 $\pm$ 0.3)(-2)	
⁷⁷ Br	0.11 $\rightarrow$ 0	9/2 ⁺ $\rightarrow$ 3/2 ⁻	6.17 $\pm$ 0.14 min	100	[0]	6.0	(1.6 $\pm$ 0.1)(-2)	
⁷⁸ Kr	2.38 $\rightarrow$ 0	3 ⁻ $\rightarrow$ 0 ⁺		from B(E3)			(1.7 $\pm$ 0.3)(+1)	
	2.87 $\rightarrow$ 0	3 ⁻ $\rightarrow$ 0 ⁺		from B(E3)			(6.2 $\pm$ 0.9)(0)	
⁷⁹ Se	0.096 $\rightarrow$ 0	1/2 ⁻ $\rightarrow$ 7/2 ⁺	5.64 $\pm$ 0.07 min	100	$\approx$ 0	9.2	(1.8 $\pm$ 0.1)(-2)	
⁷⁹ Br	0.21 $\rightarrow$ 0	9/2 ⁺ $\rightarrow$ 3/2 ⁻	7.04 $\pm$ 0.07 s	100	$\approx$ 0	0.32	(3.0 $\pm$ 0.1)(-2)	
⁷⁹ Kr	0.13 $\rightarrow$ 0	(7/2,9/2) ⁺ $\rightarrow$ (1/2,3/2) ⁻	72 $\pm$ 4 s	100	$\approx$ 0	2.5	(2.8 $\pm$ 0.2)(-2)	
⁸⁰ Kr	2.41 $\rightarrow$ 0	3 ⁻ $\rightarrow$ 0 ⁺		from B(E3)			(1.6 $\pm$ 0.2)(+1)	
	2.96 $\rightarrow$ 0	3 ⁻ $\rightarrow$ 0 ⁺		from B(E3)			(4.0 $\pm$ 0.6)(0)	
⁸² Kr	2.53 $\rightarrow$ 0	3 ⁻ $\rightarrow$ 0 ⁺		from B(E3)			(2.2 $\pm$ 0.3)(+1)	
	3.33 $\rightarrow$ 0	3 ⁻ $\rightarrow$ 0 ⁺		from B(E3)			(1.5 $\pm$ 0.2)(0)	
⁸³ Kr	0.042 $\rightarrow$ 0.009	1/2 ⁻ $\rightarrow$ 7/2 ⁺	2.64 $\pm$ 0.03 h	100	$\approx$ 0	1950	(6.2 $\pm$ 0.1)(-3)	
⁸³ Sr	0.26 $\rightarrow$ 0	1/2 ⁻ $\rightarrow$ 7/2 ⁺	7.14 $\pm$ 0.17 s	100	$\approx$ 0	0.15	(6.7 $\pm$ 0.2)(-3)	
⁸⁴ Kr	2.70 $\rightarrow$ 0	3 ⁻ $\rightarrow$ 0 ⁺		from B(E3)			(1.6 $\pm$ 0.2)(+1)	
⁸⁶ Kr	3.10 $\rightarrow$ 0	3 ⁻ $\rightarrow$ 0 ⁺		from B(E3)			(1.2 $\pm$ 0.2)(+1)	
⁸⁸ Sr	2.73 $\rightarrow$ 0	3 ⁻ $\rightarrow$ 0 ⁺	1.18 $\pm$ 0.11 ps	0.69 $\pm$ 0.05	0		(1.9 $\pm$ 0.1)(+1)	
⁸⁸ Y	0.39 $\rightarrow$ 0	1 ⁺ $\rightarrow$ 4 ⁻	432 $\pm$ 4 μ s	100	[0]		(5.8 $\pm$ 0.1)(0)	
	0.67 $\rightarrow$ 0.23	8 ⁺ $\rightarrow$ 5 ⁻	20.0 $\pm$ 0.3 ms	100	$\approx$ 0		(5.5 $\pm$ 0.1)(-2)	
⁸⁹ Y	2.22 $\rightarrow$ 0	5/2 ⁺ $\rightarrow$ 1/2 ⁻		from B(E3)			(1.8 $\pm$ 0.2)(+1)	
	2.53 $\rightarrow$ 0	7/2 ⁺ $\rightarrow$ 1/2 ⁻		from B(E3)			(2.0 $\pm$ 0.2)(+1)	
⁹⁰ Zr	2.32 $\rightarrow$ 2.19	5 ⁻ $\rightarrow$ 2 ⁺	1.168 $\pm$ 0.003 s	13 $\pm$ 2	$\approx$ 0	2.6	(1.5 $\pm$ 0.2)(-2)	
	2.75 $\rightarrow$ 0	3 ⁻ $\rightarrow$ 0 ⁺	8.3 $\pm$ 2.6 ps	7 $\pm$ 2	0		(2.5 $\pm$ 0.3)(+1)	
	3.59 $\rightarrow$ 2.32	8 ⁺ $\rightarrow$ 5 ⁻	195 $\pm$ 5 ns	1.32 $\pm$ 0.09	[0]		(4.6 $\pm$ 0.3)(-2)	
	5.64 $\rightarrow$ 0	3 ⁻ $\rightarrow$ 0 ⁺		from B(E3)			(2.0 $\pm$ 0.3)(0)	
	5.78 $\rightarrow$ 0	3 ⁻ $\rightarrow$ 0 ⁺		from B(E3)			(4.2 $\pm$ 0.6)(-1)	

a) The mixing ratio of this low-energy (24 keV) low-intensity line (0.07% of the most unknown transition in the ⁷⁵Se EC decay) obtained from a γ - γ angular measurement (77Pu04) is almost certainly in error.

TABLE V. Strengths of *E4* and *E5* Transitions
See page 552 for Explanation of Tables

Type	Nucleus	$E_{xi} \rightarrow E_{xf}$ (MeV)	$J_i^\pi \rightarrow J_f^\pi$	τ_m	Total branching (%)	δ	α_{tot}	S (W.u.)
E4	^{52}Cr	$2.37 \rightarrow 0$	$4^+ \rightarrow 0^+$	30.5 ± 0.3 min	from B(E4)	[0]	0.05	$(3.4 \pm 0.6)(0)$
	^{52}Mn	$0.38 \rightarrow 0$	$2^+ \rightarrow 6^+$		1.75 ± 0.04			$(1.4 \pm 0.1)(-1)$
	^{56}Fe	$2.09 \rightarrow 0$	$4^+ \rightarrow 0^+$		from B(E4)			$(1.6 \pm 0.2)(0)$
	^{58}Ni	$2.46 \rightarrow 0$	$4^+ \rightarrow 0^+$		from B(E4)			$(3.5 \pm 1.1)(0)$
	^{60}Ni	$2.51 \rightarrow 0$	$4^+ \rightarrow 0^+$		from B(E4)			$(5.2 \pm 0.6)(0)$
		$3.13 \rightarrow 0$	$4^+ \rightarrow 0^+$		from B(E4)			$(1.0 \pm 0.2)(0)$
		$3.67 \rightarrow 0$	$4^+ \rightarrow 0^+$		from B(E4)			$(1.8 \pm 0.4)(0)$
	^{62}Ni	$2.34 \rightarrow 0$	$4^+ \rightarrow 0^+$	29.6 ± 0.3 min	from B(E4)	[0]	0.04	$(3.0 \pm 0.3)(0)$
	^{78}Kr	$1.12 \rightarrow 0$	$4^+ \rightarrow 0^+$		from B(E4)			$(5.5 \pm 1.1)(0)$
	^{80}Kr	$1.42 \rightarrow 0$	$4^+ \rightarrow 0^+$		from B(E4)			$(2.3 \pm 0.5)(0)$
	^{82}Kr	$1.83 \rightarrow 0$	$4^+ \rightarrow 0^+$		from B(E4)			$(1.5 \pm 0.3)(0)$
	^{84}Kr	$2.10 \rightarrow 0$	$4^+ \rightarrow 0^+$		from B(E4)			$(2.3 \pm 0.6)(0)$
	^{84}Rb	$0.46 \rightarrow 0$	$6^- \rightarrow 2^-$		28 ± 3			$(3.9 \pm 0.4)(-1)$
	^{86}Kr	$2.25 \rightarrow 0$	$4^+ \rightarrow 0^+$		from B(E4)			$(3.4 \pm 0.7)(0)$
	^{90}Zr	$3.08 \rightarrow 0$	$4^+ \rightarrow 0^+$		from B(E4)			$(3.3 \pm 0.9)(0)$
		$4.32 \rightarrow 0$	$4^+ \rightarrow 0^+$		from B(E4)			$(1.7 \pm 0.5)(0)$
		$4.44 \rightarrow 0$	$4^+ \rightarrow 0^+$		from B(E4)			$(3.9 \pm 0.7)(0)$
E5	^{90}Y	$0.63 \rightarrow 0$	$7^+ \rightarrow 2^-$	4.60 ± 0.02 h	0.33 ± 0.03	[0]	0.03	$(2.1 \pm 0.2)(0)$
	^{90}Zr	$2.32 \rightarrow 0$	$5^- \rightarrow 0^+$	1.168 ± 0.003 s	87 ± 2	0		$(8.4 \pm 0.5)(0)$
		$3.98 \rightarrow 0$	$5^- \rightarrow 0^+$		from B(E5)			$(1.0 \pm 0.4)(+1)$

