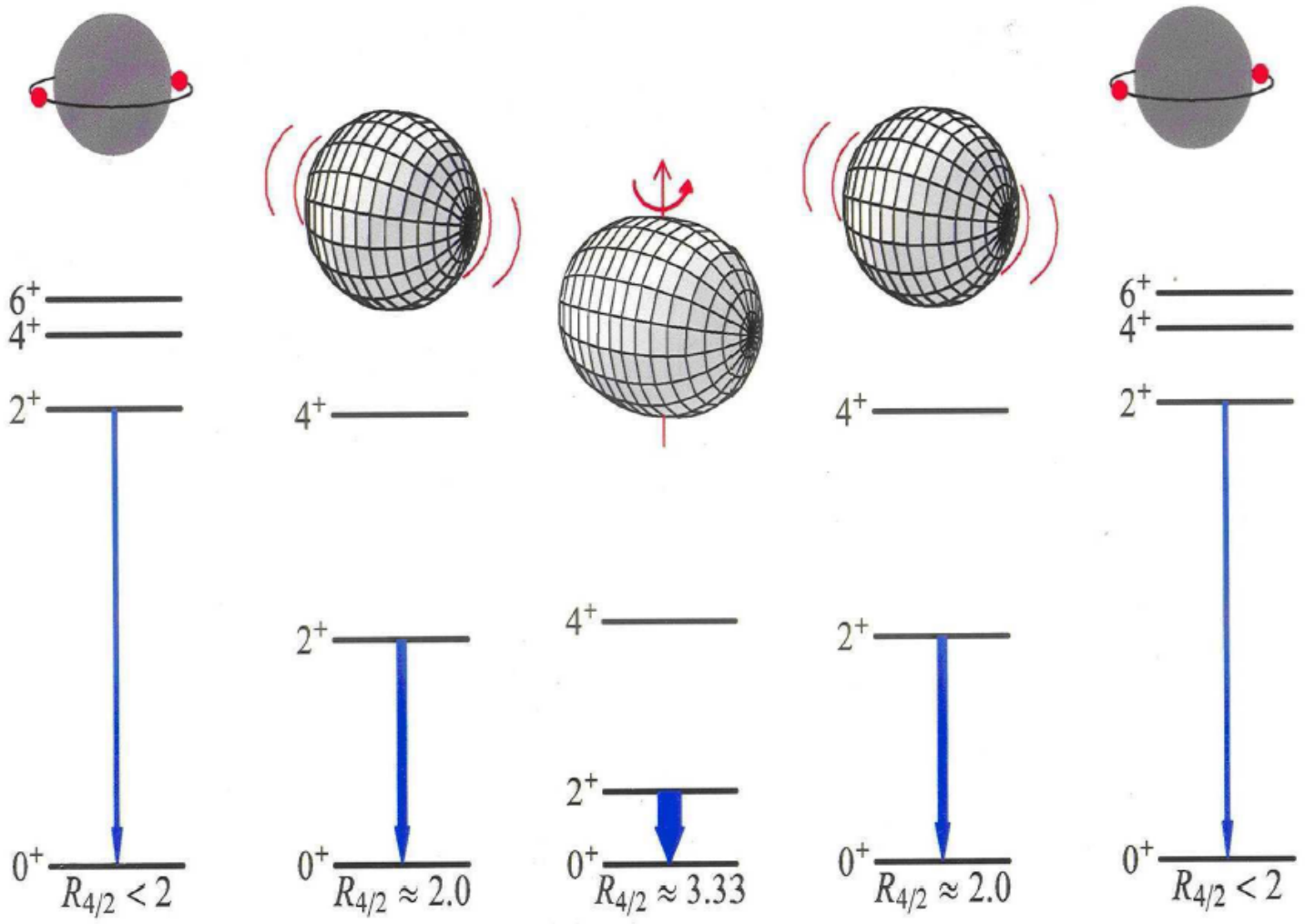


Figure 1.3: Schematic illustration of the evolution of structure from a near closed shell to a deformed midshell and then again to a near closed shell [23].

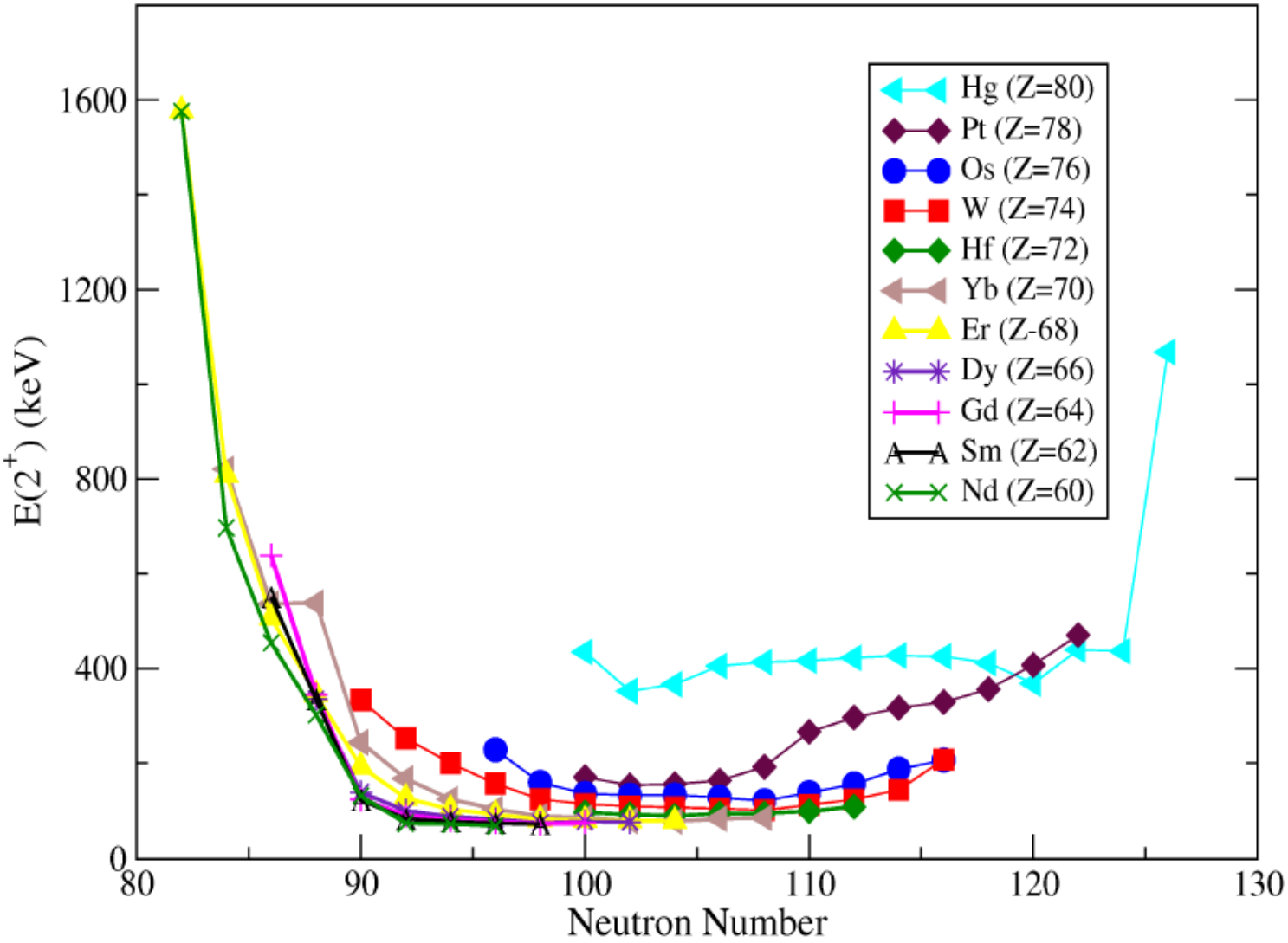


Figure 1.4: The energy of the first excited state, $E(2^+)$, versus the atomic mass number (A$\sim$150-206) for even-even nuclei between Nd and Hg. These data are taken from reference [3].

