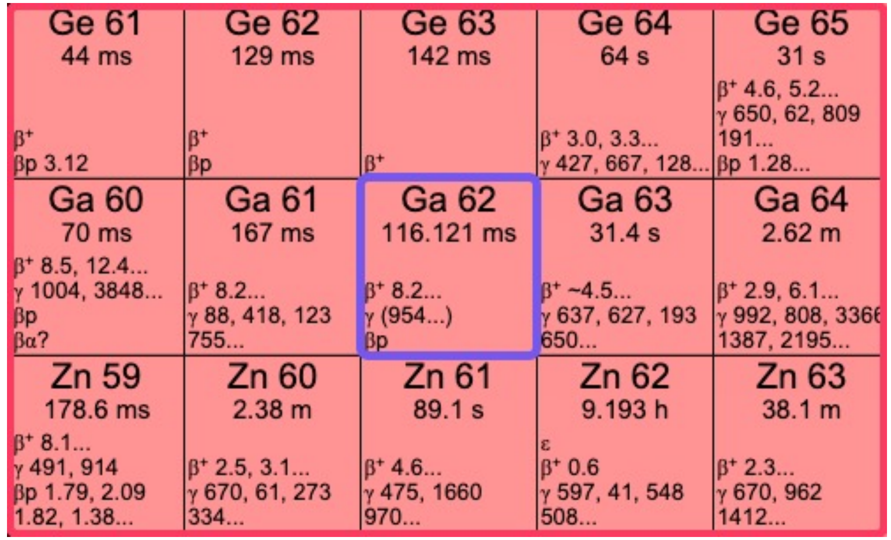

Spectroscopic investigation of low-lying T=0,1 states in self-conjugate ^{62}Ga

Radu Emanuel Mihai

IFIN-HH

Contents

- Scientific motivation
- Previous knowledge
- Experiment
- Analysis and results
- Conclusions
- Acknowledgements

Scientific motivation

- The nuclear force does not distinguish between proton and neutron
- Corresponding quantum number: Isospin (T)
- In general, the most energetically favored states have $T = T_z$
- Notable exception: odd-odd N = Z nuclei → coexistence of both T=0 and T=1 states at low excitation energies
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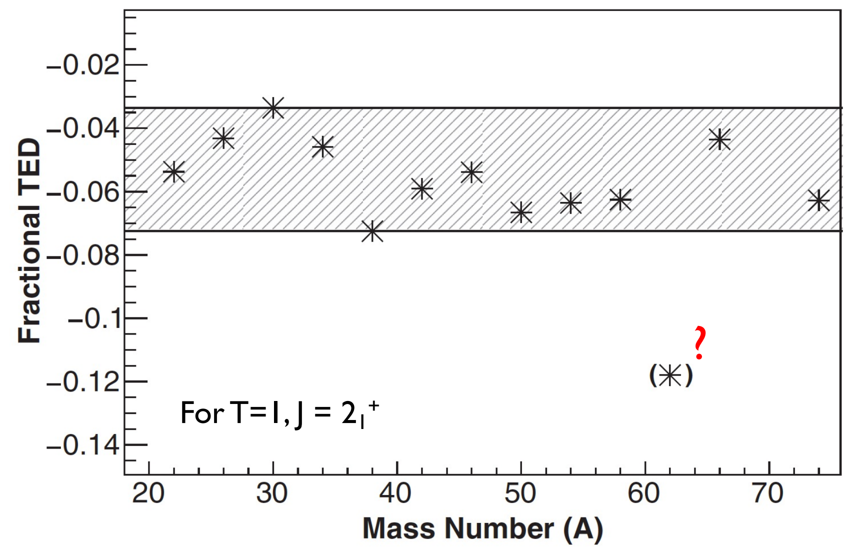

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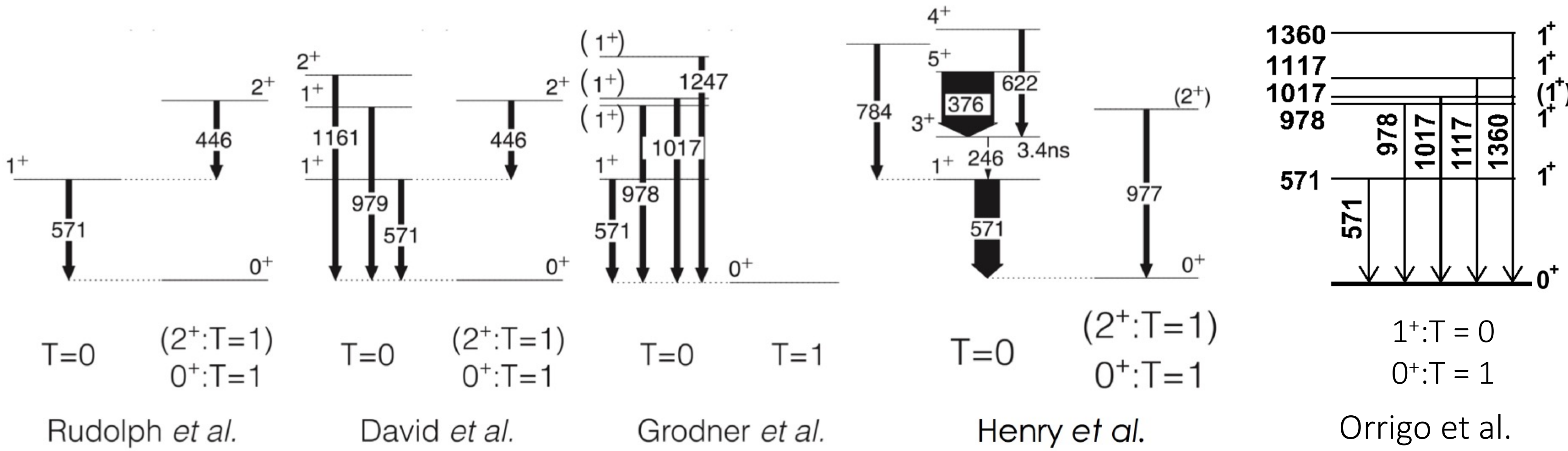
Previous papers on ^{62}Ga