TABLE VI. Strengths of $M1$ Transitions

See page 552 for Explanation of Tables

Nucleus	$E_{x_i} \rightarrow E_{x_f}$ (MeV)	$J_i^\pi \rightarrow J_f^\pi$	τ_m	Total branching (%)	δ	a_{tot}	S (W.u.)	Remarks
^{45}Sc	0.54 $\rightarrow$ 0.012	$5/2^+ \rightarrow 3/2^+$	8.1 ± 2.3 ps	58.7 ± 0.5	$+0.70 \pm 0.15$		$(1.0 \pm 0.3)(-2)$	
	0.72 $\rightarrow$ 0	$5/2^- \rightarrow 7/2^-$	320 ± 25 fs	96.5 ± 0.5	≈ 0		$(2.5 \pm 0.2)(-1)$	
	0.97 $\rightarrow$ 0.54	$7/2^+ \rightarrow 5/2^+$	2.7 ± 0.3 ps	10.4 ± 0.5	$+0.41 \pm 0.15$		$(1.3 \pm 0.2)(-2)$	
	1.07 $\rightarrow$ 0.38	$3/2^- \rightarrow 3/2^-$	500 ± 140 fs	76 ± 2	≈ 0		$(1.4 \pm 0.4)(-1)$	
	$\rightarrow$ 0.72	$\rightarrow 5/2^-$		24 ± 2	≈ 0		$(3.7 \pm 1.0)(-1)$	
	1.43 $\rightarrow$ 0.97	$9/2^+ \rightarrow 7/2^+$	7.6 ± 0.3 ps	18.2 ± 1.4	$+0.28 \pm 0.07$		$(7.2 \pm 0.6)(-3)$	
	1.56 $\rightarrow$ 1.07	$(1/2, 3/2)^- \rightarrow 3/2^-$	390 ± 140 fs	100	[0]		$(7 \pm 2)(-1)$	
	1.66 $\rightarrow$ 0	$9/2^- \rightarrow 7/2^+$	146 ± 13 fs	79 ± 3	-0.45 ± 0.04		$(3.0 \pm 0.3)(-2)$	
	$\rightarrow$ 1.24	$\rightarrow 11/2^-$		21 ± 3	≈ 0		$(6.0 \pm 0.9)(-1)$	
	2.03 $\rightarrow$ 1.43	$11/2^+ \rightarrow 9/2^+$	1.6 ± 0.7 ps	37 ± 5	≈ 0		$(3.4 \pm 1.5)(-2)$	
	2.09 $\rightarrow$ 0	$5/2^- \rightarrow 7/2^-$	10 ± 3 fs	83 ± 2	≈ 0		$(2.9 \pm 0.9)(-1)$	
	$\rightarrow$ 1.07	$\rightarrow 3/2^-$		10 ± 2	≈ 0		$(3.0 \pm 1.1)(-1)$	
	0.040 $\rightarrow$ 0	$5/2^- \rightarrow 7/2^-$	17.1 ± 0.6 ns	100	≈ 0	5.5	$(5.2 \pm 0.3)(-3)$	
	0.74 $\rightarrow$ 0.33	$5/2^+ \rightarrow 3/2^+$	15.1 ± 2.5 ps	92 ± 1	-0.40 ± 0.03		$(2.3 \pm 0.4)(-2)$	
^{45}Ti	1.23 $\rightarrow$ 0.74	$7/2^+ \rightarrow 5/2^+$	4.0 ± 0.9 ps	37 ± 2	-0.28 ± 0.03		$(2.2 \pm 0.5)(-2)$	
	1.35 $\rightarrow$ 0	$9/2^- \rightarrow 7/2^-$	148 ± 15 fs	90 ± 2	$+0.46 \pm 0.08$		$(6.4 \pm 0.7)(-2)$	
^{46}Sc	1.12 $\rightarrow$ 0.58	$4^- \rightarrow 3^-$	1.6 ± 0.3 ps	66	≈ 0		$(8.2 \pm 1.6)(-2)$	
^{47}Sc	1.30 $\rightarrow$ 0	$5/2^- \rightarrow 7/2^-$	90 ± 35 fs	91.5 ± 0.2	≈ 0		$(1.5 \pm 0.6)(-1)$	
	$\rightarrow$ 0.81	$\rightarrow 3/2^-$		8.3 ± 0.2	$+0.21 \pm 0.04$		$(2.3 \pm 0.9)(-1)$	
	1.40 $\rightarrow$ 0.77	$5/2^+ \rightarrow 3/2^+$	1.4 ± 0.4 ps	23 ± 3	$+0.72 \pm 0.28$		$(1.4 \pm 0.6)(-2)$	
^{47}Ti	1.80 $\rightarrow$ 1.30	$(3/2, 5/2)^- \rightarrow 5/2^-$	300 ± 90 fs	50 ± 8	[0]		$(4.2 \pm 1.4)(-1)$	
	0.16 $\rightarrow$ 0	$7/2^- \rightarrow 5/2^-$	301 ± 9 ps	100	≈ 0		$(2.6 \pm 0.1)(-2)$	
	1.25 $\rightarrow$ 0.16	$9/2^- \rightarrow 7/2^-$	210 ± 20 fs	88 ± 6	$+0.29 \pm 0.03$		$(9.3 \pm 1.0)(-2)$	
	1.44 $\rightarrow$ 1.25	$11/2^- \rightarrow 9/2^-$	1.4 ± 0.4 ps	94 ± 3	≈ 0		$(1.3 \pm 0.4)(-2)$	
	1.55 $\rightarrow$ 0	$3/2^- \rightarrow 5/2^-$	2.3 ± 0.7 ps	43 ± 5	-0.46 ± 0.09		$(1.3 \pm 0.4)(-3)$	
	2.16 $\rightarrow$ 0	$3/2^- \rightarrow 5/2^-$	33 ± 7 fs	100	≈ 0		$(1.0 \pm 0.2)(-1)$	
	2.17 $\rightarrow$ 0.16	$5/2^- \rightarrow 7/2^-$	24 ± 6 fs	100	≈ 0		$(1.6 \pm 0.4)(-1)$	
^{47}V	0.088 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	950 ± 50 ps	100	≈ 0	0.04	$(4.6 \pm 0.3)(-2)$	
	0.146 $\rightarrow$ 0.088	$7/2^- \rightarrow 5/2^-$	790 ± 95 ps	99.0 ± 0.5	[0]	0.10	$(1.8 \pm 0.2)(-1)$	
	1.27 $\rightarrow$ 0.146	$9/2^- \rightarrow 7/2^-$	430 ± 65 fs	82 ± 2	-0.43 ± 0.06		$(3.6 \pm 0.6)(-2)$	
^{48}Ti	2.42 $\rightarrow$ 0.98	$2^+ \rightarrow 2^+$	38 ± 5 fs	95.0 ± 0.8	≈ 0		$(2.6 \pm 0.3)(-1)$	
^{48}V	0.43 $\rightarrow$ 0	$5^+ \rightarrow 4^+$	8.80 ± 0.14 ps	100	≈ 0		$(4.5 \pm 0.1)(-2)$	
	0.63 $\rightarrow$ 0.43	$6^+ \rightarrow 5^+$	119 ± 9 ps	45 ± 8	≈ 0		$(1.6 \pm 0.3)(-2)$	
	1.06 $\rightarrow$ 0.75	$3^- \rightarrow 2^-$	6.6 ± 1.7 ps	92 ± 2	≈ 0		$(1.5 \pm 0.4)(-1)$	
^{49}Sc	2.37 $\rightarrow$ 2.23	$3/2^+ \rightarrow 1/2^+$	2.02 ± 0.14 ns	7 ± 2	[0]		$(3.9 \pm 1.1)(-4)$	
^{49}V	0.091 $\rightarrow$ 0	$5/2^- \rightarrow 7/2^-$	328 ± 19 ps	100	[0]	0.03	$(1.2 \pm 0.1)(-1)$	
	0.15 $\rightarrow$ 0.091	$3/2^- \rightarrow 5/2^-$	28.8 ± 0.3 ns	35.0 ± 0.3	[0]	0.08	$(1.5 \pm 0.1)(-3)$	
	1.14 $\rightarrow$ 0.75	$5/2^+ \rightarrow 3/2^+$	1.9 ± 0.7 ps	5.2 ± 0.6	$+0.26 \pm 0.12$		$(1.4 \pm 0.5)(-2)$	
	1.16 $\rightarrow$ 0	$9/2^- \rightarrow 7/2^-$	1.6 ± 0.4 ps	74.7 ± 0.7	-0.70 ± 0.07		$(6.2 \pm 1.6)(-3)$	
	$\rightarrow$ 1.02	$\rightarrow 11/2^-$		2.9 ± 0.6	≈ 0		$(2.4 \pm 0.8)(-2)$	
	1.51 $\rightarrow$ 0.15	$5/2^- \rightarrow 3/2^-$	45 ± 19 fs	56.3 ± 0.8	$+0.57 \pm 0.05$		$(1.2 \pm 0.5)(-1)$	
	1.60 $\rightarrow$ 1.14	$7/2^+ \rightarrow 5/2^+$	680 ± 250 fs	6.9 ± 0.6	≈ 0		$(3.3 \pm 1.2)(-2)$	
	1.99 $\rightarrow$ 1.14	$3/2^+ \rightarrow 5/2^+$	190 ± 65 fs	37 ± 2	≈ 0		$(1.0 \pm 0.3)(-1)$	
	2.18 $\rightarrow$ 0.091	$7/2^- \rightarrow 5/2^-$	48 ± 17 fs	57 ± 4	≈ 0		$(4.1 \pm 1.5)(-2)$	
	$\rightarrow$ 1.16	$\rightarrow 9/2^-$		20 ± 5	[0]		$(1.2 \pm 0.4)(-1)$	
	2.35 $\rightarrow$ 0	$9/2^- \rightarrow 7/2^-$	48 ± 17 fs	53 ± 2	$+0.54 \pm 0.23$		$(2.1 \pm 0.8)(-2)$	
	$\rightarrow$ 1.02	$\rightarrow 11/2^-$		26 ± 1	≈ 0		$(7 \pm 2)(-2)$	
	2.39 $\rightarrow$ 0.75	$5/2^+ \rightarrow 3/2^+$	82 ± 26 fs	59 ± 2	$+0.36 \pm 0.15$		$(4.5 \pm 1.4)(-2)$	
	$\rightarrow$ 1.99	$\rightarrow 3/2^+$		10 ± 1	≈ 0		$(6 \pm 2)(-1)$	
	0.27 $\rightarrow$ 0	$7/2^- \rightarrow 5/2^-$	19 ± 4 ps	100	≈ 0		$(8.4 \pm 1.8)(-2)$	
	1.08 $\rightarrow$ 0.27	$9/2^- \rightarrow 7/2^-$	220 ± 40 fs	94.1 ± 1.0	$+0.21 \pm 0.03$		$(2.4 \pm 0.4)(-1)$	
	1.56 $\rightarrow$ 1.08	$11/2^- \rightarrow 9/2^-$	530 ± 80 fs	51 ± 2	≈ 0		$(2.7 \pm 0.4)(-2)$	
^{49}Cr	1.74 $\rightarrow$ 0	$3/2^- \rightarrow 5/2^-$	1.6 ± 0.4 ps	71 ± 2	≈ 0		$(2.6 \pm 0.7)(-3)$	
	2.50 $\rightarrow$ 1.56	$13/2^- \rightarrow 11/2^-$	230 ± 50 fs	90 ± 3	≈ 0		$(1.5 \pm 0.3)(-1)$	
	2.61 $\rightarrow$ 0	$3/2^- \rightarrow 5/2^-$	65 ± 20 fs	41 ± 2	≈ 0		$(1.1 \pm 0.3)(-2)$	

TABLE VI. Strengths of $M1$ Transitions
See page 552 for Explanation of Tables

Nucleus	$E_{x_i} \rightarrow E_{x_f}$ (MeV)	$J_i^\pi \rightarrow J_f^\pi$	τ_m	Total branching (%)	δ	α_{tot}	S (W.u.)	Remarks
^{49}Cr	3.19 $\rightarrow$ 2.50	$15/2^- \rightarrow 13/2^-$	400 ± 90 fs	48 ± 5	[0]		$(1.1 \pm 0.3)(-1)$	
^{50}V	0.84 $\rightarrow$ 0	$5^+ \rightarrow 6^+$	80 ± 30 fs	51	[0]		$(3.4 \pm 1.3)(-1)$	
	$\rightarrow 0.32$	$\rightarrow 4^+$		49	≈ 0		$(1.4 \pm 0.5)(0)$	
	0.91 $\rightarrow$ 0.23	$4^+ \rightarrow 5^+$	100 ± 10 fs	100	≈ 0		$(1.0 \pm 0.1)(0)$	
	1.30 $\rightarrow$ 0.36	$2^+ \rightarrow 3^+$	65 ± 6 fs	33 ± 4	≈ 0		$(1.9 \pm 0.3)(-1)$	
	$\rightarrow 0.39$	$\rightarrow 2^+$		67 ± 4	≈ 0		$(4.3 \pm 0.4)(-1)$	
	1.33 $\rightarrow$ 0.39	$1^+ \rightarrow 2^+$	24 ± 8 fs	100	[0]		$(1.6 \pm 0.5)(0)$	
	1.49 $\rightarrow$ 0.39	$1^+ \rightarrow 2^+$	65 ± 8 fs	88 ± 5	$+0.58 \pm 0.03$		$(2.4 \pm 0.3)(-1)$	
	1.52 $\rightarrow$ 0.39	$2^+ \rightarrow 2^+$	210 ± 20 fs	82 ± 2	≈ 0		$(8.7 \pm 0.9)(-2)$	
^{50}Cr	2.92 $\rightarrow$ 0.78	$2^+ \rightarrow 2^+$	13.5 ± 2.0 fs	92 ± 2	≈ 0		$(2.2 \pm 0.3)(-1)$	
	3.16 $\rightarrow$ 0.78	$2^+ \rightarrow 2^+$	15.7 ± 2.3 fs	100	≈ 0		$(1.5 \pm 0.2)(-1)$	
	3.32 $\rightarrow$ 1.88	$4^+ \rightarrow 4^+$	140 ± 35 fs	90.1 ± 0.2	≈ 0		$(6.7 \pm 1.7)(-2)$	
^{51}V	0.32 $\rightarrow$ 0	$5/2^- \rightarrow 7/2^-$	265 ± 7 ps	100	-0.42 ± 0.02		$(3.6 \pm 0.1)(-3)$	
	0.93 $\rightarrow$ 0.32	$3/2^- \rightarrow 5/2^-$	11.2 ± 1.2 ps	16.0 ± 0.5	-6.8 ± 0.7		$(4.2 \pm 1.0)(-5)$	
	1.81 $\rightarrow$ 0	$9/2^- \rightarrow 7/2^-$	810 ± 110 fs	75 ± 2	-3.8 ± 0.7		$(3.2 \pm 1.3)(-4)$	
^{51}Cr	0.777 $\rightarrow$ 0.749	$1/2^- \rightarrow 3/2^-$	8.00 ± 0.10 ns	100	[0]	0.88	$(9.5 \pm 1.2)(-2)$	
	1.16 $\rightarrow$ 0	$9/2^- \rightarrow 7/2^-$	100 ± 15 fs	100	$+0.17 \pm 0.02$		$(1.9 \pm 0.3)(-1)$	
	1.48 $\rightarrow$ 1.16	$11/2^- \rightarrow 9/2^-$	740 ± 150 fs	48.1 ± 1.1	≈ 0		$(6.2 \pm 1.3)(-1)$	
	1.56 $\rightarrow$ 0	$7/2^- \rightarrow 7/2^-$	6.0 ± 2.0 ps	15.5 ± 0.3	$+0.38 \pm 0.11$		$(1.9 \pm 0.7)(-4)$	
	$\rightarrow 1.35$	$\rightarrow 5/2^-$		5.1 ± 0.1	[0]		$(2.9 \pm 1.0)(-2)$	
	2.00 $\rightarrow$ 0	$5/2^- \rightarrow 7/2^-$	27 ± 6 fs	100	≈ 0		$(1.5 \pm 0.3)(-1)$	
	2.31 $\rightarrow$ 1.16	$7/2^- \rightarrow 9/2^-$	29 ± 8 fs	85 ± 3	[0]		$(6.1 \pm 1.7)(-1)$	
	2.38 $\rightarrow$ 1.48	$9/2^- \rightarrow 11/2^-$	600 ± 180 fs	18 ± 3	≈ 0		$(1.3 \pm 0.4)(-2)$	
	2.39 $\rightarrow$ 1.48	$13/2^- \rightarrow 11/2^-$	80 ± 20 fs	100	≈ 0		$(5.2 \pm 1.3)(-1)$	
	2.77 $\rightarrow$ 1.48	$9/2^- \rightarrow 11/2^-$	75 ± 20 fs	22 ± 2	≈ 0		$(4.3 \pm 1.2)(-2)$	
	2.95 $\rightarrow$ 1.56	$5/2^- \rightarrow 7/2^-$	175 ± 30 fs	36 ± 2	≈ 0		$(2.4 \pm 0.4)(-2)$	
	3.11 $\rightarrow$ 1.16	$7/2^- \rightarrow 9/2^-$	80 ± 20 fs	29 ± 6	≈ 0		$(1.5 \pm 0.5)(-2)$	
	$\rightarrow 2.00$	$\rightarrow 5/2^-$		51 ± 8	[0]		$(1.5 \pm 0.4)(-1)$	
	3.21 $\rightarrow$ 1.16	$7/2^- \rightarrow 9/2^-$	80 ± 25 fs	100	$+0.4 \pm 0.2$		$(2.9 \pm 0.9)(-1)$	
^{51}Mn	0.24 $\rightarrow$ 0	$7/2^- \rightarrow 5/2^-$	20 ± 3 ps	100	≈ 0		$(1.2 \pm 0.2)(-1)$	
	1.14 $\rightarrow$ 0.24	$9/2^- \rightarrow 7/2^-$	360 ± 100 fs	87 ± 2	-0.32 ± 0.02		$(9 \pm 3)(-2)$	
	1.49 $\rightarrow$ 1.14	$11/2^- \rightarrow 9/2^-$	720 ± 170 fs	35 ± 3	≈ 0		$(3.6 \pm 0.9)(-1)$	
	2.14 $\rightarrow$ 0	$3/2^- \rightarrow 5/2^-$	52 ± 14 fs	98 ± 2	≈ 0		$(6.0 \pm 1.6)(-2)$	
	2.84 $\rightarrow$ 1.96	$(1/2, 3/2)^- \rightarrow (1/2, 3/2)^-$	390 ± 150 fs	72	[0]		$(8 \pm 3)(-2)$	
^{52}V	0.017 $\rightarrow$ 0	$(2, 3)^+ \rightarrow 3^+$	1.6 ± 0.3 ns	100	≈ 0	3.2	$(9 \pm 2)(-1)$	
^{52}Cr	2.77 $\rightarrow$ 2.37	$4^+ \rightarrow 4^+$	3.7 ± 0.9 ps	10 ± 1	[0]		$(1.3 \pm 0.3)(-2)$	
	2.96 $\rightarrow$ 1.43	$2^+ \rightarrow 2^+$	600 ± 110 fs	95.8 ± 1.7	$+6.25 \pm 0.15$		$(3.6 \pm 0.7)(-4)$	
	3.16 $\rightarrow$ 1.43	$2^+ \rightarrow 2^+$	120 ± 40 fs	89 ± 2	≈ 0		$(4.5 \pm 1.5)(-2)$	
	3.42 $\rightarrow$ 2.77	$4^+ \rightarrow 4^+$	460 ± 90 fs	94.5 ± 1.5	$+0.22 \pm 0.08$		$(2.2 \pm 0.5)(-1)$	
	3.77 $\rightarrow$ 1.43	$2^+ \rightarrow 2^+$	13 ± 6 fs	80 ± 4	-0.58 ± 0.11		$(8 \pm 4)(-2)$	
	4.02 $\rightarrow$ 3.42	$5^+ \rightarrow 4^+$	880 ± 300 fs	38 ± 2	[0]		$(8 \pm 3)(-2)$	
	$\rightarrow 3.62$	$\rightarrow 5^+$		17.5 ± 0.8	[0]		$(1.2 \pm 0.4)(-1)$	
	4.04 $\rightarrow$ 3.47	$4^+ \rightarrow 3^+$	735 ± 280 fs	100	[0]		$(2.3 \pm 0.9)(-1)$	
^{53}Cr	0.56 $\rightarrow$ 0	$1/2^- \rightarrow 3/2^-$	830 ± 170 fs	100	≈ 0		$(2.1 \pm 0.4)(-1)$	
	1.01 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	1.1 ± 0.2 ps	99.57	-0.36 ± 0.02		$(2.4 \pm 0.5)(-2)$	
	1.29 $\rightarrow$ 1.01	$7/2^- \rightarrow 5/2^-$	1.64 ± 0.10 ps	4.2 ± 0.2	≈ 0		$(3.7 \pm 0.3)(-2)$	
	1.54 $\rightarrow$ 1.01	$7/2^- \rightarrow 5/2^-$	31.2 ± 2.5 ps	58 ± 3	≈ 0		$(3.9 \pm 0.7)(-3)$	
	$\rightarrow 1.29$	$\rightarrow 7/2^-$		31 ± 3	≈ 0		$(2.0 \pm 0.4)(-2)$	
^{53}Mn	0.38 $\rightarrow$ 0	$5/2^- \rightarrow 7/2^-$	169 ± 9 ps	100	-0.55 ± 0.02		$(2.6 \pm 0.1)(-3)$	
	1.29 $\rightarrow$ 0.38	$3/2^- \rightarrow 5/2^-$	760 ± 100 fs	44 ± 3	-0.167 ± 0.019		$(2.3 \pm 0.3)(-2)$	
	1.62 $\rightarrow$ 0	$9/2^- \rightarrow 7/2^-$	610 ± 75 fs	89.0 ± 1.1	-2.9 ± 0.3		$(1.1 \pm 0.3)(-3)$	
	2.27 $\rightarrow$ 0	$5/2^- \rightarrow 7/2^-$	360 ± 55 fs	77 ± 2	-0.18 ± 0.04		$(5.3 \pm 0.8)(-3)$	
	$\rightarrow 0.38$	$\rightarrow 5/2^-$		23 ± 2	$+0.9 \pm 0.3$		$(1.6 \pm 0.6)(-3)$	
	2.41 $\rightarrow$ 0.38	$3/2^- \rightarrow 5/2^-$	180 ± 35 fs	17 ± 4	≈ 0		$(3.5 \pm 1.1)(-3)$	
	$\rightarrow 1.29$	$\rightarrow 3/2^-$		45 ± 6	≈ 0		$(5.5 \pm 1.3)(-2)$	