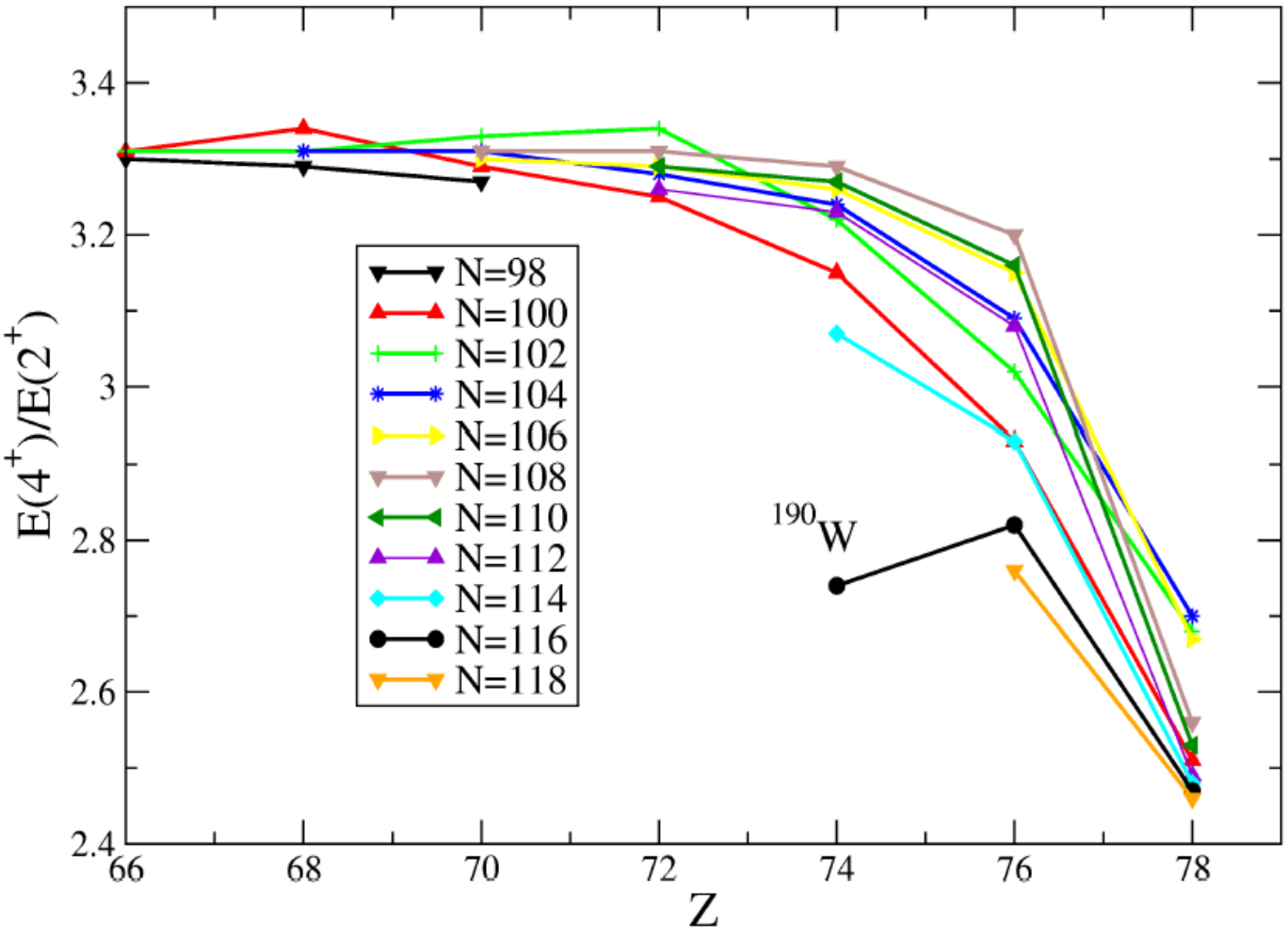
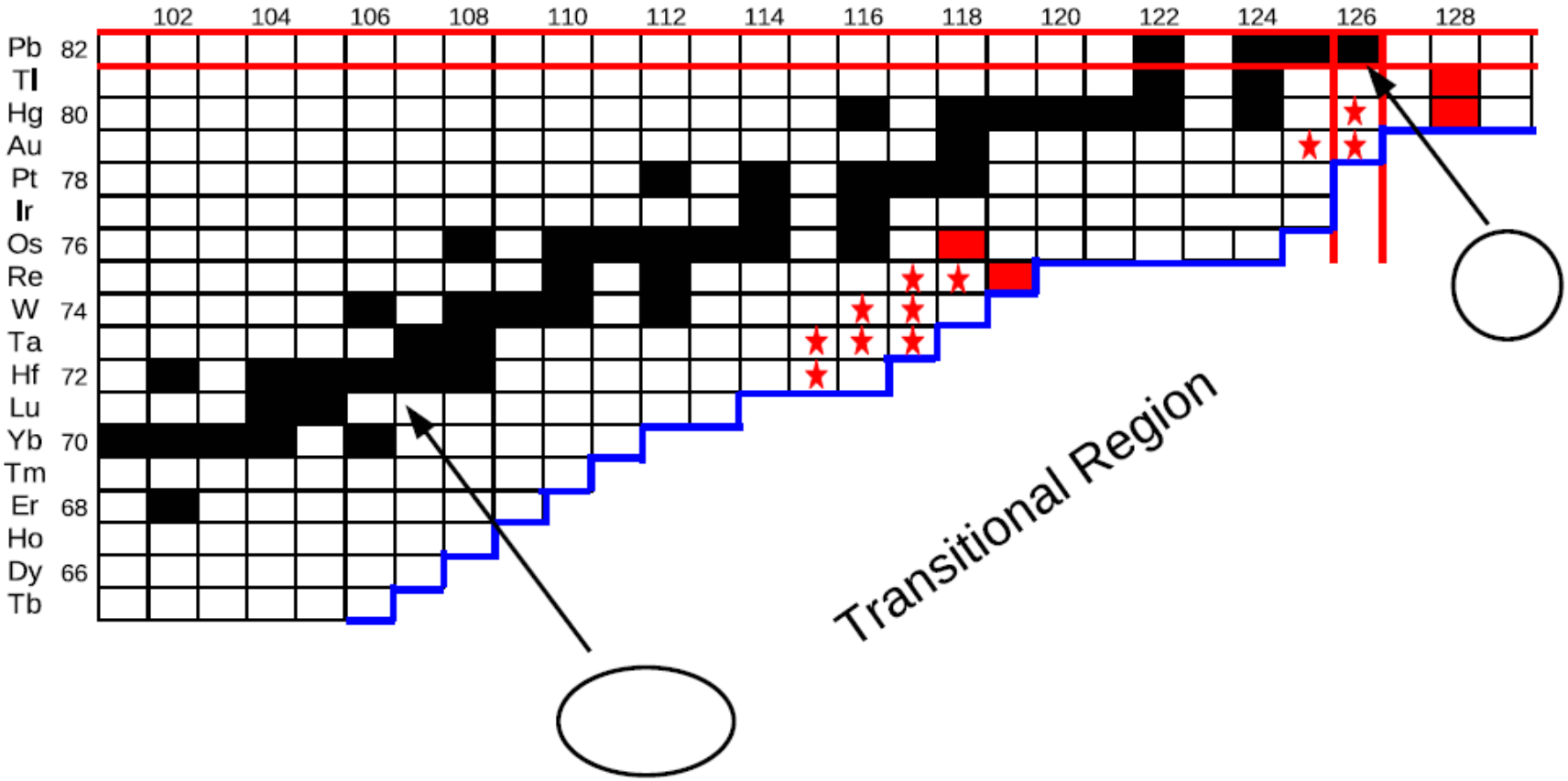


Figure 1.6: The R(4/2) ratio for the even-even as a function of Z for N=98 up to N=118. The discontinuity associated with the ^{190}W data point is notable in this figure.