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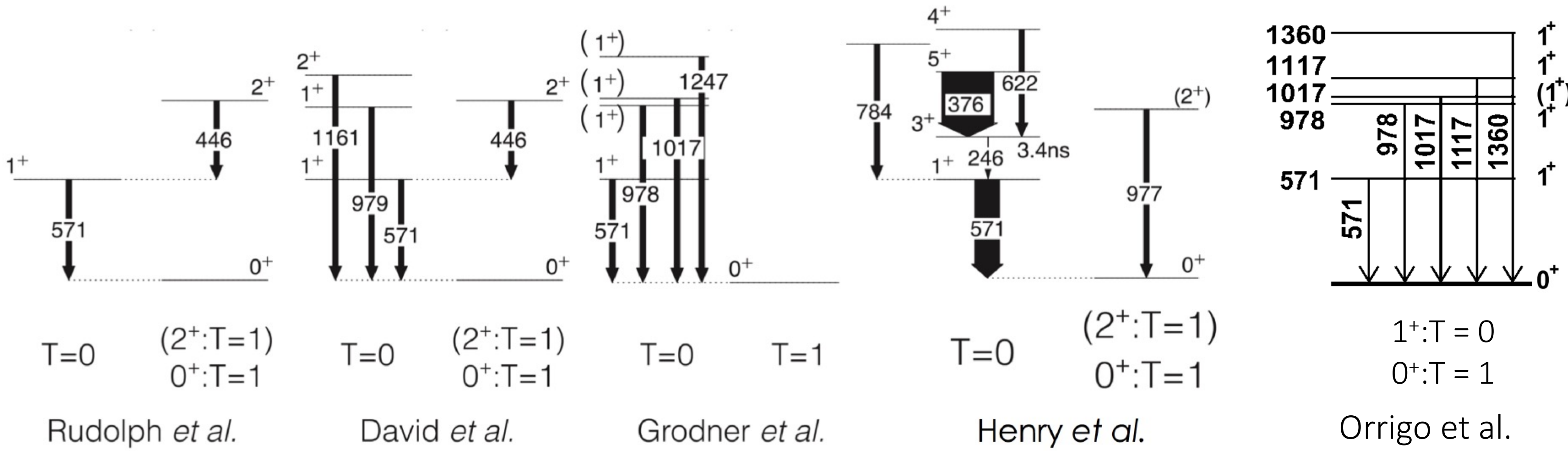

[1]PRC 69 034309 (2004)

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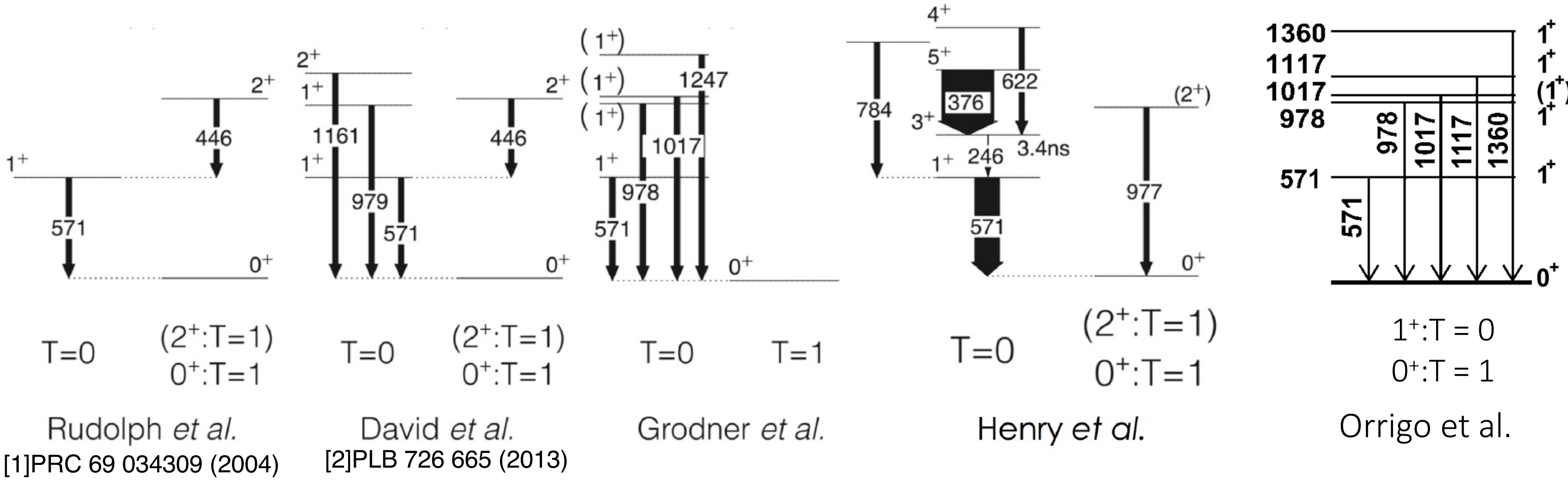

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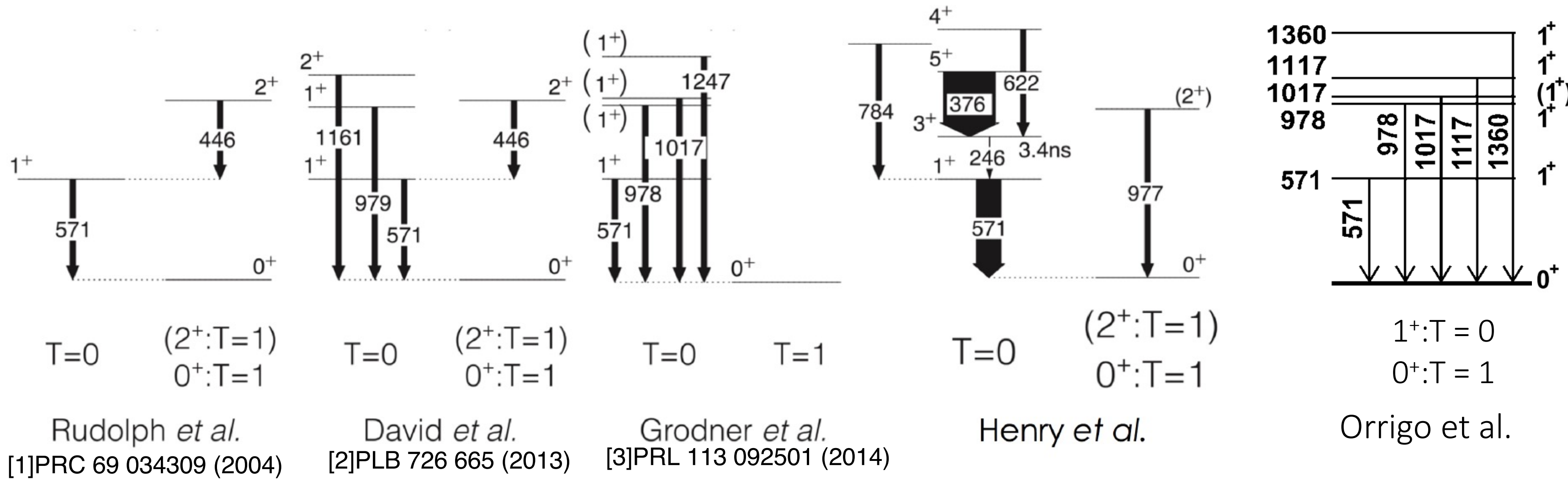

