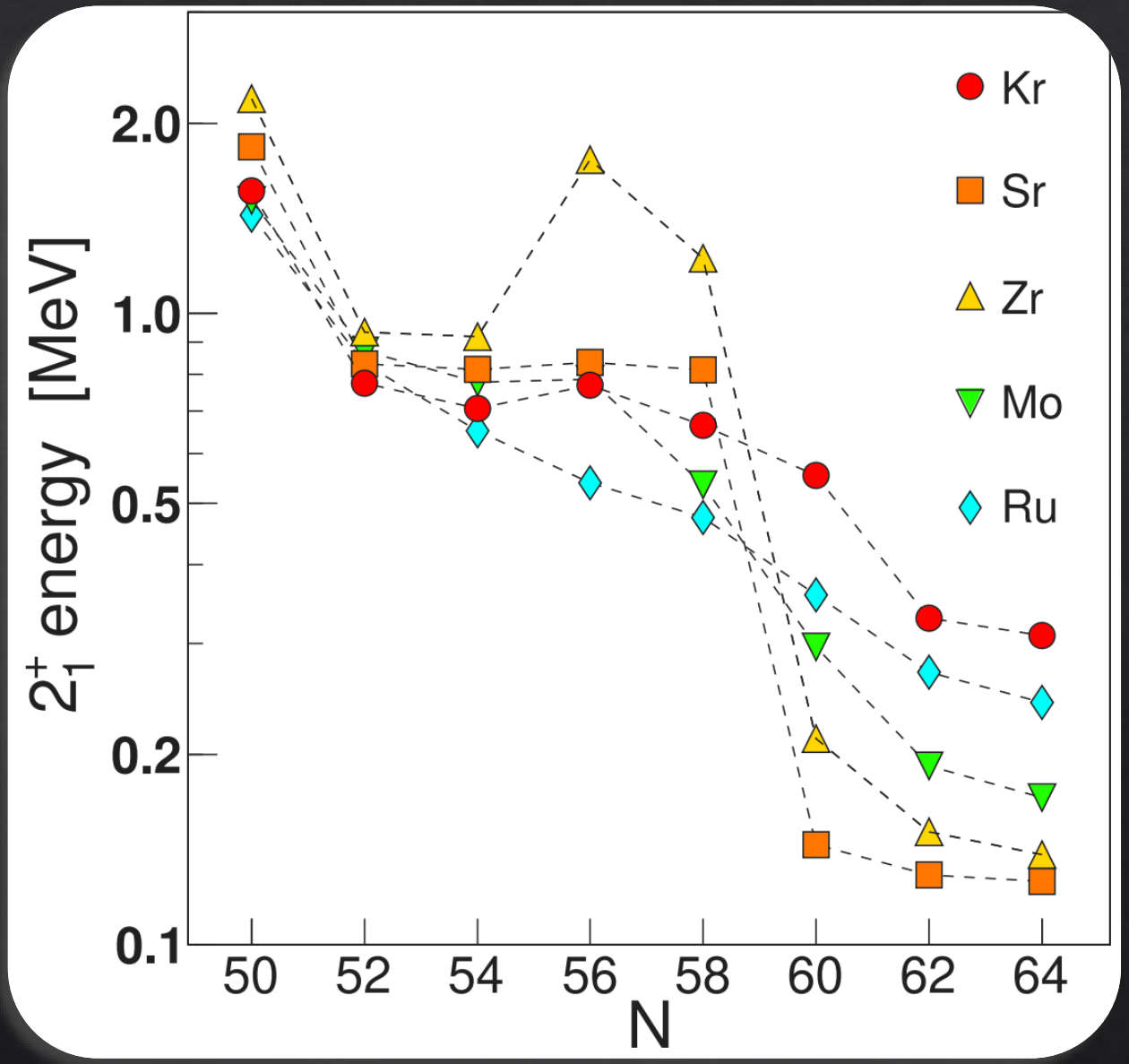
Study of the Shape Coexistence in ^{98}Zr using β decay