102
104
106
108
110
112
114
116
118
120
122
124
126
128
Pb 82
Tl
Hg 80
Au
Pt 78
Ir
Os 76
Re
W 74
Ta
Hf 72
Lu
Yb 70
Tm
Er 68
Ho
Dy 66
Tb
Transitional Region
Stable isotope
Magic nuclei
Isomer observed in the present Work
Limit of known nuclei
Nuclei studied in thesis

PHYSICAL REVIEW C **80**, 064308 (2009)

β^--delayed spectroscopy of neutron-rich tantalum nuclei: Shape evolution in neutron-rich tungsten isotopes

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Beta Decay Studies of Heavy Neutron-Rich Nuclei Around A=190

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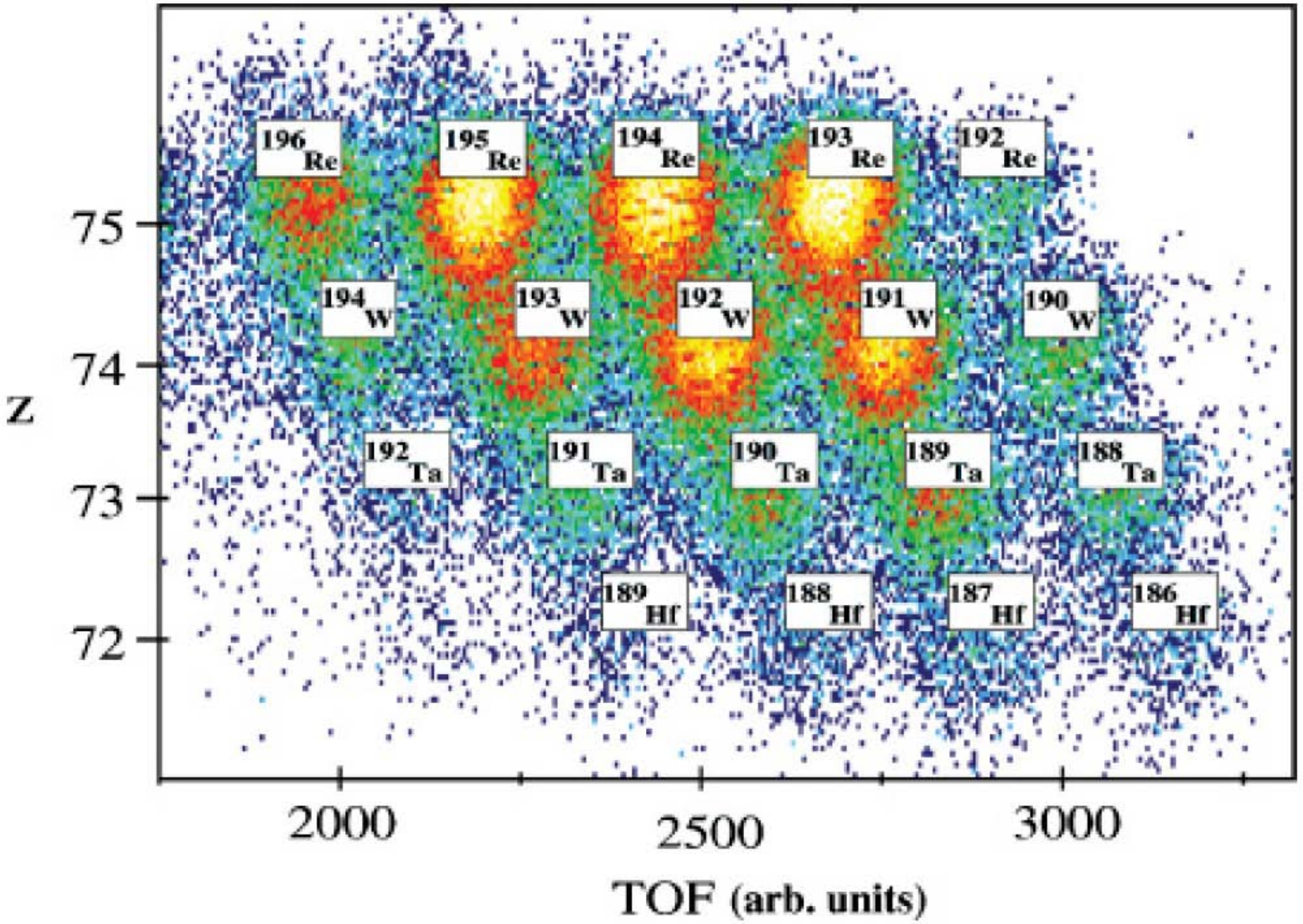
January 2010


196 Re
195 Re
194 Re
193 Re
192 Re
194 W
193 W
192 W
191 W
190 W
192 Ta
191 Ta
190 Ta
189 Ta
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189 Hf
188 Hf
187 Hf
186 Hf
75
74
73
72
Z
2000
2500
3000
TOF (arb. units)

