^{40}Ca(^{28}Si,2pnγ) 1995He27

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 202,59 (2025)	25-Feb-2025

Adapted from the XUNDL dataset of 1995He27, compiled by G. Reed and B. Singh (McMaster) on July 9, 2001.
Also includes ^{40}Ca(^{31}P,αpnγ) for γ(lin pol) data in 1995He27.

1995He27: E=93 MeV ^{28}Si beam was produced from the tandem Van de Graaff accelerator of the University of Cologne. Target was about 1 mg/cm^2 99.96% enriched ^{40}Ca backed by a 89 mg/cm^2 Bi-In-Cu layer. γ rays were detected with the OSIRIS ring spectrometer consisting of six Compton-suppressed Ge detectors in conjunction with a four segmented neutron detector. Measured Eγ, Iγ, $\gamma\gamma$-coin, n$\gamma\gamma$-coin, $\gamma(\theta)$. Also measured γ(lin pol) using ^{40}Ca(^{31}P,αpnγ) at E=115 MeV with the Compton polarimeter POLALI comprised of five HPGe detectors. Deduced levels, J, π, γ-ray multipolarties, mixing ratios. Systematics of neighboring Ge isotopes.

1987Go02: E=60-100 MeV ^{28}Si beams were produced from the University of Pennsylvania′s tandem Van de Graaff accelerator. Target was 350 μg/cm^2 ^{40}Ca evaporated onto a 30 mg/cm^2 gold backing. γ rays were detected with one pair of Ge detectors; charged particles were detected with a 4π multi-segment detector consisting of phoswich scintillator telescopes; neutrons were detected with a neutron detector. Measured Eγ, Iγ, charged particle-$\gamma\gamma$-coin, n$\gamma(\theta)$, particle-γ(t). Deduced levels, J, π, $T_{1/2}$, γ-ray multipolarities, mixing ratios. Comparisons with theoretical calculations.

Other: 2013Ru13 (111γ, 864γ, 1254γ and 1356γ seen from ^{65}Ge as a contanimant).

Additional information 1.

^{65}Ge Levels

Level scheme is from 1995He27. The level scheme from 1987Go02 is partially different above 2080 level but is much less complete.

E(level)[†‡]	J$^\pi$[#]	$T_{1/2}$[@]	Comments
0	$(3/2)^-$		J$^\pi$: from Adopted Levels.
111.01 *8*	$5/2^-$		
604.50 *9*	$5/2^-$		
890.09 *7*	$7/2^-$		
1155.22 *14*	$7/2^-$		
1215.86 *10*	$9/2^+$	7 ns *1*	
2080.16 *13*	$13/2^+$	<2 ns	
2122.1 *2*	$(11/2^+)$		
2146.08 *38*	$(11/2^-)$		
2573.28 *35*	$11/2^-$		
2837.2 *3*	$(13/2^+)$		
3035.7 *2*	$(15/2^+)$		
3436.5 *2*	$(17/2^+)$		E(level): corresponds to 3335, $15/2^{(-)}$ level in 1987Go02, if the order of 1254γ-1356γ is reversed.
3738.0 *3*	$(17/2^+)$		
3843.28 *27*	$(15/2^-)$		
4188.5 *4*	$15/2^-$		
4228.4 *3*	$15/2^-$		
4504.2 *2*	$(17/2^-)$		
4691.2 *2*	$19/2^-$		
5152.99 *20*	$(21/2^-)$	<2 ns	
5210.39 *21*	$23/2^-$	<2 ns	
5580.1 *6*			
5739.2 *5*			
6329.40 *36*	$(27/2^-)$		J$^\pi$: $(25/2^-)$ in Adopted Levels.
6348.0 *6*			
6348.9 *6*			
6555.4 *6*			

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^{40}Ca(^{28}Si,2pnγ) 1995He27 (continued)

^{65}Ge Levels (continued)

E(level)[†][‡]
7789.9 *6*
8152.4 *6*

† Additional information 2.
‡ From a least-squares fit to γ-ray energies, assuming $\Delta E\gamma$=0.5 keV where not given.
# As proposed in 1995He27 for excited states, based on measured $\gamma(\theta)$, γ(lin pol) and known assignment for the ground state. The firm assignments here will be placed in parentheses when considered in Adopted Levels, if there are no strong supporting arguments for the firm assignments.
@ From γ(t) in 1987Go02.