Konstantin Mastakov

CGS17

July 20, 2023

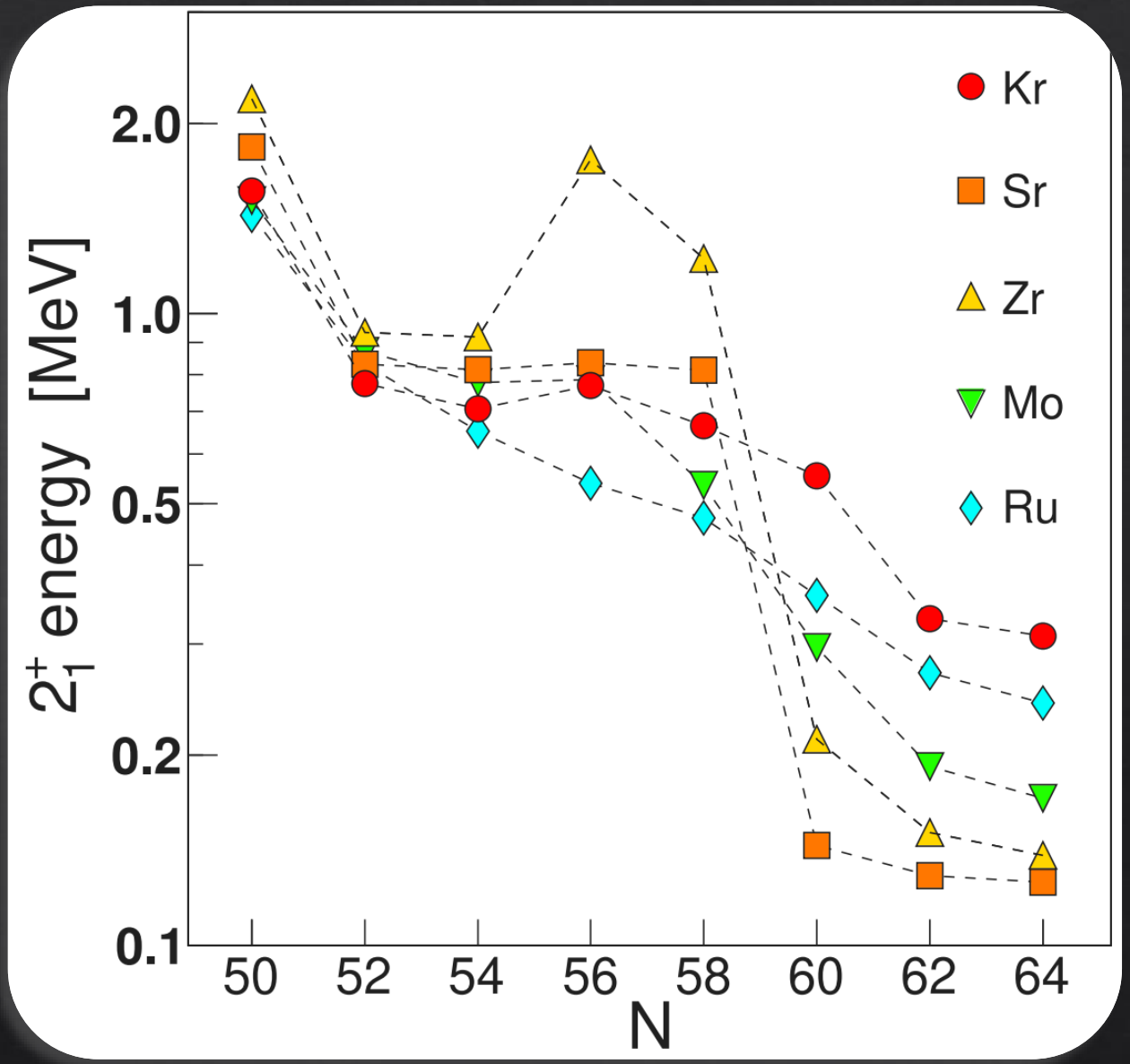
Systematics for A~100

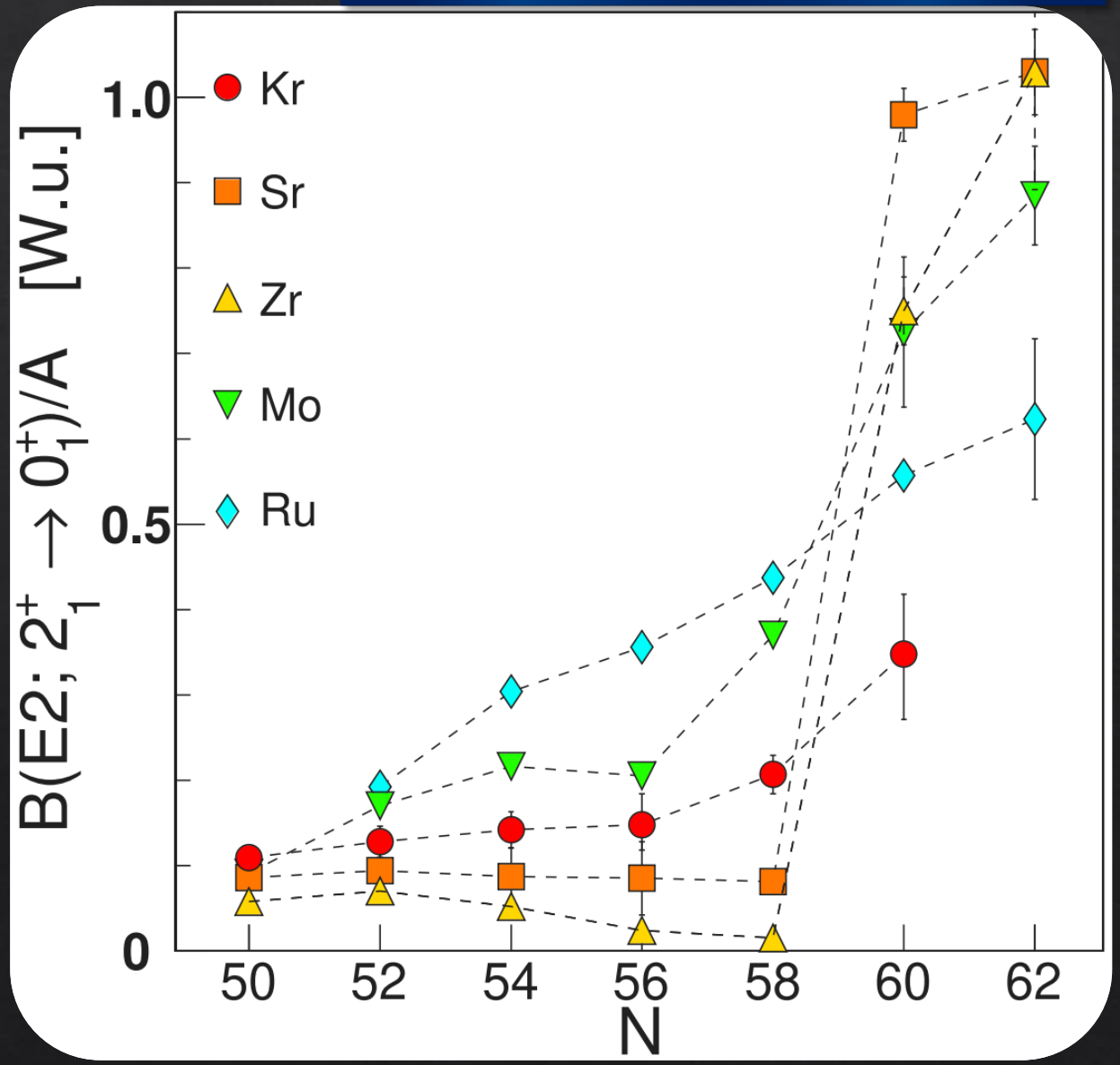


P. E. Garrett, M. Zielinska, E. Clément, Prog. Part. Nucl. Phys. ***124*** *(2022) 103931*

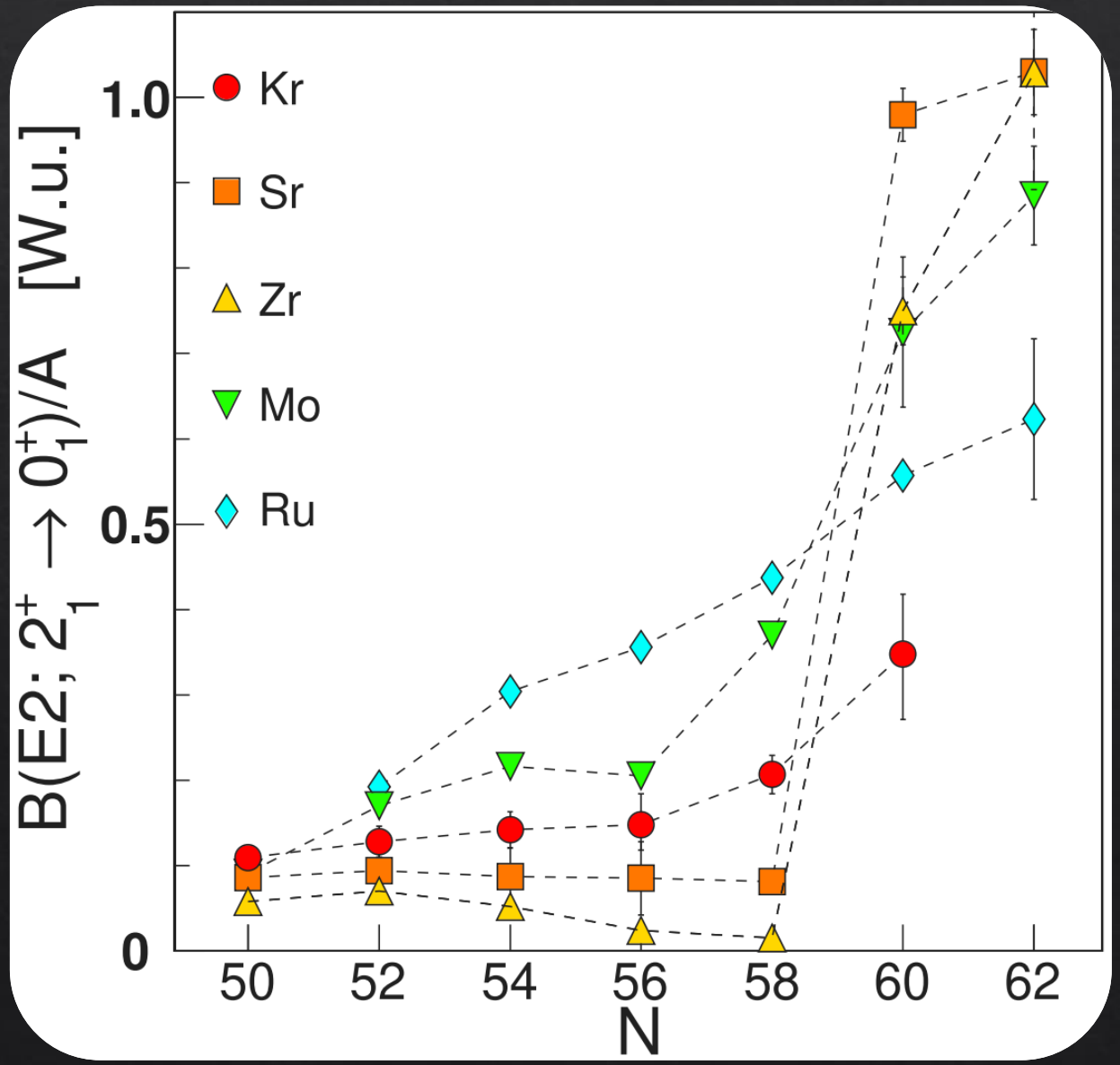
Systematics for A~100

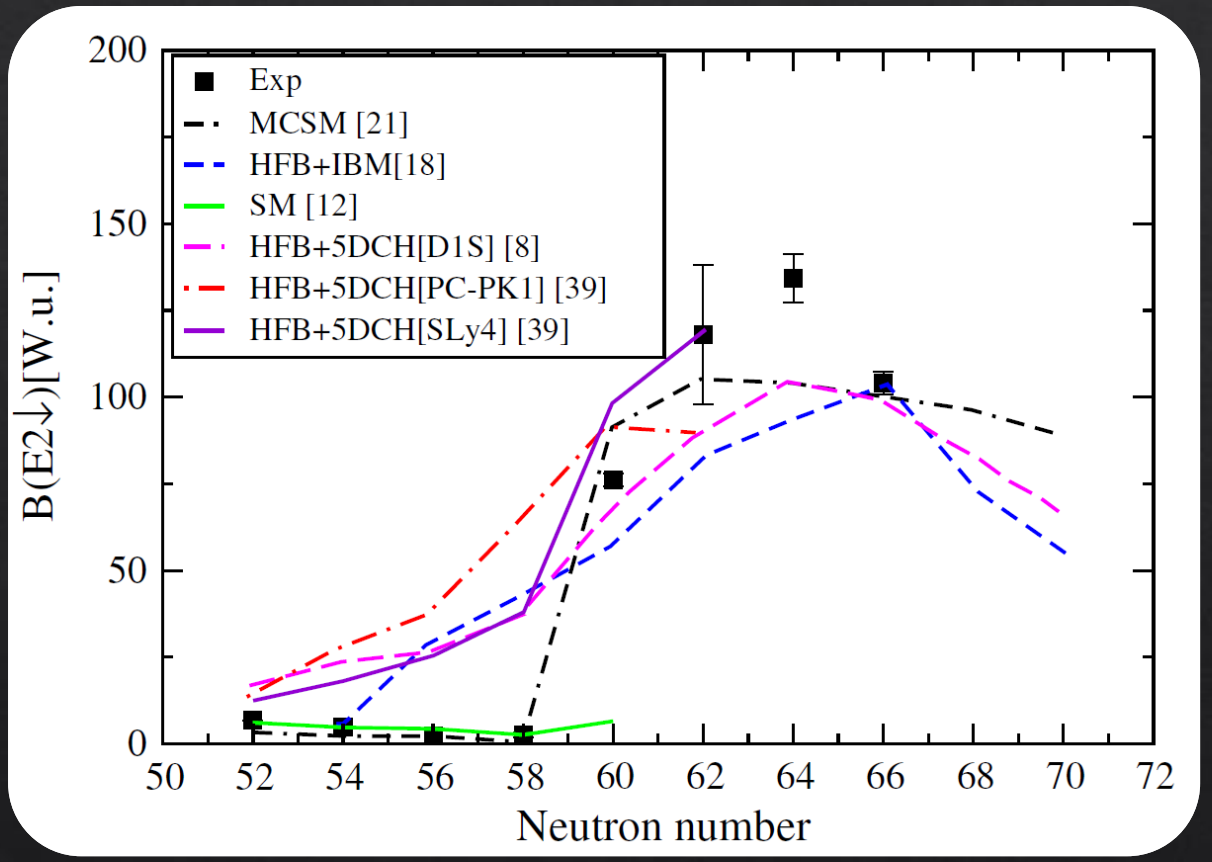
*P. E. Garrett, M. Zielinska, E. Clément, Prog. Part. Nucl. Phys. **124** (2022) 103931*





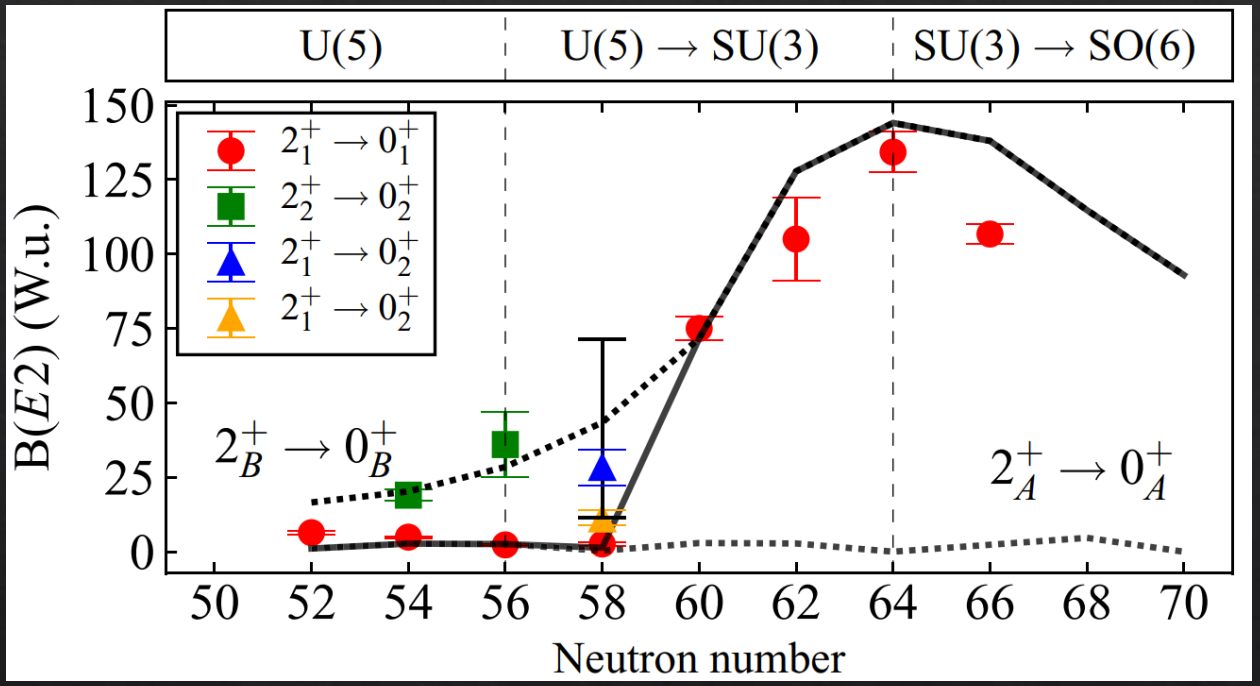
Systematics for A~100

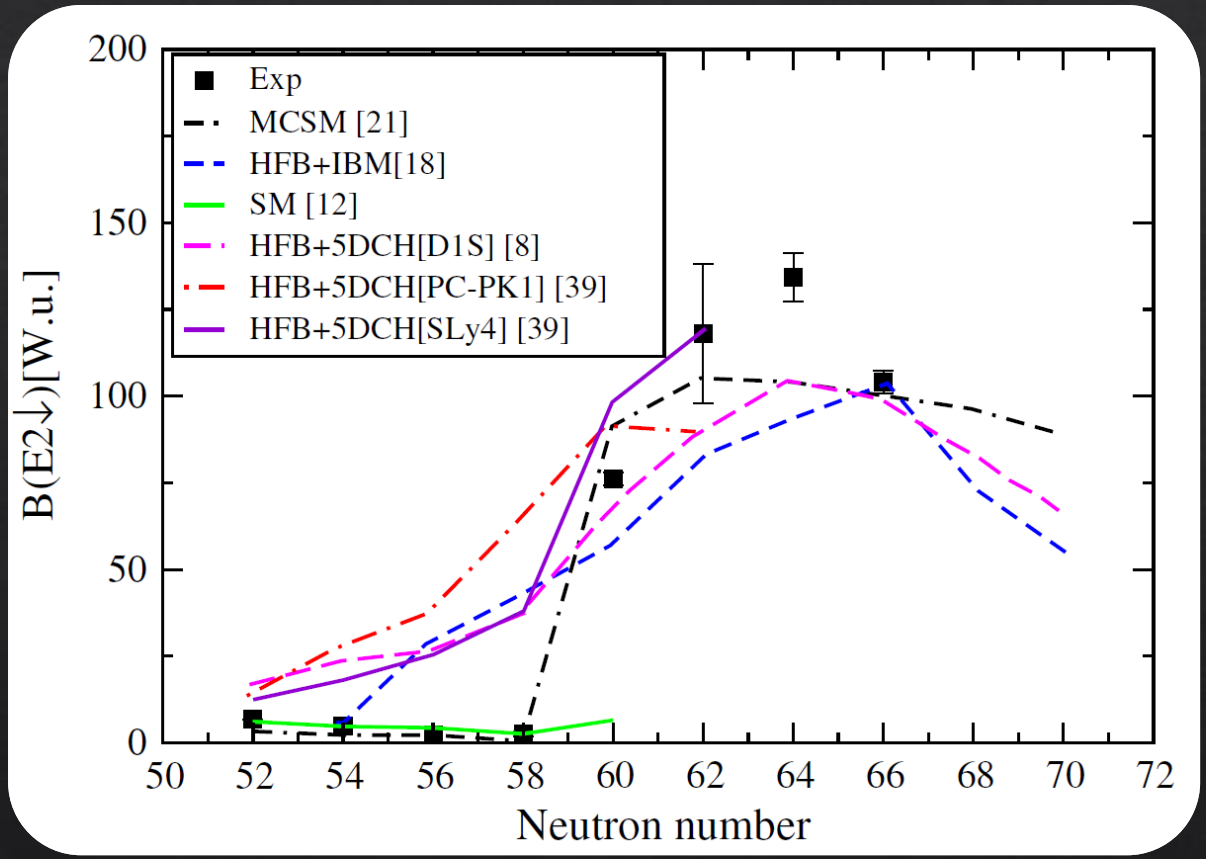




*P. Singh et. al, PRL **121**, 192501 (2018)*

Theoretical calculations vs Experiment



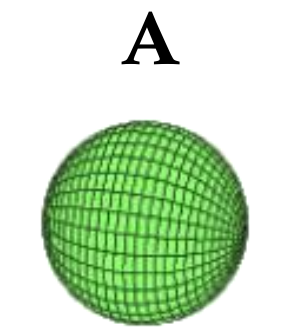


*N. Gavrielov, A. Leviatan and F. Iachello, PRC **105**, 014305 (2022)*

*P. Singh et. al, PRL **121**, 192501 (2018)*

P. E. Garrett, M. Zielinska, E. Clément,
Prog. Part. Nucl. Phys. ***124*** *(2022) 103931*

^{98}Zr



A

2^+ 1745

0.14(8)

0^+ 0

Singh *et al.*

Karayonchev *et al.*

2491 6^+ 6^+ 2491

103(36) 103(36)

1843 4^+ 4^+ 1843

68(22) 38(20)

1590 2^+ 25(11) 1590 2^+

43(14) 1436 0^+ 46(25) 1436 0^+

2^+ 1223 2^+ 1223

28(6) 51(5) 76(6) 11(3) 1.8(10) 51(5) 76(6)

0^+ 854 0^+ 854

2.9(6) 1.1(3) 0.26(14)

11.2(12) 11.2(12)

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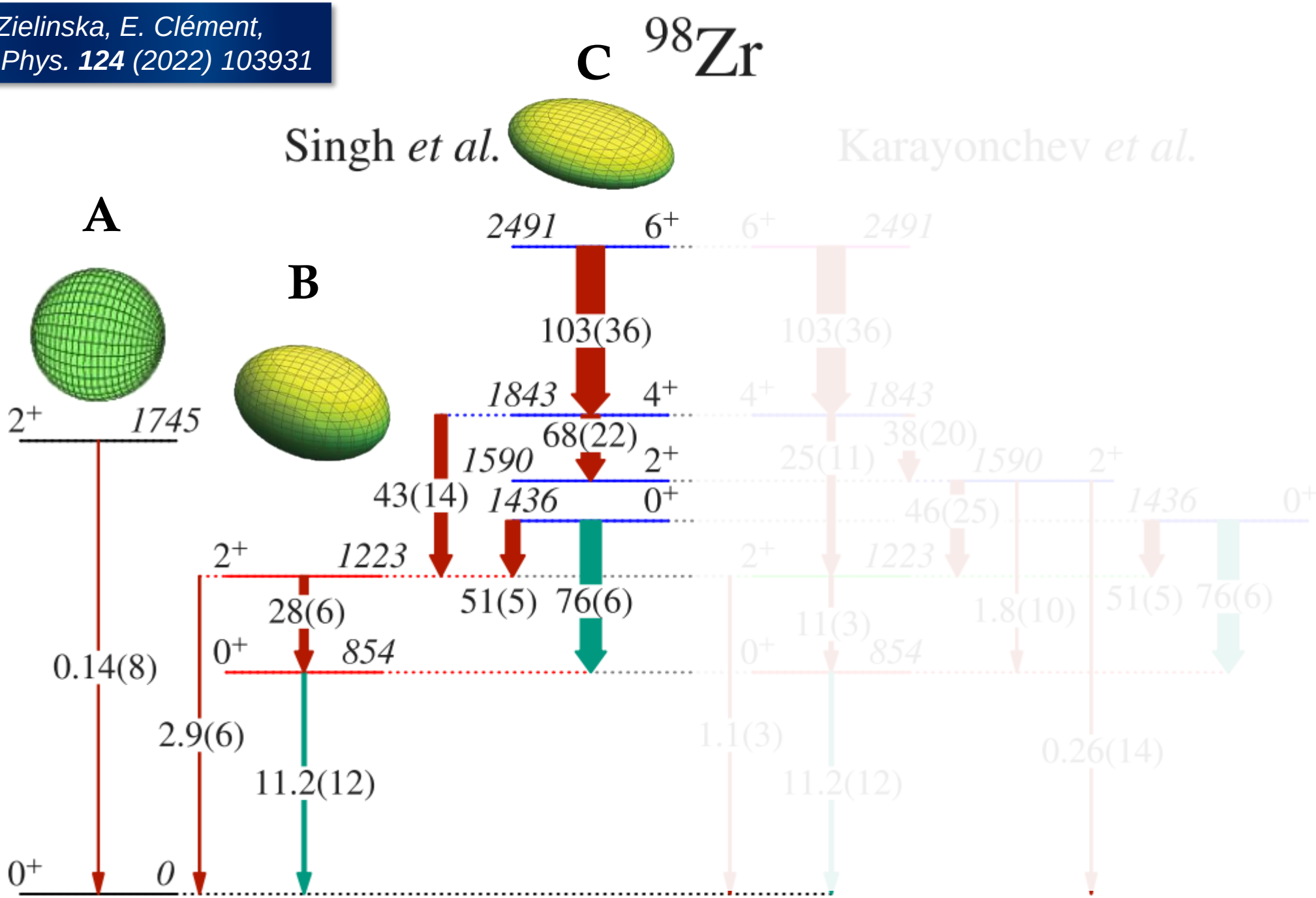