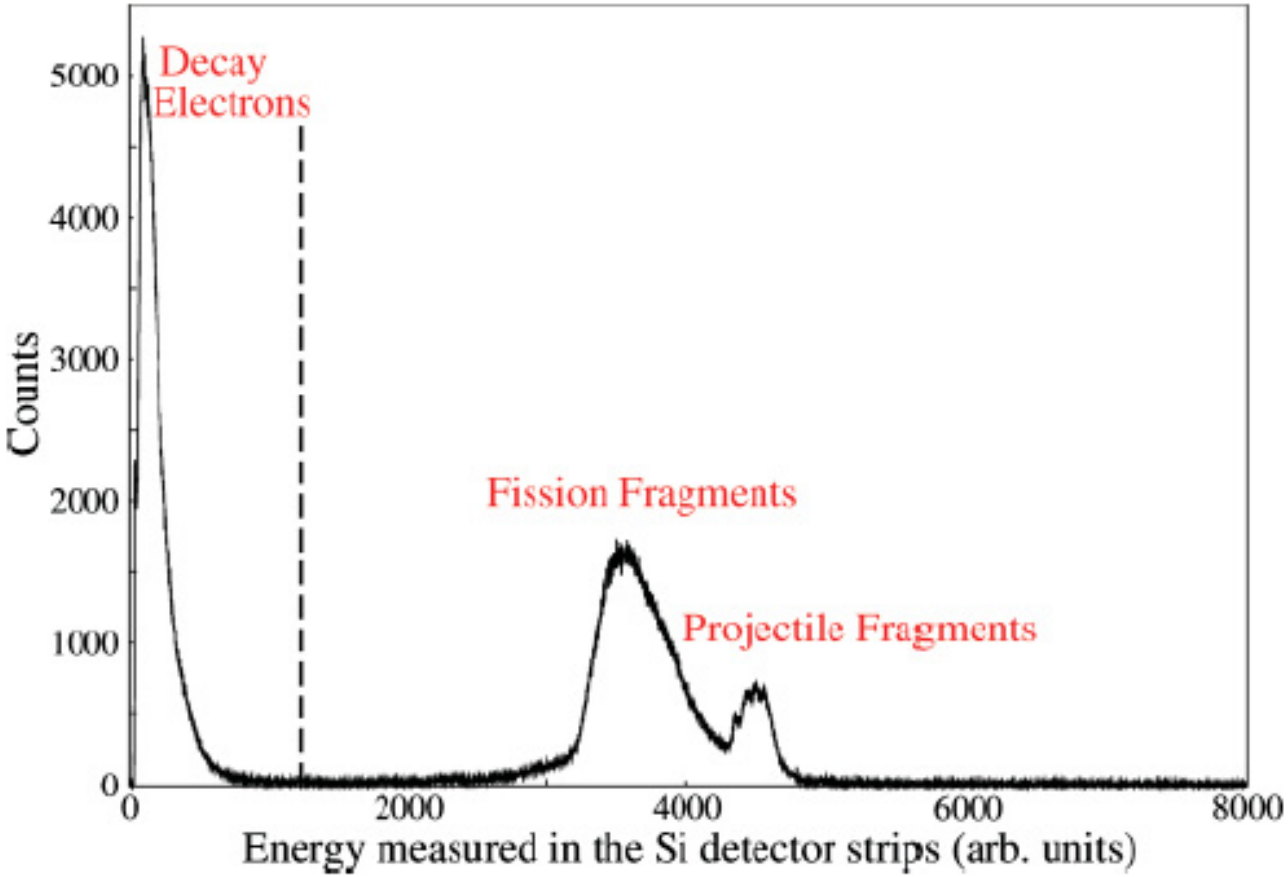


FIG. 6. (Color online) Total energy implanted by the nuclei within the silicon active stopper detector for the ^{190}Ta and ^{192}Ta settings. The double-peaked structure represents the energy deposited from both the direct implantations and for fission fragments, which are also transmitted through the FRS and pass through the active stopper. The deposited energies of β particles is shown on the left-hand side of the figure.

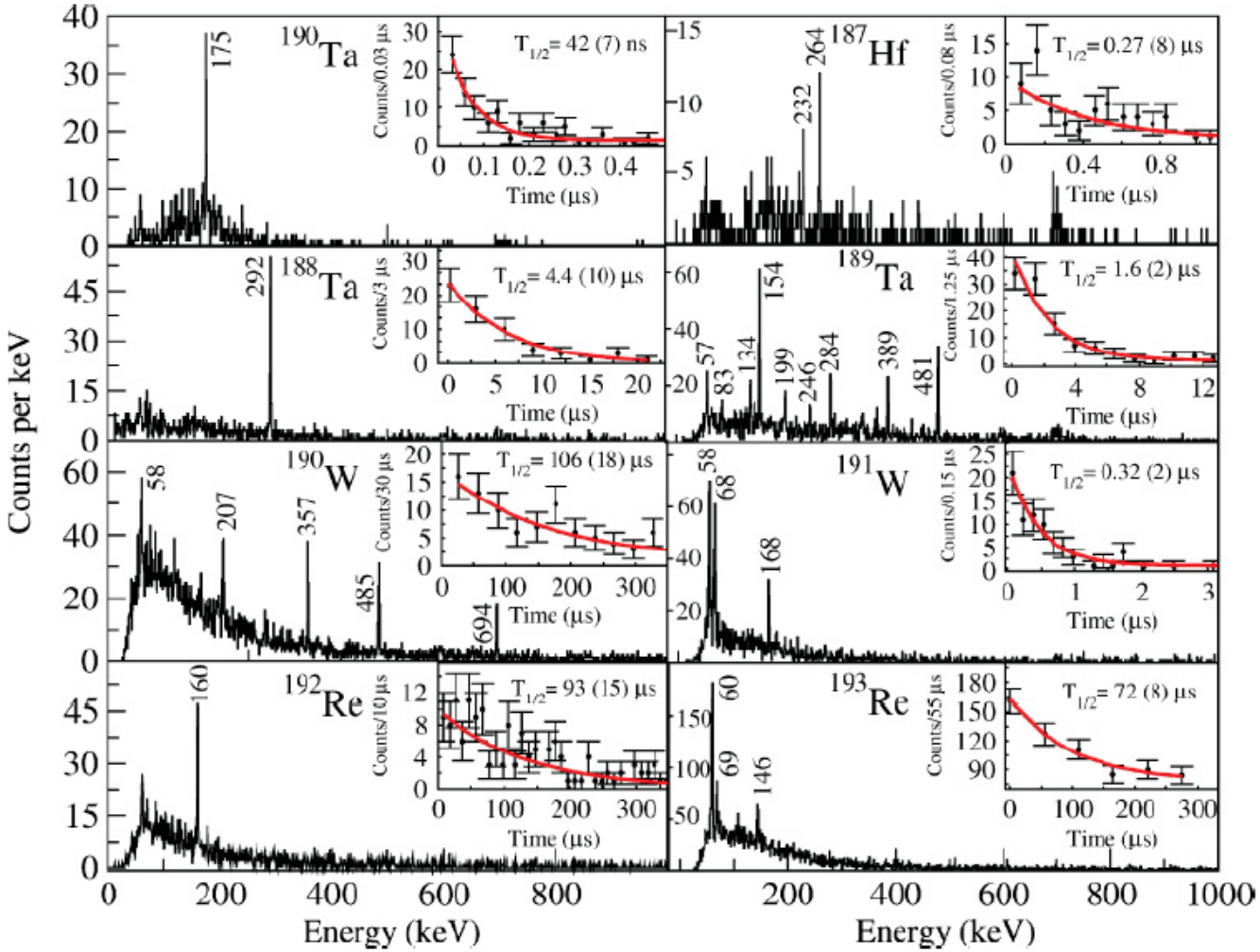
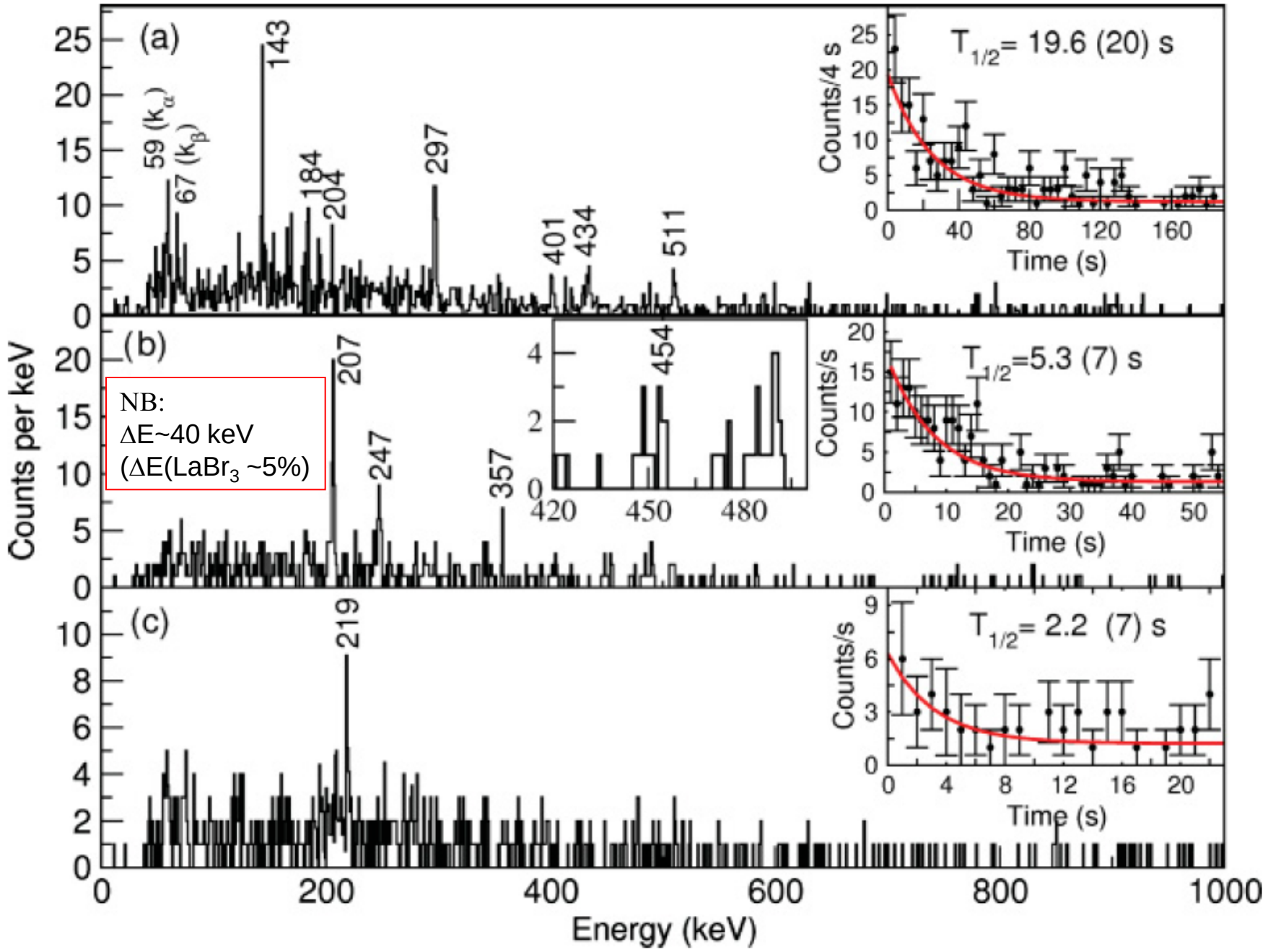