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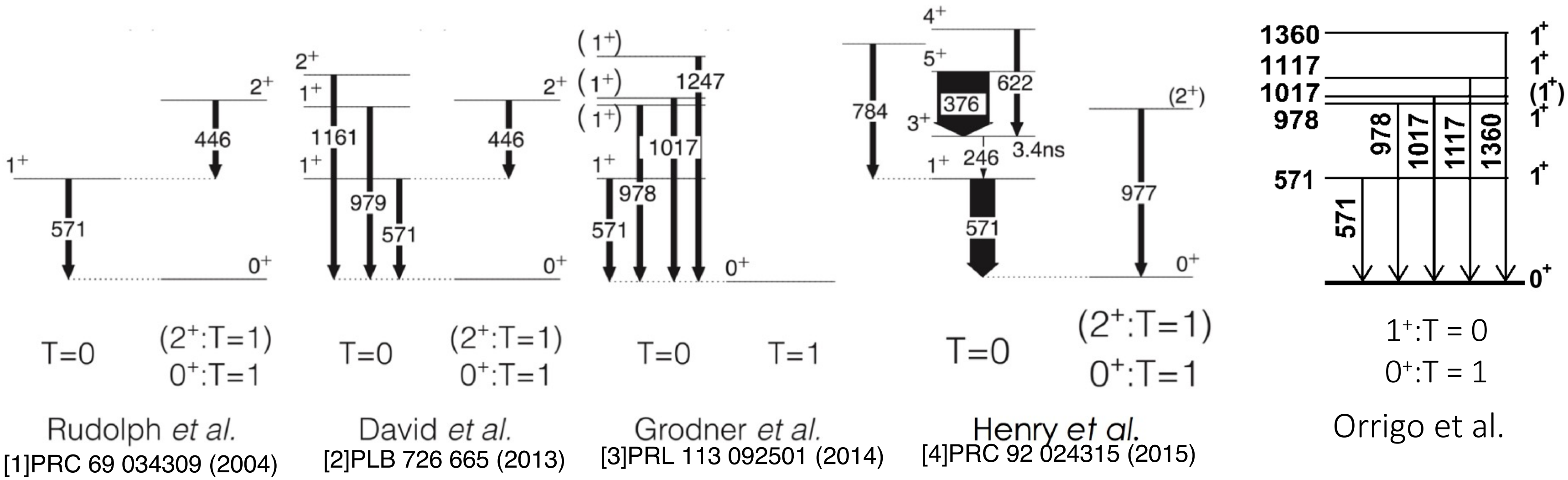

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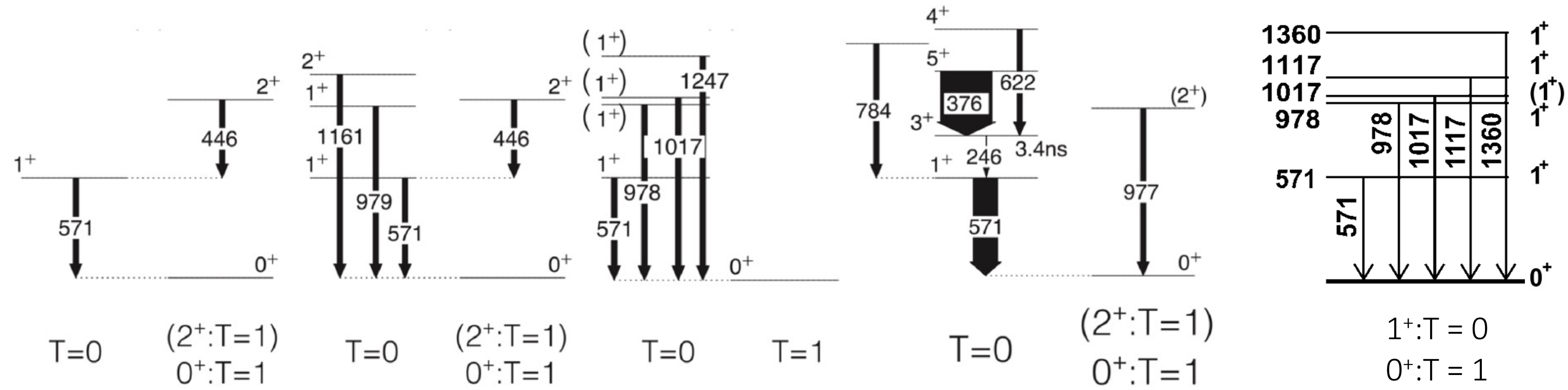

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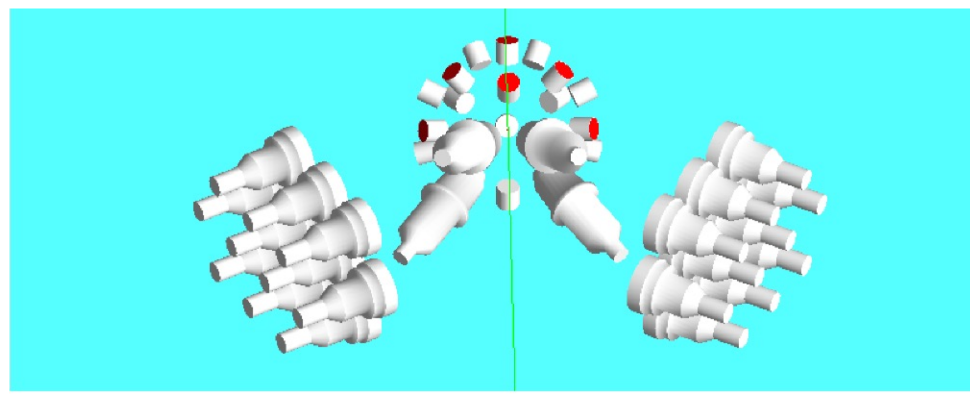
Experiment

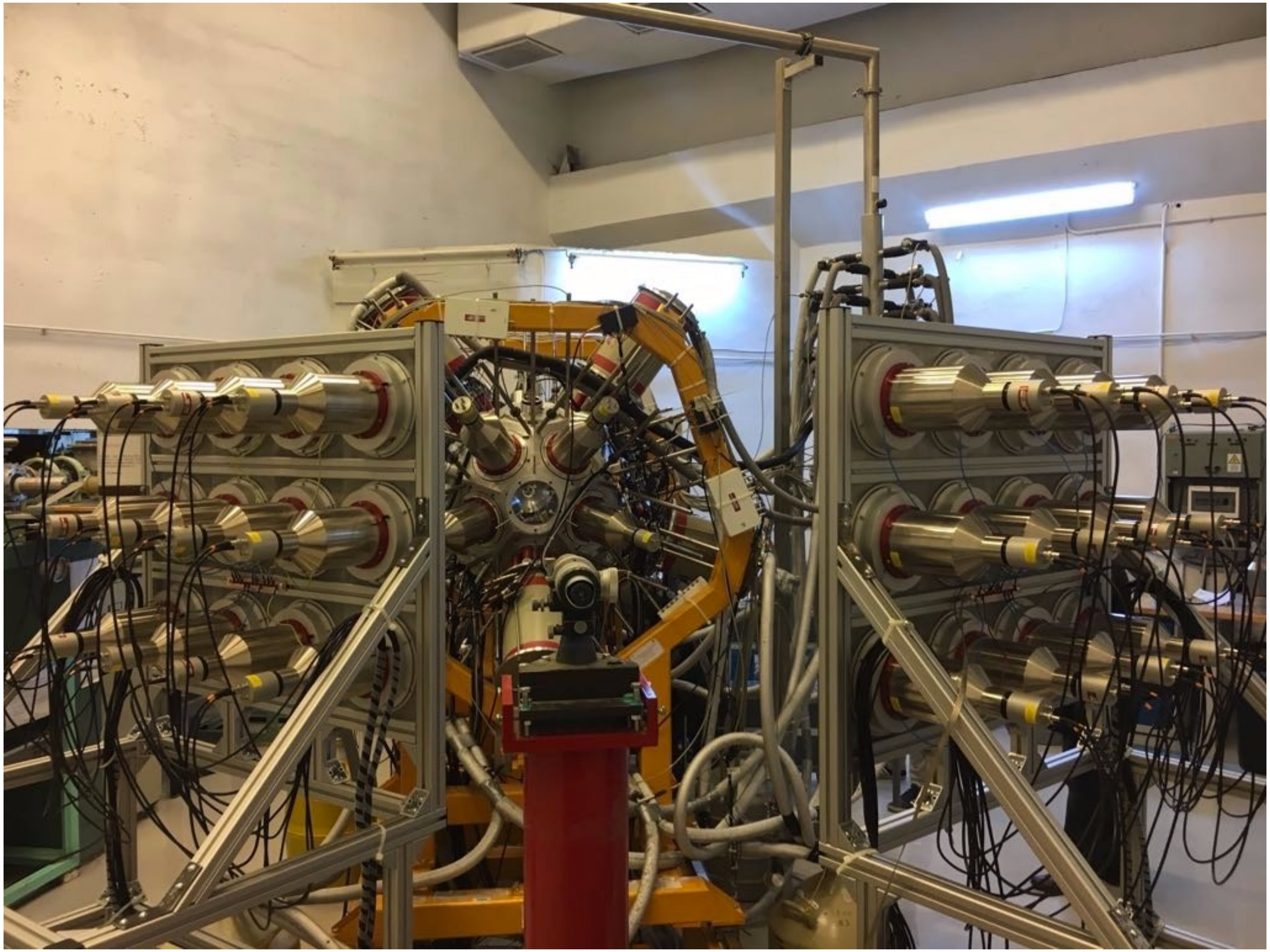
- Set-up: ROSPHERE (10 HPGe, 11 $LaBr_3(Ce)$, 28 neutron detectors)
- Target : 5 mg/cm^2 ^{58}Ni / 5 mg/cm^2 Au backing;
- Beam : ^{6}Li @ 22 MeV – 1.5 nA intensity
- Reaction : ^{58}Ni(^{6}Li , 2n)^{62}Ga with **$\sigma_{2n} \sim 5$ mb**
- **Total $\sigma_{fusion} \approx 500$ mb**