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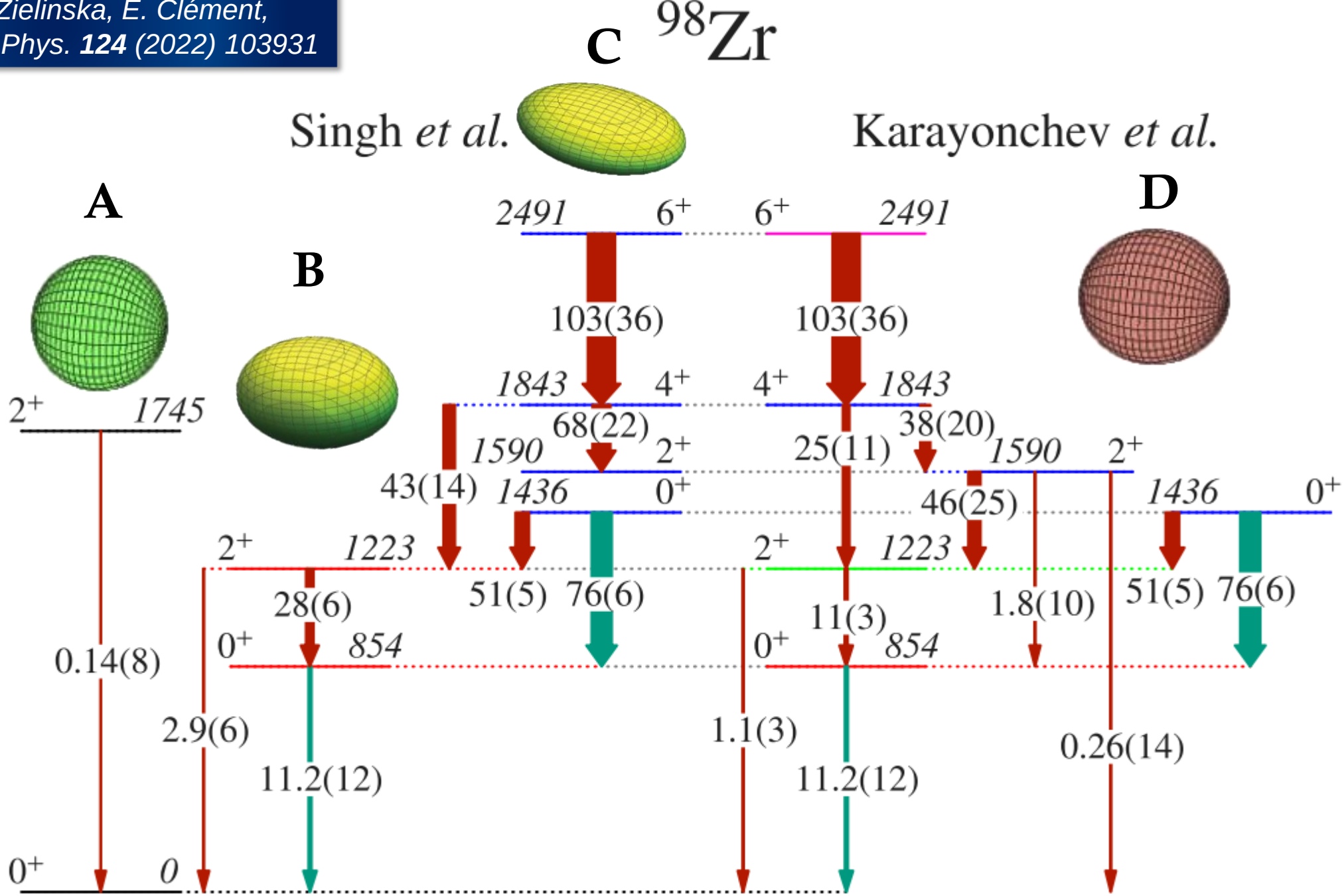
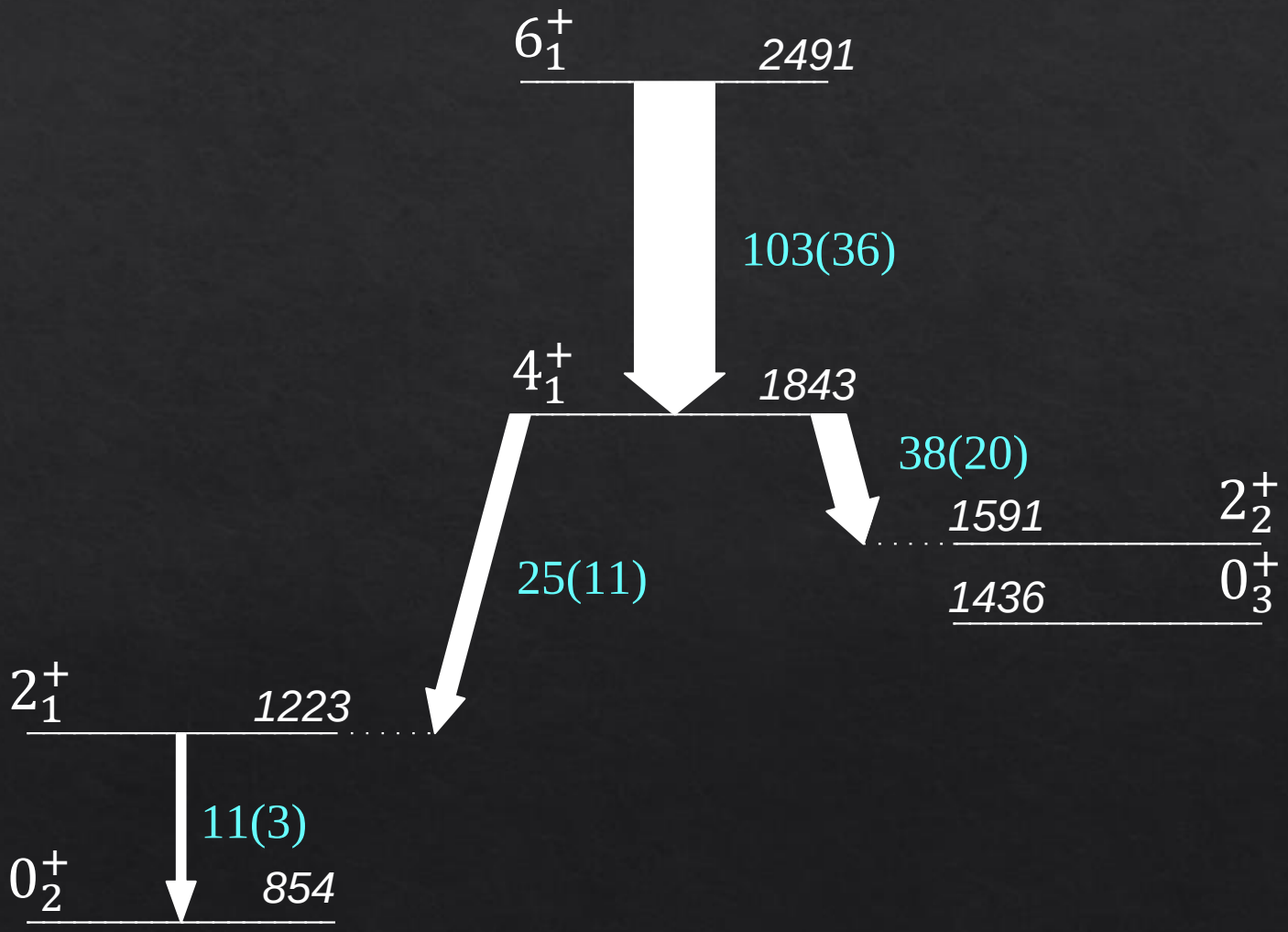


Two interpretations for the band assignments

$B(E2)$ W.u.



Missing branching ratio

MCSM:

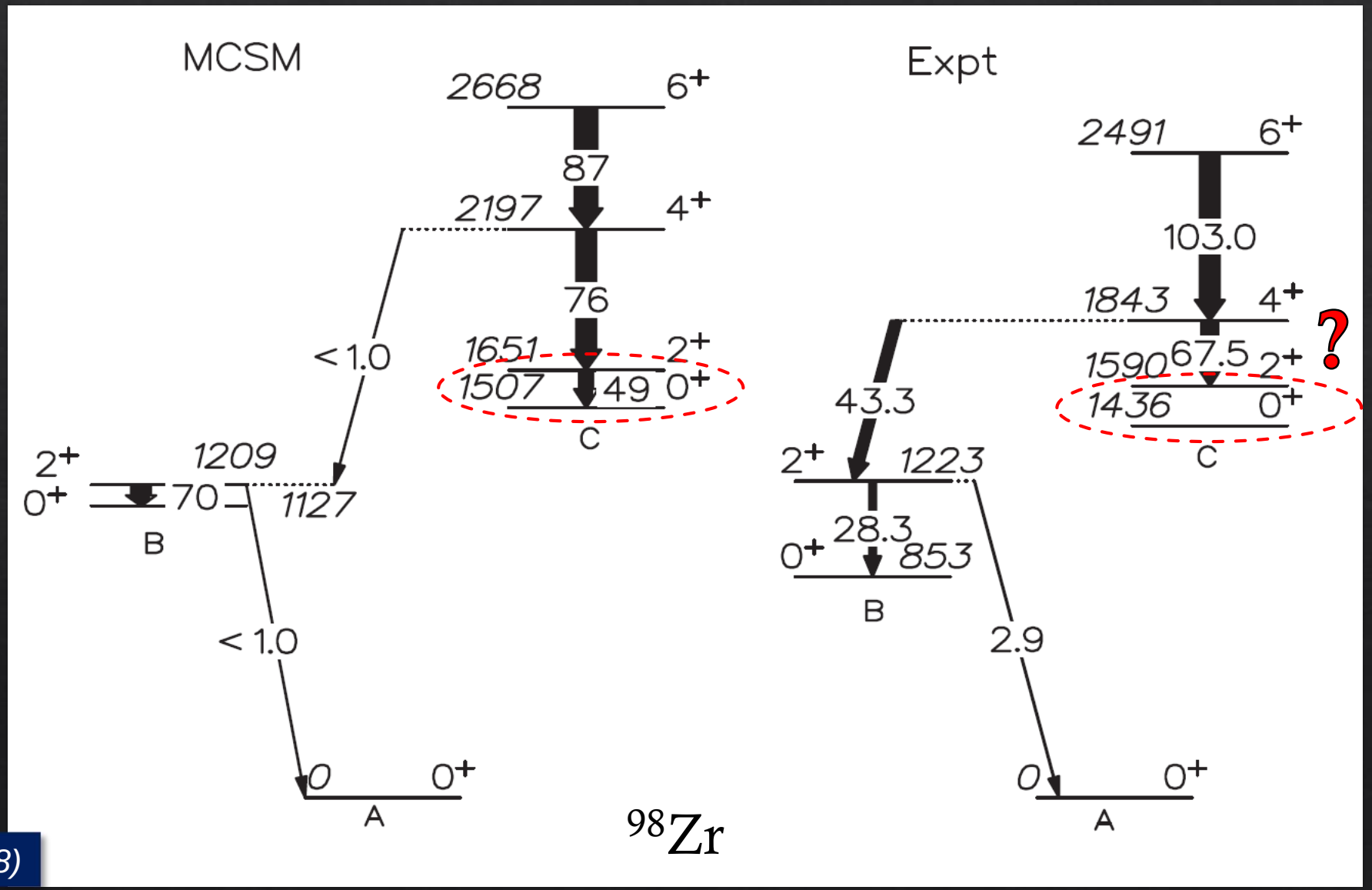
$B(E2; 2_2^+ \rightarrow 0_3^+) = \mathbf{49.0\ W.u.}$

IBM-CM-1:

$B(E2; 2_2^+ \rightarrow 0_3^+) = \mathbf{6.54\ W.u.}$

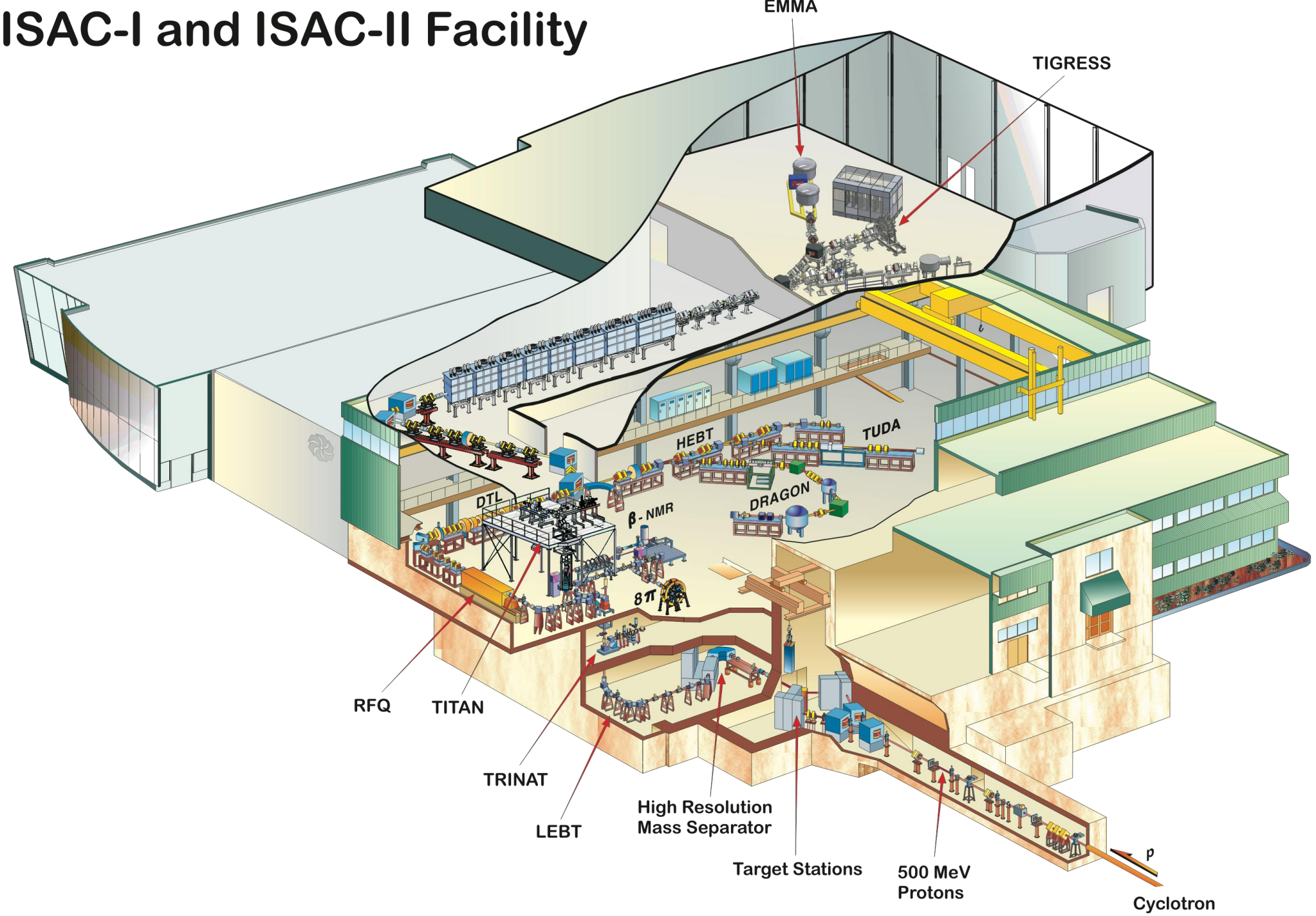
IBM-CM-2:

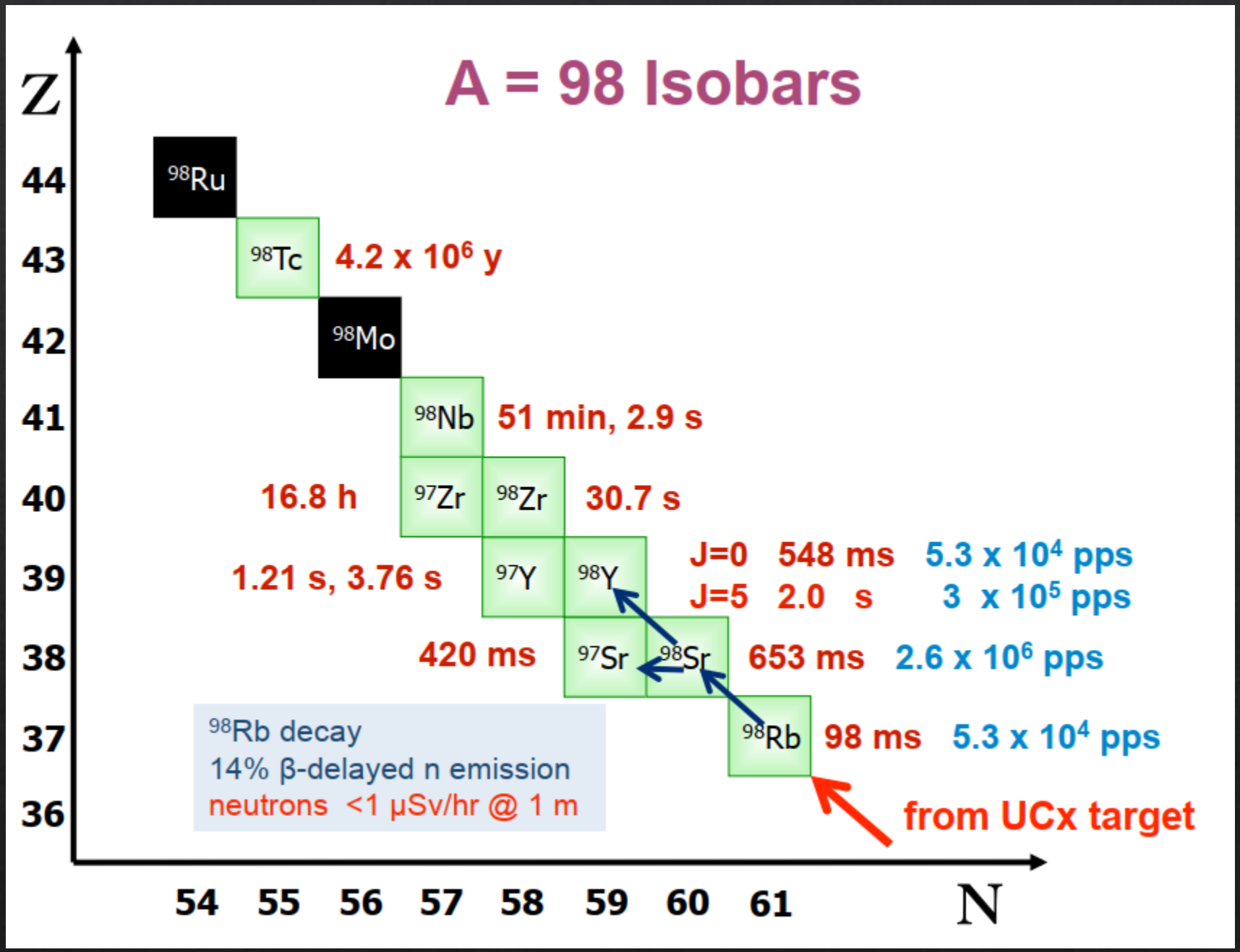
$B(E2; 2_2^+ \rightarrow 0_3^+) = \mathbf{3.20\ W.u.}$



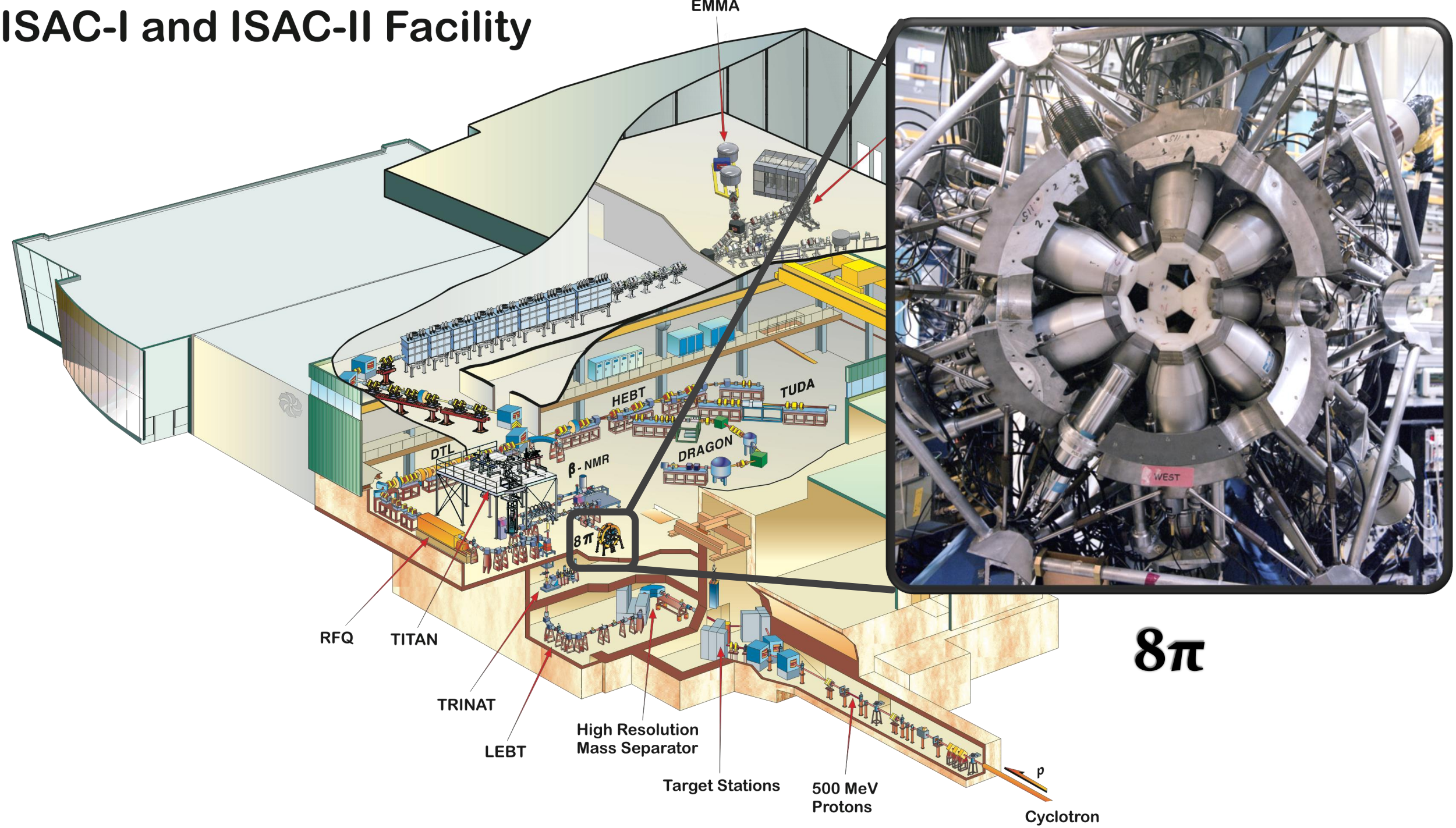
*P. Singh et. al, PRL **121**, 192501 (2018)*

ISAC-I and ISAC-II Facility



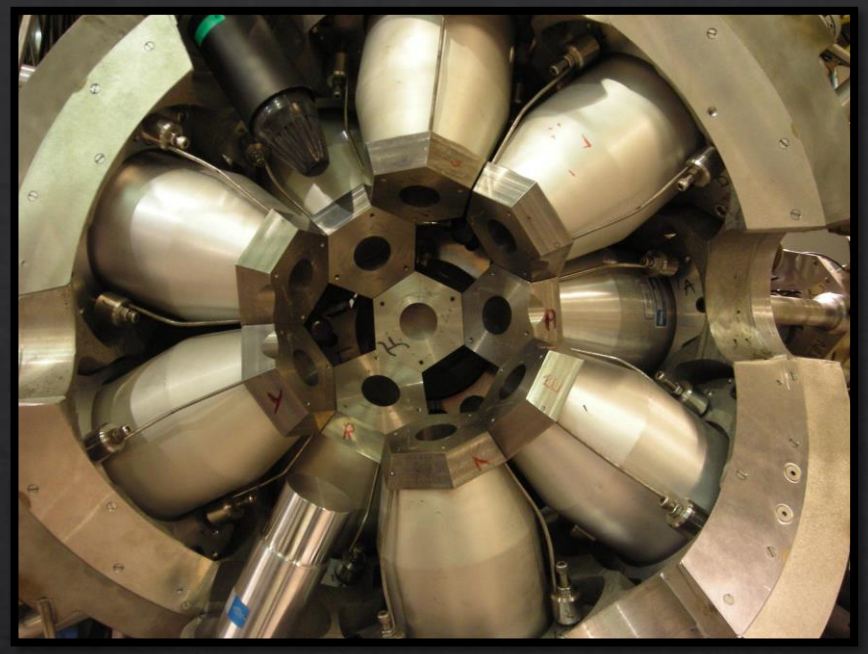

A = 98 Isobars
Z
44
43
42
41
40
39
38
37
36
54
55
56
57
58
59
60
61
N
98Ru
98Tc
4.2 x 10^6 y
98Mo
98Nb
51 min, 2.9 s
16.8 h
97Zr
98Zr
30.7 s
1.21 s, 3.76 s
97Y
98Y
J=0 548 ms 5.3 x 10^4 pps
J=5 2.0 s 3 x 10^5 pps
420 ms
97Sr
98Sr
653 ms 2.6 x 10^6 pps
98Rb
98 ms 5.3 x 10^4 pps
98Rb decay
14% β-delayed n emission
neutrons <1 μSv/hr @ 1 m
from UCx target