$\gamma(^{65}Ge)$

All data from 1995He27, unless otherwise noted.

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ[†]	Comments
57.4	<3[‡]	5210.39	23/2$^-$	5152.99	(21/2$^-$)			
60.6	9[‡]	1215.86	9/2$^+$	1155.22	7/2$^-$			
111.0 *1*	158[‡]	111.01	5/2$^-$	0	(3/2)$^-$	D+Q[#]	+0.25[#] *4*	E_γ: uncertainty is not given in 1995He27 and assigned by the evaluator considering it is stronger than 864.3γ with Iγ=100 and $\Delta E\gamma$=0.1 keV. Mult.: ΔJ=1 from nearly isotropic p$\gamma(\theta)$ in 1987Go02.
187.0 *2*	13.5 *4*	4691.2	19/2$^-$	4504.2	(17/2$^-$)			A_2<0. Mult.: ΔJ<2 based on $\gamma(\theta)$.
275.9	7[‡]	4504.2	(17/2$^-$)	4228.4	15/2$^-$			
285.6 *2*	4.2 *3*	890.09	7/2$^-$	604.50	5/2$^-$			
315.7	<5[‡]	4504.2	(17/2$^-$)	4188.5	15/2$^-$			
325.8 *1*	38.9 *4*	1215.86	9/2$^+$	890.09	7/2$^-$	E1		A_2=−0.21 *1*, A_4=0, consistent with ΔJ=1. POL=+0.28 *5*.
400.7	<6[‡]	3436.5	(17/2$^+$)	3035.7	(15/2$^+$)			
427.1	<3[‡]	5580.1		5152.99	(21/2$^-$)			
461.8 *1*	15.3 *20*	5152.99	(21/2$^-$)	4691.2	19/2$^-$	D+Q	−0.03 *1*	E_γ: tentatively placed from a 6790, (31/2$^-$) level in 1987Go02, not adopted in Adopted Levels. A_2=−0.26 *3*, A_4=0, consistent with ΔJ=1.
462.8	9[‡]	4691.2	19/2$^-$	4228.4	15/2$^-$			
493.5	14[‡]	604.50	5/2$^-$	111.01	5/2$^-$			
502.7	<3[‡]	4691.2	19/2$^-$	4188.5	15/2$^-$			
519.2 *1*	47.8 *4*	5210.39	23/2$^-$	4691.2	19/2$^-$	E2[#]		A_2=+0.30 *2*, A_4=−0.07 *2*, consistent with ΔJ=2. Mult.: Q from $\gamma(\theta)$ in 1995He27; M2 ruled out by RUL.
604.5 *1*	10.3 *5*	604.50	5/2$^-$	0	(3/2)$^-$	D+Q	−2.4 *+6−5*	A_2=−0.31 *4*, A_4=+0.07 *1*, consistent with ΔJ=1.
648.8	<5[‡]	5152.99	(21/2$^-$)	4504.2	(17/2$^-$)			
660.9 *2*	11.8 *5*	4504.2	(17/2$^-$)	3843.28	(15/2$^-$)			A_2<0. Mult.: ΔJ<2 based on $\gamma(\theta)$.

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^{40}Ca(^{28}Si,2pnγ) 1995He27 (continued)

$\gamma(^{65}Ge)$ (continued)

