

NEW DECAY MODES OF THE HIGH-SPIN ISOMER OF ^{124}Cs

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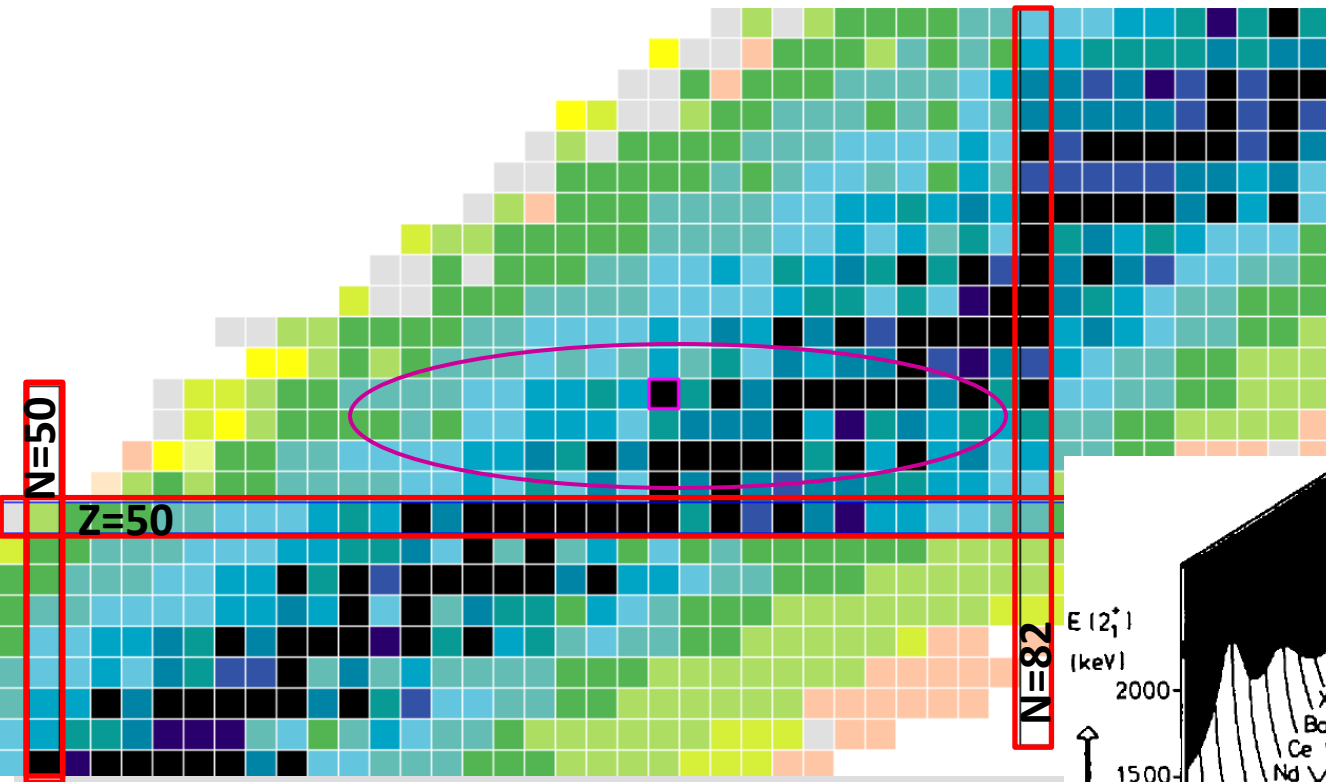
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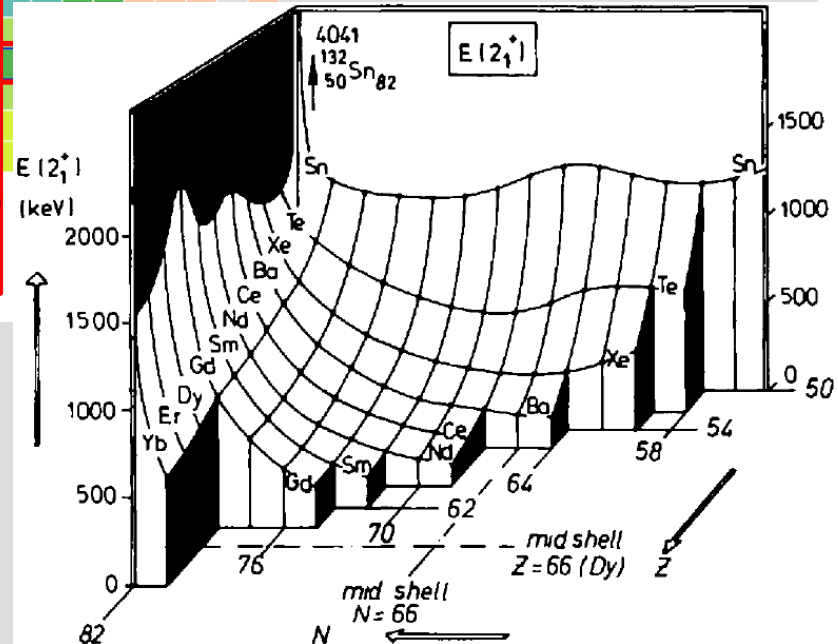


TRIUMF

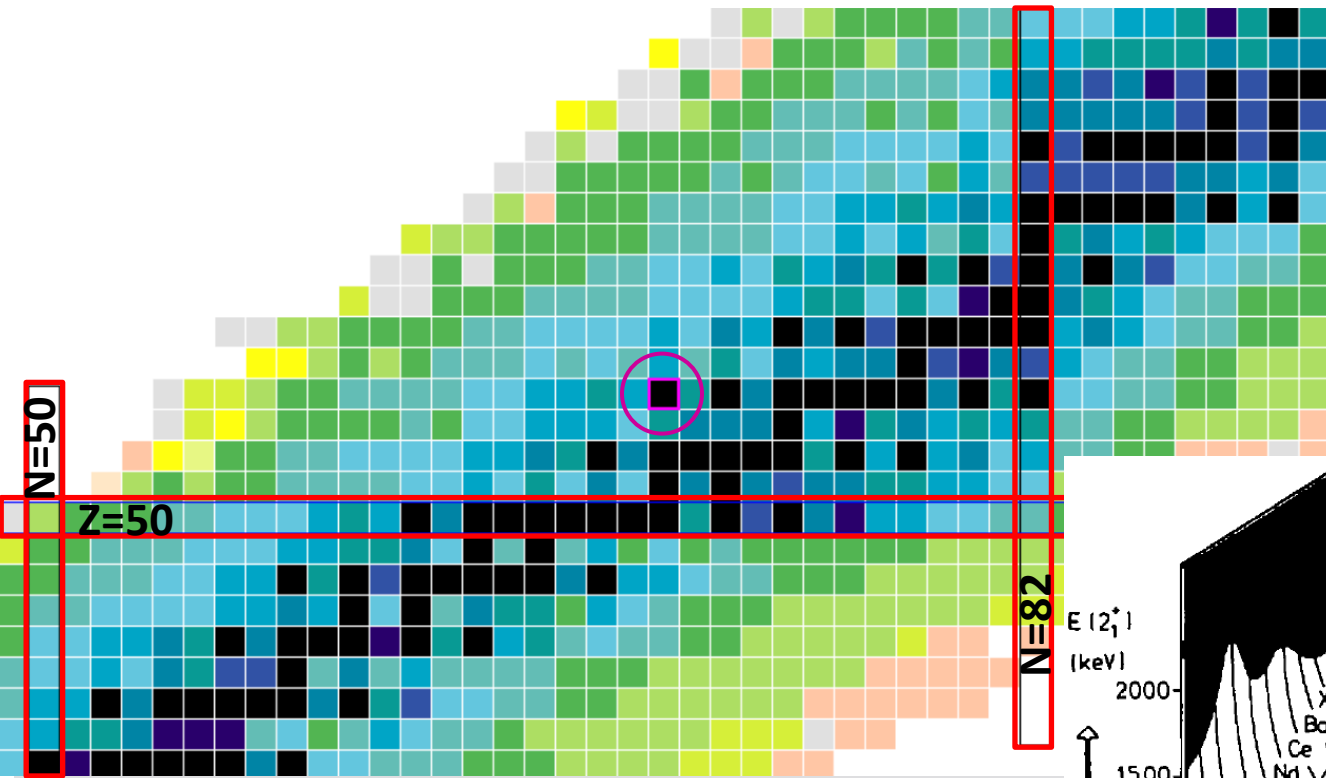
COLLECTIVITY IN THE $Z > 50$, $N < 82$ REGION