TABLE VI. Strengths of $M1$ Transitions
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Nucleus	$E_{x_i} \rightarrow E_{x_f}$ (MeV)	$J_i^\pi \rightarrow J_f^\pi$	τ_m	Total branching (%)	δ	α_{tot}	S (W.u.)	Remarks
^{53}Mn	2.56 $\pm$ 1.44	13/2 ⁻ $\rightarrow$ 11/2 ⁻	15.8 $\pm$ 1.9 ps	100	≈ 0		(1.4 $\pm$ 0.2)(-3)	
	2.88 $\pm$ 0.38	3/2 ⁻ $\rightarrow$ 5/2 ⁻	90 $\pm$ 35 fs	85	-0.4 $\pm$ 0.3		(1.6 $\pm$ 0.7)(-2)	
	3.18 $\pm$ 0.38	3/2 ⁻ $\rightarrow$ 5/2 ⁻	35 $\pm$ 15 fs	61 $\pm$ 8	≈ 0		(2.5 $\pm$ 1.1)(-2)	
	3.44 $\pm$ 2.56	15/2 ⁻ $\rightarrow$ 13/2 ⁻	130 $\pm$ 45 fs	24 $\pm$ 3	[0]		(8 $\pm$ 3)(-2)	
	+ 2.69	+ 15/2 ⁻		76 $\pm$ 3	≈ 0		(4.3 $\pm$ 1.5)(-1)	
^{53}Fe	0.774 $\pm$ 0.741	1/2 ⁻ $\rightarrow$ 3/2 ⁻	2.9 $\pm$ 0.3 ns	100	[0]	0.77	(1.7 $\pm$ 0.2)(-1)	
	1.33 $\pm$ 0	9/2 ⁻ $\rightarrow$ 7/2 ⁻	25 $\pm$ 10 fs	100	≈ 0		(5 $\pm$ 2)(-1)	
	1.42 $\pm$ 0.74	5/2 ⁻ $\rightarrow$ 3/2 ⁻	4.0 $\pm$ 1.0 ps	76 $\pm$ 2	-0.36 $\pm$ 0.02		(1.7 $\pm$ 0.4)(-2)	
	2.34 $\pm$ 1.33	11/2 ⁻ $\rightarrow$ 9/2 ⁻	76 $\pm$ 17 fs	86 $\pm$ 2	≈ 0		(3.4 $\pm$ 0.8)(-1)	
^{54}Mn	0.16 $\pm$ 0	4 ⁺ $\rightarrow$ 3 ⁺	289 $\pm$ 20 ps	100	≈ 0		(2.8 $\pm$ 0.2)(-2)	
	0.37 $\pm$ 0.16	5 ⁺ $\rightarrow$ 4 ⁺	9.7 $\pm$ 1.2 ps	100	≈ 0		(3.5 $\pm$ 0.4)(-1)	
	0.84 $\pm$ 0	4 ⁺ $\rightarrow$ 3 ⁺	530 $\pm$ 110 fs	54 $\pm$ 3	[0]		(5.4 $\pm$ 1.1)(-2)	
	+ 0.37	+ 5 ⁺		37 $\pm$ 3	≈ 0		(2.1 $\pm$ 0.4)(-1)	
	1.01 $\pm$ 0.05	3 ⁺ $\rightarrow$ 2 ⁺	64 $\pm$ 13 fs	57 $\pm$ 3	≈ 0		(3.1 $\pm$ 0.6)(-1)	
	+ 0.16	+ 4 ⁺		43 $\pm$ 3	≈ 0		(3.4 $\pm$ 0.7)(-1)	
	1.07 $\pm$ 0.37	6 ⁺ $\rightarrow$ 5 ⁺	319 $\pm$ 13 ps	100	≈ 0		(2.9 $\pm$ 0.1)(-4)	
	1.93 $\pm$ 1.07	7 ⁺ $\rightarrow$ 6 ⁺	1.1 $\pm$ 0.5 ps	100	+0.40 $\pm$ 0.15		(3.8 $\pm$ 1.8)(-2)	
	2.96 $\pm$ 1.41	2 ⁺ $\rightarrow$ 2 ⁺	75 $\pm$ 12 fs	45 $\pm$ 3	≈ 0		(5.1 $\pm$ 0.9)(-2)	
	3.17 $\pm$ 1.41	2 ⁺ $\rightarrow$ 2 ⁺	230 $\pm$ 50 fs	19 $\pm$ 3	-0.6 $\pm$ 0.3		(3.5 $\pm$ 1.3)(-3)	
^{54}Fe	4.26 $\pm$ 2.54	4 ⁺ $\rightarrow$ 4 ⁺	120 $\pm$ 30 fs	79 $\pm$ 6	+0.53 $\pm$ 0.24		(3.2 $\pm$ 1.0)(-2)	
	4.95 $\pm$ 2.54	4 ⁺ $\rightarrow$ 4 ⁺	42 $\pm$ 14 fs	55 $\pm$ 5	+0.36 $\pm$ 0.03		(2.5 $\pm$ 0.8)(-2)	
^{55}Mn	0.13 $\pm$ 0	7/2 ⁻ $\rightarrow$ 5/2 ⁻	373 $\pm$ 12 ps	100	≈ 0		(3.7 $\pm$ 0.1)(-2)	
	1.53 $\pm$ 0	3/2 ⁻ $\rightarrow$ 5/2 ⁻	71 $\pm$ 14 fs	96 $\pm$ 1	-0.22 $\pm$ 0.04		(1.1 $\pm$ 0.2)(-1)	
	2.57 $\pm$ 0	3/2 ⁻ $\rightarrow$ 5/2 ⁻	7 $\pm$ 2 fs	100	≈ 0		(2.6 $\pm$ 0.7)(-1)	
^{55}Fe	0.93 $\pm$ 0	5/2 ⁻ $\rightarrow$ 3/2 ⁻	1.3 $\pm$ 0.4 ps	98.7 $\pm$ 0.4	-0.34 $\pm$ 0.02		(2.5 $\pm$ 0.8)(-2)	
	1.32 $\pm$ 0.93	7/2 ⁻ $\rightarrow$ 5/2 ⁻	17 $\pm$ 6 ps	5 $\pm$ 1	≈ 0		(1.6 $\pm$ 0.6)(-3)	
	1.41 $\pm$ 0.93	7/2 ⁻ $\rightarrow$ 5/2 ⁻	58 $\pm$ 4 ps	51 $\pm$ 3	≈ 0		(2.5 $\pm$ 0.3)(-3)	
	+ 1.32	+ 7/2 ⁻		6.8 $\pm$ 1.3	[0]		(4.7 $\pm$ 0.9)(-2)	
^{56}Mn	2.14 $\pm$ 1.32	5/2 ⁻ $\rightarrow$ 7/2 ⁻	55 $\pm$ 14 fs	36 $\pm$ 5	[0]		(3.6 $\pm$ 1.0)(-1)	
	0.027 $\pm$ 0	2 ⁺ $\rightarrow$ 3 ⁺	12.5 $\pm$ 0.7 ns	100	[0]	2.0	(4.5 $\pm$ 0.3)(-2)	
	0.11 $\pm$ 0.027	1 ⁺ $\rightarrow$ 2 ⁺	7.3 $\pm$ 0.2 ns	99.58	[0]	0.06	(6.9 $\pm$ 0.2)(-3)	
	0.21 $\pm$ 0	4 ⁺ $\rightarrow$ 3 ⁺	43 $\pm$ 3 ps	100	[0]		(7.6 $\pm$ 0.5)(-2)	
^{56}Fe	0.34 $\pm$ 0.21	5 ⁺ $\rightarrow$ 4 ⁺	2.9 $\pm$ 0.2 ns	58 $\pm$ 5	-0.21 $\pm$ 0.07		(3.1 $\pm$ 0.3)(-3)	
	2.66 $\pm$ 0.85	2 ⁺ $\rightarrow$ 2 ⁺	40 $\pm$ 10 fs	97.7 $\pm$ 0.1	+0.185 $\pm$ 0.015		(1.2 $\pm$ 0.3)(-1)	
	2.96 $\pm$ 0.85	2 ⁺ $\rightarrow$ 2 ⁺	39 $\pm$ 12 fs	97.9 $\pm$ 0.1	-0.249 $\pm$ 0.009		(8 $\pm$ 2)(-2)	
	3.12 $\pm$ 2.09	4 ⁺ $\rightarrow$ 4 ⁺	110 $\pm$ 50 fs	99.2 $\pm$ 0.1	≈ 0		(2.6 $\pm$ 1.2)(-1)	
	3.37 $\pm$ 0.85	2 ⁺ $\rightarrow$ 2 ⁺	26 $\pm$ 10 fs	98.5 $\pm$ 0.1	≈ 0		(7 $\pm$ 3)(-2)	
	3.76 $\pm$ 3.39	6 ⁺ $\rightarrow$ 6 ⁺	190 $\pm$ 30 fs	77 $\pm$ 2	≈ 0		(2.5 $\pm$ 0.4)(0)	
^{56}Co	0.58 $\pm$ 0	5 ⁺ $\rightarrow$ 4 ⁺	410 $\pm$ 85 fs	100	≈ 0		(3.9 $\pm$ 0.8)(-1)	
	0.97 $\pm$ 0.16	2 ⁺ $\rightarrow$ 3 ⁺	160 $\pm$ 40 fs	99.70 $\pm$ 0.05	≈ 0		(3.6 $\pm$ 0.9)(-1)	
	1.01 $\pm$ 0	5 ⁺ $\rightarrow$ 4 ⁺	520 $\pm$ 110 fs	88.9 $\pm$ 1.2	≈ 0		(5.3 $\pm$ 1.1)(-2)	
	+ 0.58	+ 5 ⁺		7.1 $\pm$ 0.5	[0]		(5.4 $\pm$ 1.1)(-2)	
	+ 0.83	+ 4 ⁺		4.0 $\pm$ 1.2	[0]		(4.1 $\pm$ 1.5)(-1)	
	1.11 $\pm$ 0	3 ⁺ $\rightarrow$ 4 ⁺	280 $\pm$ 60 fs	84.2 $\pm$ 1.0	≈ 0		(7.0 $\pm$ 1.5)(-2)	
	+ 0.83	+ 4 ⁺		11.0 $\pm$ 1.0	≈ 0		(5.6 $\pm$ 1.2)(-1)	
	1.72 $\pm$ 0.97	1 ⁺ $\rightarrow$ 2 ⁺	540 $\pm$ 200 fs	49.7 $\pm$ 0.9	≈ 0		(7 $\pm$ 2)(-2)	
	+ 1.45	+ 0 ⁺		36.5 $\pm$ 0.8	0		(1.1 $\pm$ 0.4)(-0)	
	1.93 $\pm$ 0.97	(2,3) ⁺ $\rightarrow$ 2 ⁺	47 $\pm$ 10 fs	52 $\pm$ 5	[0]		(3.9 $\pm$ 0.9)(-1)	
	2.06 $\pm$ 1.11	2 ⁺ $\rightarrow$ 3 ⁺	34 $\pm$ 8 fs	53 $\pm$ 6	[0]		(5.7 $\pm$ 1.5)(-1)	
	2.64 $\pm$ 1.45	1 ⁺ $\rightarrow$ 0 ⁺	20 $\pm$ 9 fs	100	0		(9 $\pm$ 4)(-1)	
	2.73 $\pm$ 1.45	1 ⁺ $\rightarrow$ 0 ⁺	99 $\pm$ 22 fs	14 $\pm$ 4	0		(2.1 $\pm$ 0.8)(-2)	
	+ 2.06	+ 2 ⁺		25 $\pm$ 6	[0]		(2.6 $\pm$ 0.9)(-1)	
	+ 2.23	+ (1,2) ⁺		14 $\pm$ 3	[0]		(3.6 $\pm$ 1.1)(-1)	
	3.08 $\pm$ 1.45	1 ⁺ $\rightarrow$ 0 ⁺	32 $\pm$ 10 fs	75 $\pm$ 3	0		(1.7 $\pm$ 0.5)(-1)	
	+ 2.06	+ 2 ⁺		18 $\pm$ 3	[0]		(1.7 $\pm$ 0.6)(-1)	