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ[†]	Comments
702.3	<5[‡]	3738.0	$(17/2^+)$	3035.7	$(15/2^+)$			
715.1 *2*	7.9 *4*	2837.2	$(13/2^+)$	2122.1	$(11/2^+)$	D+Q	+0.66 *+9−6*	A_2=+0.50 *2*, A_4=+0.06 *1*, consistent with ΔJ=1.
779.1 *1*	22.2 *4*	890.09	$7/2^-$	111.01	$5/2^-$	D+Q	−2.58 *+17−19*	A_2=−0.37 *1*, A_4=+0.10 *2*, consistent with ΔJ=1.
864.3 *1*	100.0 *6*	2080.16	$13/2^+$	1215.86	$9/2^+$	E2		A_2=+0.30 *1*, A_4=−0.07 *1*, consistent with ΔJ=2. POL=+0.52 *5*.
890.1 *1*	16.5 *13*	890.09	$7/2^-$	0	$(3/2)^-$	Q[@]		A_2=+0.27 *3*, A_4=−0.06 *4*, consistent with ΔJ=2.
900.8	<5[‡]	3738.0	$(17/2^+)$	2837.2	$(13/2^+)$			
906.2 *2*	10.2 *15*	2122.1	$(11/2^+)$	1215.86	$9/2^+$			
913.6	<3[‡]	3035.7	$(15/2^+)$	2122.1	$(11/2^+)$			
953.2	<5[‡]	4691.2	$19/2^-$	3738.0	$(17/2^+)$			
955.5 *2*	13.9 *16*	3035.7	$(15/2^+)$	2080.16	$13/2^+$			
1044.2 *2*	7.0 *5*	1155.22	$7/2^-$	111.01	$5/2^-$			
1048.0	<5[‡]	5739.2		4691.2	$19/2^-$			
1104.8 *1*	77.5 *5*	1215.86	$9/2^+$	111.01	$5/2^-$	M2+E3	−0.02 *1*	A_2=+0.28 *1*, A_4=−0.08 *1*, consistent with ΔJ=2. POL=−0.41 *10*.
1119.0 *3*	18.2 *18*	6329.40	$(27/2^-)$	5210.39	$23/2^-$			
1138.5	<5[‡]	6348.9		5210.39	$23/2^-$			
1155.2 *2*	12.0 *20*	1155.22	$7/2^-$	0	$(3/2)^-$			
1195.0	<5[‡]	6348.0		5152.99	$(21/2^-)$			
1254.7 *1*	51.2 *7*	4691.2	$19/2^-$	3436.5	$(17/2^+)$	E1		A_2=−0.22 *1*, A_4=0, consistent with ΔJ=1. POL=+0.33 *6*. Placed from a 3335 level, $15/2^{(-)}$ in 1987Go02, where the order of 1254γ-1356γ is reversed.
1255.9	<5[‡]	2146.08	$(11/2^-)$	890.09	$7/2^-$			
1345.0	<5[‡]	6555.4		5210.39	$23/2^-$			
1356.3 *1*	63.5 *9*	3436.5	$(17/2^+)$	2080.16	$13/2^+$	E2		A_2=+0.30 *1*, A_4=−0.06 *1*, consistent with ΔJ=2. POL=+0.45 *10*. Placed from 4691 level in 1987Go02, where the order of 1254γ-1356γ is reversed.
1418.1	<5[‡]	2573.28	$11/2^-$	1155.22	$7/2^-$			
1460.5	<5[‡]	7789.9		6329.40	$(27/2^-)$			
1615.2	<5[‡]	4188.5	$15/2^-$	2573.28	$11/2^-$			
1621.3	<5[‡]	2837.2	$(13/2^+)$	1215.86	$9/2^+$			
1655.1	<5[‡]	4228.4	$15/2^-$	2573.28	$11/2^-$			
1697.1	<5[‡]	3843.28	$(15/2^-)$	2146.08	$(11/2^-)$			
1763.1	<6[‡]	3843.28	$(15/2^-)$	2080.16	$13/2^+$			
1823.0	<6[‡]	8152.4		6329.40	$(27/2^-)$			
2148.2	7[‡]	4228.4	$15/2^-$	2080.16	$13/2^+$			

[†] From 1995He27 deduced based on $\gamma(\theta)$ and γ(lin pol), unless otherwises noted.

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^{40}Ca(^{28}Si,2pnγ) 1995He27 (continued)

γ(^{65}Ge) (continued)

‡ Not given in 1995He27 and estimated by the evaluator based on the widths of the transition arrows in Fig.5 of 1995He27 compared to that of 864.3γ with Iγ=100, as the transition intensities are proportional to the widths of the arrows, as stated by the authors.
# From 1987Go02, deduced based on measured n$\gamma(\theta)$.
@ Deduced by the evaluator based on $\gamma(\theta)$ in 1995He27; not given in 1995He27.