Smooth evolution of collectivity above the $Z=50$ proton shell closure

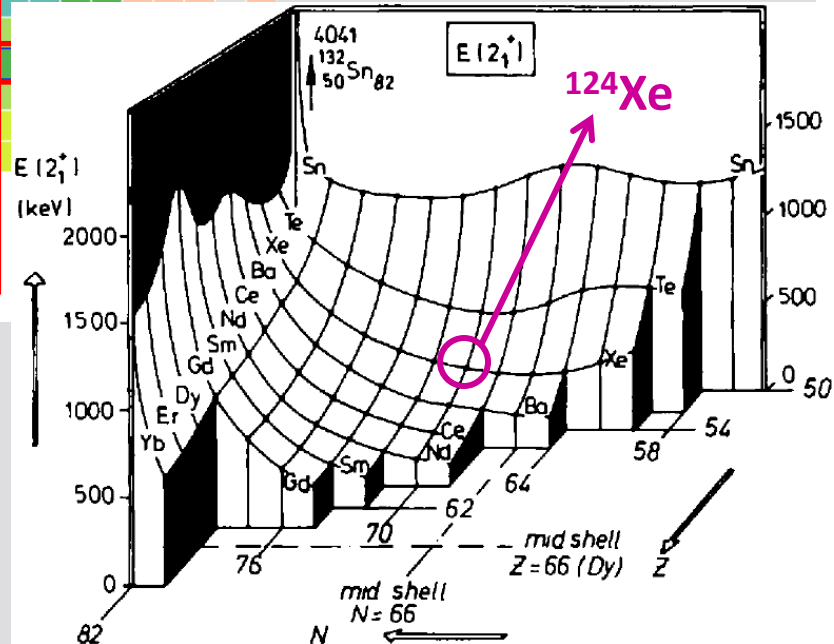


COLLECTIVITY IN THE $Z > 50$, $N < 82$ REGION



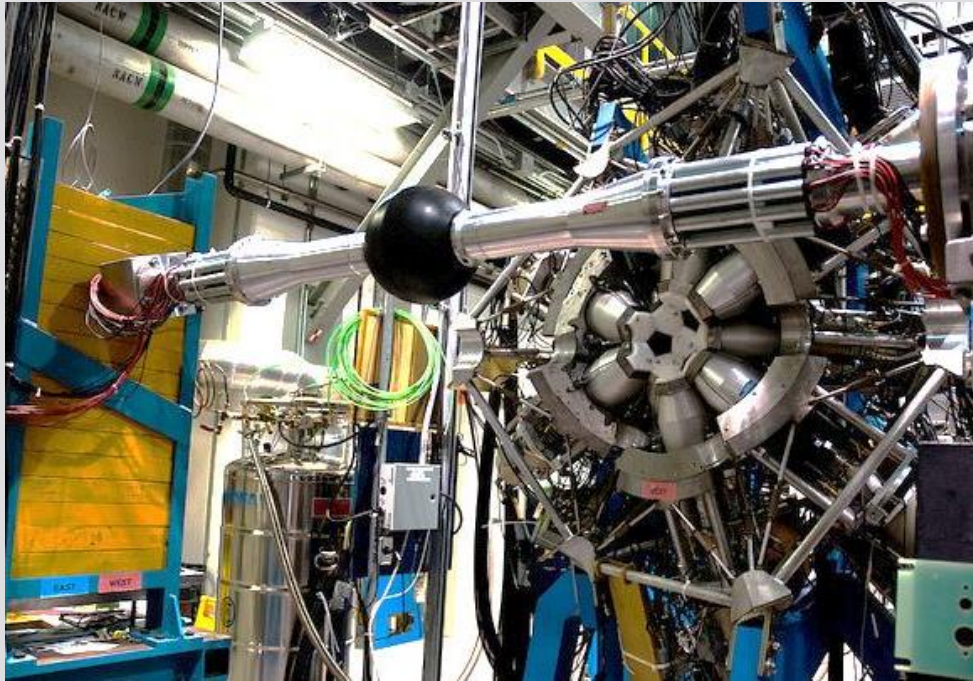
Experimental program:
Study Xe & Te isotopes by Cs & I
 β -decay

First isotope: ^{124}Xe



8 π SPECTROMETER AT TRIUMF

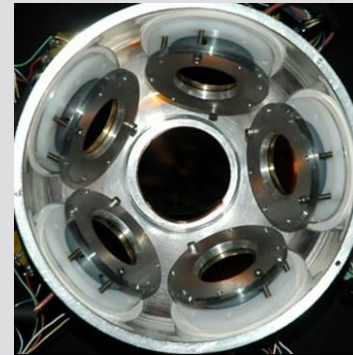
20 HPGe γ -ray detectors with BGO Compton suppression shields



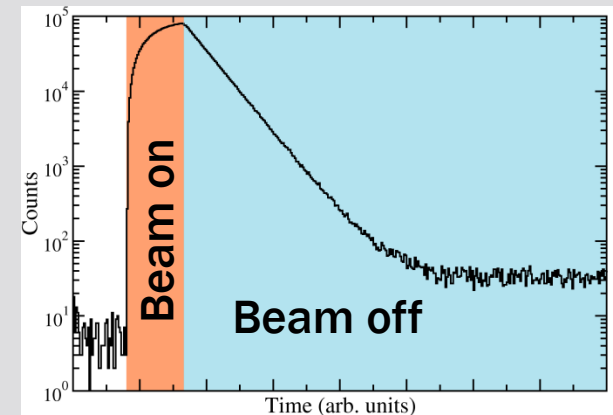
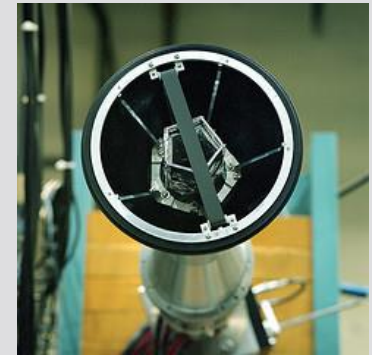
Beam cycles: 300 s beam on/45 s beam off
1 s beam on/ 12 s beam off

Beam components: 9.5×10^7 ions/s ^{124}Cs ($J^\pi=1^+$, $T_{1/2}=30.8\text{s}$)
 2.6×10^6 ions/s $^{124}\text{Cs}^m$ ($J^\pi=(7)^+$, $T_{1/2}=6\text{s}$)