TABLE VI. Strengths of $M1$ Transitions
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Nucleus	$E_{x_i} \rightarrow E_{x_f}$ (MeV)	$J_i^\pi \rightarrow J_f^\pi$	τ_m	Total branching (%)	δ	α_{tot}	S (W.u.)	Remarks
^{56}Co	$3.60 \rightarrow 1.72$ $\rightarrow 2.64$ $\rightarrow 2.73$	$0^+ \rightarrow 1^+$ $\rightarrow 1^+$ $\rightarrow 1^+$	26 ± 7 fs	51 ± 3 17 ± 3 32 ± 4	0 0 0		$(9 \pm 3)(-2)$ $(2.3 \pm 0.7)(-1)$ $(5.9 \pm 1.8)(-1)$	
	$3.64 \rightarrow 2.28$ $4.18 \rightarrow 3.64$	$8^+ \rightarrow 7^+$ $9^+ \rightarrow 8^+$	80 ± 35 fs 590 ± 60 fs	100 27 ± 1	≈ 0 ≈ 0		$(1.6 \pm 0.7)(-1)$ $(9.1 \pm 1.0)(-2)$	
^{57}Fe	$0.014 \rightarrow 0$ $0.14 \rightarrow 0.014$ $0.37 \rightarrow 0.014$ $\rightarrow 0.14$ $0.71 \rightarrow 0.014$ $\rightarrow 0.14$ $\rightarrow 0.37$	$3/2^- \rightarrow 1/2^-$ $5/2^- \rightarrow 3/2^-$ $3/2^- \rightarrow 3/2^-$ $\rightarrow 5/2^-$ $5/2^- \rightarrow 3/2^-$ $\rightarrow 5/2^-$ $\rightarrow 3/2^-$	142 ± 12 ns 12.4 ± 0.4 ns 10 ± 2 ps 4.2 ± 0.7 ps	100 87.7 ± 0.2 76.3 ± 1.7 8.3 ± 1.1 84.4 ± 0.8 9.9 ± 0.6 2.2 ± 0.3	≈ 0 -0.120 ± 0.001 ≈ 0 ≈ 0 $+0.465 \pm 0.008$ ≈ 0 ≈ 0	8.2 0.02	$(7.9 \pm 0.7)(-3)$ $(1.2 \pm 0.1)(-3)$ $(5.4 \pm 1.1)(-2)$ $(2.1 \pm 0.5)(-2)$ $(1.5 \pm 0.3)(-2)$ $(3.9 \pm 0.7)(-3)$ $(4.2 \pm 0.9)(-3)$	
^{57}Co	$1.22 \rightarrow 0$ $1.50 \rightarrow 1.38$ $1.69 \rightarrow 1.22$ $1.90 \rightarrow 1.22$ $2.13 \rightarrow 0$ $\rightarrow 1.38$ $2.31 \rightarrow 0$ $\rightarrow 1.22$	$9/2^- \rightarrow 7/2^-$ $(1/2, 3/2)^- \rightarrow 3/2^-$ $11/2^- \rightarrow 9/2^-$ $7/2^- \rightarrow 9/2^-$ $5/2^- \rightarrow 7/2^-$ $\rightarrow 3/2^-$ $7/2^- \rightarrow 7/2^-$ $\rightarrow 9/2^-$	76 ± 10 fs 300 ± 30 ps 350 ± 35 fs 149 ± 15 fs 580 ± 70 fs 14 ± 2 290 ± 60 fs	100 100 54 ± 2 59 ± 4 83 ± 2 14 ± 2 10 ± 2 70 ± 2	-0.26 ± 0.01 [0] ≈ 0 ≈ 0 ≈ 0 $+0.35 \pm 0.14$ $+0.4 \pm 0.6$ -0.13 ± 0.02		$(2.1 \pm 0.3)(-1)$ $(5.1 \pm 0.5)(-2)$ $(4.6 \pm 0.5)(-1)$ $(3.9 \pm 0.5)(-1)$ $(4.6 \pm 0.6)(-3)$ $(1.6 \pm 0.3)(-2)$ $(8 \pm 4)(-4)$ $(5.8 \pm 1.2)(-2)$	
^{57}Ni	$0.77 \rightarrow 0$ $1.11 \rightarrow 0$	$5/2^- \rightarrow 3/2^-$ $1/2^- \rightarrow 3/2^-$	4.6 ± 0.6 ps 110 ± 17 fs	100 100	-0.23 ± 0.02 [0]		$(1.4 \pm 0.2)(-2)$ $(2.1 \pm 0.3)(-1)$	
^{58}Fe	$1.67 \rightarrow 0.81$ $2.60 \rightarrow 2.08$ $\rightarrow 2.13$ $2.78 \rightarrow 0$ $\rightarrow 0.81$ $\rightarrow 1.67$ $\rightarrow 2.26$ $2.88 \rightarrow 0.81$ $3.08 \rightarrow 0.81$ $3.23 \rightarrow 2.60$	$2^+ \rightarrow 2^+$ $4^+ \rightarrow 4^+$ $\rightarrow 3^+$ $1^+ \rightarrow 0^+$ $\rightarrow 2^+$ $\rightarrow 2^+$ $\rightarrow 0^+$ $2^+ \rightarrow 2^+$ $2^+ \rightarrow 2^+$ $(3,4)^+ \rightarrow 4^+$	2.3 ± 0.6 ps 540 ± 100 fs 265 ± 40 fs 48 ± 3 22.2 ± 1.3 7.8 ± 0.4 135 ± 20 fs 36 ± 7 fs	56 ± 1 38.9 ± 1.2 13.3 ± 0.5 22 ± 3 48 ± 3 22.2 ± 1.3 7.8 ± 0.4 100 100	$+0.69 \pm 0.05$ [0] [0] 0 $+0.17 \pm 0.04$ $+0.18 \pm 0.03$ 0 $+0.33 \pm 0.15$ ≈ 0		$(8 \pm 2)(-3)$ $(1.6 \pm 0.3)(-1)$ $(7.4 \pm 1.4)(-2)$ $(1.2 \pm 0.2)(-3)$ $(6.6 \pm 1.1)(-3)$ $(1.8 \pm 0.3)(-2)$ $(6.6 \pm 1.1)(-2)$ $(2.4 \pm 0.4)(-2)$ $(7.4 \pm 1.5)(-2)$ $(7.0 \pm 1.7)(-2)$	
^{58}Co	$0.11 \rightarrow 0$ $\rightarrow 0.053$ $0.37 \rightarrow 0$ $0.46 \rightarrow 0.025$ $\rightarrow 0.11$ $\rightarrow 0.37$	$3^+ \rightarrow 2^+$ $\rightarrow 4^+$ $3^+ \rightarrow 2^+$ $4^+ \rightarrow 5^+$ $\rightarrow 3^+$ $\rightarrow 3^+$	260 ± 40 ps 2.0 ± 0.9 ps 1.3 ± 0.4 ps	57 ± 4 43 ± 4 99.3 83 14.8 1.5	≈ 0 ≈ 0 ≈ 0 ≈ 0 [0] [0]	0.03 0.19 0.05	$(4.8 \pm 0.7)(-2)$ $(2.2 \pm 0.4)(-1)$ $(3.2 \pm 1.4)(-1)$ $(2.5 \pm 0.8)(-1)$ $(9 \pm 3)(-2)$ $(4.4 \pm 1.4)(-1)$	a)
^{58}Ni	$2.78 \rightarrow 1.45$ $3.04 \rightarrow 1.45$ $\rightarrow 2.78$ $3.26 \rightarrow 1.45$ $3.90 \rightarrow 1.45$	$2^+ \rightarrow 2^+$ $2^+ \rightarrow 2^+$ $\rightarrow 2^+$ $2^+ \rightarrow 2^+$ $2^+ \rightarrow 2^+$	580 ± 160 fs 72 ± 7 fs 42 ± 4 fs 33 ± 4 fs	95.9 ± 0.3 57 ± 2 1.0 ± 0.2 76 ± 2	$+1.18 \pm 0.15$ -0.21 ± 0.03 [0] ≈ 0		$(9 \pm 3)(-3)$ $(6.0 \pm 0.6)(-2)$ $(2.4 \pm 0.5)(-1)$ $(5.4 \pm 0.7)(-2)$	
^{59}Co	$1.19 \rightarrow 0$ $1.29 \rightarrow 1.10$ $1.75 \rightarrow 1.19$	$9/2^- \rightarrow 7/2^-$ $3/2^- \rightarrow 3/2^-$ $7/2^- \rightarrow 9/2^-$	76 ± 8 fs 790 ± 40 fs 590 ± 160 fs	100 6.7 ± 0.4 32	-0.21 ± 0.02 ≈ 0 ≈ 0		$(2.3 \pm 0.2)(-1)$ $(3.5 \pm 0.3)(-1)$ $(1.0 \pm 0.3)(-1)$	
^{59}Ni	$0.34 \rightarrow 0$ $0.88 \rightarrow 0$ $1.19 \rightarrow 0$ $1.30 \rightarrow 0.47$ $\rightarrow 0.88$ $1.34 \rightarrow 0.34$ $1.74 \rightarrow 1.19$ $1.77 \rightarrow 1.34$ $2.71 \rightarrow 1.77$	$5/2^- \rightarrow 3/2^-$ $3/2^- \rightarrow 3/2^-$ $5/2^- \rightarrow 3/2^-$ $1/2^- \rightarrow 1/2^-$ $\rightarrow 3/2^-$ $7/2^- \rightarrow 5/2^-$ $3/2^- \rightarrow 5/2^-$ $9/2^- \rightarrow 7/2^-$ $11/2^- \rightarrow 9/2^-$	99 ± 10 ps 660 ± 70 fs 400 ± 45 fs 220 ± 25 fs 1.45 ± 0.26 ps 170 ± 30 fs 820 ± 100 fs 500 ± 60 fs	100 98.6 ± 0.1 89 ± 5 12 ± 2 14 ± 1 71 ± 1 16 ± 3 7 10	≈ 0 ≈ 0 $+0.56 \pm 0.17$ 0 [0] -4.8 ± 0.9 [0] ≈ 0 $+0.95 \pm 0.39$		$(8.0 \pm 0.8)(-3)$ $(6.8 \pm 0.7)(-2)$ $(3.1 \pm 0.4)(-2)$ $(3.0 \pm 0.6)(-2)$ $(2.7 \pm 0.3)(-1)$ $(6 \pm 3)(-4)$ $(1.8 \pm 0.5)(-1)$ $(3.4 \pm 0.4)(-2)$ $(4.0 \pm 1.6)(-3)$	