FIG. 4. (Color online) γ-ray energy and decay-time spectra of delayed events associated with isomeric states identified in ^{188,189,190}Ta ($\Delta t = 0.2 \rightarrow 22$, $0.2 \rightarrow 12$, and $0.03 \rightarrow 0.55\ \mu$s, respectively), ^{190,191}W ($\Delta t = 2 \rightarrow 395$ and $0.08 \rightarrow 3\ \mu$s, respectively), ^{192,193}Re ($\Delta t = 3 \rightarrow 350$ and $2 \rightarrow 350\ \mu$s, respectively), and ^{187}Hf ($\Delta t = 0.08 \rightarrow 1.1\ \mu$s).

Note for fast-timing array, expected ΔE ~5% (~ 10 keV at 500 keV; 20 keV at 1 MeV)
What about P:T though (need to continue to simulate using known cases…)


(a)
(b)
(c)
59 (k_α)
67 (k_β)
143
184
204
297
401
434
511
207
247
357
454
219
NB:
ΔE~40 keV
(ΔE(LaBr$_3$ ~5%)
$T_{1/2}$= 19.6 (20) s
$T_{1/2}$=5.3 (7) s
$T_{1/2}$= 2.2 (7) s
Counts/4 s
Counts/s
Time (s)
Counts per keV
Energy (keV)

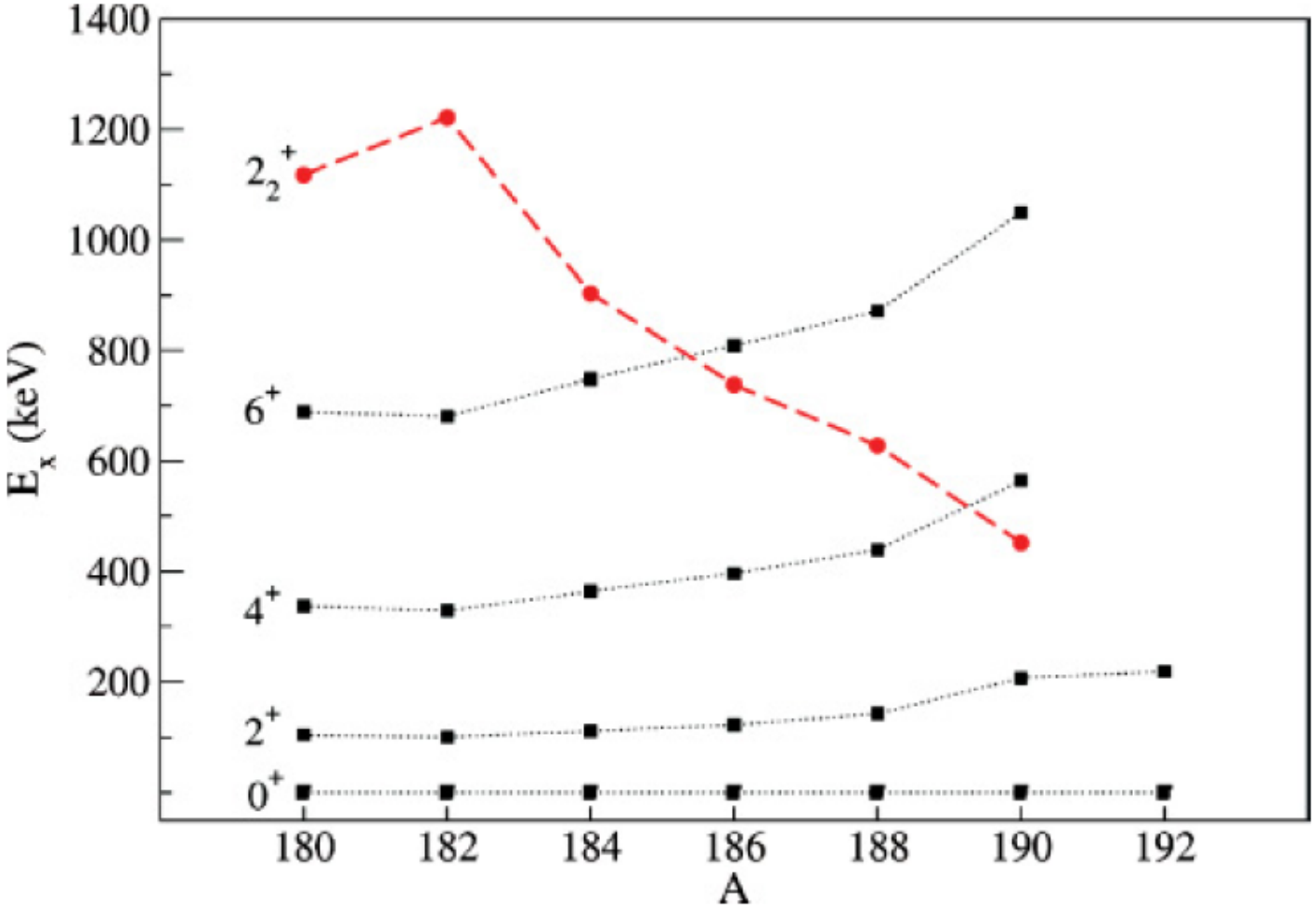


FIG. 9. (Color online) Systematic behavior of the low-lying states of even-A tungsten isotopes with $A = 180 \rightarrow 192$. The dashed lines correspond to the second $I^{\pi} = 2^{+}$ states. The data are taken from Ref. [51] and the current work.