^{58}Ni target made in our target lab

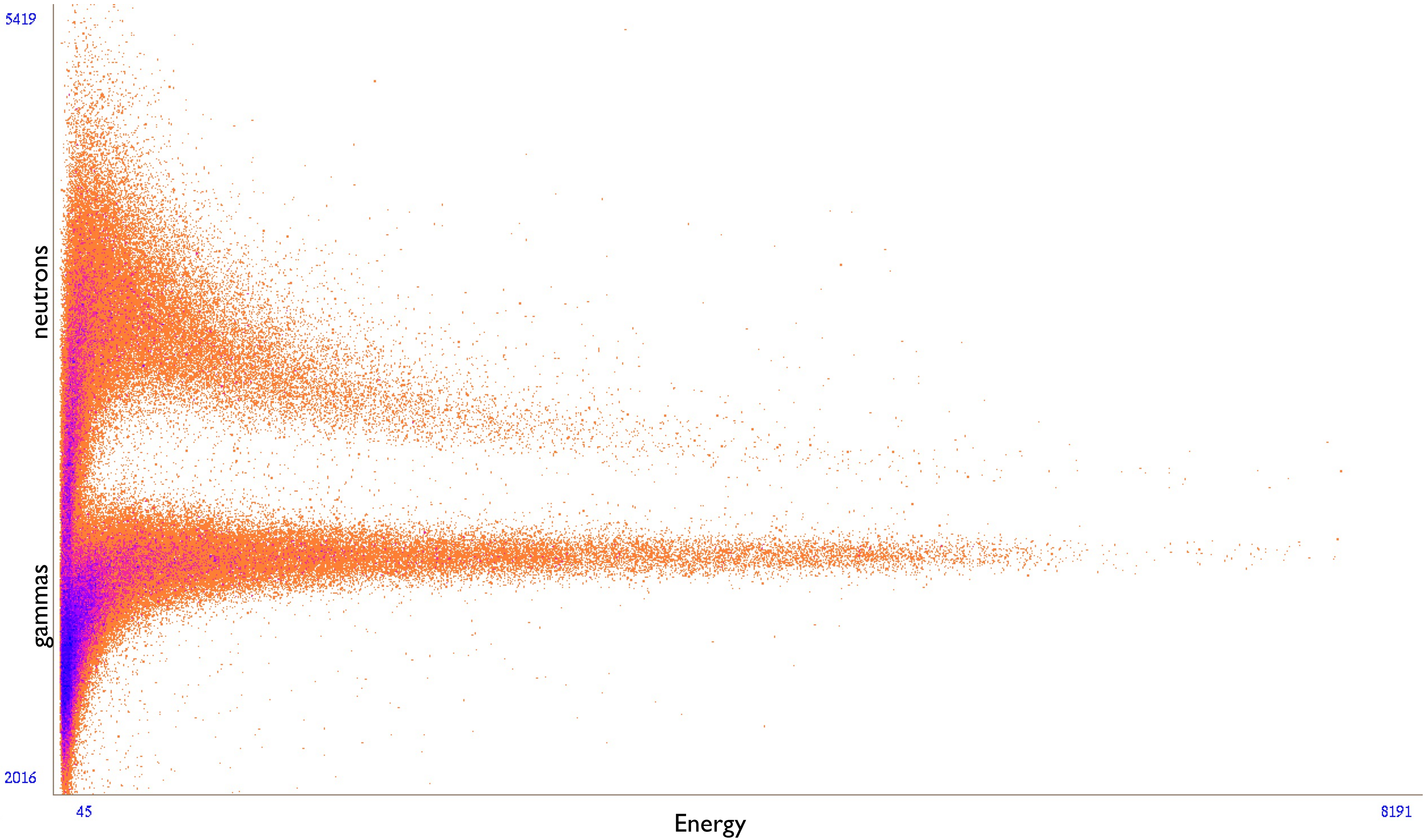


3D schematic of the ROSPHERE setup configured for this experiment

Experiment



Analysis