PACES array: 5 Si(Li) conversion electron detectors

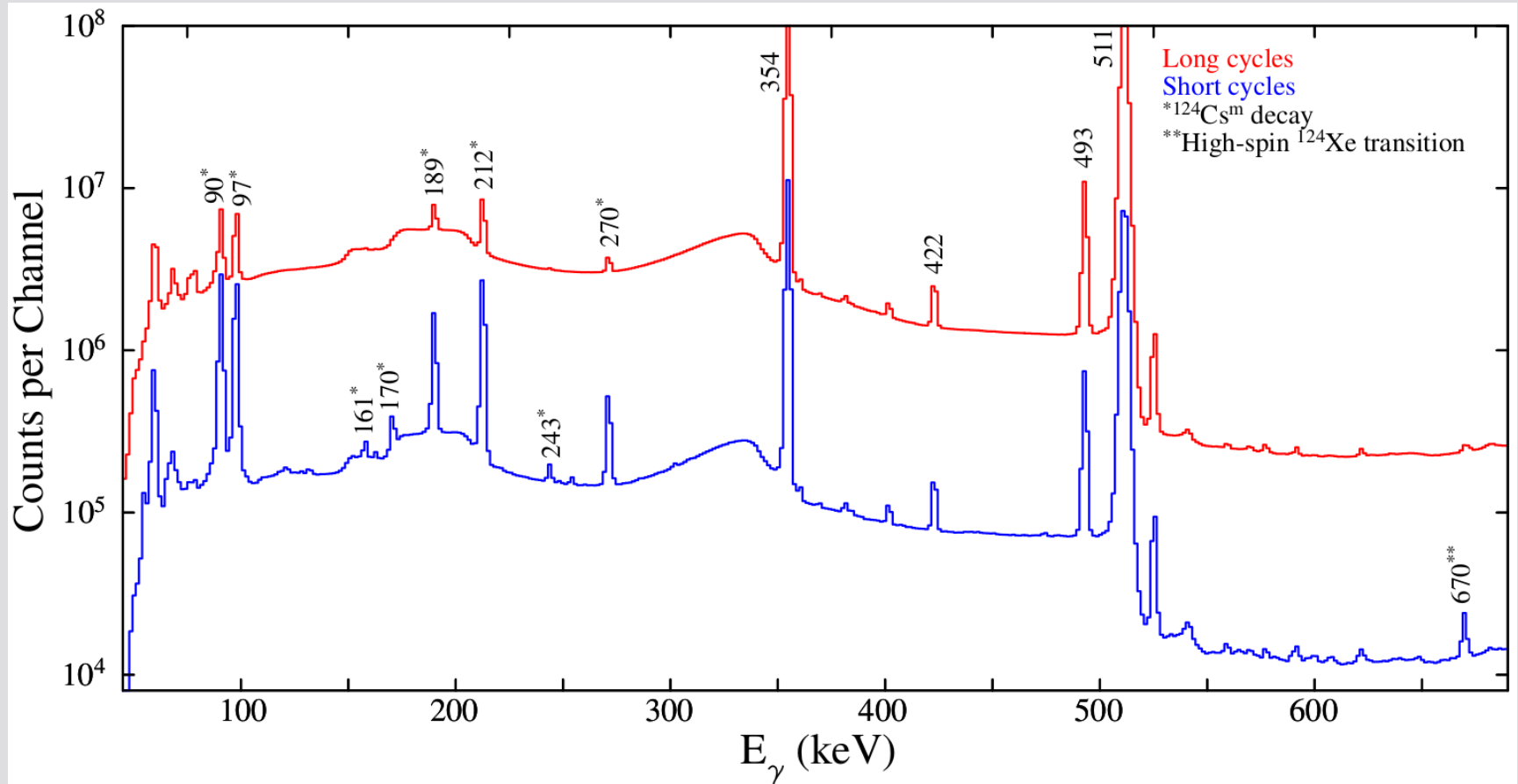


Moving tape collection system



COINCIDENCE ANALYSIS

Time-random-background subtracted γ - γ coincidence matrix contains 460 million events

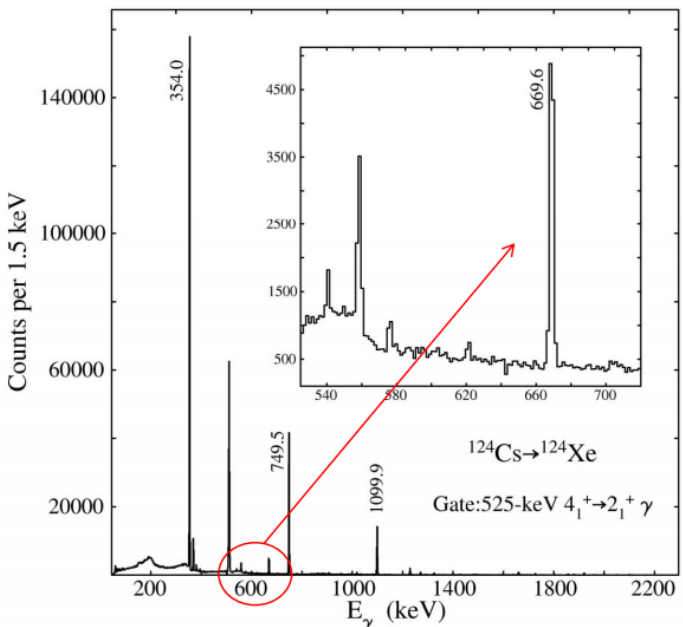
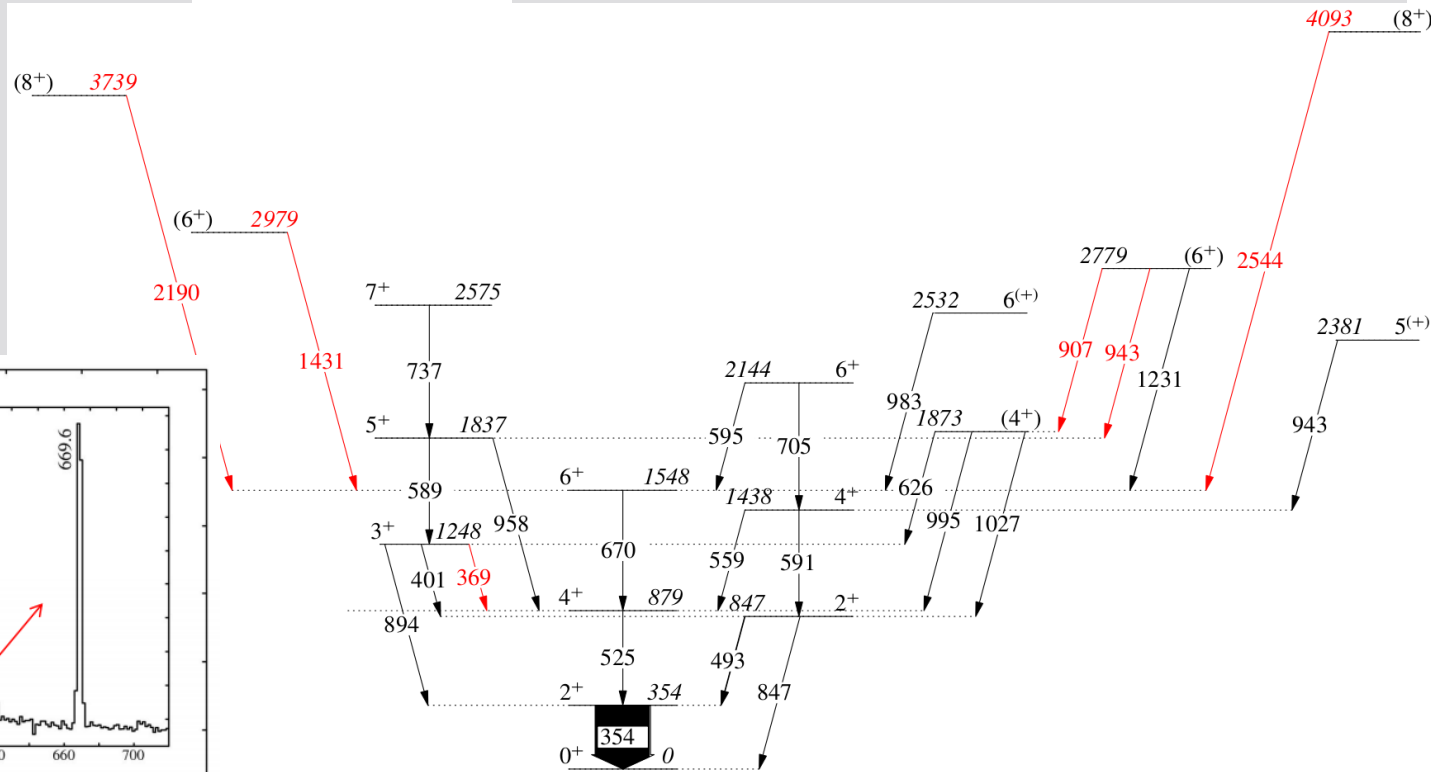
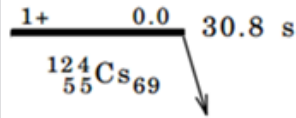