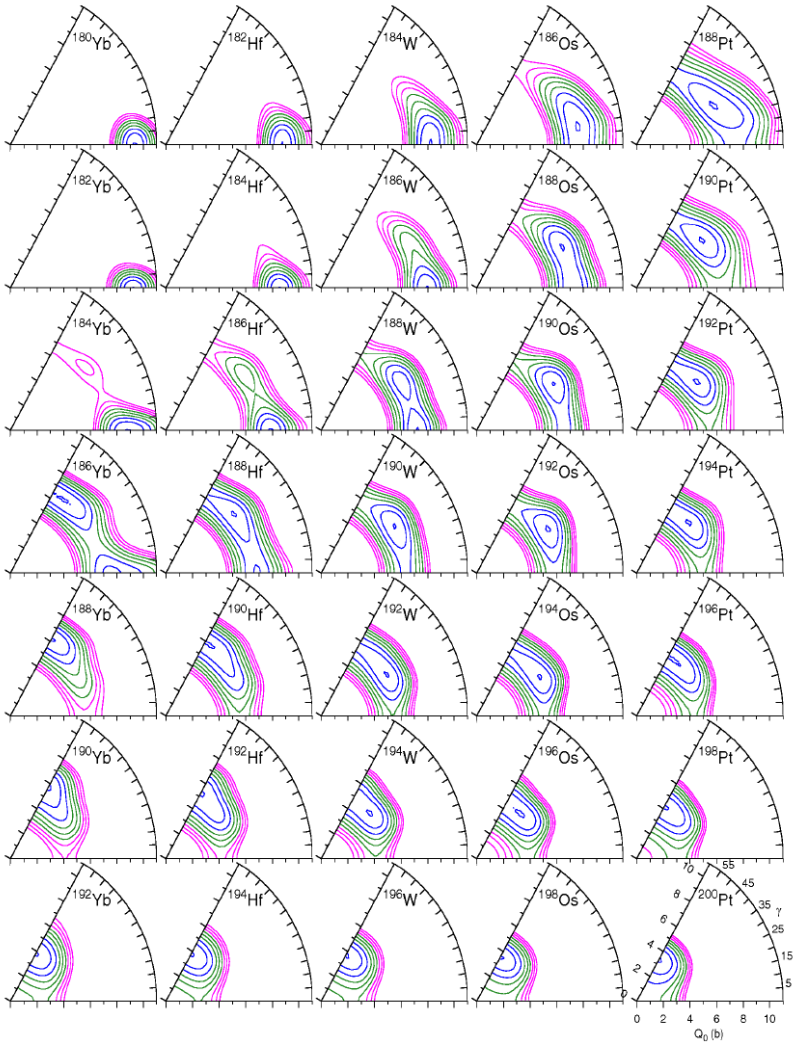


Figure 1.8: β (in term of axial quadrupole moment)-γ contour planes for Yb, Hf, W, Os and Pt nuclei ranging from N= 110 for the top row up to N= 122 for the bottom row, performed by Robledo *et. al.*, and taken from reference [34].

R. Rodriguez et al., JPG; PRC

P.D.Stevenson et al., PRC

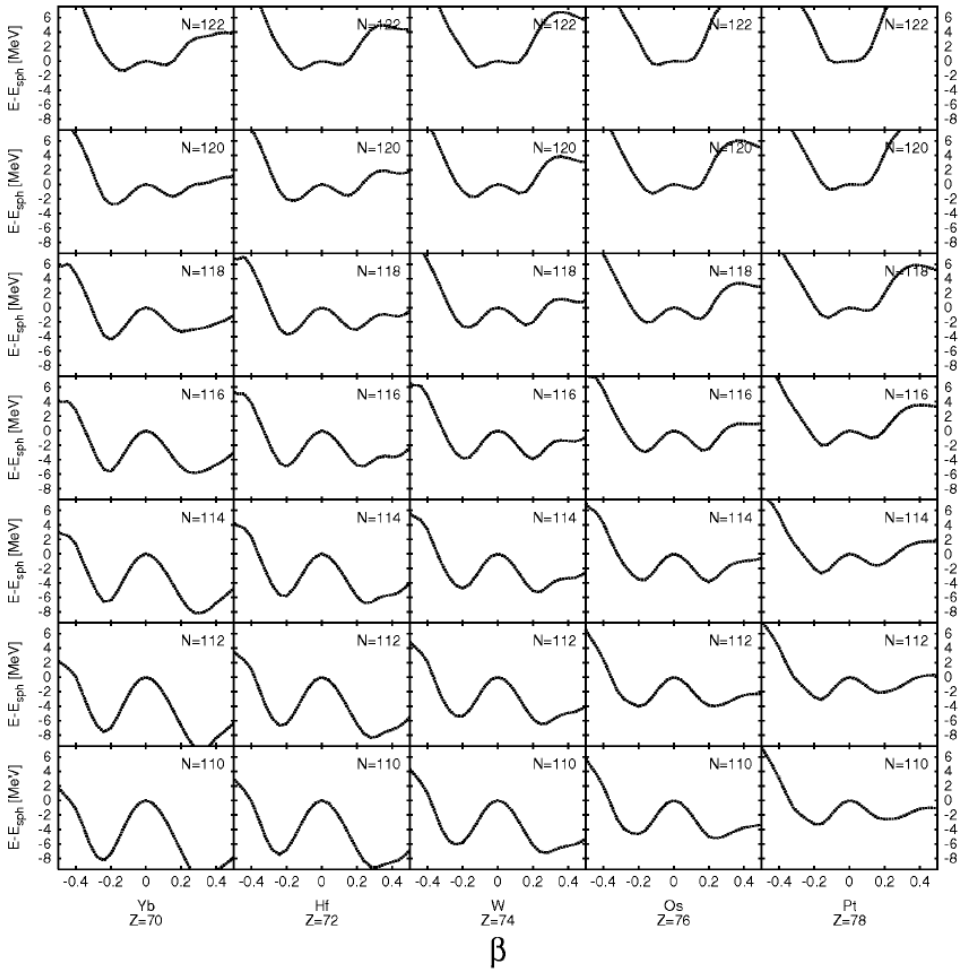


Figure 1.7: Potential energy as a function of quadrupole deformation from axially symmetric Hartree-Fock calculations for Yb, Hf, W, Os and Pt nuclei with neutron number between N=110 and 122, performed by Stevenson *et. al.*, and taken from reference [33].

Isomer and β-delayed gamma-ray spectroscopy for structure studies of heavy, neutron-rich nuclei

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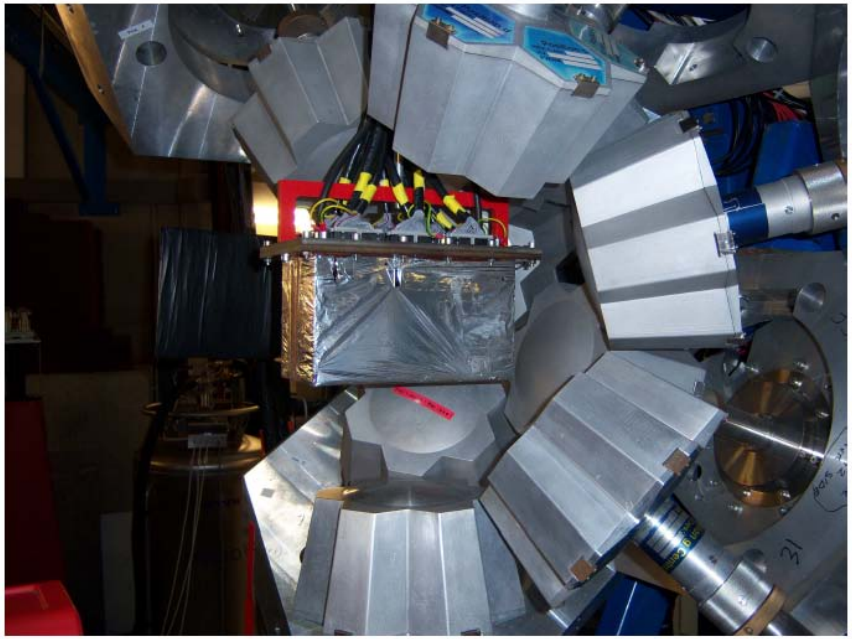
July 2010