ISAC-I and ISAC-II Facility



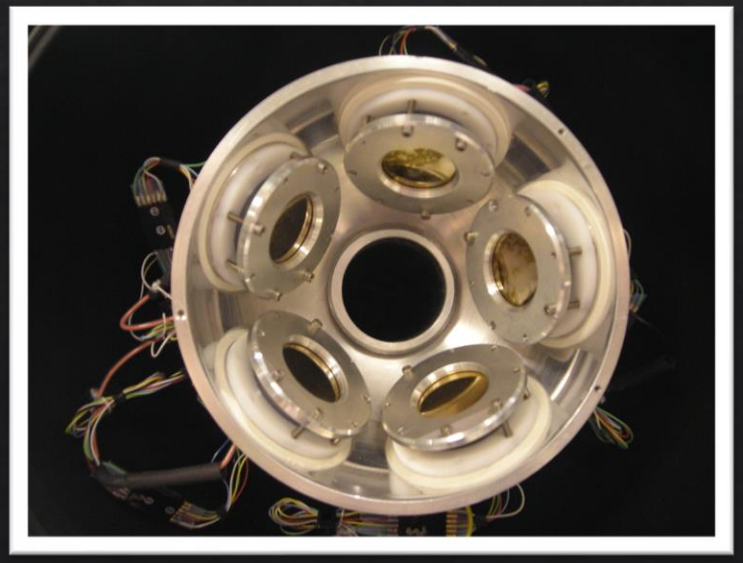
8π

Measurements using the 8π@TRIUMF-ISAC and β decay to populate ^{98}Zr

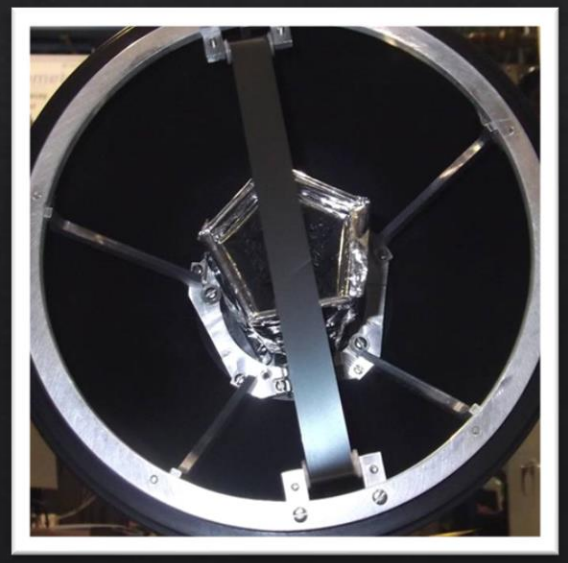


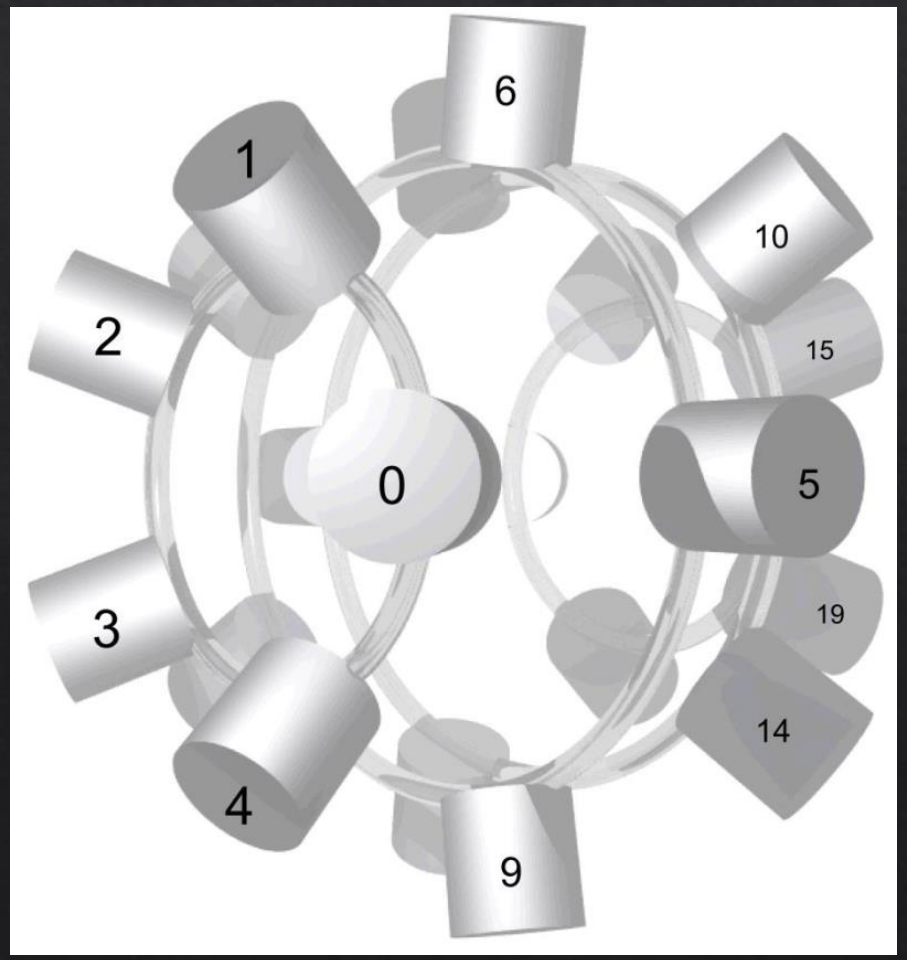
8π

PACES

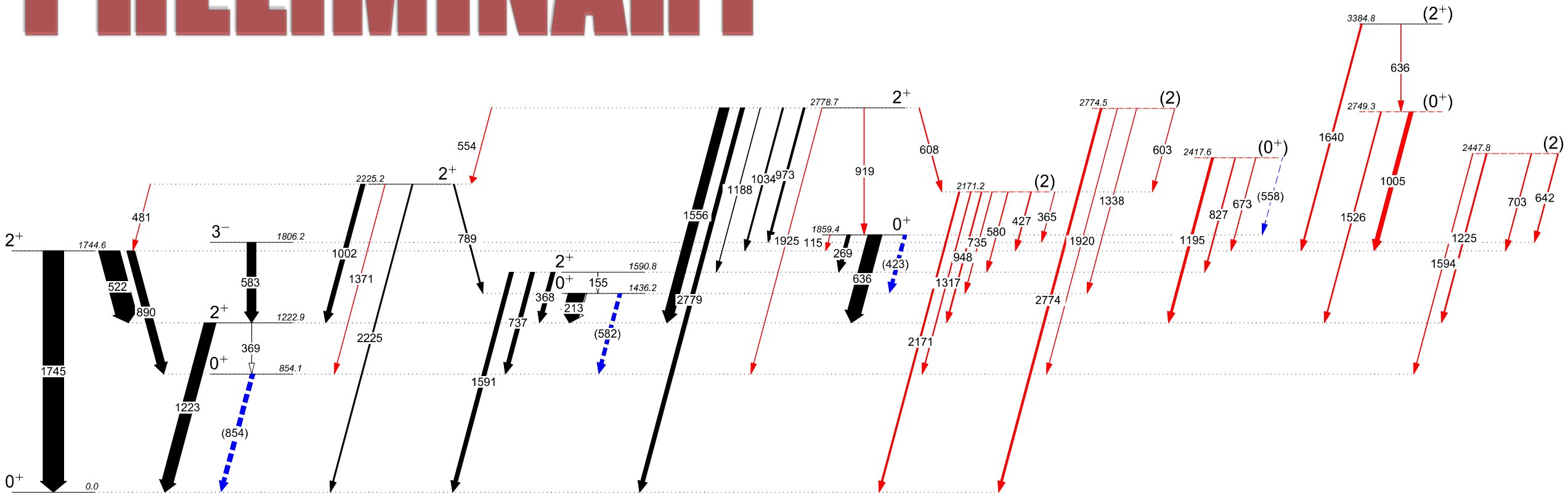


SCEPTAR





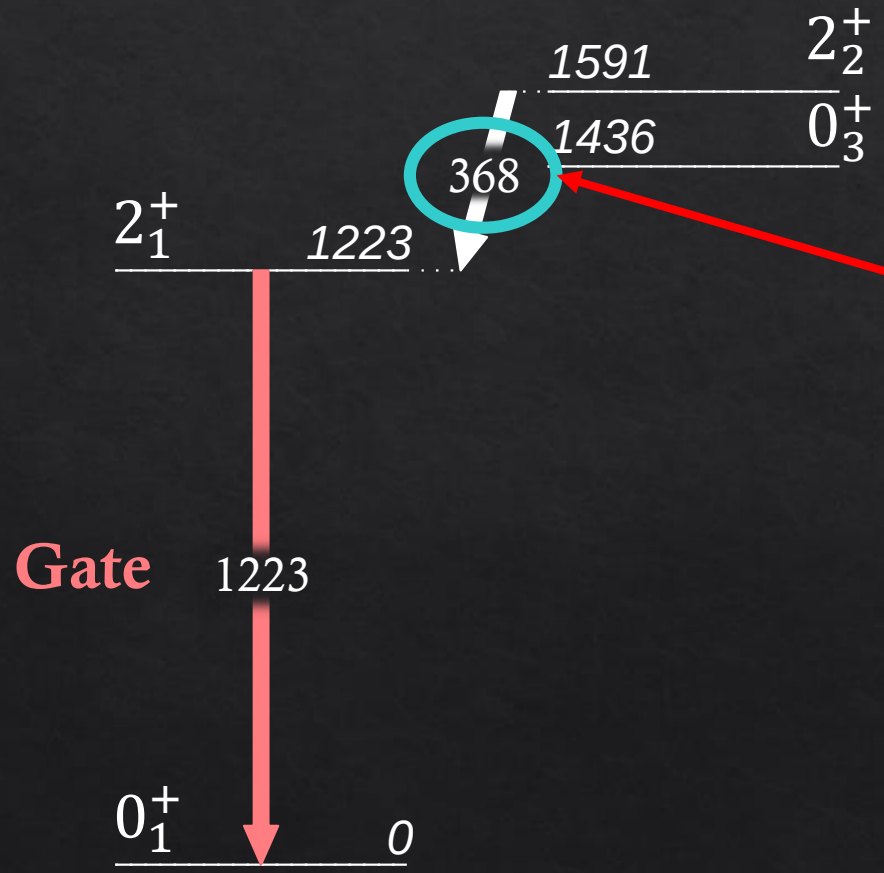
PRELIMINARY

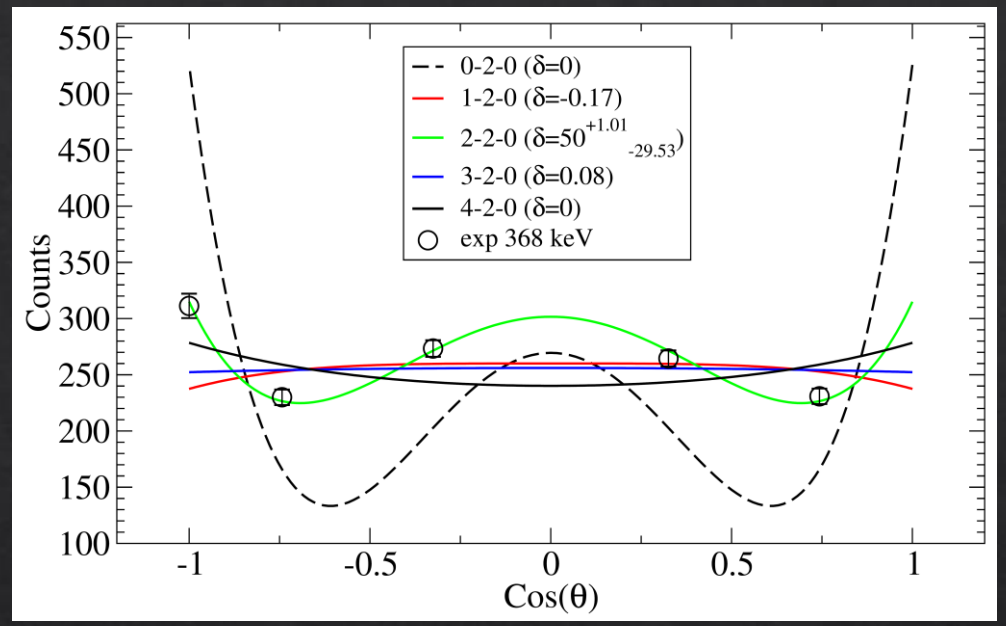


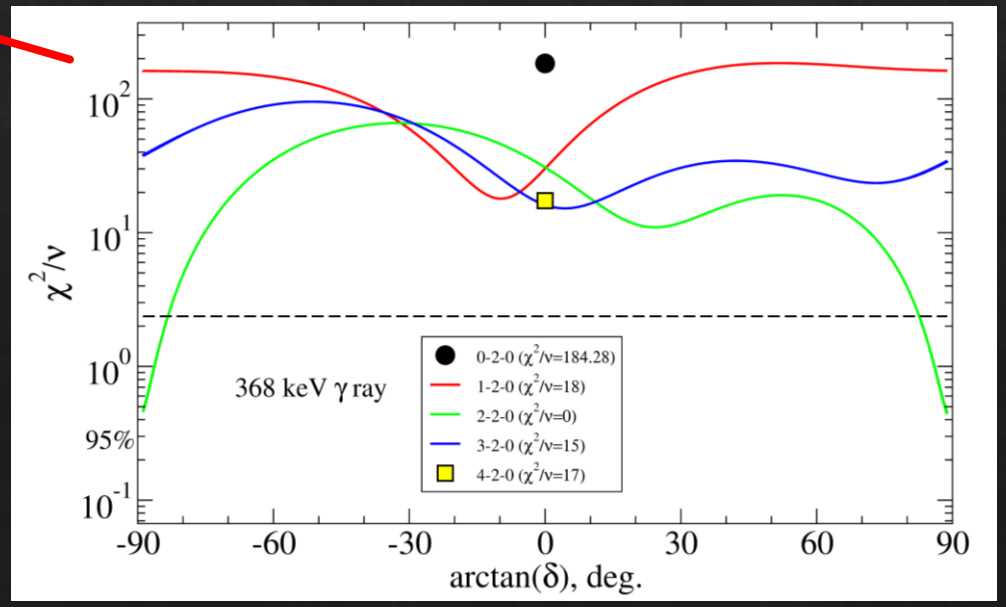
^{98}Zr

Angular Correlations

- $J^{\pi} \rightarrow 2_1^+ \rightarrow 0_1^+$ cascade, determined both $J^{(\pi)}$ and E2/M1 mixing ratio (δ)