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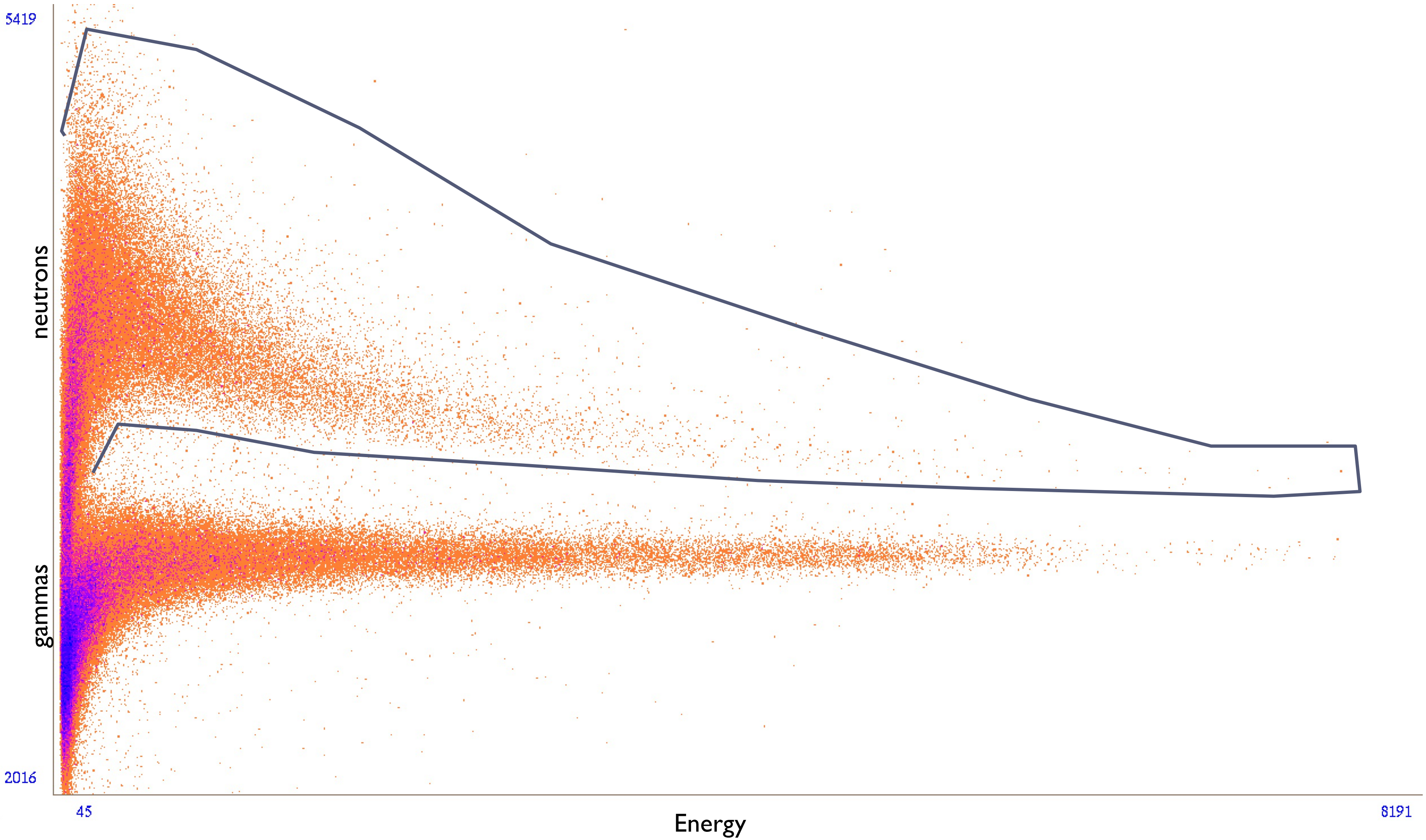

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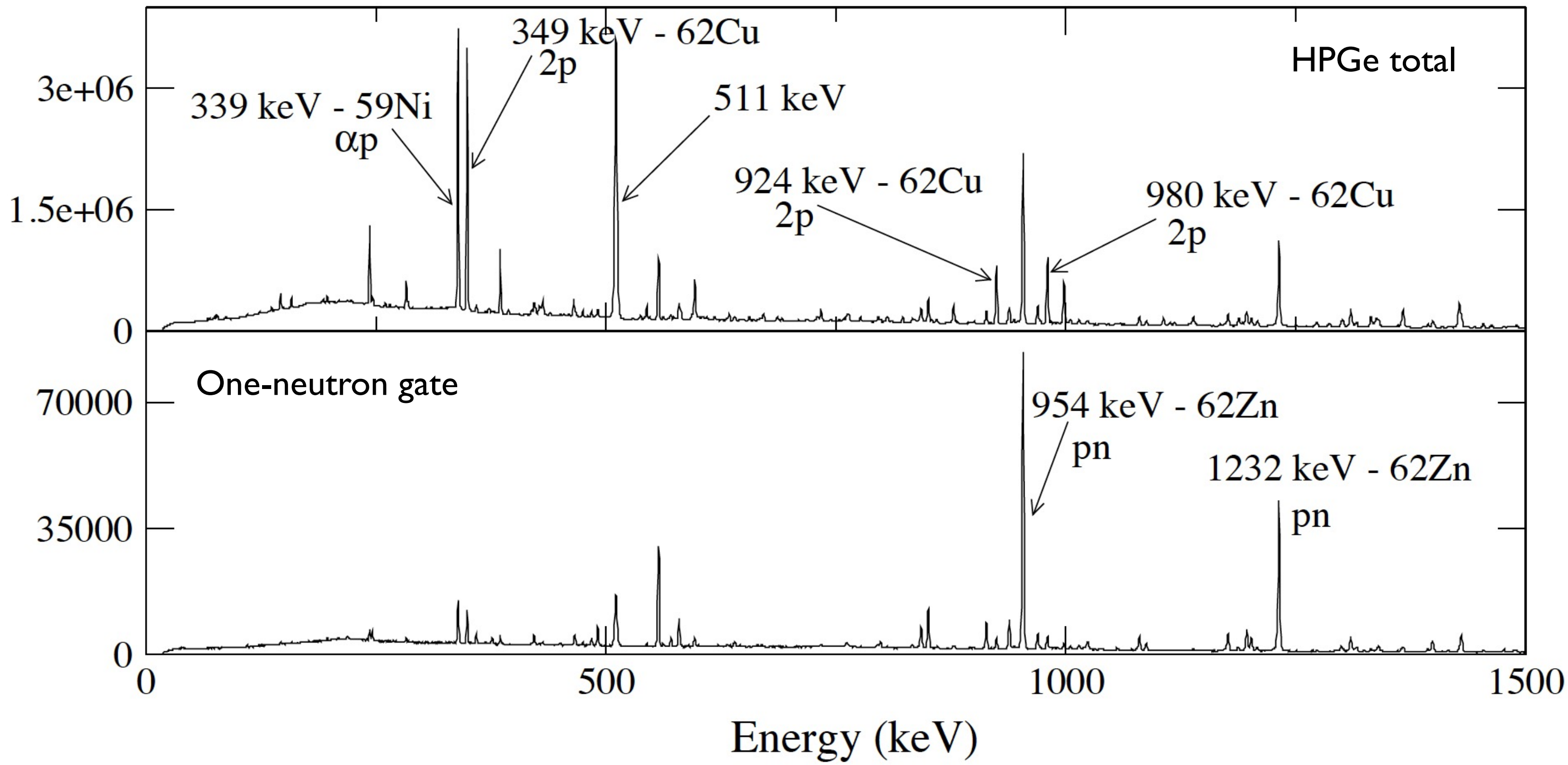
Neutron filter