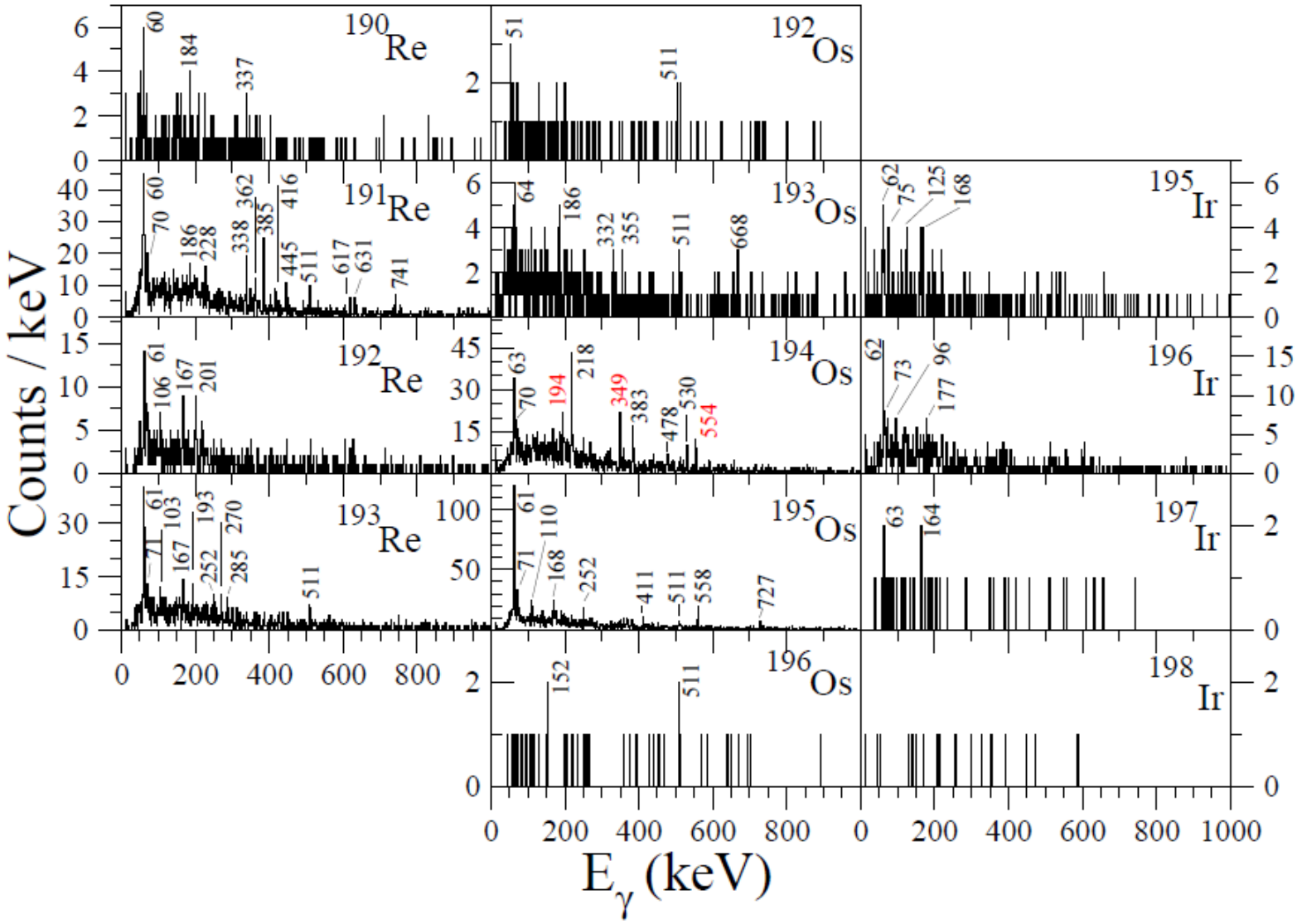
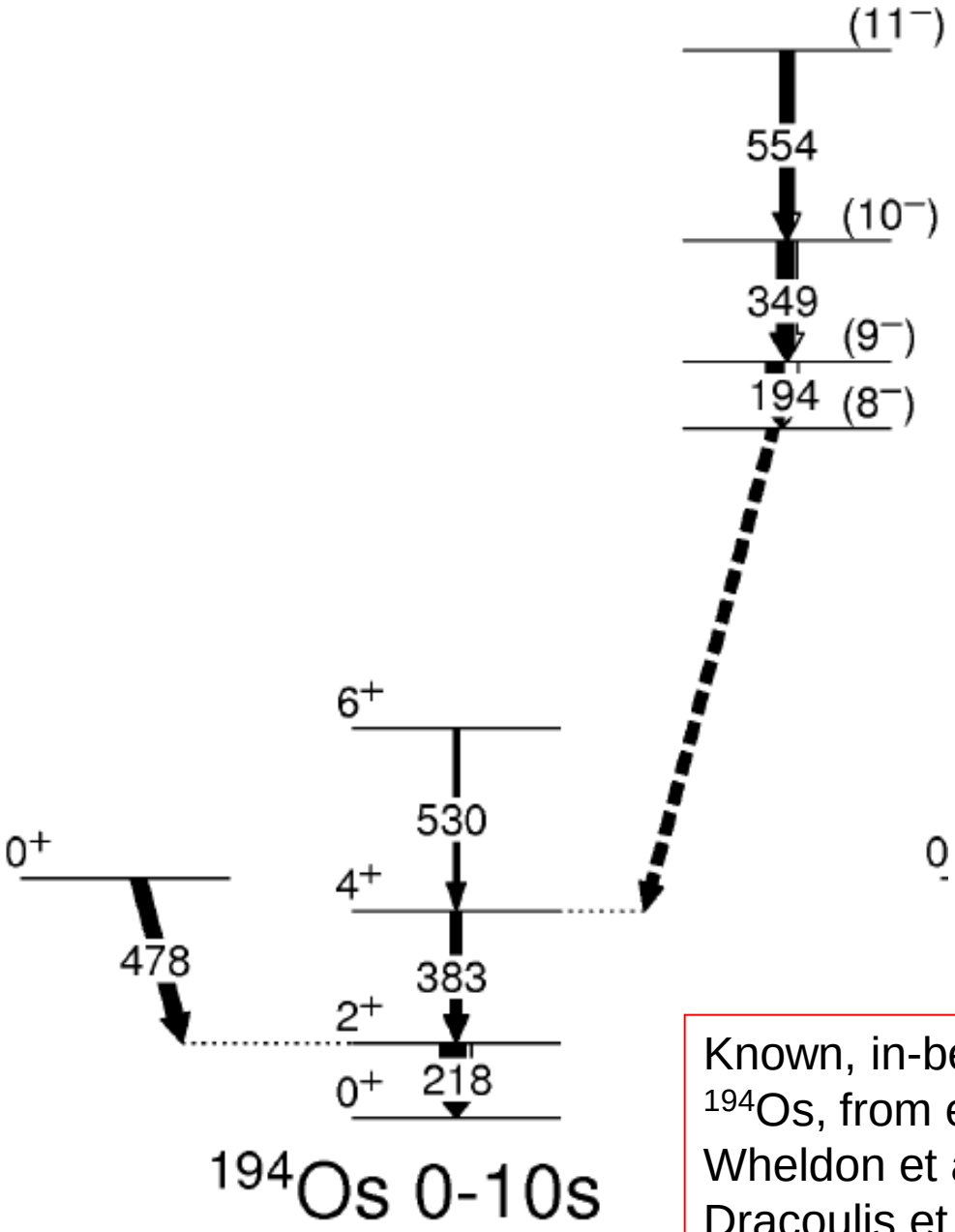


Figure 4.23: β-delayed γ-ray spectra of the Rhenium, Osmium and Iridium isotopes daughter for correlation times $\Delta t(implant - \beta) = 120$ s from the current work.