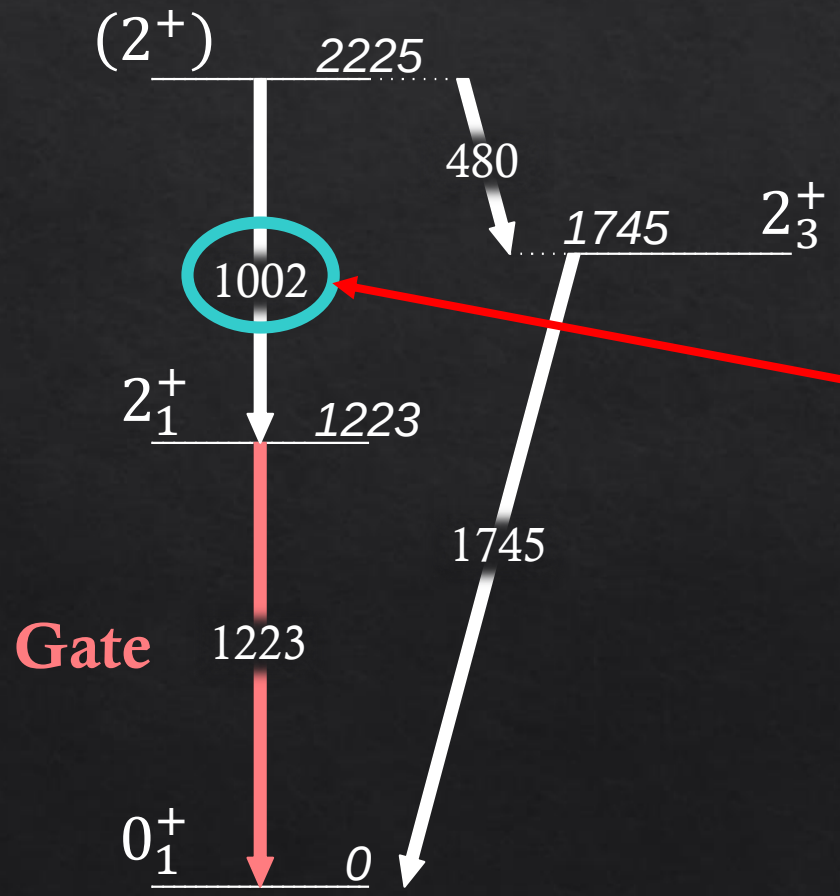


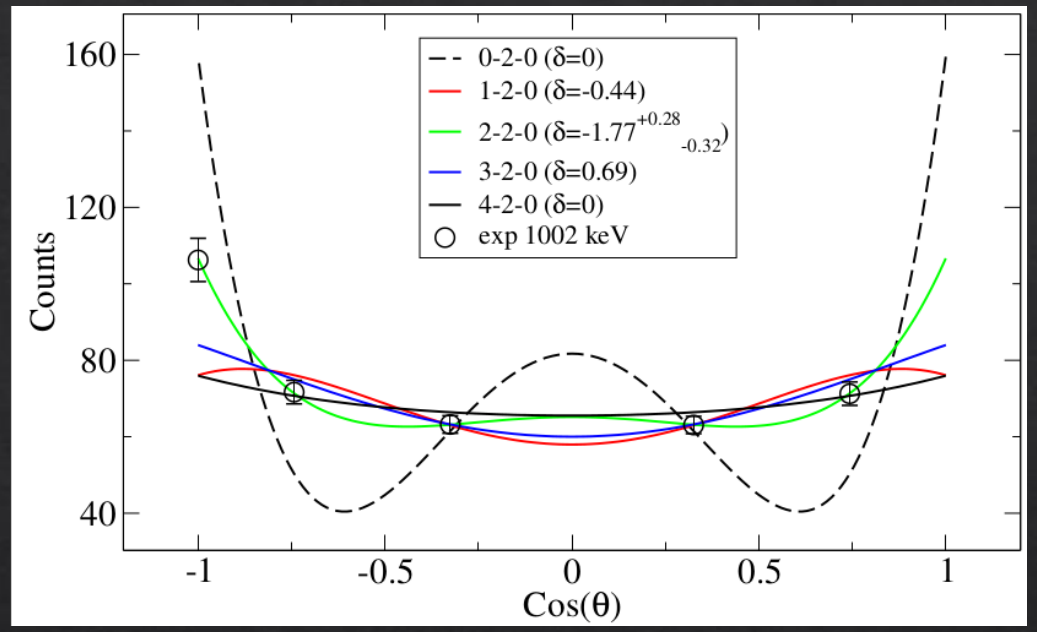


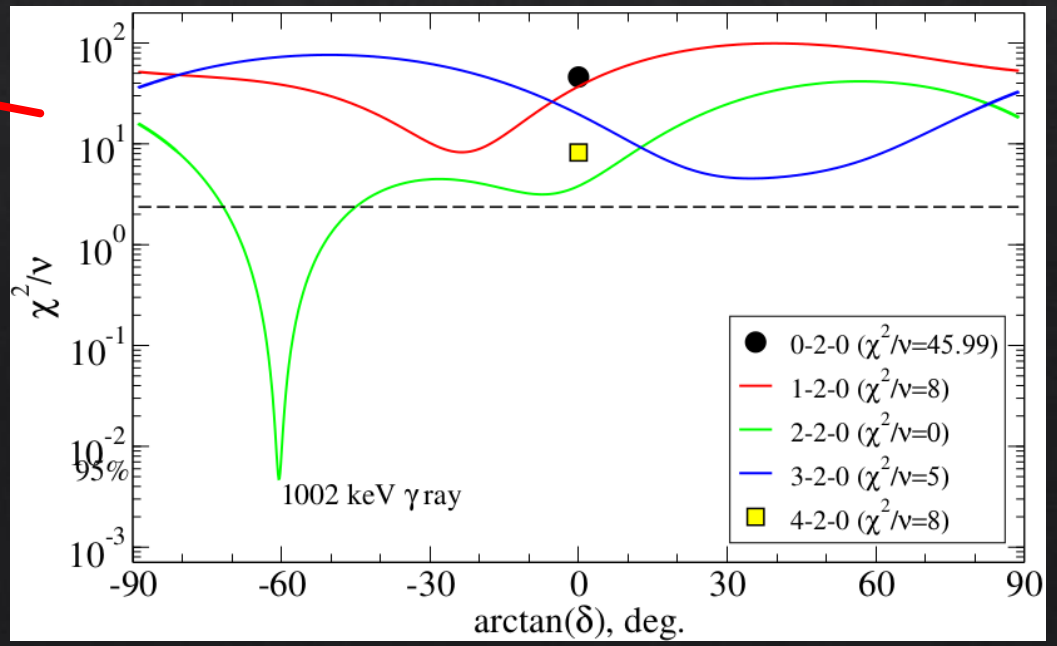


Angular Correlations

Firmly established the $J^{\pi}=2^{+}$ character for states at 2225 and 2779 keV







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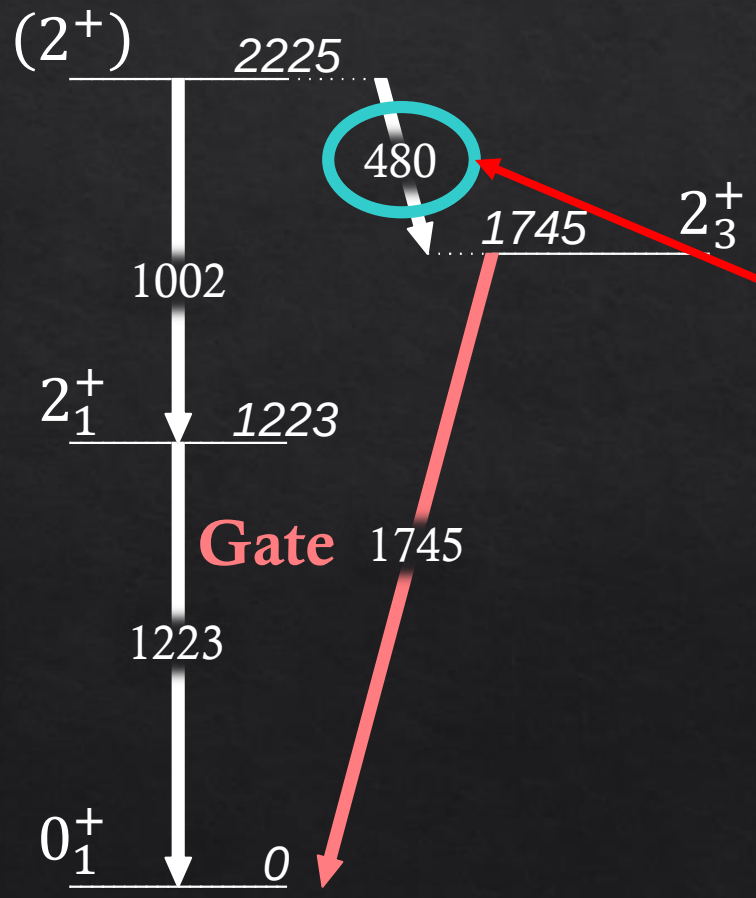
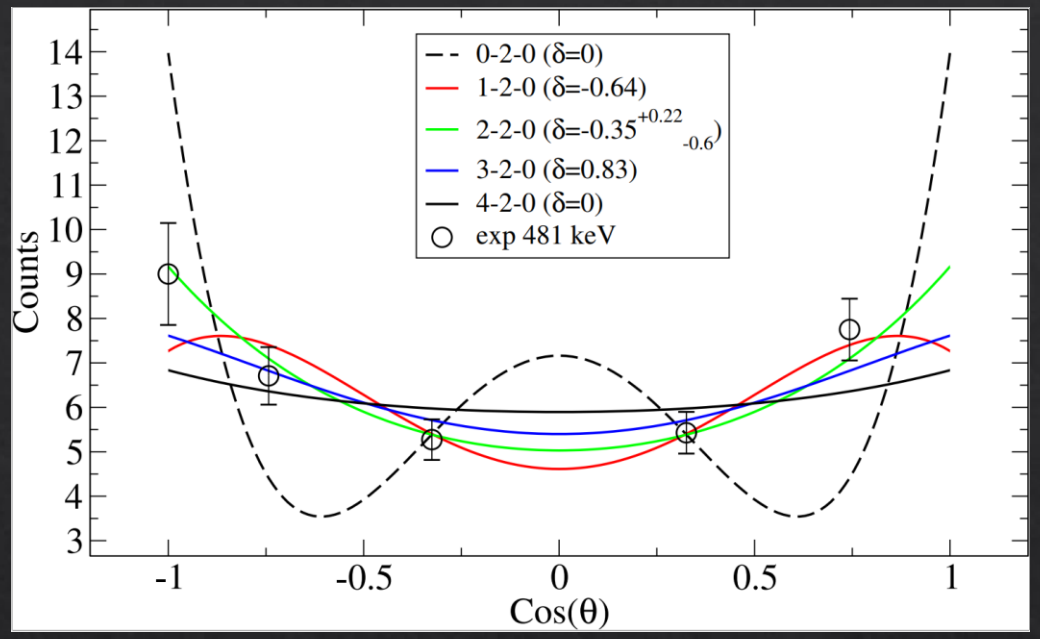
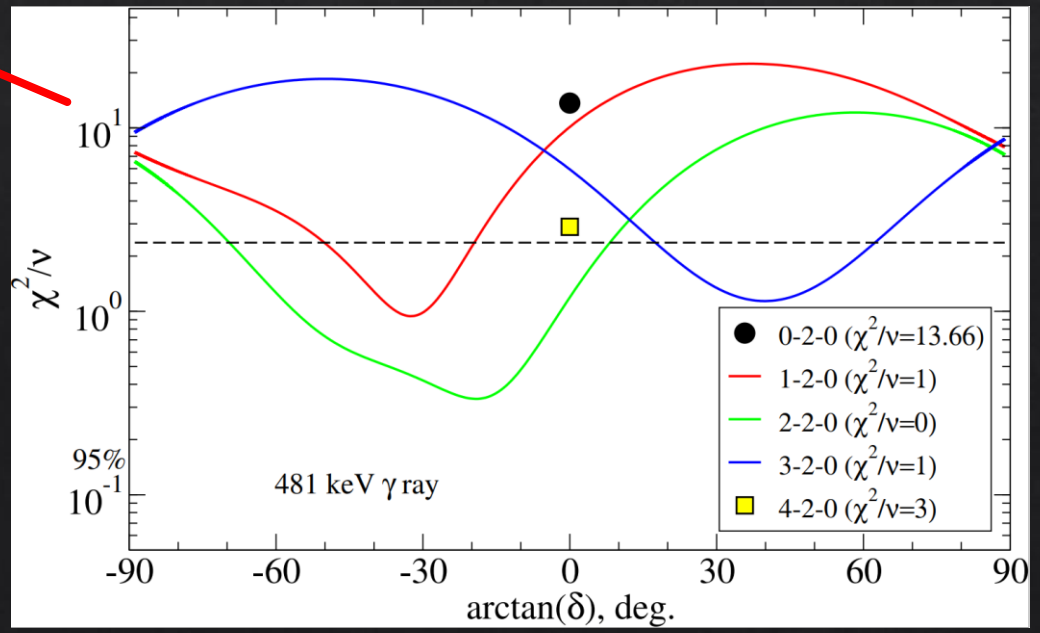
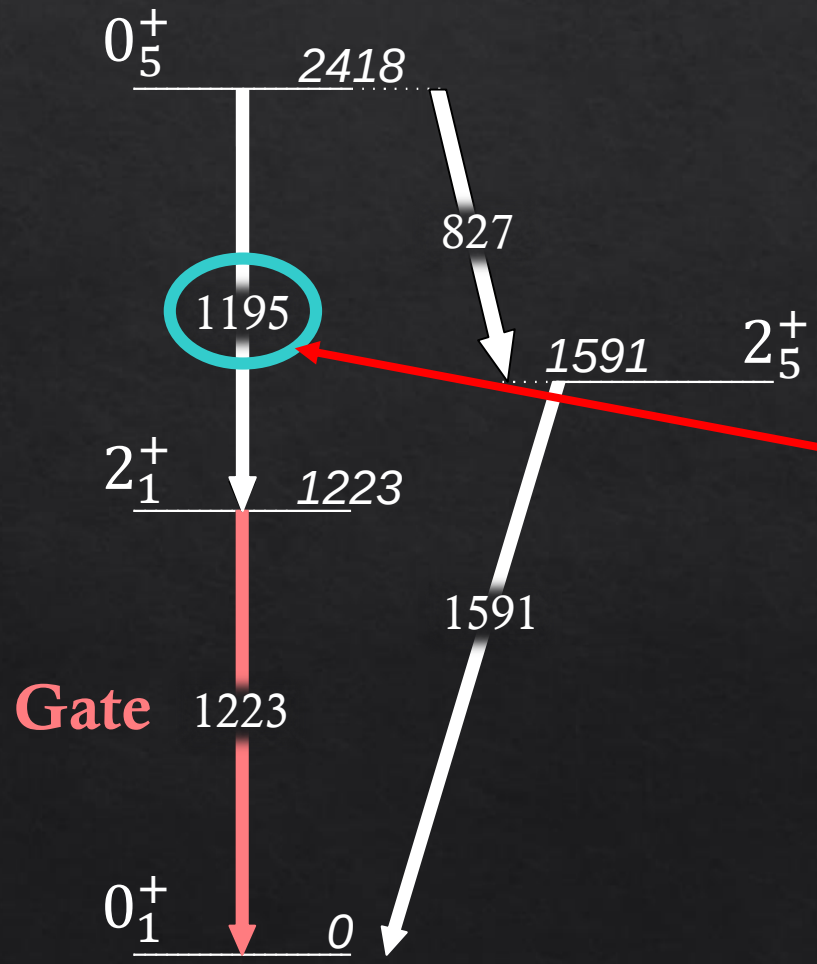