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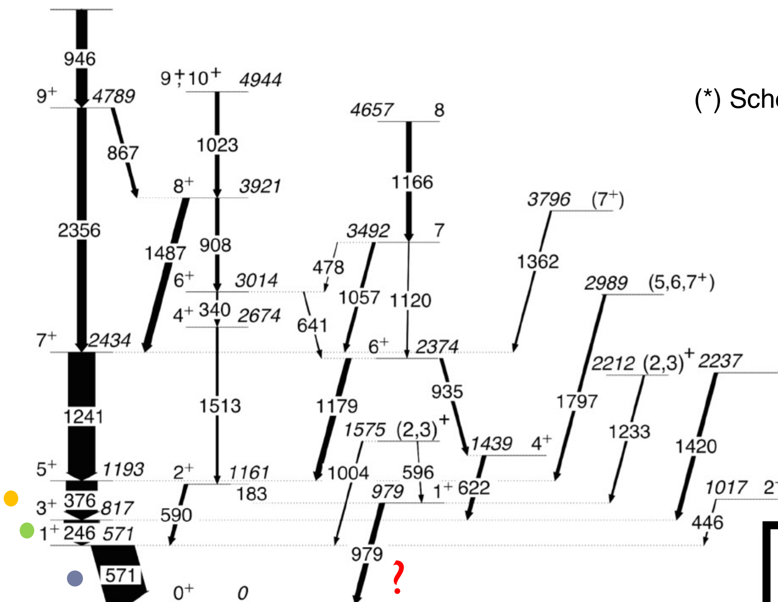
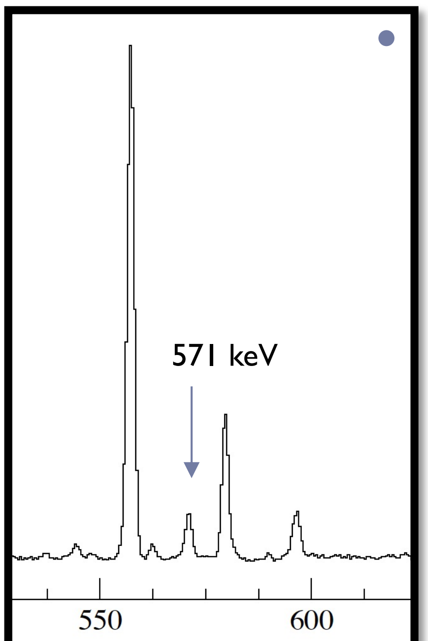
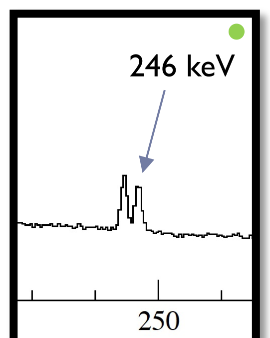
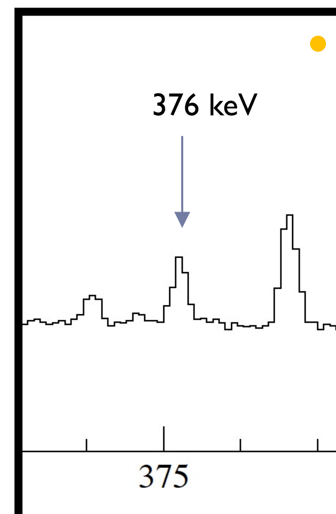


(*) Scheme taken from H.M. David et al. , Phys. Lett. B726 , 665 (2013).







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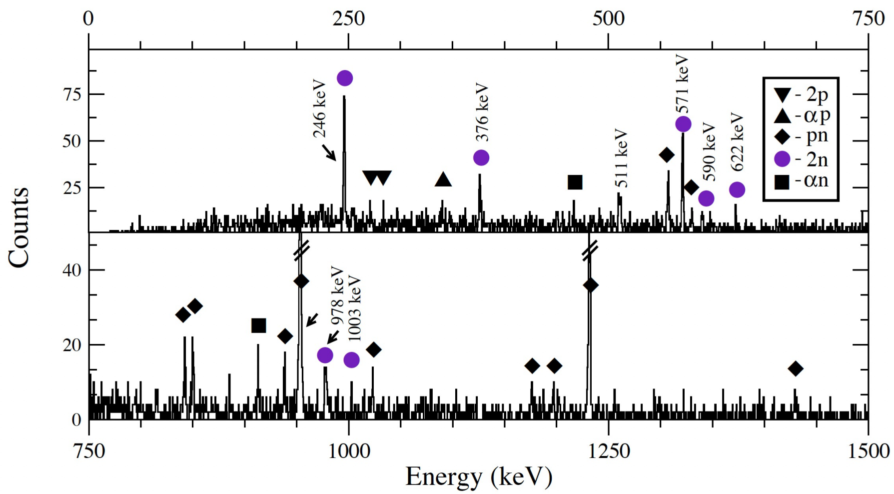
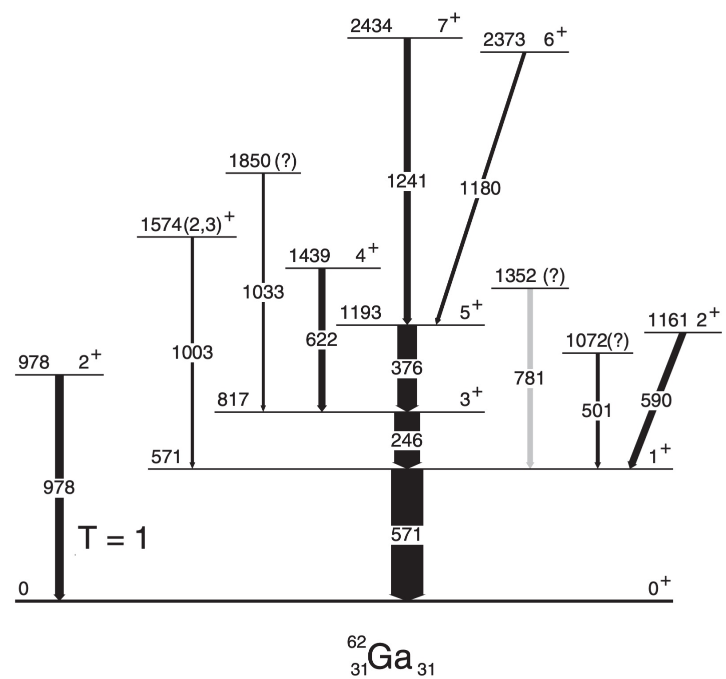