TABLE VI. Strengths of $M1$ Transitions

See page 552 for Explanation of Tables

Nucleus	$E_{x1} \rightarrow E_{xf}$ (MeV)	$J_1^\pi \rightarrow J_f^\pi$	τ_m	Total branching (%)	δ	α_{tot}	S (W.u.)	Remarks
^{59}Cu	0.49 $\rightarrow$ 0	$1/2^- \rightarrow 3/2^-$	840 ± 300 fs	100	[0]		$(3.2 \pm 1.1)(-1)$	
	1.40 $\rightarrow$ 0.91	$7/2^- \rightarrow 5/2^-$	580 ± 250 fs	9 ± 2	[0]		$(4.1 \pm 2.0)(-2)$	
^{60}Ni	2.16 $\rightarrow$ 1.33	$2^+ \rightarrow 2^+$	770 ± 150 fs	86.7 ± 0.8	-0.82 ± 0.15		$(2.9 \pm 0.7)(-2)$	
	3.186 $\rightarrow$ 1.33	$3^+ \rightarrow 2^+$	200 ± 50 fs	32.0 ± 1.6	≈ 0		$(8 \pm 2)(-3)$	
	$\rightarrow$ 2.16	$\rightarrow 2^+$		42 ± 2	-0.42 ± 0.03		$(5.1 \pm 1.3)(-2)$	
	$\rightarrow$ 2.51	$\rightarrow 4^+$		26.0 ± 1.3	≈ 0		$(1.3 \pm 0.3)(-1)$	
	3.194 $\rightarrow$ 0	$1^+ \rightarrow 0^+$	60 ± 20 fs	16.2 ± 0.7	0		$(2.6 \pm 0.9)(-3)$	
	$\rightarrow$ 2.16	$\rightarrow 2^+$		29.6 ± 1.4	≈ 0		$(1.4 \pm 0.5)(-1)$	
	$\rightarrow$ 2.28	$\rightarrow 0^+$		16.2 ± 0.7	0		$(1.1 \pm 0.4)(-1)$	
	4.02 $\rightarrow$ 0	$1^+ \rightarrow 0^+$	17 ± 4 fs	55 ± 5	0		$(1.6 \pm 0.4)(-2)$	
^{60}Cu	0.061 $\rightarrow$ 0	$1^+ \rightarrow 2^+$	2.89 ± 0.14 ns	100	[0]	0.20	$(3.8 \pm 0.2)(-2)$	
^{60}Ni	0.067 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	7.43 ± 0.20 ns	100	≈ 0	0.14	$(1.3 \pm 0.1)(-2)$	
	0.28 $\rightarrow$ 0	$1/2^- \rightarrow 3/2^-$	34 ± 4 ps	100	≈ 0		$(4.1 \pm 0.5)(-2)$	
	0.66 $\rightarrow$ 0.28	$1/2^- \rightarrow 1/2^-$	25 ± 6 ps	16 ± 1	0		$(3.9 \pm 0.9)(-3)$	
	0.91 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	1.6 ± 0.5 ps	77 ± 2	$+0.18 \pm 0.05$		$(1.9 \pm 0.6)(-2)$	
	$\rightarrow$ 0.067	$\rightarrow 5/2^-$		19 ± 2	-1.83 ± 0.20		$(1.4 \pm 0.5)(-3)$	
	1.02 $\rightarrow$ 0.067	$7/2^- \rightarrow 5/2^-$	6.8 ± 1.0 ps	75 ± 1	-2.46 ± 0.16		$(5.7 \pm 1.0)(-4)$	
	1.13 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	440 ± 65 fs	63 ± 1	$+0.47 \pm 0.09$		$(2.5 \pm 0.4)(-2)$	
	$\rightarrow$ 0.067	$\rightarrow 5/2^-$		37 ± 1	≈ 0		$(2.2 \pm 0.3)(-2)$	
	1.19 $\rightarrow$ 0	$3/2^- \rightarrow 3/2^-$	150 ± 20 fs	88 ± 1	$\pm 0.14 \pm 0.01$		$(1.1 \pm 0.2)(-1)$	
	$\rightarrow$ 0.66	$\rightarrow 1/2^-$		9 ± 1	[0]		$(1.2 \pm 0.2)(-1)$	
	1.45 $\rightarrow$ 0.067	$7/2^- \rightarrow 5/2^-$	1.20 ± 0.34 ps	25 ± 3	-2.7 ± 0.4		$(2.9 \pm 1.2)(-4)$	
	1.61 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	370 ± 60 fs	37 ± 1	$+0.33 \pm 0.14$		$(6.7 \pm 1.1)(-3)$	
	$\rightarrow$ 0.067	$\rightarrow 5/2^-$		54 ± 2	≈ 0		$(1.2 \pm 0.2)(-2)$	
	$\rightarrow$ 1.13	$\rightarrow 5/2^-$		4 ± 1	[0]		$(3.1 \pm 0.9)(-2)$	
	1.81 $\rightarrow$ 1.02	$9/2^- \rightarrow 7/2^-$	1.60 ± 0.34 ps	11 ± 2	-0.97 ± 0.18		$(2.2 \pm 0.7)(-3)$	
	1.99 $\rightarrow$ 1.02	$9/2^- \rightarrow 7/2^-$	900 ± 250 fs	12 ± 2	$+0.70 \pm 0.23$		$(3.1 \pm 1.2)(-3)$	
	$\rightarrow$ 1.45	$\rightarrow 7/2^-$		13 ± 1	≈ 0		$(2.9 \pm 0.8)(-2)$	
	2.00 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	60 ± 12 fs	68 ± 2	$+0.27 \pm 0.06$		$(4.1 \pm 0.8)(-2)$	
	2.02 $\rightarrow$ 0.067	$7/2^- \rightarrow 5/2^-$	580 ± 110 fs	90	≈ 0		$(6.5 \pm 1.2)(-3)$	
	2.41 $\rightarrow$ 1.45	$9/2^- \rightarrow 7/2^-$	280 ± 45 fs	17 ± 2	≈ 0		$(2.1 \pm 0.4)(-2)$	
	3.30 $\rightarrow$ 2.12	$11/2^+ \rightarrow 9/2^+$	870 ± 230 fs	100	-0.63 ± 0.08		$(1.6 \pm 0.4)(-2)$	
^{61}Cu	0.48 $\rightarrow$ 0	$1/2^- \rightarrow 3/2^-$	950 ± 130 fs	100	[0]		$(3.0 \pm 0.4)(-1)$	
	0.97 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	1.00 ± 0.17 ps	99.1 ± 0.1	$+0.33 \pm 0.02$		$(3.0 \pm 0.5)(-2)$	
	1.31 $\rightarrow$ 0.97	$7/2^- \rightarrow 5/2^-$	760 ± 120 fs	6.2 ± 0.2	≈ 0		$(6.5 \pm 1.0)(-2)$	
	1.39 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	1.2 ± 0.2 ps	85.3 ± 0.7	$+3.54 \pm 0.14$		$(5.6 \pm 0.9)(-4)$	
	1.66 $\rightarrow$ 0.48	$3/2^- \rightarrow 1/2^-$	270 ± 30 fs	14.4 ± 0.9	$+0.6 \pm 0.4$		$(7 \pm 3)(-3)$	
	$\rightarrow$ 1.39	$\rightarrow 5/2^-$		4.6 ± 0.3	[0]		$(2.7 \pm 0.3)(-1)$	
	1.90 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	260 ± 40 fs	36.3 ± 1.9	-0.69 ± 0.08		$(4.3 \pm 0.7)(-3)$	
	$\rightarrow$ 0.97	$\rightarrow 5/2^-$		41.6 ± 1.3	$+0.18 \pm 0.03$		$(6.0 \pm 0.9)(-2)$	
	$\rightarrow$ 1.31	$\rightarrow 7/2^-$		22.1 ± 1.0	≈ 0		$(1.3 \pm 0.2)(-1)$	
	2.20 $\rightarrow$ 0.97	$5/2^- \rightarrow 5/2^-$	250 ± 40 fs	46.8 ± 0.6	≈ 0		$(3.1 \pm 0.5)(-2)$	
	$\rightarrow$ 1.73	$\rightarrow 7/2^-$		11.4 ± 0.8	[0]		$(1.4 \pm 0.2)(-1)$	
	2.30 $\rightarrow$ 1.31	$9/2^- \rightarrow 7/2^-$	2.6 ± 0.7 ps	34.2 ± 1.1	$+0.17 \pm 0.03$		$(4.1 \pm 1.2)(-3)$	
	$\rightarrow$ 1.73	$\rightarrow 7/2^-$		19.9 ± 0.6	-0.56 ± 0.04		$(1.0 \pm 0.3)(-2)$	
	$\rightarrow$ 1.94	$\rightarrow 7/2^-$		7.6 ± 0.4	≈ 0		$(2.0 \pm 0.6)(-2)$	
	2.34 $\rightarrow$ 1.31	$9/2^- \rightarrow 7/2^-$	620 ± 90 fs	22.0 ± 1.3	$+0.25 \pm 0.08$		$(9.5 \pm 1.4)(-3)$	
	2.36 $\rightarrow$ 1.93	$3/2^- \rightarrow 3/2^-$	285 ± 45 fs	11.1 ± 0.6	[0]		$(1.5 \pm 0.2)(-1)$	
	2.40 $\rightarrow$ 0.97	$7/2^- \rightarrow 5/2^-$	175 ± 25 fs	58.2 ± 1.0	-0.16 ± 0.02		$(3.5 \pm 0.5)(-2)$	
	$\rightarrow$ 1.31	$\rightarrow 7/2^-$		41.8 ± 1.0	-0.6 ± 0.3		$(4.2 \pm 1.3)(-2)$	
	2.61 $\rightarrow$ 1.73	$9/2^- \rightarrow 7/2^-$	410 ± 60 fs	58.6 ± 0.9	-0.36 ± 0.10		$(5.8 \pm 0.9)(-2)$	
	$\rightarrow$ 1.94	$\rightarrow 7/2^-$		30.1 ± 0.5	-0.25 ± 0.04		$(7.2 \pm 1.1)(-2)$	
	$\rightarrow$ 2.30	$\rightarrow 9/2^-$		1.4 ± 0.1	[0]		$(3.6 \pm 0.5)(-2)$	
	2.73 $\rightarrow$ 0.097	$7/2^- \rightarrow 5/2^-$	330 ± 50 fs	60 ± 2	-1.6 ± 0.3		$(2.9 \pm 0.9)(-3)$	
	$\rightarrow$ 1.31	$\rightarrow 7/2^-$		33.2 ± 1.6	-0.4 ± 0.6		$(9.5 \pm 1.4)(-3)$	

TABLE VI. Strengths of $M1$ Transitions
See page 552 for Explanation of Tables

Nucleus	$E_{x1} + E_{xf}$ (MeV)	$J_i^\pi \rightarrow J_f^\pi$	τ_m	Total branching (%)	δ	α_{tot}	S (W.u.)	Remarks
^{61}Cu	2.73 ± 2.40	$7/2^- \rightarrow 7/2^-$	330 ± 50 fs	2.7 ± 0.3	[0]		$(7.1 \pm 1.3)(-2)$	
	3.02 ± 0.48	$3/2^- \rightarrow 1/2^-$	100 ± 20 fs	71 ± 4	$+0.6 \pm 0.3$		$(1.0 \pm 0.3)(-2)$	
^{62}Ni	2.30 ± 1.17	$2^+ \rightarrow 2^+$	950 ± 170 fs	43 ± 4	-3.19 ± 0.11		$(8.8 \pm 1.6)(-4)$	
	3.06 ± 1.17	$2^+ \rightarrow 2^+$	3.3 ± 1.5 ps	39 ± 4	-0.65 ± 0.18		$(3.7 \pm 1.8)(-4)$	
	3.52 ± 1.17	$2^+ \rightarrow 2^+$	290 ± 55 fs	80 ± 2	-0.44 ± 0.09		$(5.6 \pm 1.1)(-3)$	
	$+ 3.06$	$+ 2^+$		6.2 ± 0.9	[0]		$(6.9 \pm 1.6)(-2)$	
^{62}Cu	0.041 ± 0	$2^+ \rightarrow 1^+$	6.6 ± 0.2 ns	100	≈ 0	0.65	$(4.2 \pm 0.2)(-2)$	
^{63}Cu	0.67 ± 0	$1/2^- \rightarrow 3/2^-$	300 ± 20 fs	100	≈ 0		$(3.5 \pm 0.2)(-1)$	
	0.96 ± 0	$5/2^- \rightarrow 3/2^-$	850 ± 40 fs	100	$+0.49 \pm 0.04$		$(3.3 \pm 0.2)(-2)$	
	1.33 ± 0.96	$7/2^- \rightarrow 5/2^-$	780 ± 60 fs	15.8 ± 0.4	≈ 0		$(1.2 \pm 0.1)(-1)$	
	1.41 ± 0	$5/2^- \rightarrow 3/2^-$	1.6 ± 0.3 ps	72.2 ± 0.8	-0.62 ± 0.05		$(3.6 \pm 0.7)(-3)$	
	$+ 0.96$	$+ 5/2^-$		21.6 ± 0.7	[0]		$(4.7 \pm 0.9)(-2)$	
	1.55 ± 0	$3/2^- \rightarrow 3/2^-$	160 ± 15 fs	80.1 ± 0.4	≈ 0		$(4.2 \pm 0.4)(-1)$	
	$+ 0.96$	$+ 5/2^-$		17.7 ± 0.4	≈ 0		$(1.7 \pm 0.2)(-1)$	
	1.86 ± 0.96	$7/2^- \rightarrow 5/2^-$	850 ± 130 fs	43 ± 2	≈ 0		$(2.2 \pm 0.3)(-2)$	
	2.01 ± 0.96	$3/2^- \rightarrow 5/2^-$	55 ± 9 fs	30 ± 2	$+0.23 \pm 0.12$		$(1.4 \pm 0.2)(-1)$	
	2.06 ± 1.55	$(1/2, 3/2)^- \rightarrow 3/2^-$	440 ± 110 fs	30 ± 4	[0]		$(1.6 \pm 0.4)(-1)$	
	2.09 ± 0.96	$7/2^- \rightarrow 5/2^-$	535 ± 120 fs	47 ± 2	-1.1 ± 0.2		$(9 \pm 3)(-3)$	
	$+ 1.33$	$+ 7/2^-$		43 ± 2	≈ 0		$(5.8 \pm 1.3)(-2)$	
	2.21 ± 1.33	$9/2^- \rightarrow 7/2^-$	445 ± 105 fs	57 ± 2	$+0.26 \pm 0.04$		$(5.5 \pm 1.3)(-2)$	
	2.41 ± 1.33	$7/2^- \rightarrow 7/2^-$	180 ± 40 fs	32 ± 3	≈ 0		$(4.3 \pm 1.1)(-2)$	
	2.54 ± 2.09	$5/2^- \rightarrow 7/2^-$	310 ± 60 fs	6.3 ± 1.5	[0]		$(7 \pm 2)(-2)$	
	2.68 ± 2.21	$11/2^- \rightarrow 9/2^-$	840 ± 220 fs	30 ± 2	≈ 0		$(1.1 \pm 0.3)(-1)$	
^{63}Zn	0.19 ± 0	$5/2^- \rightarrow 3/2^-$	760 ± 170 ps	100	≈ 0		$(5.7 \pm 1.3)(-3)$	
	0.25 ± 0	$1/2^- \rightarrow 3/2^-$	48 ± 11 ps	100	[0]		$(4.3 \pm 1.0)(-2)$	
	1.39 ± 0	$3/2^- \rightarrow 3/2^-$	125 ± 35 fs	48 ± 1	-0.36 ± 0.12		$(4.0 \pm 1.0)(-2)$	
	1.66 ± 0.19	$7/2^- \rightarrow 5/2^-$	335 ± 90 fs	75 ± 1	-0.18 ± 0.03		$(2.1 \pm 0.6)(-2)$	
	1.69 ± 0	$5/2^- \rightarrow 3/2^-$	120 ± 30 fs	88 ± 1	≈ 0		$(4.9 \pm 1.2)(-2)$	
	1.86 ± 1.07	$9/2^- \rightarrow 7/2^-$	710 ± 230 fs	26 ± 3	≈ 0		$(2.3 \pm 0.8)(-2)$	
	2.16 ± 0.25	$3/2^- \rightarrow 1/2^-$	260 ± 70 fs	90 ± 1	$+2.3 \pm 0.2$		$(2.5 \pm 0.8)(-3)$	
	2.25 ± 1.07	$9/2^- \rightarrow 7/2^-$	150 ± 40 fs	71 ± 2	-0.9 ± 0.2		$(5.0 \pm 1.7)(-2)$	
	2.64 ± 1.21	$7/2^- \rightarrow 7/2^-$	270 ± 75 fs	70 ± 2	≈ 0		$(2.8 \pm 0.8)(-2)$	
	2.83 ± 1.70	$11/2^+ \rightarrow 9/2^+$	420 ± 130 fs	100	-0.7 ± 0.1		$(3.5 \pm 1.1)(-2)$	
^{64}Cu	0.16 ± 0	$2^+ \rightarrow 1^+$	30 ± 5 ps	100	≈ 0	0.02	$(2.6 \pm 0.4)(-2)$	
^{64}Zn	1.80 ± 0.99	$2^+ \rightarrow 2^+$	3.0 ± 0.4 ps	75 ± 2	$+3.3 \pm 0.7$		$(1.2 \pm 0.5)(-3)$	
	3.08 ± 2.31	$4^+ \rightarrow 4^+$	610 ± 160 fs	47 ± 3	-0.54 ± 0.12		$(4.1 \pm 1.2)(-2)$	
	3.19 ± 1.91	$1^+ \rightarrow 0^+$	580 ± 240 fs	20.8 ± 0.5	0		$(5 \pm 2)(-3)$	
	3.37 ± 0	$1^+ \rightarrow 0^+$	40 ± 7 fs	52.0 ± 1.0	0		$(1.1 \pm 0.2)(-2)$	
	$+ 1.91$	$+ 0^+$	$\pm$	7.4 ± 0.4	0		$(1.9 \pm 0.3)(-2)$	
	$+ 2.61$	$+ 0^+$		4.9 ± 0.3	0		$(8.8 \pm 1.5)(-2)$	
	3.43 ± 0	$1^+ \rightarrow 0^+$	63 ± 14 fs	69.4 ± 1.6	0		$(8.6 \pm 1.9)(-3)$	
	$+ 1.91$	$+ 0^+$		3.0 ± 0.6	0		$(4.2 \pm 1.3)(-3)$	
	4.46 ± 0	$1^+ \rightarrow 0^+$	4.6 ± 0.8 fs	60 ± 5	0		$(4.6 \pm 0.9)(-2)$	
	$+ 1.91$	$+ 0^+$		14 ± 3	0		$(5.7 \pm 1.6)(-2)$	
^{64}Ga	0.13 ± 0	$1^+ \rightarrow 0^+$	10.0 ± 1.0 ns	≈ 56	0	0.04	$(8.0 \pm 0.8)(-4)$	
^{65}Cu	0.77 ± 0	$1/2^- \rightarrow 3/2^-$	150 ± 9 fs	100	≈ 0		$(4.6 \pm 0.3)(-1)$	
	1.12 ± 0	$5/2^- \rightarrow 3/2^-$	380 ± 25 fs	≈ 100	$+0.44 \pm 0.02$		$(4.9 \pm 0.3)(-2)$	
	1.48 ± 1.12	$7/2^- \rightarrow 5/2^-$	475 ± 5 fs	16.0 ± 0.6	≈ 0		$(2.2 \pm 0.1)(-1)$	
	1.62 ± 1.12	$5/2^- \rightarrow 5/2^-$	1.3 ± 0.3 ps	35 ± 2	-0.20 ± 0.02		$(6.5 \pm 1.5)(-2)$	
	1.73 ± 0	$3/2^- \rightarrow 3/2^-$	123 ± 13 fs	72 ± 2	≈ 0		$(3.5 \pm 0.4)(-2)$	
	$+ 1.12$	$+ 5/2^-$		26 ± 2	[0]		$(2.9 \pm 0.4)(-1)$	
	2.33 ± 0	$3/2^- \rightarrow 3/2^-$	21 ± 2 fs	45	≈ 0		$(5.3 \pm 0.5)(-2)$	
	$+ 1.12$	$+ 5/2^-$		23	[0]		$(1.9 \pm 0.2)(-1)$	
	2.66 ± 1.73	$5/2^- \rightarrow 3/2^-$	83 ± 23 fs	69 ± 3	[0]		$(3.3 \pm 0.9)(-1)$	
^{65}Zn	0.12 ± 0	$3/2^- \rightarrow 5/2^-$	635 ± 9 ps	84 ± 2	≈ 0	0.05	$(2.6 \pm 0.1)(-2)$	