HIGH-SPIN TRANSITIONS

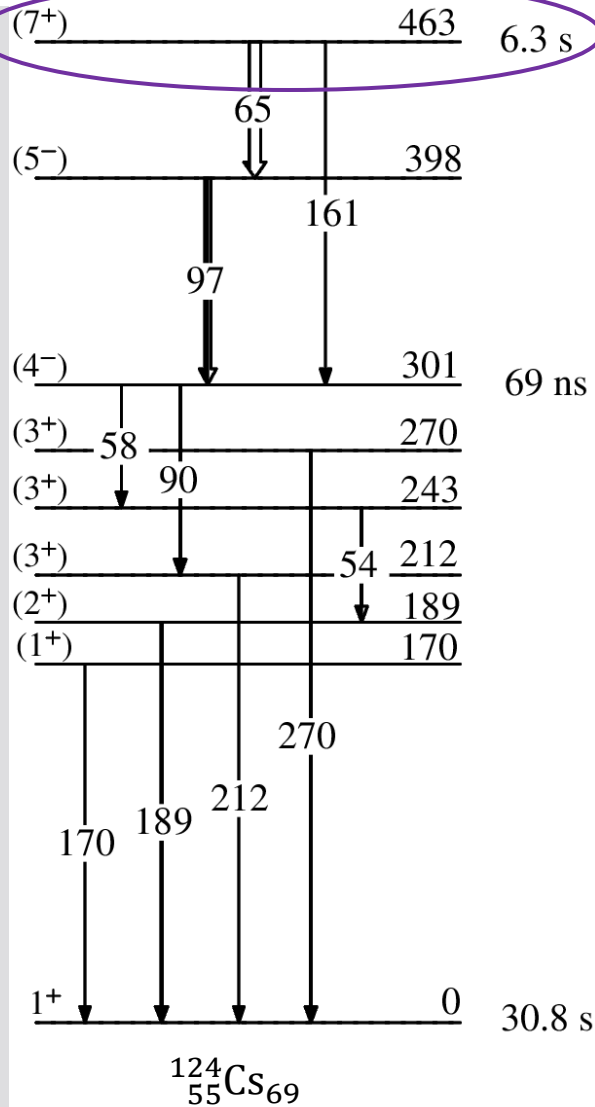
Allowed Gamow-Teller
 β -decay ($S_\beta=1$):

$$\Delta J = 0, \pm 1$$

$$\pi_i = \pi_f$$

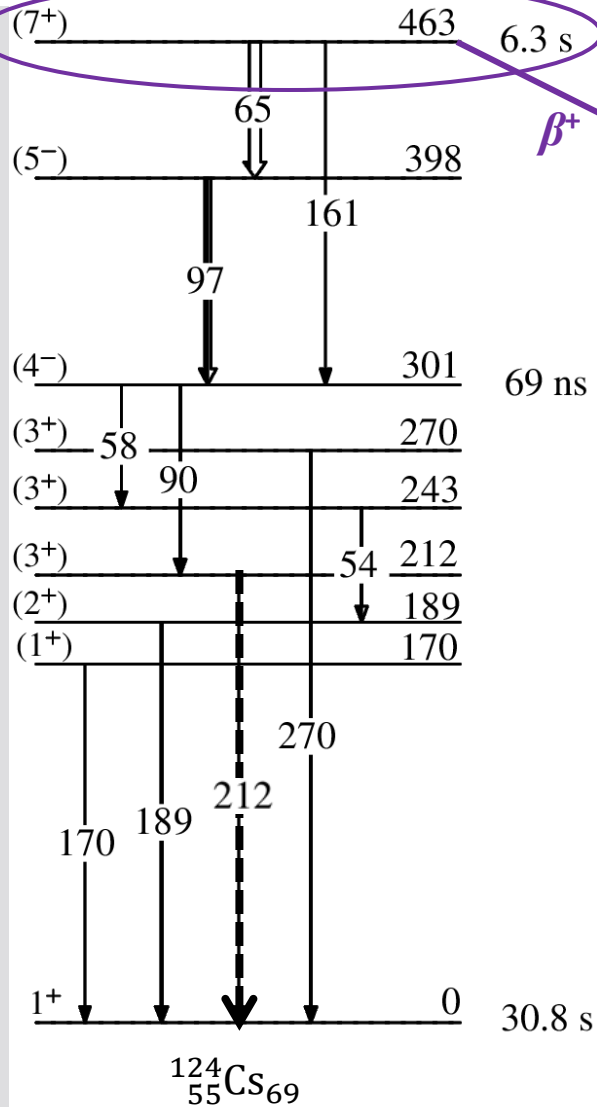


HIGH-SPIN TRANSITIONS



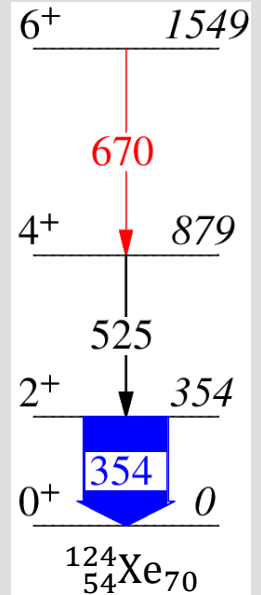
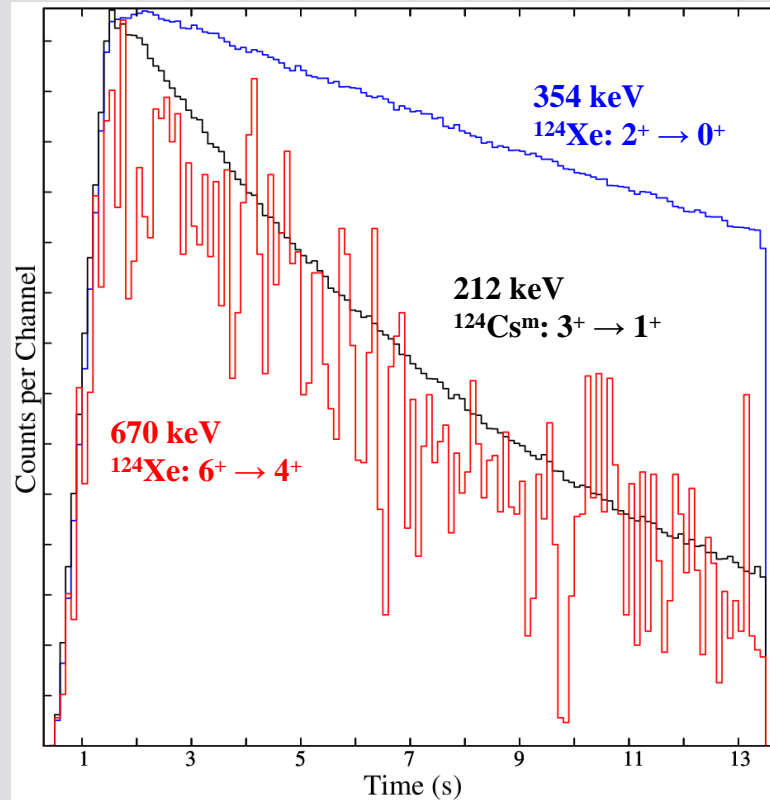
$^{124}\text{Cs}^m$ undergoes 100%
isomeric decay to ^{124}Cs