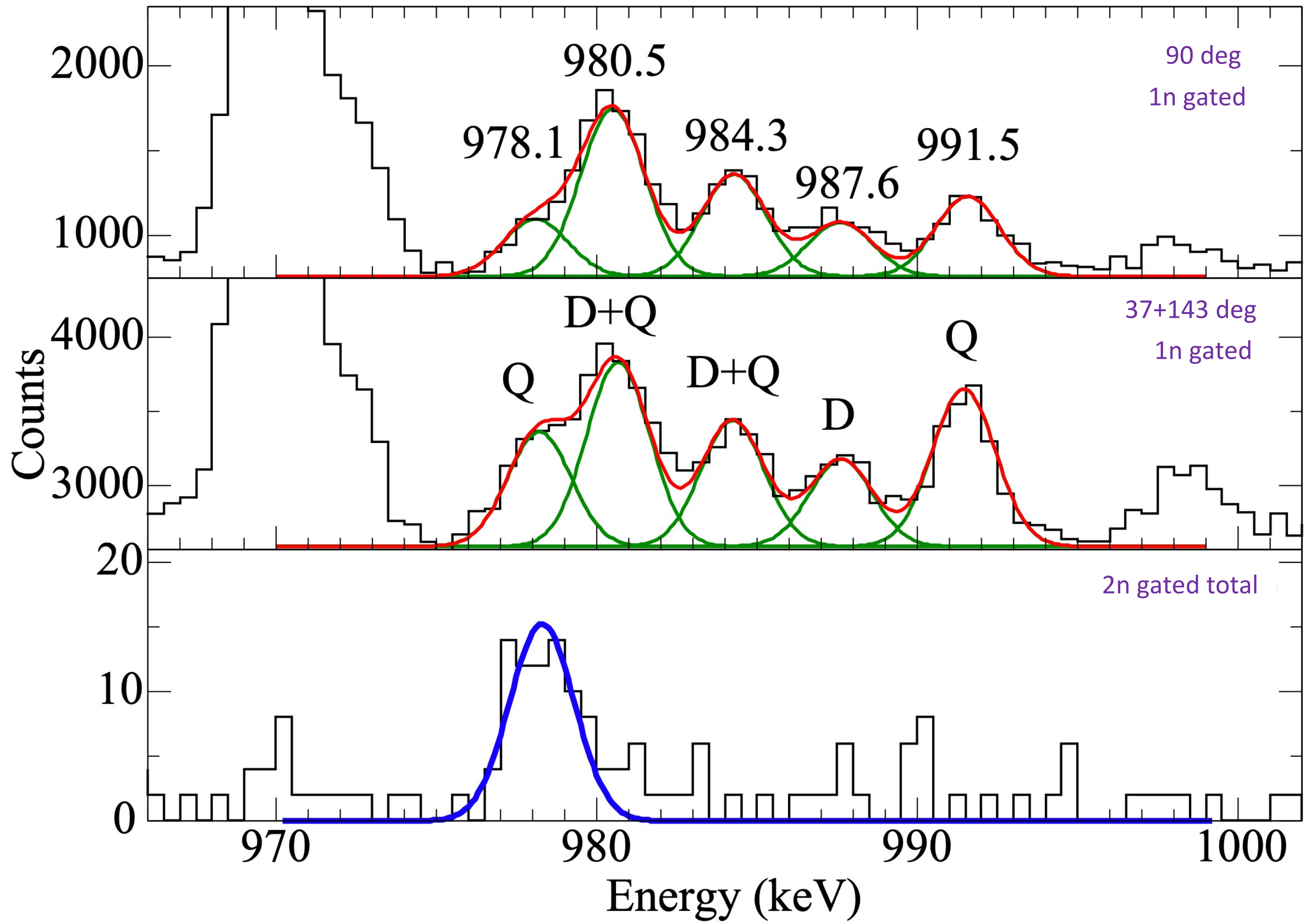
TABLE I. A listing of ^{62}Ga transitions and their relative intensities observed in this work. Values noted with an asterisk are estimated using γ-ray coincidences.

E_x (keV)	E_γ (keV)	I_{rel} (%)	]I_i^π	I_f^π
571.2(1)	571.2(1)	100(3)	1^+	0^+
817.3(1)	246.0(1)	61(2)	3^+	1^+
978.1(1)	978.1(1)	27(2)	2^+	0^+
1072.5(1)	501.3(1)	5(2)*		1^+
1161.0(1)	589.8(1)	20(2)*	2^+	1^+
1193.8(2)	376.5(1)	37(2)	5^+	3^+
1352.0(1)	780.8(1)	6(3)*		1^+
1439.2(2)	621.9(2)	20(6)	4^+	3^+
1574.3(1)	1003.1(1)	4(1)*	$(2,3)^+$	1^+
1850.2(3)	1032.9(3)	3(1)*		3^+
2374.4(3)	1180.6(2)	10(4)*	6^+	5^+
2434.8(3)	1241.0(2)	33(7)*	7^+	5^+



Level scheme constructed from observed transitions in current work

Analysis



2000
1000
980.5
978.1
984.3
987.6
991.5
90 deg
1n gated
4000
3000
D+Q
Q
D+Q
D
Q
37+143 deg
1n gated
Counts
20
10
0
2n gated total
970
980
990
1000
Energy (keV)

Results

- Intensities had to be corrected for detector efficiencies
- Prior to the experiment, ^{152}Eu source runs were taken
- The energetically closest transition → 963 keV ($1^- \rightarrow 2^+$) in ^{152}Sm
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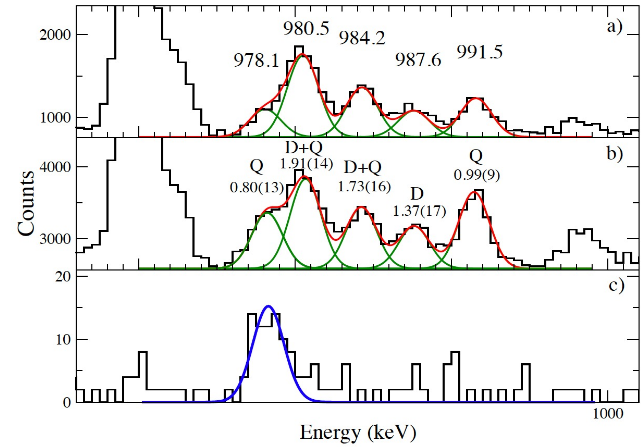

TABLE II. Angular anisotropy ratio values ($R_{90°/(37°+143°)}$) along with the multipolarities(M_γ) determined for transitions observed in this study.

Nucleus	E_γ (keV)	$I_i^\pi \rightarrow I_f^\pi$	$R_{90°/(37°+143°)}$	M_γ
^{62}Zn	953.75(2)	$2^+ \rightarrow 0^+$	0.84(3)	Q
^{62}Zn	1857.5(4)	$(5)^- \rightarrow 4^+$	1.26(4)	D
^{62}Ga	978.1(1)	$2^+ \rightarrow 0^+$	0.80(13)	Q
^{62}Cu	980.5(2)	$5^+ \rightarrow 4^+$	1.91(14)	D+Q
^{61}Cu	984.3(2)	$9/2^- \rightarrow 7/2^-$	1.73(16)	D+Q
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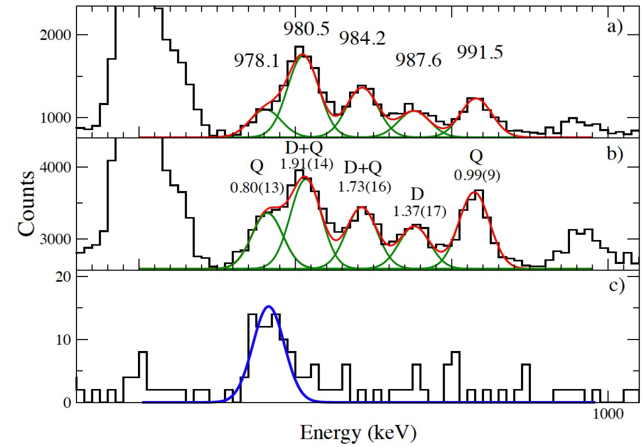