TABLE VI. Strengths of $M1$ Transitions
See page 552 for Explanation of Tables

Nucleus	$E_{x_i} \rightarrow E_{x_f}$ (MeV)	$J_i^\pi \rightarrow J_f^\pi$	τ_m	Total branching (%)	δ	α_{tot}	S (W.u.)	Remarks
^{65}Zn	0.12 $\rightarrow$ 0.054	$3/2^- \rightarrow 1/2^-$	635 $\pm$ 9 ps	16 $\pm$ 2	≈ 0	0.24	(3.0 $\pm$ 0.4)(-2)	
	0.21 $\rightarrow$ 0	$3/2^- \rightarrow 5/2^-$	830 $\pm$ 40 ps	23 $\pm$ 2	-0.27 $\pm$ 0.09		(9.1 $\pm$ 0.9)(-4)	
	$\rightarrow$ 0.054	$\rightarrow 1/2^-$		76 $\pm$ 2	≈ 0		(8.2 $\pm$ 0.4)(-3)	
	0.77 $\rightarrow$ 0	$5/2^- \rightarrow 5/2^-$	1.9 $\pm$ 0.8 ps	53 $\pm$ 1	-0.27 $\pm$ 0.06		(1.8 $\pm$ 0.8)(-2)	
	$\rightarrow$ 0.115	$\rightarrow 3/2^-$		33 $\pm$ 1	+0.43 $\pm$ 0.04		(1.7 $\pm$ 0.7)(-2)	
	0.87 $\rightarrow$ 0.054	$1/2^- \rightarrow 1/2^-$	800 $\pm$ 300 fs	1.5 $\pm$ 0.2	0		(1.1 $\pm$ 0.4)(-3)	
	$\rightarrow$ 0.12	$\rightarrow 3/2^-$		95.7 $\pm$ 0.5	[0]		(9 $\pm$ 3)(-2)	
	0.91 $\rightarrow$ 0	$3/2^- \rightarrow 5/2^-$	2.1 $\pm$ 0.5 ps	48 $\pm$ 1	-0.25 $\pm$ 0.04		(9 $\pm$ 2)(-3)	
	$\rightarrow$ 0.054	$\rightarrow 1/2^-$		22 $\pm$ 1	+0.96 $\pm$ 0.20		(2.7 $\pm$ 0.8)(-3)	
	$\rightarrow$ 0.12	$\rightarrow 3/2^-$		23 $\pm$ 1	-0.40 $\pm$ 0.12		(6.0 $\pm$ 1.5)(-3)	
	1.05 $\rightarrow$ 0.12	$5/2^- \rightarrow 3/2^-$	520 $\pm$ 100 fs	63 $\pm$ 2	+0.43 $\pm$ 0.04		(4.0 $\pm$ 0.8)(-2)	
	1.25 $\rightarrow$ 0.77	$7/2^- \rightarrow 5/2^-$	2.3 $\pm$ 0.8 ps	36 $\pm$ 2	≈ 0		(4.4 $\pm$ 1.5)(-2)	
	1.47 $\rightarrow$ 0.054	$3/2^- \rightarrow 1/2^-$	210 $\pm$ 60 fs	19	-0.24 $\pm$ 0.05		(9 $\pm$ 3)(-3)	
	$\rightarrow$ 0.12	$\rightarrow 3/2^-$		67	-2.1 $\pm$ 0.3		(8 $\pm$ 3)(-3)	
	1.58 $\rightarrow$ 0.054	$3/2^- \rightarrow 1/2^-$	250 $\pm$ 30 fs	29 $\pm$ 2	+2.5 $\pm$ 0.3		(1.4 $\pm$ 0.3)(-3)	
	1.59 $\rightarrow$ 0	$7/2^- \rightarrow 5/2^-$	220 $\pm$ 70 fs	68 $\pm$ 2	-0.31 $\pm$ 0.02		(2.2 $\pm$ 0.7)(-2)	
	$\rightarrow$ 0.77	$\rightarrow 5/2^-$		10 $\pm$ 1	+0.23 $\pm$ 0.03		(2.4 $\pm$ 0.8)(-2)	
	1.96 $\rightarrow$ 1.07	$7/2^+ \rightarrow 9/2^+$	600 $\pm$ 290 fs	79 $\pm$ 1	+0.27 $\pm$ 0.01		(5 $\pm$ 2)(-2)	
	$\rightarrow$ 1.37	$\rightarrow 5/2^+$		21 $\pm$ 1	≈ 0		(5 $\pm$ 2)(-2)	
	2.14 $\rightarrow$ 1.07	$11/2^+ \rightarrow 9/2^+$	960 $\pm$ 100 fs	100	-0.67 $\pm$ 0.05		(1.8 $\pm$ 0.2)(-2)	
	^{66}Zn 4.30 $\rightarrow$ 0	$1^+ \rightarrow 0^+$	6.5 $\pm$ 2.2 fs	60 $\pm$ 1	0		(3.6 $\pm$ 1.2)(-2)	
	4.81 $\rightarrow$ 0	$1^+ \rightarrow 0^+$	5.5 $\pm$ 1.9 fs	80.6 $\pm$ 0.3	0		(4.1 $\pm$ 1.4)(-2)	
^{66}Ga	0.044 $\rightarrow$ 0	$1^+ \rightarrow 0^+$	23 $\pm$ 3 ns	100	0	0.73	(1.6 $\pm$ 0.2)(-2)	
^{67}Zn	0.19 $\rightarrow$ 0	$3/2^- \rightarrow 5/2^-$	1.49 $\pm$ 0.02 ns	86.7 $\pm$ 0.2	-0.39 $\pm$ 0.02	0.02	(2.5 $\pm$ 0.1)(-3)	
	$\rightarrow$ 0.093	$\rightarrow 1/2^-$		13.3 $\pm$ 0.2	≈ 0	0.08	(3.4 $\pm$ 0.1)(-3)	
	0.39 $\rightarrow$ 0	$3/2^- \rightarrow 5/2^-$	17 $\pm$ 8 ps	19.4 $\pm$ 0.8	≈ 0		(6 $\pm$ 3)(-3)	
	$\rightarrow$ 0.093	$\rightarrow 1/2^-$		70.4 $\pm$ 0.8	≈ 0		(5 $\pm$ 2)(-2)	
	$\rightarrow$ 0.19	$\rightarrow 3/2^-$		10.2 $\pm$ 0.5	≈ 0		(2.1 $\pm$ 1.0)(-2)	
	0.81 $\rightarrow$ 0	$7/2^- \rightarrow 5/2^-$	9 $\pm$ 2 ps	91 $\pm$ 1	-6.0 $\pm$ 0.7		(1.6 $\pm$ 0.5)(-4)	
	0.89 $\rightarrow$ 0	$5/2^- \rightarrow 5/2^-$	4.0 $\pm$ 1.7 ps	49 $\pm$ 2	+0.14 $\pm$ 0.03		(5 $\pm$ 2)(-3)	
	1.36 $\rightarrow$ 0.19	$5/2^- \rightarrow 3/2^-$	260 $\pm$ 55 fs	27 $\pm$ 3	+0.28 $\pm$ 0.07		(1.8 $\pm$ 0.4)(-2)	
	$\rightarrow$ 0.39	$\rightarrow 3/2^-$		37 $\pm$ 3	+0.31 $\pm$ 0.06		(4.4 $\pm$ 1.0)(-2)	
	$\rightarrow$ 0.89	$\rightarrow 5/2^-$		8 $\pm$ 1	+0.37 $\pm$ 0.05		(8 $\pm$ 2)(-2)	
	1.54 $\rightarrow$ 0	$3/2^- \rightarrow 5/2^-$	270 $\pm$ 45 fs	64 $\pm$ 5	-0.5 $\pm$ 0.3		(1.6 $\pm$ 0.5)(-2)	
	1.60 $\rightarrow$ 0.60	$7/2^+ \rightarrow 9/2^+$	200 $\pm$ 35 fs	80 $\pm$ 3	+0.28 $\pm$ 0.03		(1.2 $\pm$ 0.2)(-1)	
	$\rightarrow$ 0.98	$\rightarrow 5/2^+$		20 $\pm$ 3	≈ 0		(1.3 $\pm$ 0.3)(-1)	
	1.80 $\rightarrow$ 0	$7/2^- \rightarrow 5/2^-$	170 $\pm$ 30 fs	31 $\pm$ 3	+0.38 $\pm$ 0.08		(8.6 $\pm$ 1.7)(-3)	
	$\rightarrow$ 0.89	$\rightarrow 5/2^-$		27 $\pm$ 3	≈ 0		(6.6 $\pm$ 1.4)(-2)	
	1.88 $\rightarrow$ 0.89	$5/2^- \rightarrow 3/2^-$	190 $\pm$ 35 fs	21 $\pm$ 2	+0.8 $\pm$ 0.2		(6.4 $\pm$ 1.8)(-3)	
	^{67}Ga 0.36 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	70 $\pm$ 7 ps	100	≈ 0		(1.0 $\pm$ 0.1)(-2)	
	0.83 $\rightarrow$ 0	$3/2^- \rightarrow 3/2^-$	250 $\pm$ 40 fs	86.9 $\pm$ 1.2	+0.16 $\pm$ 0.03		(1.8 $\pm$ 0.3)(-1)	
	$\rightarrow$ 0.17	$\rightarrow 1/2^-$		9.4 $\pm$ 1.2	+0.36 $\pm$ 0.09		(3.6 $\pm$ 0.7)(-2)	
	$\rightarrow$ 0.36	$\rightarrow 5/2^-$		3.7 $\pm$ 0.4	[0]		(4.4 $\pm$ 0.9)(-2)	
	0.91 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	360 $\pm$ 95 fs	95.5 $\pm$ 0.5	-0.33 $\pm$ 0.2		(1.0 $\pm$ 0.3)(-1)	
	1.08 $\rightarrow$ 0.17	$1/2^- \rightarrow 1/2^-$	400 $\pm$ 150 fs	68.8 $\pm$ 1.6	0		(7 $\pm$ 3)(-2)	
	$\rightarrow$ 0.83	$\rightarrow 3/2^-$		7.6 $\pm$ 0.6	[0]		(3.8 $\pm$ 1.4)(-1)	
	1.20 $\rightarrow$ 0.36	$7/2^- \rightarrow 5/2^-$	1.5 $\pm$ 0.5 ps	25 $\pm$ 2	+2.3 $\pm$ 0.1		(1.4 $\pm$ 0.5)(-3)	
	1.41 $\rightarrow$ 0.36	$7/2^- \rightarrow 5/2^-$	900 $\pm$ 300 fs	35 $\pm$ 2	+1.7 $\pm$ 0.2		(2.7 $\pm$ 1.0)(-3)	
	$\rightarrow$ 0.91	$\rightarrow 5/2^-$		10.5 $\pm$ 0.9	≈ 0		(2.9 $\pm$ 1.0)(-2)	
	1.55 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	230 $\pm$ 35 fs	43 $\pm$ 3	-0.42 $\pm$ 0.04		(1.3 $\pm$ 0.2)(-2)	
	$\rightarrow$ 0.36	$\rightarrow 5/2^-$		57 $\pm$ 3	+0.65 $\pm$ 0.03		(3.2 $\pm$ 0.5)(-2)	
	1.64 $\rightarrow$ 0.17	$3/2^- \rightarrow 1/2^-$	165 $\pm$ 25 fs	53 $\pm$ 2	+0.16 $\pm$ 0.02		(3.1 $\pm$ 0.5)(-2)	
	$\rightarrow$ 0.91	$\rightarrow 5/2^-$		26 $\pm$ 2	[0]		(1.3 $\pm$ 0.2)(-1)	
	2.26 $\rightarrow$ 1.20	$9/2^- \rightarrow 7/2^-$	980 $\pm$ 250 fs	50.4 $\pm$ 1.4	+2.4 $\pm$ 0.2		(2.0 $\pm$ 0.6)(-3)	
	2.86 $\rightarrow$ 1.52	$11/2^- \rightarrow 9/2^-$	1.25 $\pm$ 0.30 ps	68.4 $\pm$ 1.4	+2.5 $\pm$ 0.2		(1.0 $\pm$ 0.3)(-3)	