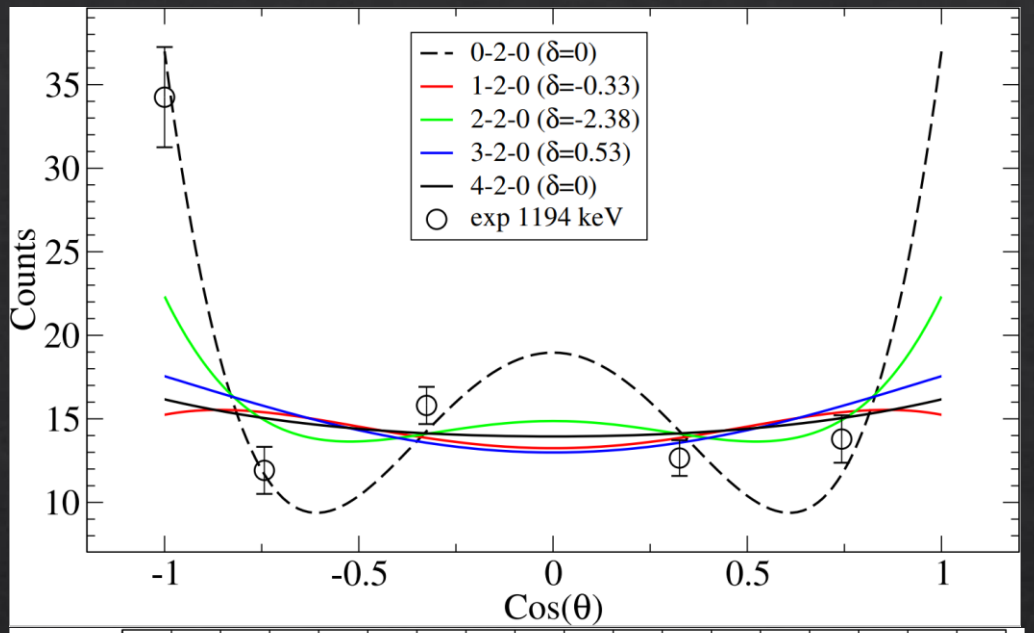


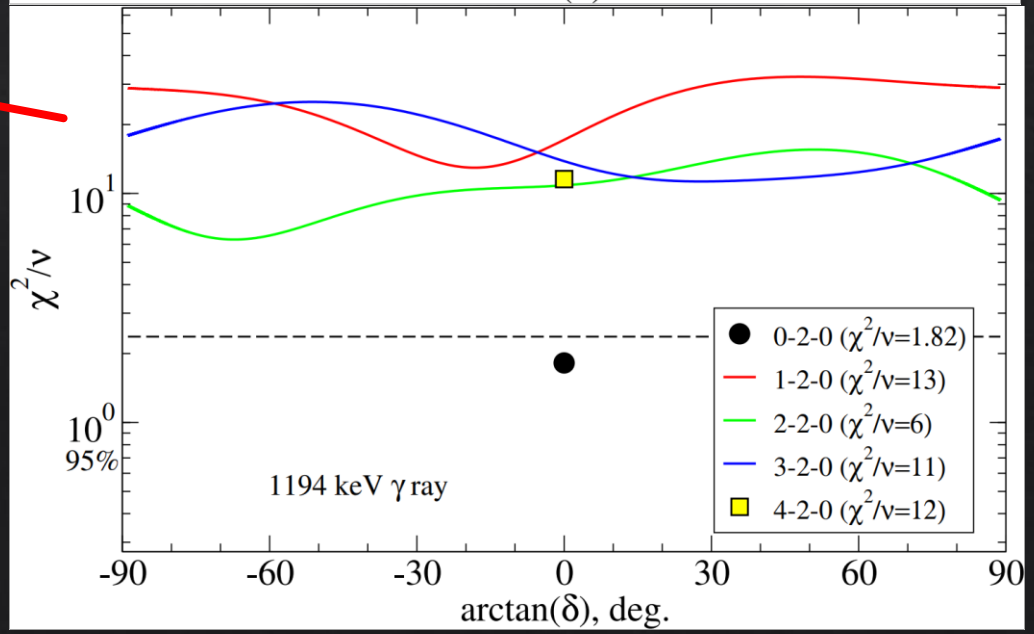


Angular Correlations

Identified previously unknown 0_5^+ and 0_6^+ levels at 2418 keV and 2749 keV







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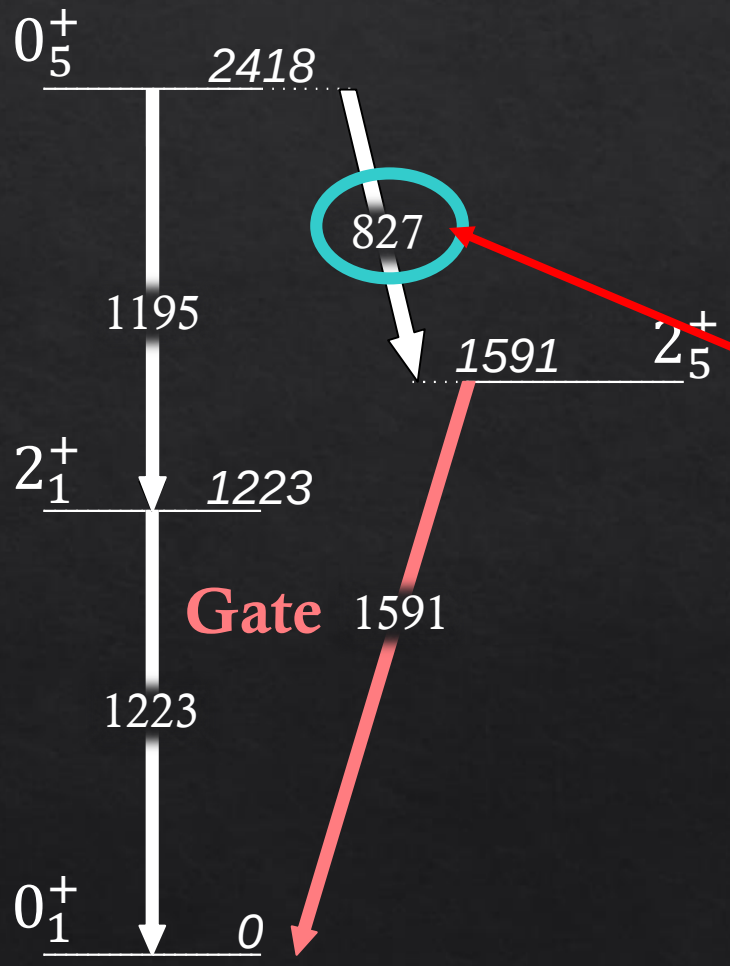
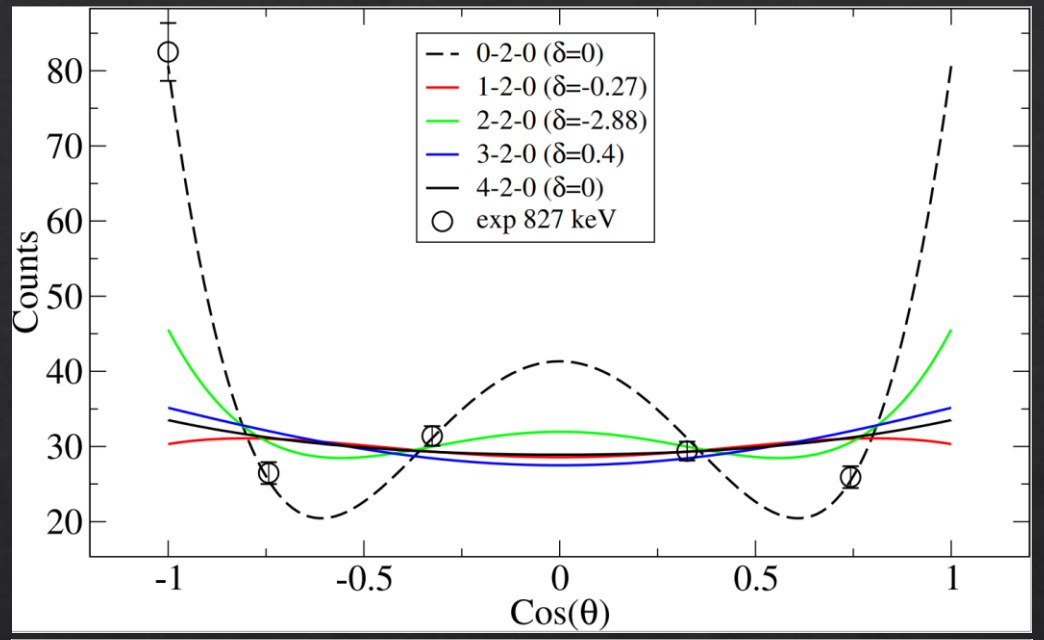
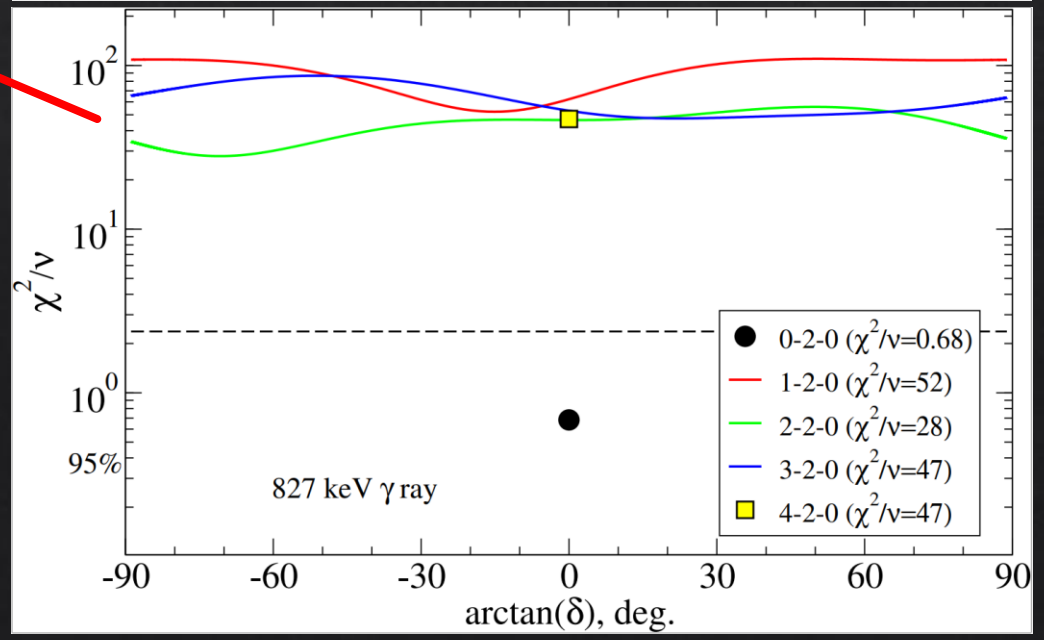
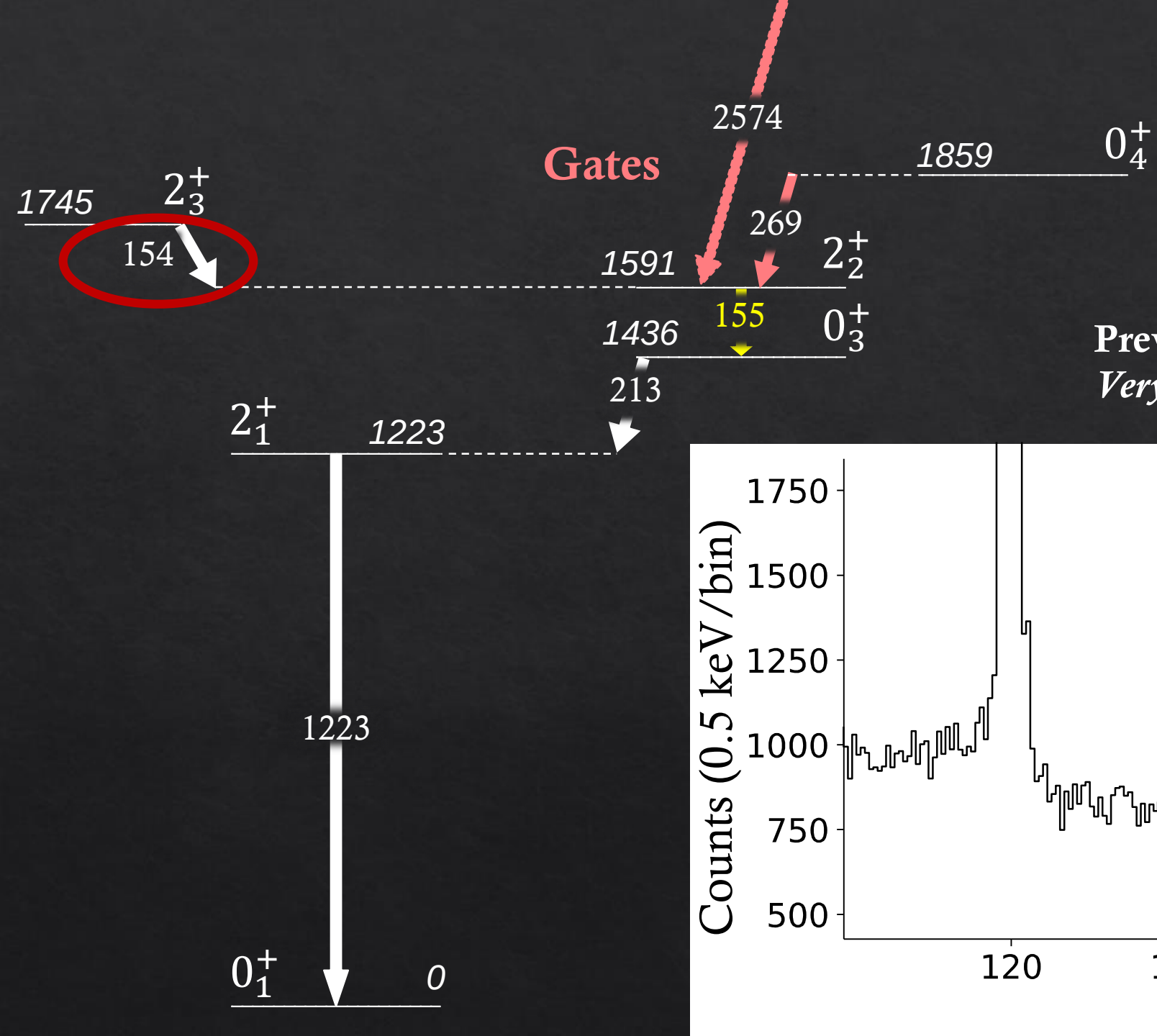