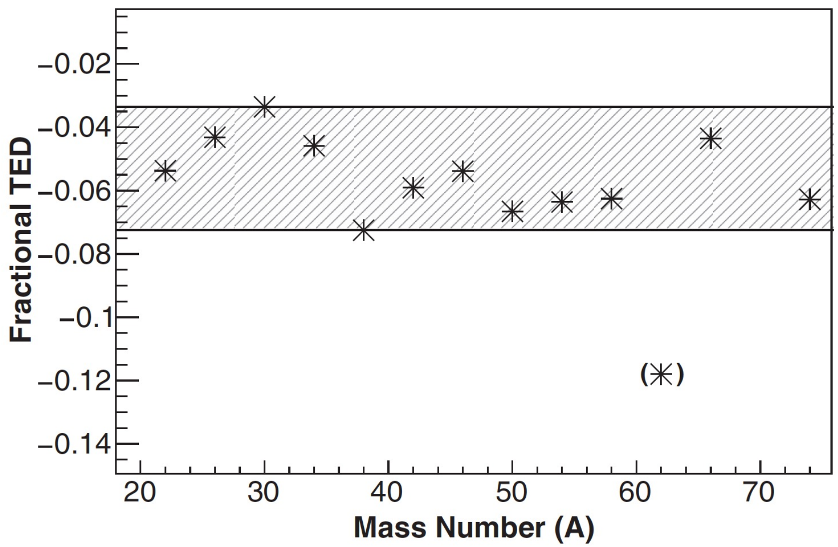

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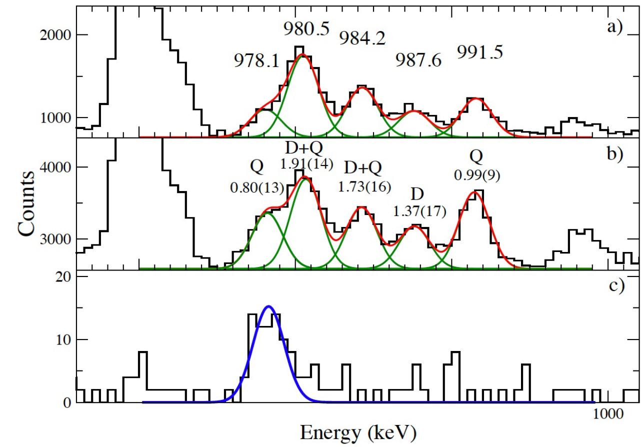

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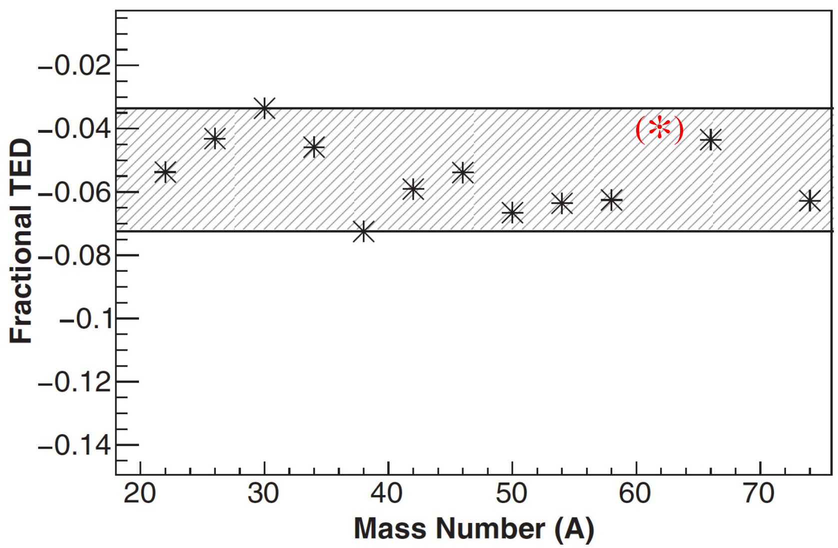

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PHYSICAL REVIEW C **106**, 024332 (2022)

Search for isospin-symmetry breaking in the $A = 62$ isovector triplet

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[1]*Horia Hulubei National Institute of Physics and Nuclear Engineering - IFIN-HH, Bucharest, 077125, Romania*

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[3]*CERN, CH-1211 Geneva 23, Switzerland*

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Thank you for your attention

Bonus - theory

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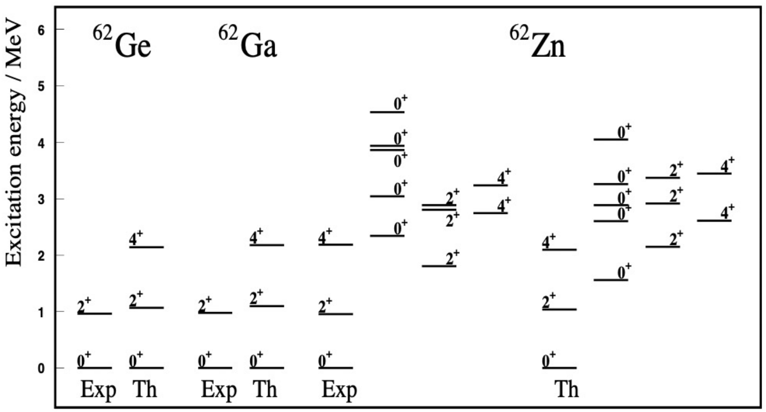
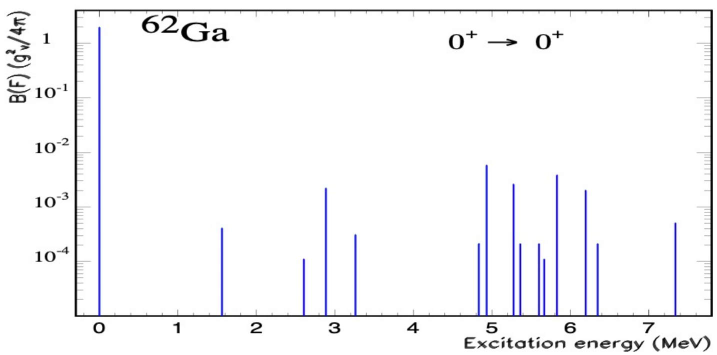
A. Petrovici spetro@nipne.ro

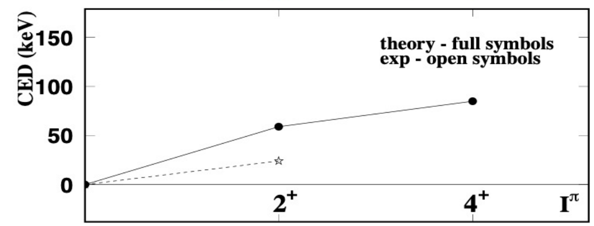
Isospin symmetry breaking in the A=62 isovector triplet



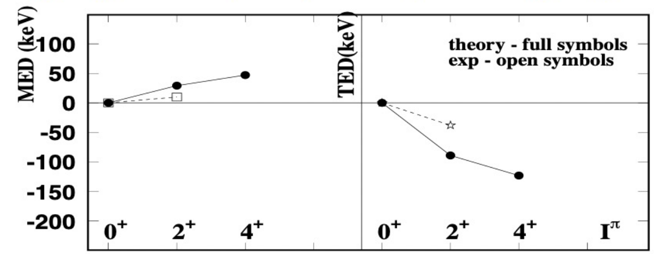


Superallowed Fermi β decay within the triplet

Coulomb Energy Differences (CED)



Mirror Energy Differences (MED) *Triplet Energy Differences (TED)*



Realistic description of the interplay between isospin-symmetry breaking and shape coexistence and mixing effects in the frame of the beyond-mean-field complex Excited Vampir model using a strong charge dependent interaction plus Coulomb interaction in a large model space.