TABLE VI. Strengths of $M1$ Transitions
See page 552 for Explanation of Tables

Nucleus	$E_{x_i} \rightarrow E_{x_f}$ (MeV)	$J_i^\pi \rightarrow J_f^\pi$	τ_m	Total branching (%)	δ	α_{tot}	S (W.u.)	Remarks
^{68}Zn	1.88 $\rightarrow$ 1.08	$2^+ \rightarrow 2^+$	2.2 ± 0.4 ps	39 ± 2	$+1.46 \pm 0.14$		$(3.4 \pm 0.8)(-3)$	
	3.35 $\rightarrow$ 0	$1^+ \rightarrow 0^+$	8.4 ± 2.9 fs	61 ± 9	0		$(6.0 \pm 1.4)(-2)$	
^{69}Ga	0.57 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	19 ± 3 ps	≈ 100	≈ 0		$(8.9 \pm 1.4)(-3)$	
	0.87 $\rightarrow$ 0	$3/2^- \rightarrow 3/2^-$	350 ± 30 fs	94.8 ± 0.5	-0.14 ± 0.04		$(1.3 \pm 0.1)(-1)$	
	1.11 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	290 ± 30 fs	96.4 ± 0.1	$+0.41 \pm 0.05$		$(6.5 \pm 0.7)(-2)$	
	$\rightarrow 0.57$	$\rightarrow 5/2^-$		0.80 ± 0.08	≈ 0		$(5.5 \pm 0.8)(-3)$	
	$\rightarrow 0.87$	$\rightarrow 3/2^-$		1.6 ± 0.2	≈ 0		$(1.3 \pm 0.2)(-1)$	
	1.34 $\rightarrow$ 0.57	$7/2^- \rightarrow 5/2^-$	1.18 ± 0.16 ps	6.3 ± 0.6	$+0.68 \pm 0.10$		$(2.5 \pm 0.5)(-3)$	
	1.49 $\rightarrow$ 0.57	$7/2^- \rightarrow 5/2^-$	2.9 ± 1.2 ps	35 ± 8	-2.54 ± 0.10		$(7 \pm 3)(-4)$	
^{69}Ge	0.23 $\rightarrow$ 0	$3/2^- \rightarrow 5/2^-$	252 ± 17 ps	69 ± 1	-0.27 ± 0.04		$(6.6 \pm 0.4)(-3)$	
	$\rightarrow 0.087$	$\rightarrow 1/2^-$		31 ± 1	≈ 0		$(1.2 \pm 0.1)(-2)$	
	0.86 $\rightarrow$ 0	$7/2^- \rightarrow 5/2^-$	3.1 ± 0.5 ps	94.4 ± 0.8	-2.4 ± 0.3		$(2.2 \pm 0.6)(-3)$	
	1.00 $\rightarrow$ 0.087	$3/2^- \rightarrow 1/2^-$	1.8 ± 0.8 ps	68 ± 1	-0.31 ± 0.06		$(1.4 \pm 0.6)(-2)$	
	1.31 $\rightarrow$ 0.087	$3/2^- \rightarrow 1/2^-$	720 ± 250 fs	49 ± 1	-0.3 ± 0.1		$(1.1 \pm 0.4)(-2)$	
	1.35 $\rightarrow$ 0.40	$11/2^+ \rightarrow 9/2^+$	810 ± 110 fs	100	-0.6 ± 0.1		$(3.3 \pm 0.5)(-2)$	
	1.42 $\rightarrow$ 0	$5/2^- \rightarrow 5/2^-$	1.4 ± 0.6 ps	64 ± 2	$+0.65 \pm 0.10$		$(3.5 \pm 1.5)(-3)$	
	$\rightarrow 0.23$	$3/2^-$		15 ± 1	-0.49 ± 0.10		$(1.6 \pm 0.7)(-3)$	
	1.48 $\rightarrow$ 0.93	$7/2^- \rightarrow 5/2^-$	430 ± 120 fs	11 ± 2	≈ 0		$(4.8 \pm 1.7)(-2)$	
^{70}Ge	1.71 $\rightarrow$ 1.04	$2^+ \rightarrow 2^+$	5 ± 2 ps	52.9 ± 0.5	$+1.0 \pm 0.2$		$(5 \pm 2)(-3)$	
^{71}Ga	0.51 $\rightarrow$ 0	$3/2^- \rightarrow 3/2^-$	32 ± 12 ps	90.2 ± 0.9	-0.37 ± 0.06		$(6 \pm 2)(-3)$	
	$\rightarrow 0.39$	$\rightarrow 1/2^-$		9.8 ± 0.9	≈ 0	0.06	$(4.9 \pm 1.7)(-2)$	
	0.96 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	2.1 ± 0.3 ps	78 ± 2	$\pm 1.2 \pm 0.1$		$(5 \pm 2)(-3)$	
	$\rightarrow 0.51$	$\rightarrow 3/2^-$		20 ± 2	[0]		$(3.3 \pm 0.6)(-2)$	
^{72}Ge	1.46 $\rightarrow$ 0.83	$2^+ \rightarrow 2^+$	4.0 ± 1.0 ps	87.6 ± 0.3	$+10.3 \pm 1.3$		$(2.4 \pm 0.8)(-4)$	
^{73}Ge	0.069 $\rightarrow$ 0	$(7/2, 11/2)^+ \rightarrow 9/2^+$	2.3 ± 0.2 ns	100	[0]	0.23	$(3.4 \pm 0.3)(-2)$	
^{73}As	0.067 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	7.2 ± 0.2 ns	100	≈ 0	0.27	$(1.1 \pm 0.1)(-2)$	
^{74}Ge	1.20 $\rightarrow$ 0.60	$2^+ \rightarrow 2^+$	7.8 ± 1.1 ps	68 ± 1	-3.3 ± 0.2		$(1.1 \pm 0.2)(-3)$	
^{74}Se	1.27 $\rightarrow$ 0.63	$2^+ \rightarrow 2^+$	4.8 ± 0.6 ps	69 ± 3	$+2.6 \pm 0.2$		$(2.2 \pm 0.4)(-3)$	
^{75}As	0.20 $\rightarrow$ 0	$1/2^- \rightarrow 3/2^-$	1.25 ± 0.04 ns	100	$\pm 0.44 \pm 0.02$		$(2.6 \pm 0.1)(-3)$	
	0.27 $\rightarrow$ 0	$3/2^- \rightarrow 3/2^-$	17.0 ± 1.0 ps	97.57 ± 0.06	≈ 0		$(9.3 \pm 0.5)(-3)$	
	$\rightarrow 0.20$	$\rightarrow 1/2^-$		2.43 ± 0.06	≈ 0	0.35	$(1.0 \pm 0.1)(-1)$	
	0.28 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	400 ± 14 ps	≈ 100	$+0.36 \pm 0.03$		$(3.1 \pm 0.2)(-3)$	
	0.57 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	4.1 ± 0.5 ps	98.6 ± 0.3	-0.39 ± 0.05		$(3.5 \pm 0.5)(-3)$	
	0.82 $\rightarrow$ 0.57	$7/2^- \rightarrow 5/2^-$	3.6 ± 0.4 ps	5.5 ± 0.8	[0]		$(3.0 \pm 0.5)(-2)$	
^{75}Se	0.113 $\rightarrow$ 0	$7/2^+ \rightarrow 5/2^+$	1.00 ± 0.17 ns	100	$+0.35 \pm 0.06$	0.14	$(1.9 \pm 0.3)(-2)$	
	0.134 $\rightarrow$ 0.113	$9/2^+ \rightarrow 7/2^+$	7.6 ± 0.9 ns	63 ± 8	[0]	7.1	$(3.5 \pm 0.6)(-2)$	
^{76}Ge	1.11 $\rightarrow$ 0.56	$2^+ \rightarrow 2^+$	13.1 ± 1.4 ps	62 ± 4	-3.4 ± 0.4		$(7.0 \pm 1.7)(-4)$	
^{76}Se	1.22 $\rightarrow$ 0.56	$2^+ \rightarrow 2^+$	4.9 ± 0.3 ps	61 ± 2	-5.2 ± 0.2		$(4.8 \pm 0.5)(-4)$	
^{76}Br	0.045 $\rightarrow$ 0	$(0-2)^- \rightarrow 1^-$	1.63 ± 0.09 ns	100	≈ 0	1.1	$(1.0 \pm 0.1)(-1)$	
	0.36 $\rightarrow$ 0.25	$1^+ \rightarrow (0-2)^+$	700 ± 300 ps	34 ± 3	≈ 0	0.13	$(1.2 \pm 0.5)(-2)$	
	$\rightarrow 0.316$	$\rightarrow 1^+$		1.3 ± 0.3	[0]	1.6	$(3.7 \pm 1.8)(-3)$	
	0.45 $\rightarrow$ 0.25	$1^+ \rightarrow (0-2)^+$	580 ± 140 ps	4.7 ± 0.5	≈ 0		$(3.2 \pm 0.8)(-4)$	
	$\rightarrow 0.317$	$\rightarrow (0-2)^+$		10.2 ± 1.0	≈ 0		$(2.2 \pm 0.6)(-3)$	
^{77}As	0.26 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	500 ± 30 ps	100	$+0.32 \pm 0.01$		$(3.1 \pm 0.2)(-3)$	
^{77}Se	0.24 $\rightarrow$ 0	$3/2^- \rightarrow 1/2^-$	39 ± 10 ps	≈ 100	-0.18 ± 0.02		$(5.7 \pm 1.5)(-2)$	
	0.44 $\rightarrow$ 0.24	$5/2^- \rightarrow 3/2^-$	33 ± 3 ps	43 ± 2	≈ 0		$(5.1 \pm 0.5)(-2)$	
^{77}Br	0.28 $\rightarrow$ 0.13	$(3/2, 5/2)^+ \rightarrow 5/2^+$	130 ± 30 ps	92 ± 2	≈ 0		$(6.6 \pm 1.5)(-2)$	
^{77}Kr	0.25 $\rightarrow$ 0.067	$5/2^- \rightarrow 3/2^-$	48 ± 13 ps	≈ 100	[0]		$(1.1 \pm 0.3)(-1)$	
^{78}Se	1.31 $\rightarrow$ 0.61	$2^+ \rightarrow 2^+$	3.9 ± 0.4 ps	59.0 ± 1.3	-2.7 ± 0.8		$(1.7 \pm 0.8)(-3)$	
^{78}Kr	1.56 $\rightarrow$ 1.12	$3^+ \rightarrow 4^+$	6.4 ± 0.5 ps	15 ± 3	$+11 \pm 2$		$(7 \pm 3)(-5)$	
^{79}Br	0.31 $\rightarrow$ 0	$1/2^- \rightarrow 3/2^-$	12.0 ± 2.5 ps	100	≈ 0		$(9.1 \pm 1.8)(-2)$	
	0.40 $\rightarrow$ 0	$3/2^- \rightarrow 3/2^-$	19 ± 4 ps	91.9 ± 0.7	≈ 0		$(2.4 \pm 0.5)(-2)$	
	$\rightarrow 0.22$	$\rightarrow 5/2^-$		0.28 ± 0.10	≈ 0		$(8 \pm 3)(-4)$	
	$\rightarrow 0.26$	$\rightarrow (3/2, 5/2)^-$		7.9 ± 1.7	≈ 0		$(5.2 \pm 1.5)(-2)$	
	0.52 $\rightarrow$ 0	$5/2^- \rightarrow 3/2^-$	1.9 ± 0.4 ps	100	-0.19 ± 0.04		$(1.1 \pm 0.2)(-1)$	