^{40}Ca(^{28}Si,2pnγ) 1995He27

Level Scheme

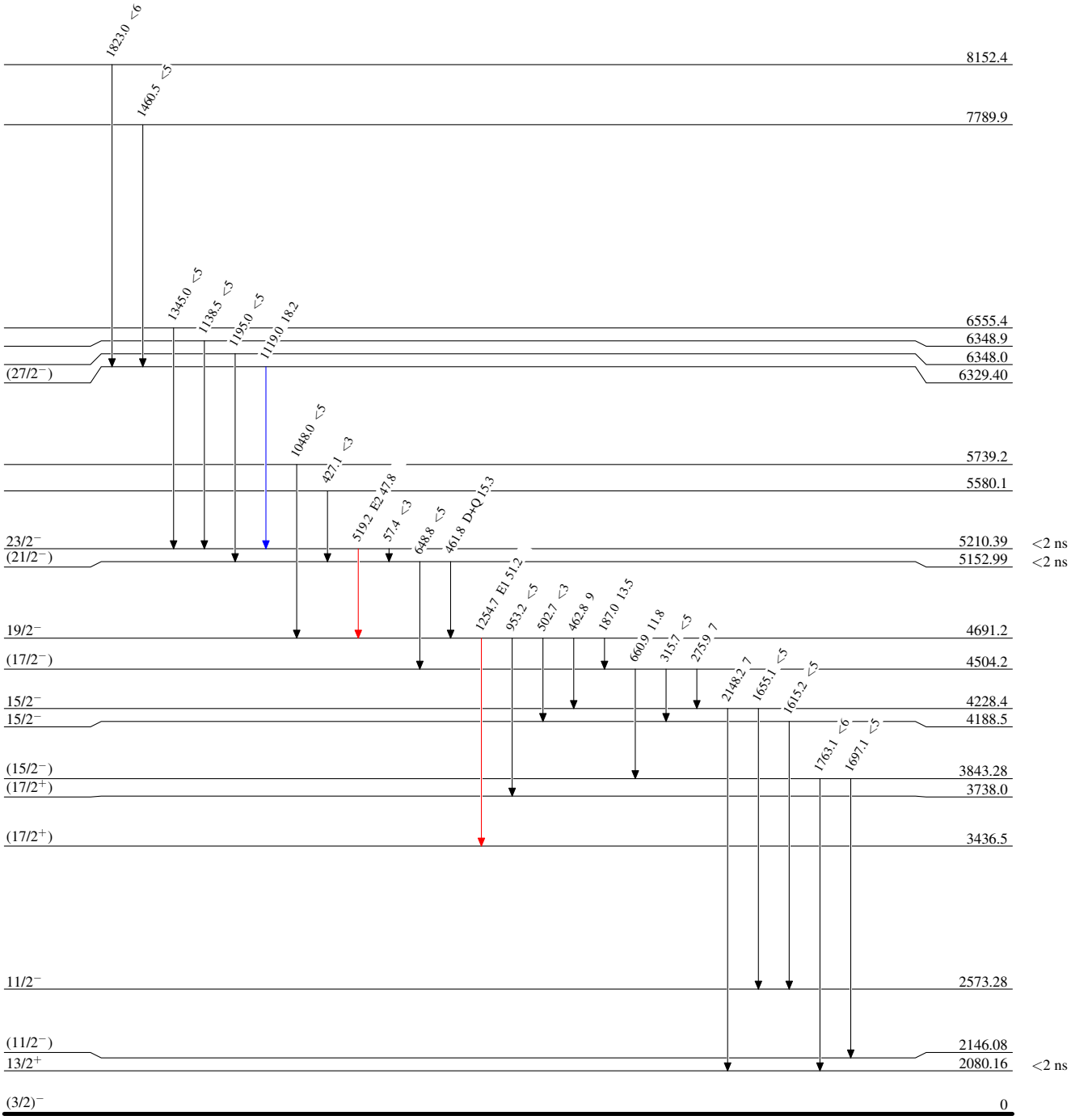
Intensities: Relative I_γ

Legend

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

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