HIGH-SPIN TRANSITIONS

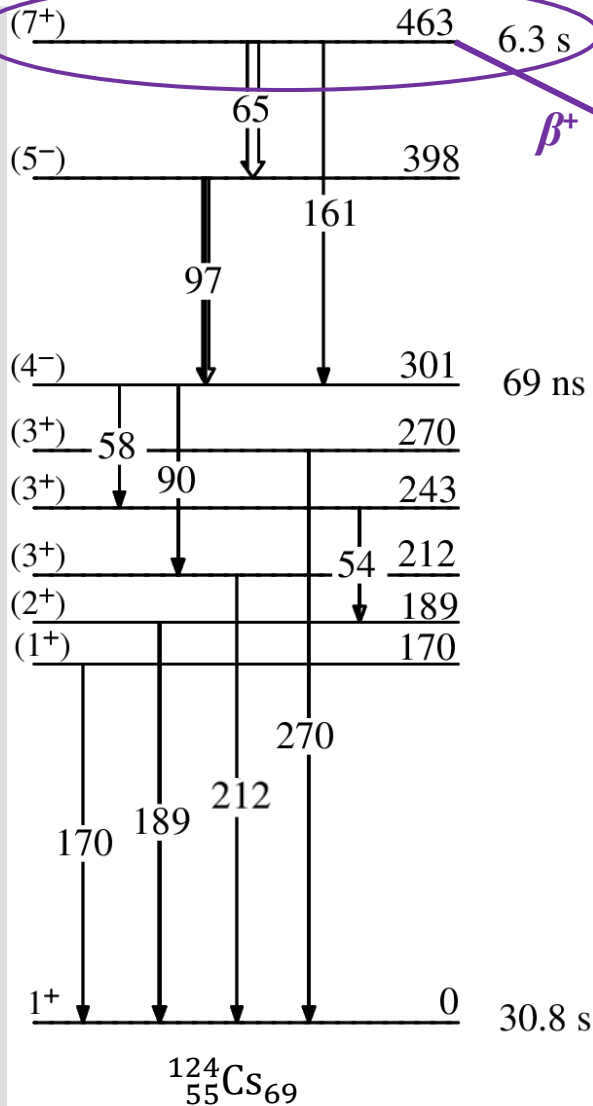


High-spin levels ($6^+, 7^+, 8^+$)

$^{124}_{54}\text{Xe}_{70}$



HIGH-SPIN TRANSITIONS

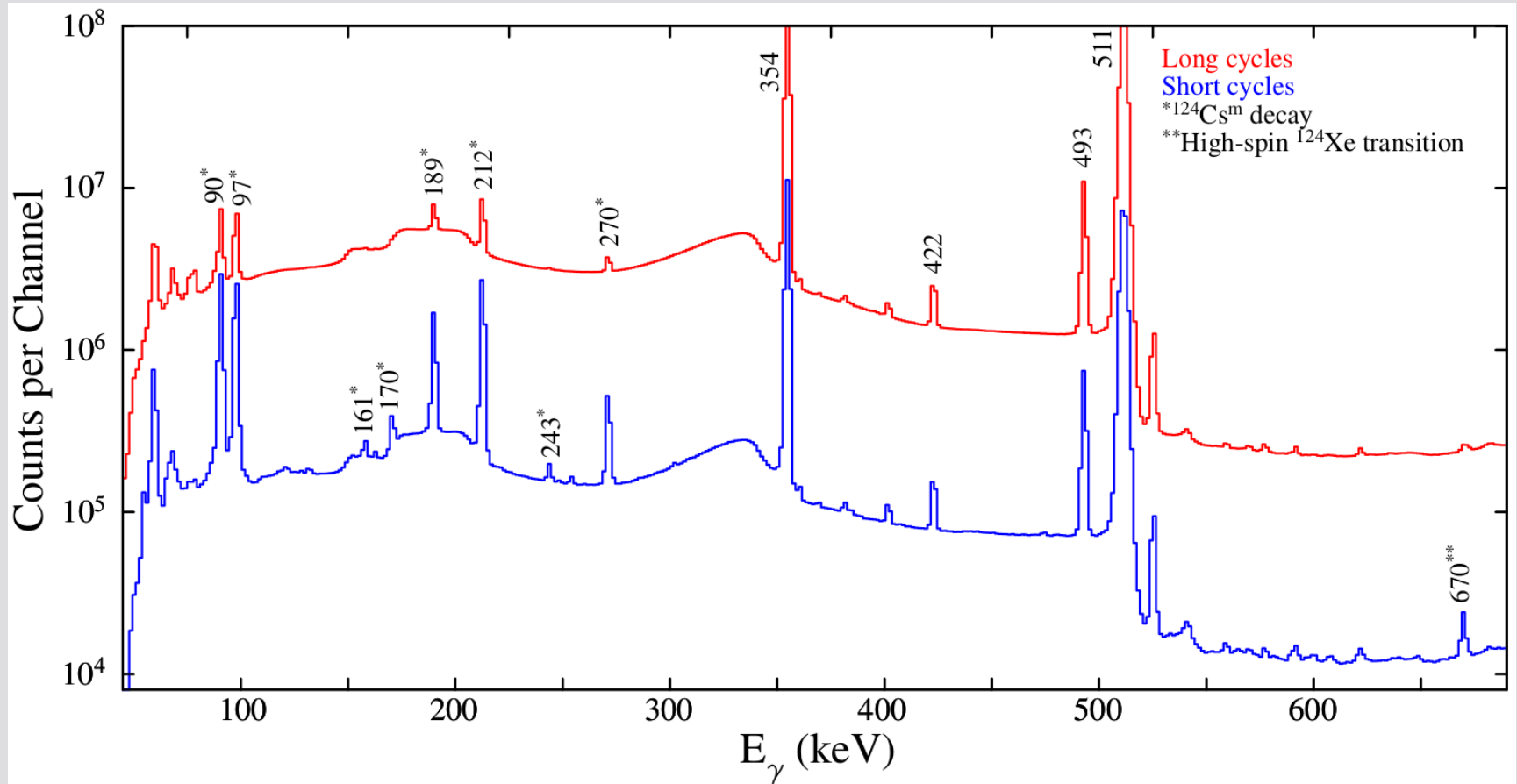


$$BR(^{124}\text{Cs}^m, \beta^+) = (0.11 \pm 0.02)\%$$

E_i (keV)	E_γ (keV)	E_f (keV)	B-feeding Intensity (%)	Log ft
1549	670	879	0.007(3)	7.79(0.19)
1837	589	1248	0.008(2)	6.60(2)
2144	958	879		
	705	1438	0.004(1)	7.73(11)
2381	943	1438	0.0011(4)	8.17(16)
2532	983	1548	0.0019(4)	7.85(10)
2575	737	1837	0.0013(4)	7.99(1)
2779	907	1873	0.07(2)	6.13(11)
	943	1837		
	1231	1548		
2979	1431	1548	0.011(4)	6.82(16)
3739	2190	1548	0.0022(5)	7.06(10)
4093	2544	1548	0.0014(5)	7.05(16)