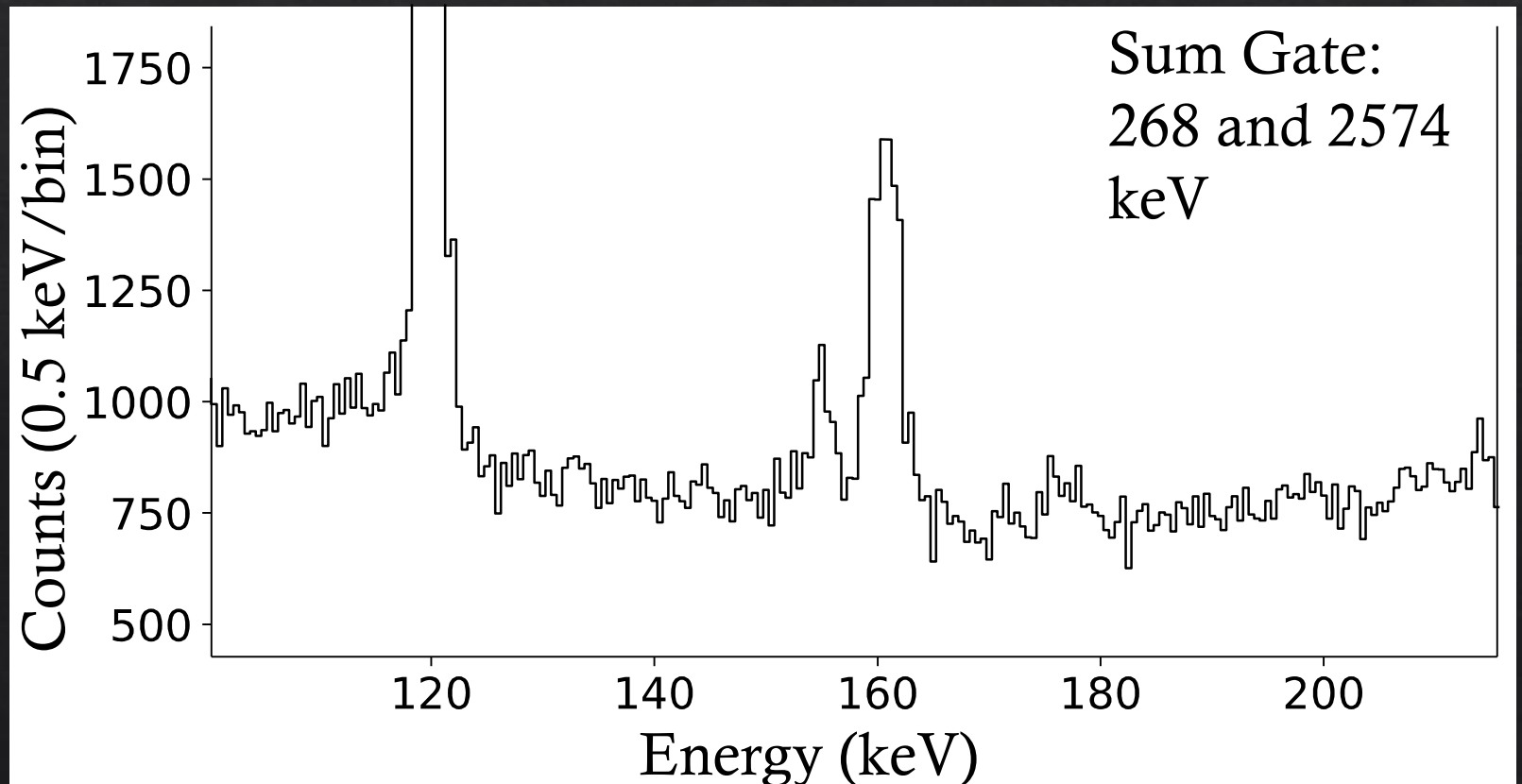






Previous branch: ~1.5%

***Very* new result: =0.109(22)%**



Missing branching ratio

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$B(E2; 2_2^+ \rightarrow 0_3^+) = \mathbf{49.0}$

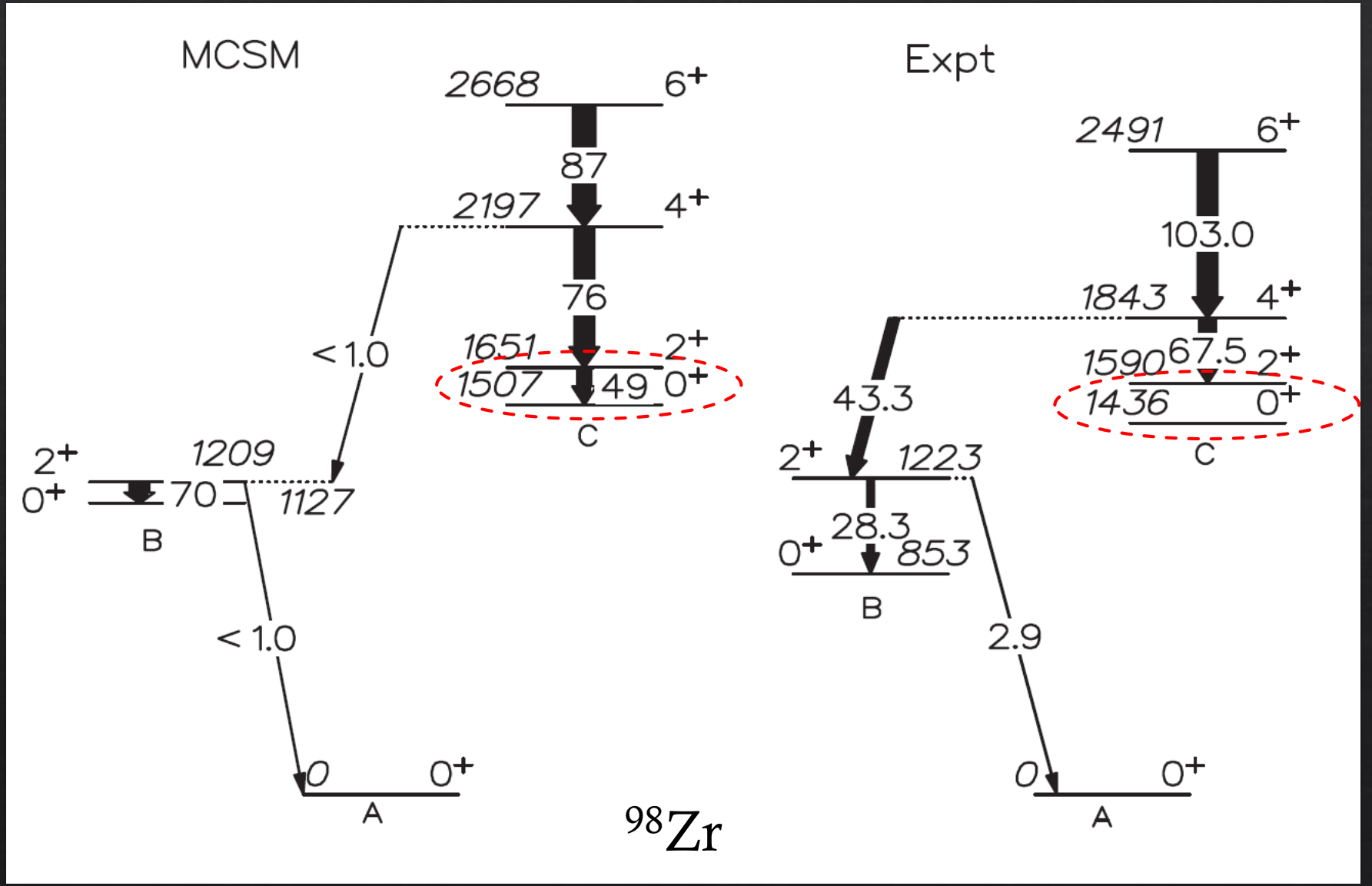
IBM-CM-1:

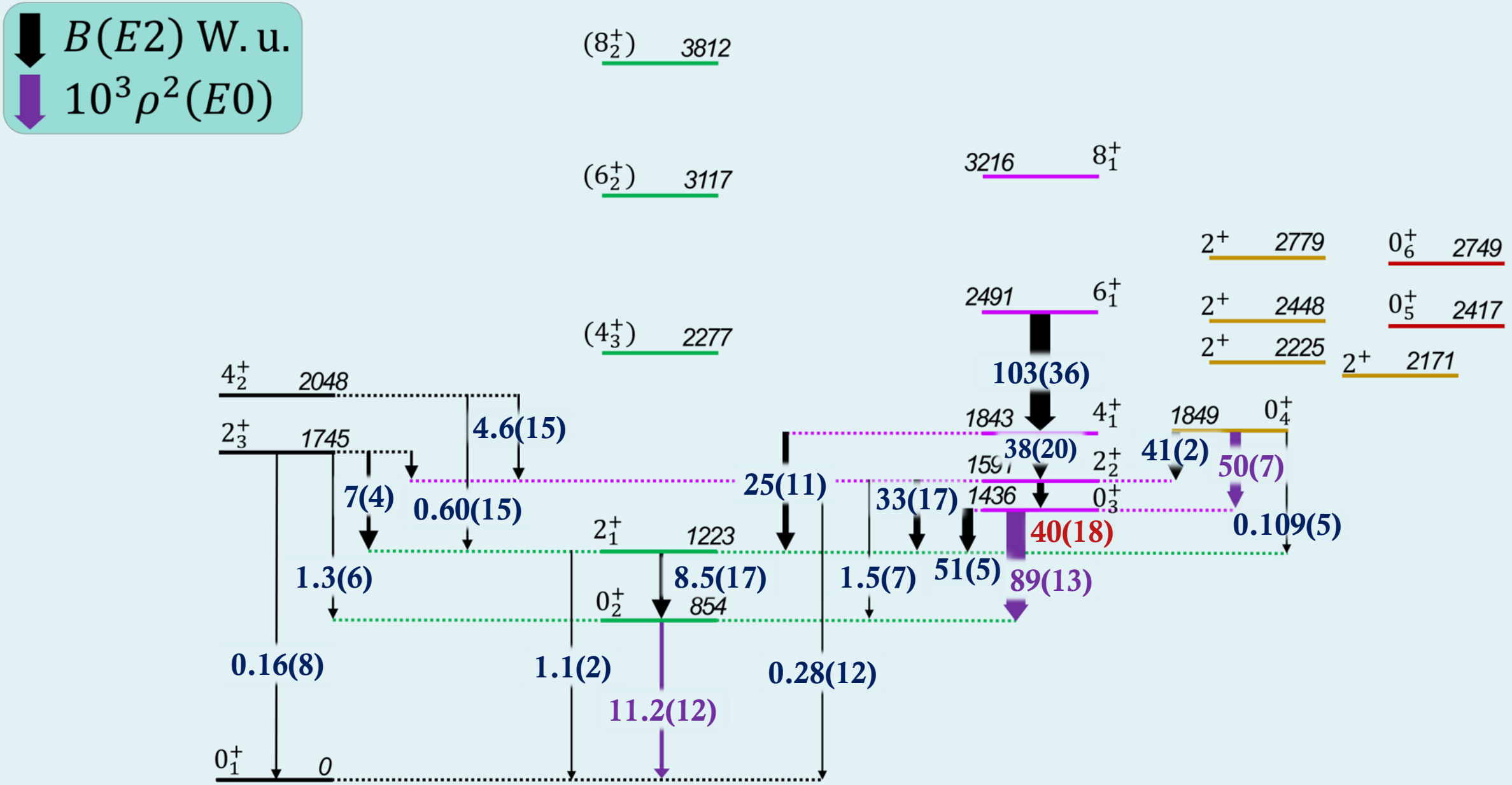
$B(E2; 2_2^+ \rightarrow 0_3^+) = \mathbf{6.54}$

This work:

BR(155 keV) = 0.109(22)%

$B(E2; 2_2^+ \rightarrow 0_3^+) = \mathbf{40(18)}$




$B(E2)$ W.u.
$10^3\rho^2(E0)$
(8_2^+) 3812
(6_2^+) 3117
(4_3^+) 2277
3216 8_1^+
2491 6_1^+
2^+ 2779
0_6^+ 2749
2^+ 2448
0_5^+ 2417
2^+ 2225
2^+ 2171
1849 0_4^+
1843 4_1^+
1597 2_2^+
1436 0_3^+
4_2^+ 2048
2_3^+ 1745
2_1^+ 1223
0_2^+ 854
0_1^+ 0
103(36)
38(20)
41(2)
50(7)
0.109(5)
4.6(15)
7(4)
0.60(15)
25(11)
33(17)
40(18)
1.3(6)
8.5(17)
1.5(7)
51(5)
89(13)
0.16(8)
1.1(2)
0.28(12)
11.2(12)

K. R. Mashtakov[1], P. E. Garrett[1], B. Olaizola[1,2], C. Andreoiu[3], G. C. Ball[4], P. Bender[4,5], V. Bildstein[1], A. S. Chester[3], D. S. Cross[3], H. Dawkins[1], G. A. Demand[1], A. Diaz-Varela[1], G. Deng[1], A. B. Garnsworthy[4], G. Hackman[4], B. Hadinia[1], A. T. Laffoley[1], M. Moukaddam[4], J. Park[4], E. Peters[6], A. J. Radich[1], M. Rajabali[4], E. T. Rand[1], U. Rizwan[3], B. Singh[7], K. Starosta[3], C. E. Svensson[1], P. Voss[3], Z-M. Wang[3,4], J. L. Wood[8], S. W. Yates[6]

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[2] *ISOLDE-EP, CERN, Geneva, Switzerland*
[3] *Department of Chemistry, Simon Fraser University, Burnaby, Canada*
[4] *TRIUMF, Vancouver, Canada*
[5] *Department of Physics and Applied Physics, University of Massachusetts Lowell, Lowell, USA*
[6] *Department of Chemistry, University of Kentucky, Kentucky, USA*
[7] *Department of Physics & Astronomy, McMaster University, Hamilton, Canada*
[8] *Department of Physics, Georgia Institute of Technology, Georgia, USA*

Thank you!

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