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

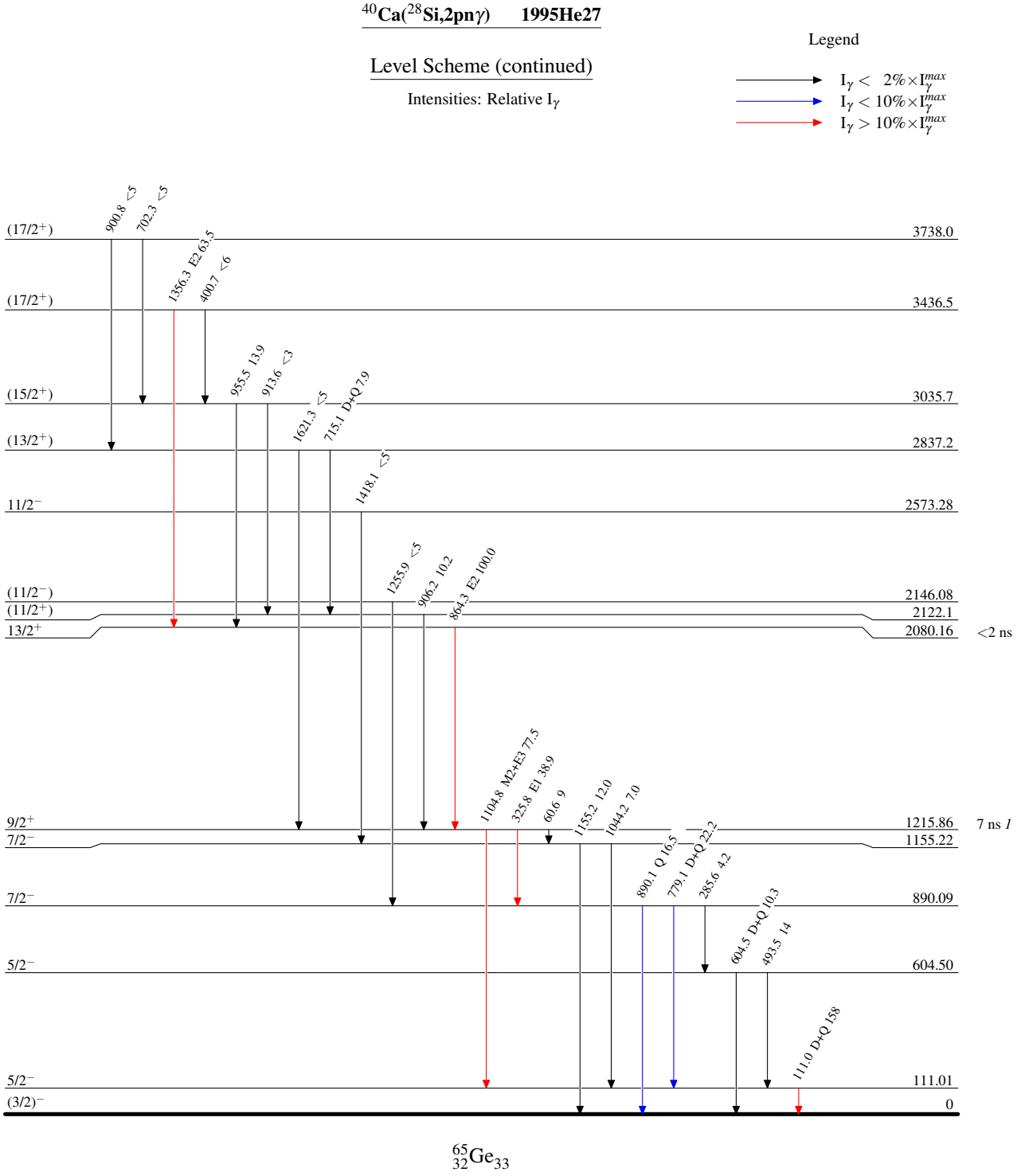


$^{65}_{32}Ge_{33}$

^{40}Ca(^{28}Si,2pnγ) 1995He27

Level Scheme (continued)

Intensities: Relative I_γ



$^{65}_{32}Ge_{33}$