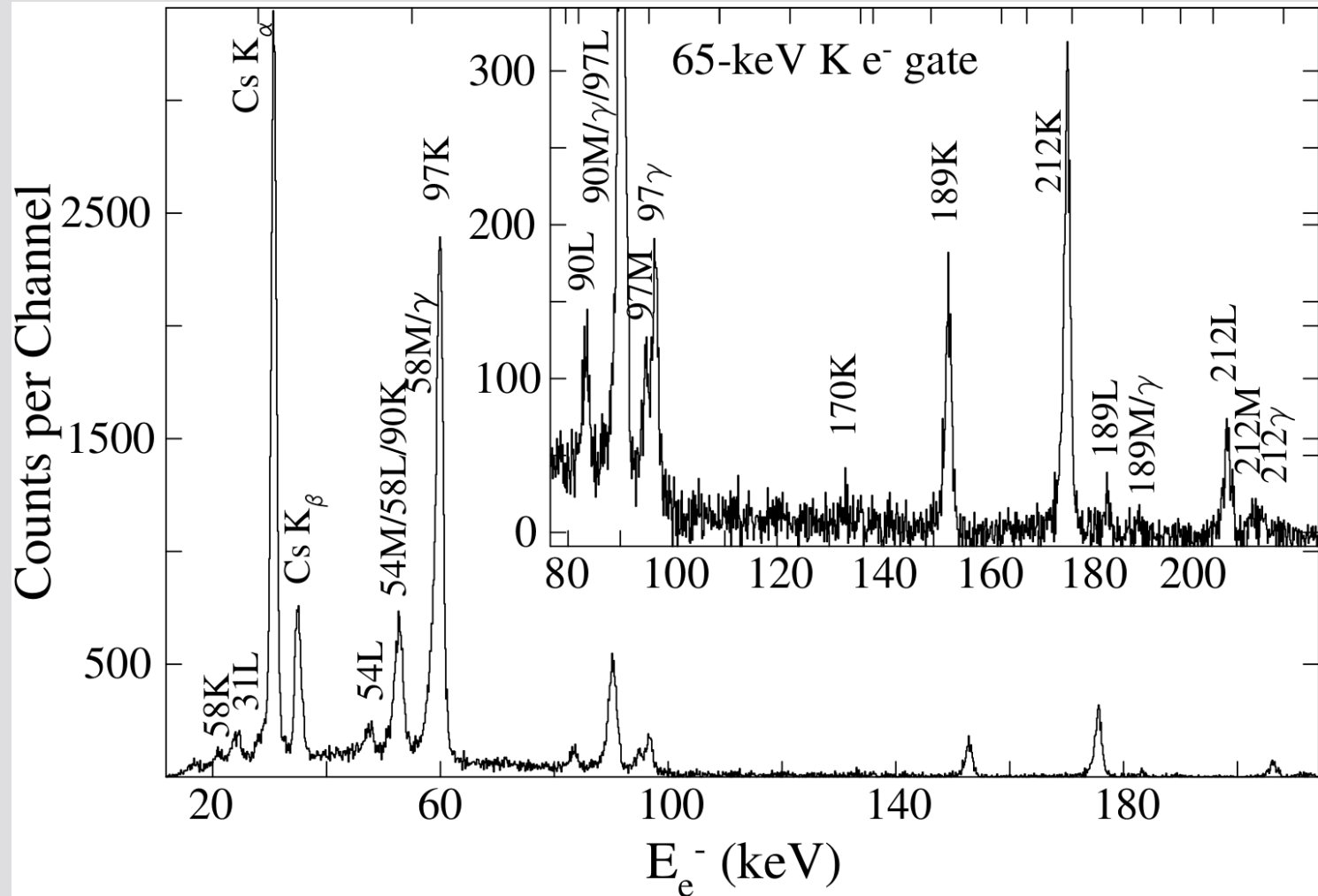
New transition

ISOMERIC DECAY

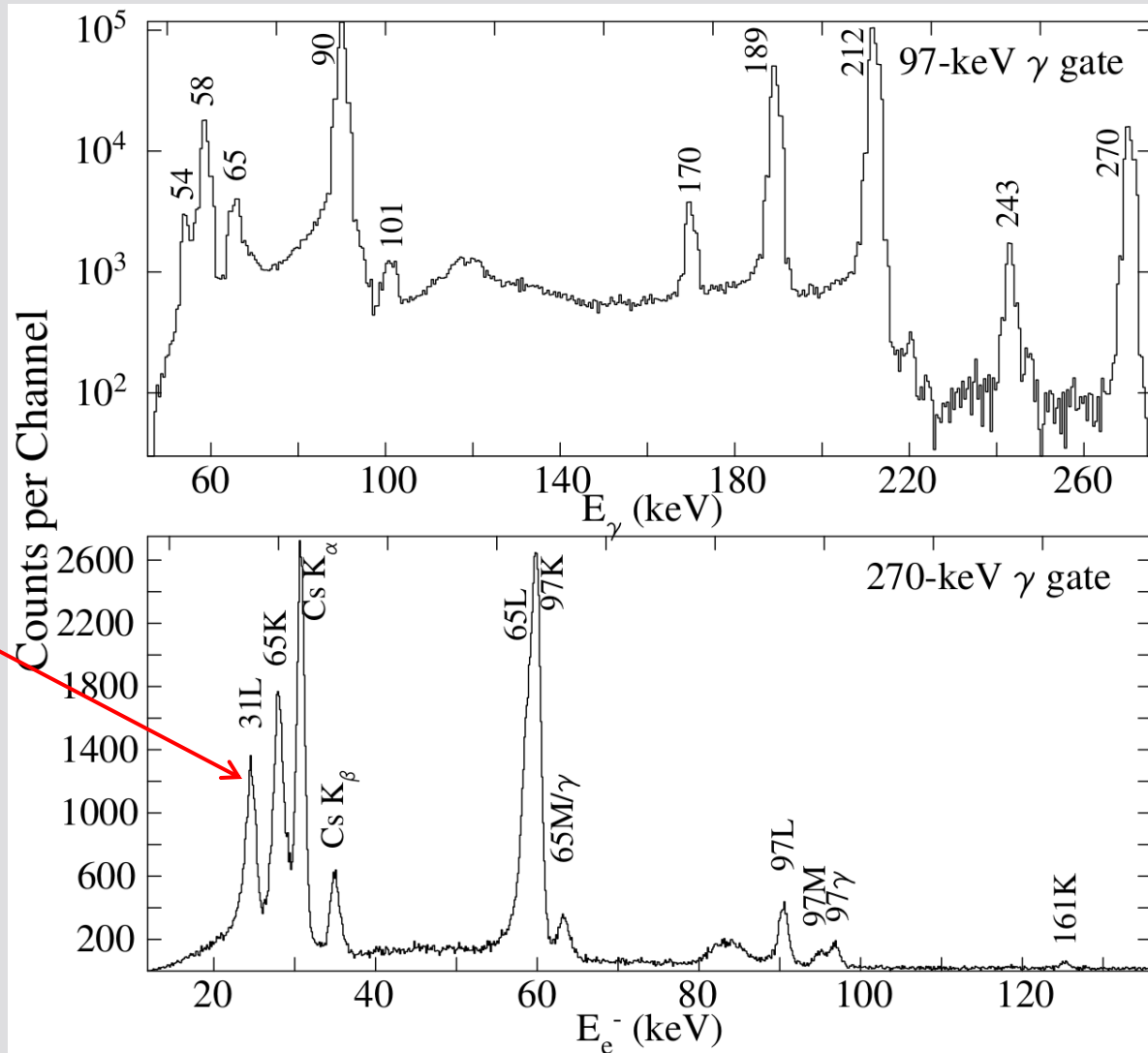
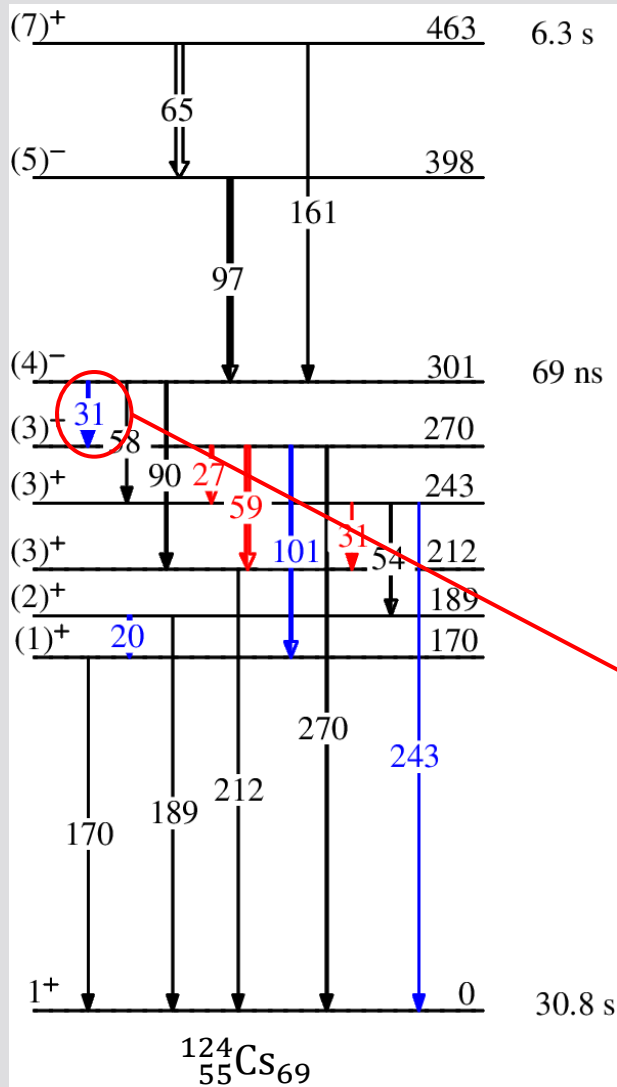