TABLE VI. Strengths of M1 Transitions

See page 552 for Explanation of Tables

Nucleus	$E_{xi} \rightarrow E_{xf}$ (MeV)	$J_i^\pi \rightarrow J_f^\pi$	τ_m	Total branching (%)	δ	a_{tot}	S (W.u.)
^{79}Br	0.61 ± 0	$3/2^- \rightarrow 3/2^-$	2.9 ± 0.3 ps	67 ± 2	≈ 0		$(3.3 \pm 0.3)(-2)$
	$+ 0.22$	$+ 5/2^-$		12.6 ± 1.6	$+0.19 \pm 0.02$		$(2.5 \pm 0.4)(-2)$
	$+ 0.31$	$+ 1/2^-$		11.4 ± 1.6	≈ 0		$(4.6 \pm 0.8)(-2)$
	$+ 0.40$	$+ 3/2^-$		6.8 ± 1.5	≈ 0		$(8 \pm 2)(-2)$
	0.76 ± 0.22	$7/2^- \rightarrow 5/2^-$	1.7 ± 0.3 ps	56 ± 3	[0]		$(6.4 \pm 1.1)(-2)$
	$+ 0.52$	$+ 5/2^-$		6 ± 1	[0]		$(8 \pm 2)(-2)$
	0.83 ± 0	$3/2^- \rightarrow 3/2^-$	170 ± 23 fs	76 ± 3	[0]		$(2.4 \pm 0.3)(-1)$
	$+ 0.22$	$+ 5/2^-$		4.6 ± 1.2	[0]		$(3.6 \pm 1.0)(-2)$
	$+ 0.31$	$+ 1/2^-$		17 ± 3	[0]		$(2.1 \pm 0.5)(-1)$
	$+ 0.40$	$+ 3/2^-$		2.3 ± 0.4	[0]		$(5.1 \pm 1.1)(-2)$
^{81}Br	0.28 ± 0	$5/2^- \rightarrow 3/2^-$	12 ± 5 ps	100	≈ 0		$(1.2 \pm 0.5)(-1)$
	0.54 ± 0	$(1/2, 3/2)^- \rightarrow 3/2^-$	870 ± 190 fs	100	[0]		$(2.3 \pm 0.5)(-1)$
	0.65 ± 0	$(1/2, 3/2)^- \rightarrow 3/2^-$	5 ± 2 ps	100	≈ 0		$(2.3 \pm 0.9)(-2)$
	0.77 ± 0	$(3/2, 5/2)^- \rightarrow 3/2^-$	610 ± 130 fs	87 ± 1	≈ 0		$(1.0 \pm 0.2)(-1)$
	$+ 0.28$	$+ 5/2^-$		13 ± 1	[0]		$(5.7 \pm 1.2)(-2)$
^{81}Kr	0.84 ± 0.28	$7/2^- \rightarrow 5/2^-$	920 ± 220 fs	87 ± 4	-0.193 ± 0.012		$(1.6 \pm 0.4)(-1)$
	0.050 ± 0	$(5/2-9/2)^+ \rightarrow 7/2^+$	12.1 ± 1.4 ns	100	≈ 0	0.97	$(1.0 \pm 0.1)(-2)$
^{83}Kr	0.009 ± 0	$7/2^+ \rightarrow 9/2^+$	212 ± 6 ns	100	≈ 0	16	$(1.1 \pm 0.1)(-2)$
^{83}Rb	0.005 ± 0	$3/2^- \rightarrow 5/2^-$	103.1 ± 1.2 ns	100	≈ 0	85	$(2.5 \pm 0.1)(-2)$
^{85}Rb	0.15 ± 0	$3/2^- \rightarrow 5/2^-$	1.07 ± 0.07 ns	100	≈ 0	0.05	$(8.0 \pm 0.5)(-3)$
	0.28 ± 0.15	$1/2^- \rightarrow 3/2^-$	420 ± 90 ps	95.5 ± 0.9	[0]	0.08	$(3.0 \pm 0.6)(-2)$
	0.73 ± 0	$3/2^- \rightarrow 3/2^-$	6.4 ± 0.7 ps	64 ± 3	$+0.8 \pm 0.2$		$(4.9 \pm 1.1)(-3)$
	$+ 0.28$	$+ 1/2^-$		36 ± 3	$+0.6 \pm 0.3$		$(1.4 \pm 0.4)(-2)$
^{85}Sr	0.23 ± 0	$(5/2-9/2)^+ \rightarrow (7/2, 9/2)^+$	300 ± 70 ps	100	≈ 0		$(8 \pm 2)(-3)$
^{88}Sr	3.49 ± 0	$1^+ \rightarrow 0^+$	4.4 ± 0.7 fs	100	0		$(1.7 \pm 0.3)(-1)$
^{89}Y	1.51 ± 0	$3/2^- \rightarrow 1/2^-$	20 ± 7 fs	100	-0.15 ± 0.05		$(4.4 \pm 1.5)(-1)$
^{89}Zr	1.87 ± 1.10	$3/2^- \rightarrow 3/2^-$	250 ± 40 fs	74 ± 5	[0]		$(2.0 \pm 0.3)(-1)$
	2.10 ± 1.10	$5/2^- \rightarrow 3/2^-$	110 ± 20 fs	75 ± 3	$+3.5 \pm 0.5$		$(7 \pm 2)(-3)$
	$+ 1.45$	$+ 5/2^-$		25 ± 3	[0]		$(2.6 \pm 0.6)(-1)$
^{90}Y	0.20 ± 0	$3^- \rightarrow 2^-$	361 ± 10 ps	100	-0.28 ± 0.06		$(9.6 \pm 0.3)(-3)$

a) The $J^\pi(3.23 \text{ MeV}) = 2^+$ assignment from the $A = 58$ compilation would lead to an impossibly strong $3.23 \pm 2.60 \text{ MeV}$ E2 transition. This assignment was based on $\lambda_n(d,p) = 1 + 3$ (72Ra17) with the $\lambda_n = 1$ component quite weak. Accepting $\lambda_n(d,p) = 3$ one arrives at $J^\pi(3.23 \text{ MeV}) = (3,4)^+$, which is consistent with the fact that the level is excited in the $^{58}\text{Co}(\beta^-)$ decay ($\log ft = 6.09$), but not in the (n,γ) reaction.

TABLE VII. Strengths of $M2$ Transitions
See page 552 for Explanation of Tables

Nucleus	$E_{xi} \rightarrow E_{xf}$ (MeV)	$J_i^\pi \rightarrow J_f^\pi$	τ_m	Total branching (%)	δ	α_{tot}	S (W.u.)	Remarks
^{45}Sc	$0.012 \rightarrow 0$	$3/2^+ \rightarrow 7/2^-$	470 ± 6 ms	100	≈ 0	481	$(6.2 \pm 0.1)(-2)$	
^{47}Sc	$0.77 \rightarrow 0$	$3/2^+ \rightarrow 7/2^-$	390 ± 17 ns	100	[0]		$(3.2 \pm 0.1)(-2)$	
^{62}Cu	$2.29 \rightarrow 0.39$	$6^- \rightarrow 4^+$	23.3 ± 1.9 ps	1.2	≈ 0		$(5.9 \pm 0.5)(-2)$	
^{65}Zn	$1.07 \rightarrow 0$	$9/2^+ \rightarrow 5/2^-$	830 ± 40 ps	5 ± 1	$+0.13 \pm 0.02$		$(1.1 \pm 0.2)(-1)$	
^{67}Zn	$0.60 \rightarrow 0$	$9/2^+ \rightarrow 5/2^-$	480 ± 20 ns	100	≈ 0		$(7.1 \pm 0.3)(-2)$	
^{69}Ge	$0.40 \rightarrow 0$	$9/2^+ \rightarrow 5/2^-$	4.0 ± 0.1 μs	100	≈ 0		$(6.6 \pm 0.2)(-2)$	
	$[0.81 \rightarrow 0$	$5/2^+ \rightarrow 5/2^-$	1.5 ± 0.2 ps	58 ± 2	$+0.13 \pm 0.03$		$(5 \pm 2)(+1)]$	a)
^{71}Ge	$0.198 \rightarrow 0.175$	$9/2^+ \rightarrow 5/2^-$	31.6 ± 1.4 ms	100	≈ 0	208	$(6.1 \pm 0.3)(-2)$	
^{72}Ge	$[2.51 \rightarrow 1.46$	$3^- \rightarrow 2^+$	35 ± 7 ps	59.2 ± 0.7	$+0.31 \pm 0.05$		$(2.9 \pm 1.0)(0)]$	b)
^{73}As	$0.43 \rightarrow 0.067$	$9/2^+ \rightarrow 5/2^-$	8.1 ± 0.4 μs	100	≈ 0		$(5.0 \pm 0.2)(-2)$	
^{75}As	$0.304 \rightarrow 0.280$	$9/2^+ \rightarrow 5/2^-$	25.30 ± 0.11 ms	92 ± 2	-0.18 ± 0.02	189	$(3.3 \pm 0.1)(-2)$	
^{76}Br	$0.103 \rightarrow 0.045$	$(0-4)^+ \rightarrow (0-2)^-$	2.15 ± 0.03 s	100	≈ 0	9.8	$(2.0 \pm 0.1)(-4)$	
^{77}As	$0.48 \rightarrow 0.26$	$9/2^+ \rightarrow 5/2^-$	167 ± 6 μs	96.7 ± 0.3	≈ 0	0.08	$(2.5 \pm 0.1)(-2)$	
	$[0.63 \rightarrow 0.22$	$5/2^+ \rightarrow 3/2^-$	108 ± 22 ps	50 ± 4	-0.087 ± 0.019		$(7 \pm 3)(0)]$	b)
	$\rightarrow 0.26$	$\rightarrow 5/2^-$		30 ± 4	$+0.290 \pm 0.009$		$(8 \pm 2)(-1)$	
^{81}Br	$0.54 \rightarrow 0.28$	$9/2^+ \rightarrow 5/2^-$	52.0 ± 1.4 μs	100	≈ 0	0.05	$(3.6 \pm 0.1)(-2)$	
^{83}Rb	$0.042 \rightarrow 0$	$9/2^+ \rightarrow 5/2^-$	11.2 ms	100	≈ 0	40	3.7 (-2)	
^{85}Rb	$0.51 \rightarrow 0$	$(7/2, 9/2)^+ \rightarrow 5/2^-$	1.38 ± 0.02 μs	100	[0]		$(4.8 \pm 0.1)(-2)$	

a) For comment see note ^{c)} of Table III.

b) These mixing ratios in ^{72}Ge and ^{77}As result from $^{72}\text{Ga}(\beta^- \gamma)$ (74Ch07) and $^{77}\text{Ge}(\beta^- \gamma)$ (75Ch32) $\gamma\text{-}\gamma$ angular correlation work, respectively. The authors do not comment on the ensuing large $M2$ strengths which should be considered suspect.

TABLE VIII. Strengths of $M3$ and $M4$ Transitions
See page 552 for Explanation of Tables

Type	Nucleus	$E_{xi} + E_{xf}$ (MeV)	$J_i^\pi \rightarrow J_f^\pi$	τ_m	Total branching (%)	δ	α_{tot}	S (W.u.)	Remarks
M3	^{58}Co	$0.025 \rightarrow 0$	$5^+ \rightarrow 2^+$	13.20 ± 0.14 h	100	≈ 0	2840	$(5.4 \pm 0.2)(-1)$	
	^{60}Co	$0.059 \rightarrow 0$	$2^+ \rightarrow 5^+$	15.10 ± 0.03 min	99.75	≈ 0	44	$(4.2 \pm 0.1)(0)$	
	^{80}Br	$0.086 \rightarrow 0.037$	$5^- \rightarrow 2^-$	6.37 ± 0.02 h	100	≈ 0	305	$(5.9 \pm 0.1)(-2)$	
	^{81}Se	$0.10 \rightarrow 0$	$7/2^- \rightarrow 1/2^-$	82.60 ± 0.13 min	99.9	≈ 0	9.1	$(4.4 \pm 0.1)(-2)$	a)
	^{82}Br	$0.046 \rightarrow 0$	$2^- \rightarrow 5^-$	8.85 ± 0.12 min	100	≈ 0	400	$(2.9 \pm 0.1)(0)$	
	^{84}Rb	$0.46 \rightarrow 0.25$	$6^- \rightarrow (3,4)^-$	29.6 ± 0.3 min	72 ± 3	$\pm 0.8 \pm 0.3$	0.90	$(2.2 \pm 0.6)(-3)$	
	^{90}Rb	$0.11 \rightarrow 0$	$(4^-) \rightarrow (1^-)$	372 ± 4 s	2.3 ± 0.3	≈ 0	11.5	$(7.3 \pm 1.1)(-3)$	b)
M4	^{69}Zn	$0.44 \rightarrow 0$	$9/2^+ \rightarrow 1/2^-$	20.2 ± 0.4 h	≈ 100	≈ 0	0.05	$(1.4 \pm 0.1)(0)$	
	^{85}Kr	$0.30 \rightarrow 0$	$1/2^- \rightarrow 9/2^+$	6.46 ± 0.01 h	21.0 ± 0.8	≈ 0	0.51	$(1.2 \pm 0.1)(+1)$	
	^{85}Sr	$0.24 \rightarrow 0$	$(1/2, 3/2)^- \rightarrow (7/2, 9/2)^+$	100.3 ± 0.7 min	1.1	≈ 0	2.1	$(1.5 \pm 0.1)(+1)$	
	^{87}Sr	$0.39 \rightarrow 0$	$1/2^- \rightarrow 9/2^+$	4.50 ± 0.02 h	≈ 100	≈ 0	0.22	$(1.1 \pm 0.1)(+1)$	
	^{87}Y	$0.38 \rightarrow 0$	$9/2^+ \rightarrow 1/2^-$	18.3 ± 0.3 h	≈ 100	≈ 0	0.26	$(3.0 \pm 0.1)(0)$	
	^{89}Y	$0.91 \rightarrow 0$	$9/2^+ \rightarrow 1/2^-$	2.38 ± 0.01 s	100	[0]		$(3.9 \pm 0.1)(0)$	
	^{89}Zr	$0.59 \rightarrow 0$	$1/2^- \rightarrow 9/2^+$	6.02 ± 0.02 min	93.76 ± 0.06	[0]	0.05	$(1.2 \pm 0.1)(+1)$	
	^{90}Y	$0.68 \rightarrow 0.20$	$7^+ \rightarrow 3^-$	4.60 ± 0.02 h	99.67 ± 0.03	≈ 0	0.10	$(1.6 \pm 0.1)(0)$	

- a) The J^π value of the initial state is listed in the $A = 81$ compilation as $J^\pi = 7/2^+$, based on the (not very convincing) $\epsilon_n(d,p) = 4$ value of 65Li08 and the measured conversion coefficient. The latter would lead to $\delta(M4/E3) = \pm 0.177 \pm 0.014$ with an impossibly strong M4 component of $(2.3 \pm 0.4) \times 10^4$ W.u. and an exceptionally weak E3 component of $(7.0 \pm 0.1) \times 10^{-4}$ W.u. The conversion data (α_K, α_L), however, can almost equally well be explained by pure M3 character; the resulting M3 strength is apparently quite reasonable.
- b) Although spins nor parities of the initial and final states are known, the M3 character of this transition is determined through a measurement of the conversion coefficient.

TABLE IX. Recommended Upper Limits in the $A = 6-20$, $21-44$, and $45-90$ Regions
See page 552 for Explanation of Tables

Character ^{a)}	Number of Transitions			RUL (W.u.)		
	$A = 6-20$	$21-44$	$45-90$	$A = 6-20$	$21-44$	$45-90$
E0	8	13	4			
E1 _{IV}	139	567	127	0.3	0.1	0.01
E1 _{IS}	36	100		0.003	0.003	
E2 _{IS}	112	562	515	100	100	300
E2 _{IV}	11	10		10	10	
E3	16	37	45	100	100	100
E4	3	7	17	100	100	100
E5	1	1	3			
M1 _{IV}	135	559	470	10	10	3
M1 _{IS}	13	31		0.03	0.03	
M2 _{IV}	8	37	15	3	3	1
M2 _{IS}	4	4		0.1	0.1	
M3 _{IV}		4	7	10	10	10
M3 _{IS}		1				
M4			8			30
M5	1					

^{a)} With the indices IV and IS denoting isovector and isoscalar character, respectively.

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