ISOMERIC DECAY

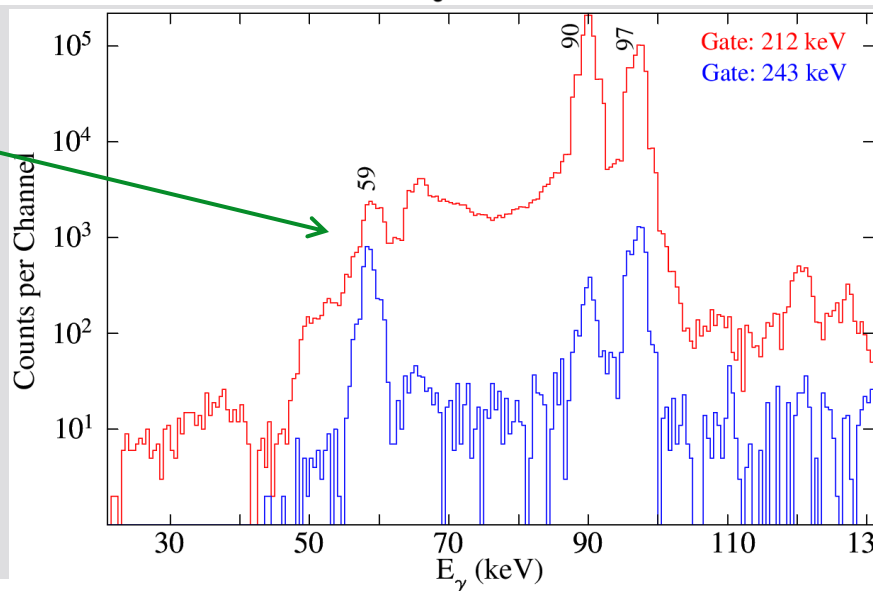
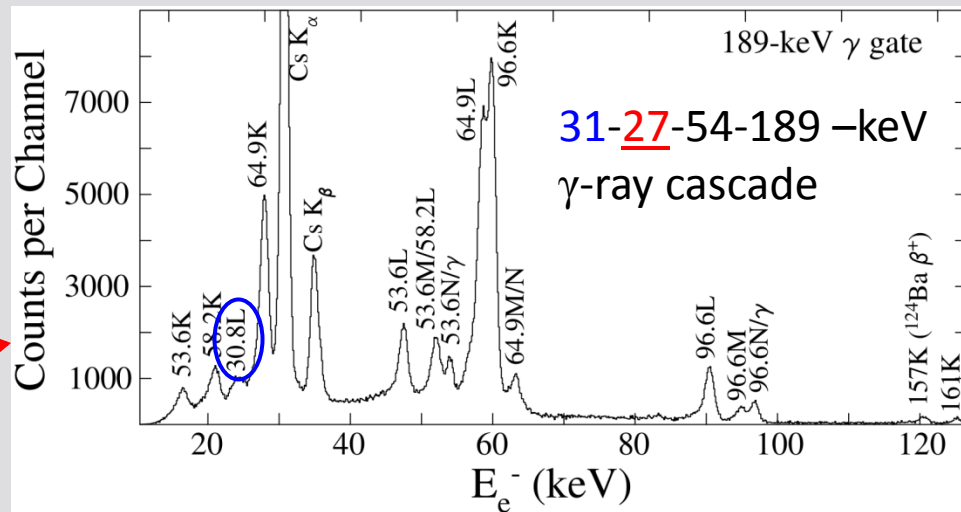
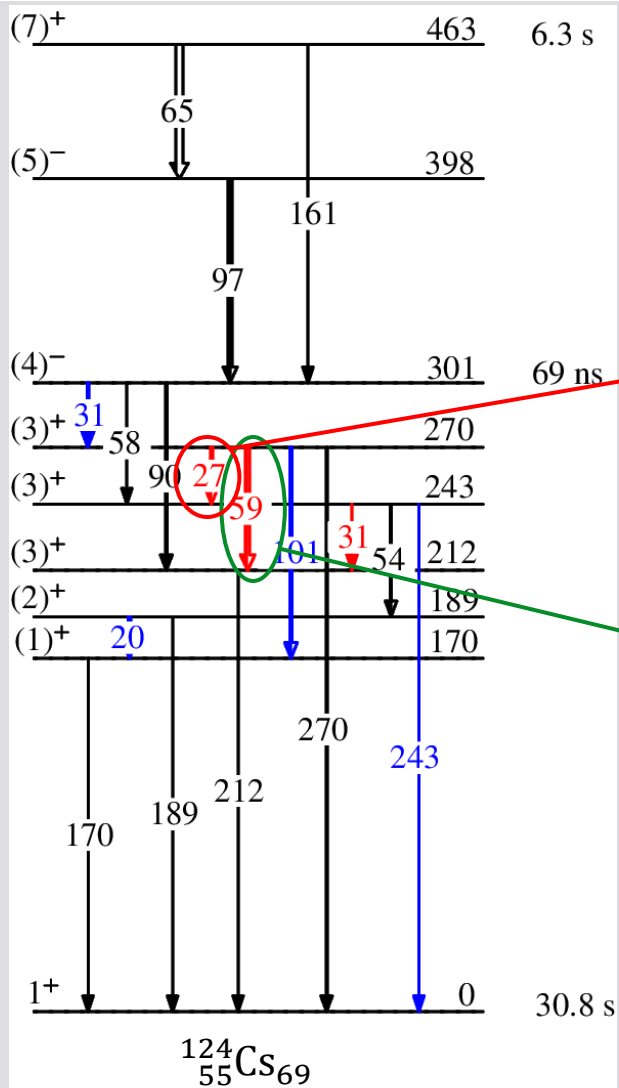
E_e^- - spectrum gated on the 65-keV K conversion electron



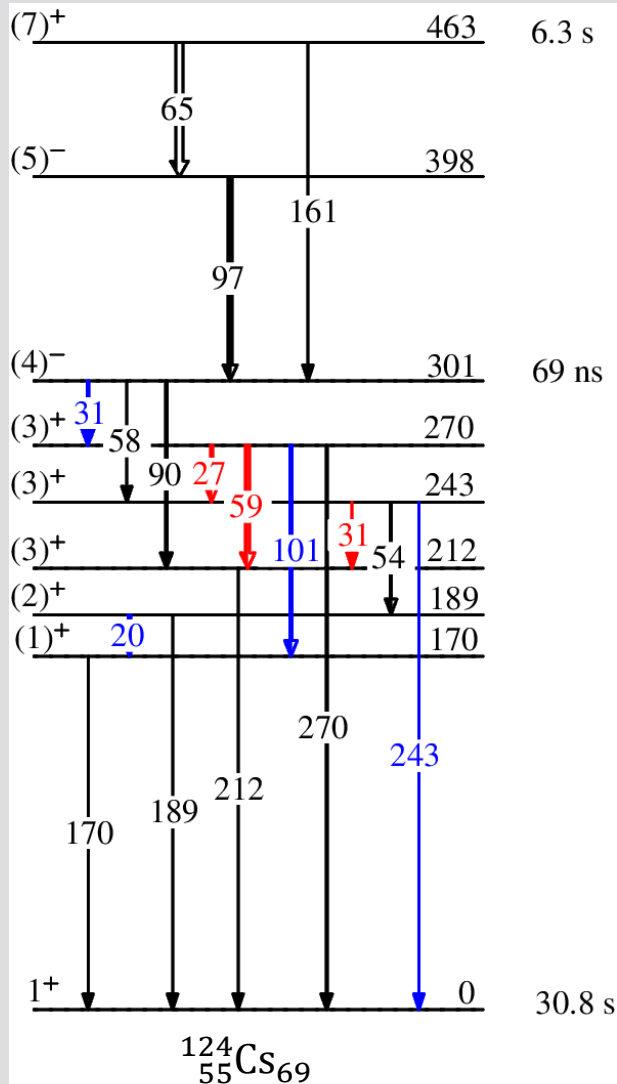
ISOMERIC DECAY



ISOMERIC DECAY



ISOMERIC DECAY



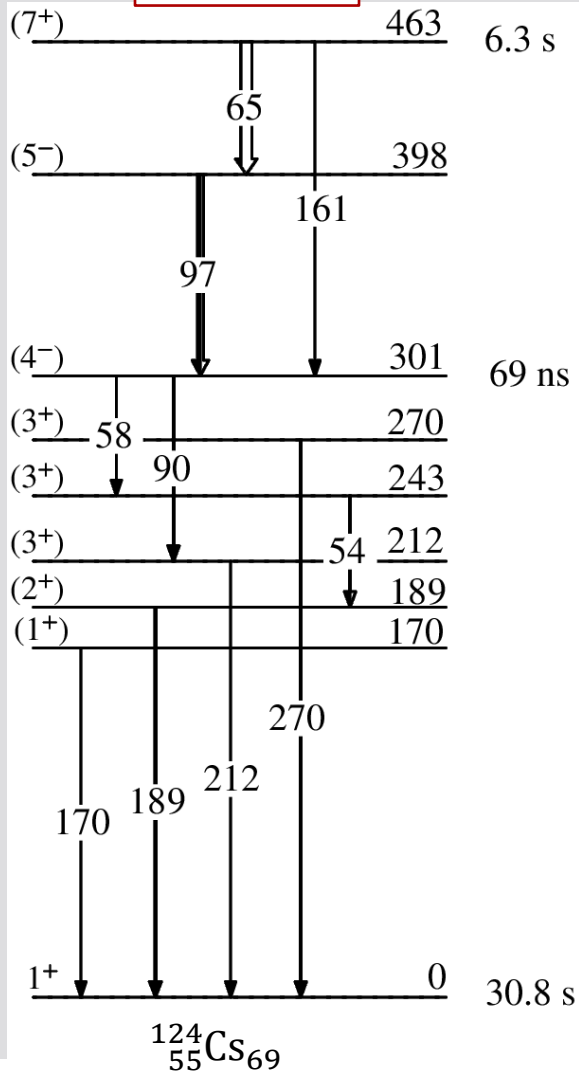
E_i (keV)	E_γ (keV)	E_f (keV)	$I_i^\pi \rightarrow I_f^\pi$	BR (%)
170	169.5	0	$1^+ \rightarrow 1^+$	100
189	19.5	170	$2^+ \rightarrow 1^+$	7.7(8)
	189.0	0	$2^+ \rightarrow 1^+$	92.3(8)
212	211.6	0	$3^+ \rightarrow 1^+$	100
243	31.3	212	$3^+ \rightarrow 3^+$	4.3(5)
	53.6	189	$3^+ \rightarrow 2^+$	90.9(9)
	242.9	0	$3^+ \rightarrow 1^+$	4.8(7)
270	27.4	243	$3^+ \rightarrow 3^+$	49(17)
	58.7	212	$3^+ \rightarrow 3^+$	29(10)
	100.8	170	$3^+ \rightarrow 1^+$	2.4(9)
	270.3	0	$3^+ \rightarrow 1^+$	20(7)
301	30.8	270	$4^- \rightarrow 3^+$	41(11)
	58.2	243	$4^- \rightarrow 3^+$	0.34(7)
	89.5	212	$4^- \rightarrow 3^+$	59(11)
398	96.6	301	$5^- \rightarrow 4^-$	100
463	64.9	398	$7^+ \rightarrow 5^-$	98.9(3)
	161.0	301	$7^+ \rightarrow 4^-$	1.1(3)

New transition

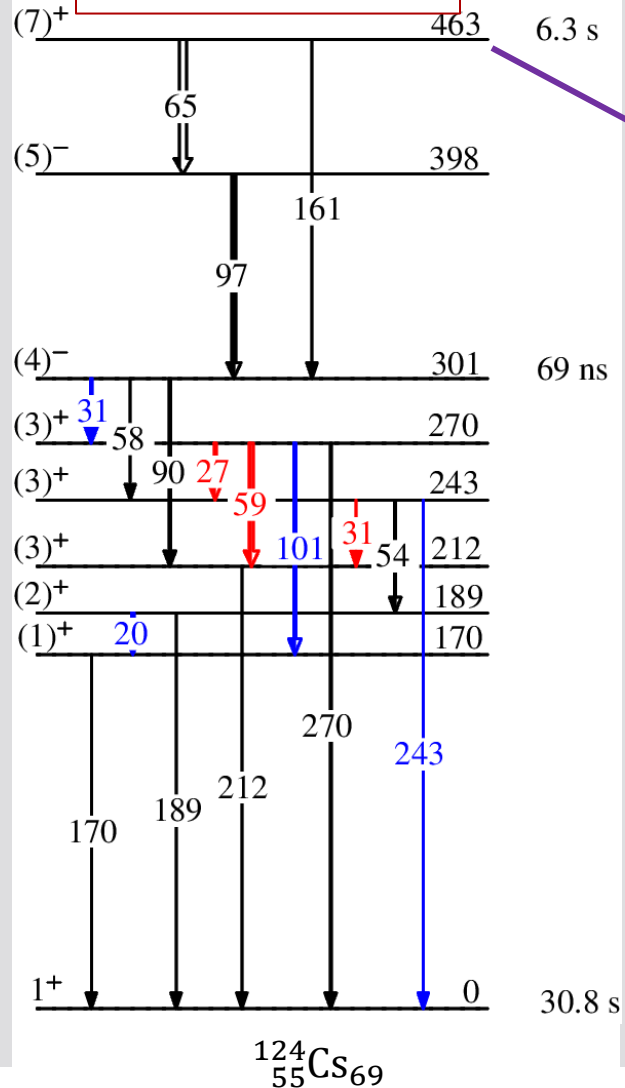
New transition in isomeric decay

CONCLUSIONS

Previous



Current results



$\beta^+ 0.11(2)\%$

$^{124}\text{Xe}_{70}$

ACKNOWLEDGEMENTS

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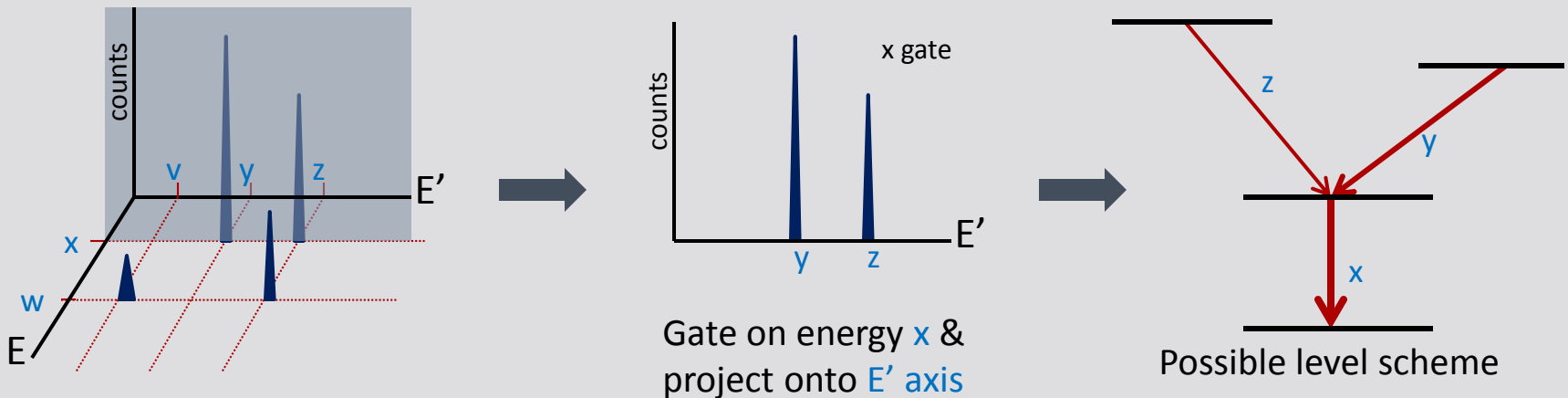


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COINCIDENCE ANALYSIS

- Two events detected in two different detectors within a very small time window (10 ns)
- Coincidence matrix created: E vs E'
- "Gate" on an energy and project onto opposite axis to produce coincidence spectrum
- Build level scheme



$$BR(^{124}\text{Cs}^m, \beta^+) = \frac{\text{High spin intensity}}{\text{Total intensity from } ^{124}\text{Cs}^m}$$
$$= (0.11 \pm 0.02)\%$$