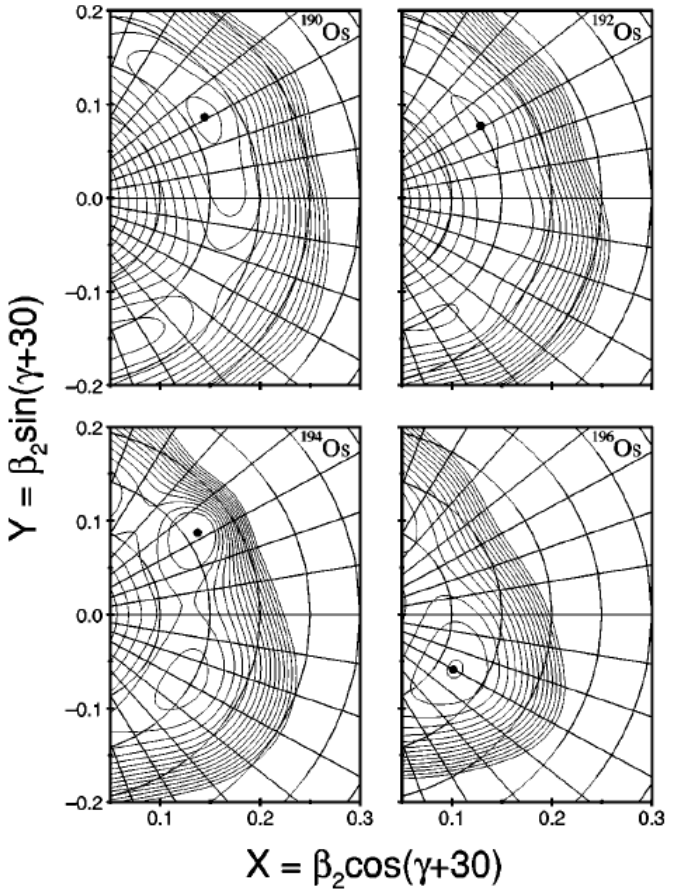


FIG. 6. Total Routhian surface calculations for the ground states of (a): ^{190}Os with $|\beta_2|=0.17$ and $\gamma\leqslant 2°$; (b): ^{192}Os with $|\beta_2|=0.15$ and $\gamma\leqslant 2°$; (c): ^{194}Os with $|\beta_2|=0.16$ and $\gamma\leqslant 2°$; (d): ^{196}Os with $|\beta_2|=0.12$ and $\gamma=-60°$. The contour lines represent energy increments of 200 keV.

Known, in-beam decay scheme for ^{194}Os, from e.g.,
Wheldon et al., Phys. Rev. C63 (1997) 011304(R)
Dracoulis et al., (private communication)

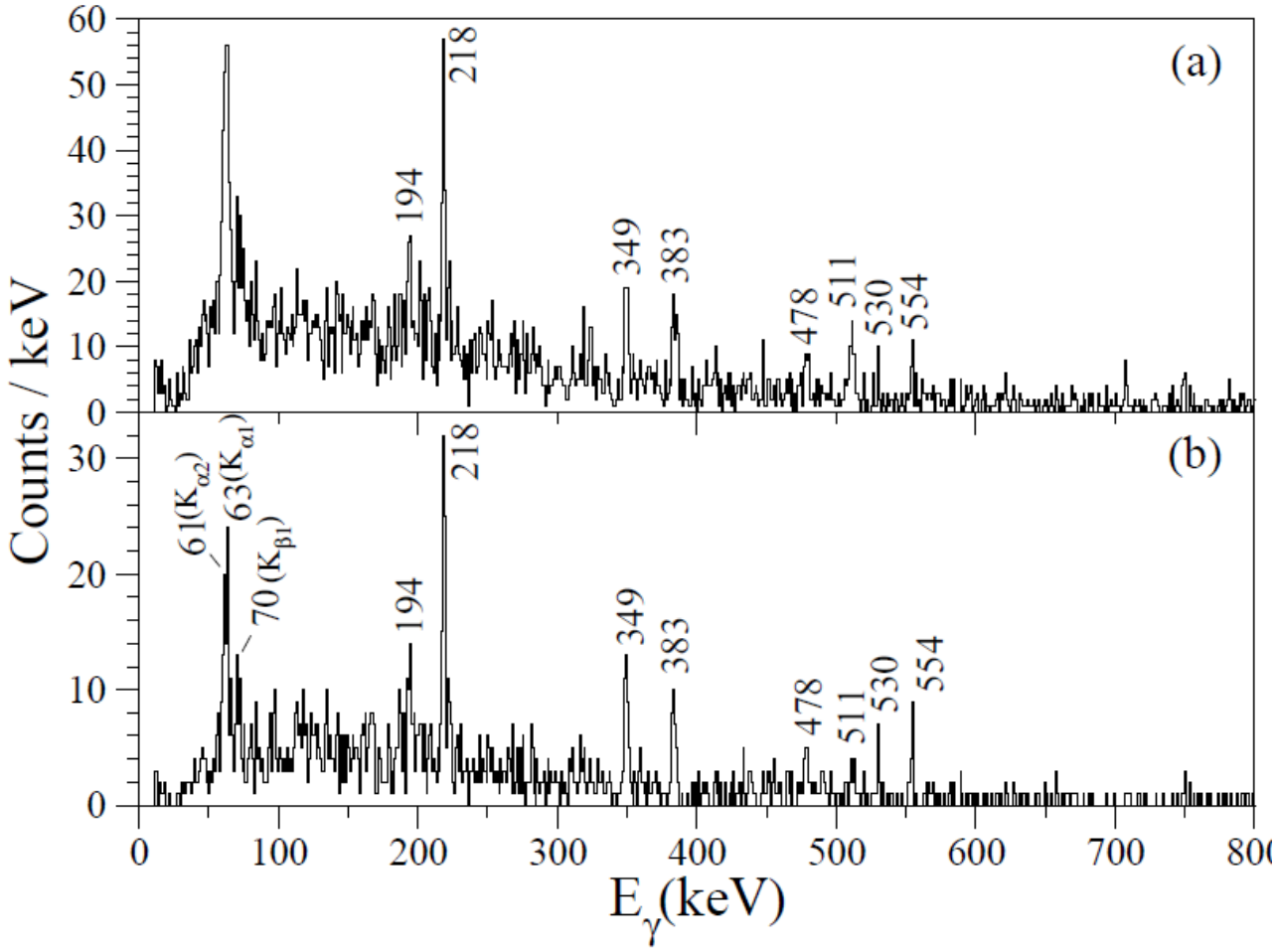


Figure 4.15: β-delayed γ-ray spectrum showing decays from excited states in ^{194}Os. The correlation time range was $\Delta t = (0 - 50)$ s show these data the difference of applying only the correlation between the implantations and decays in the same pixel (lower panel *(a)*) and implantations and decays in the same pixel plus decays in the 8 neighbouring pixel upper panel.

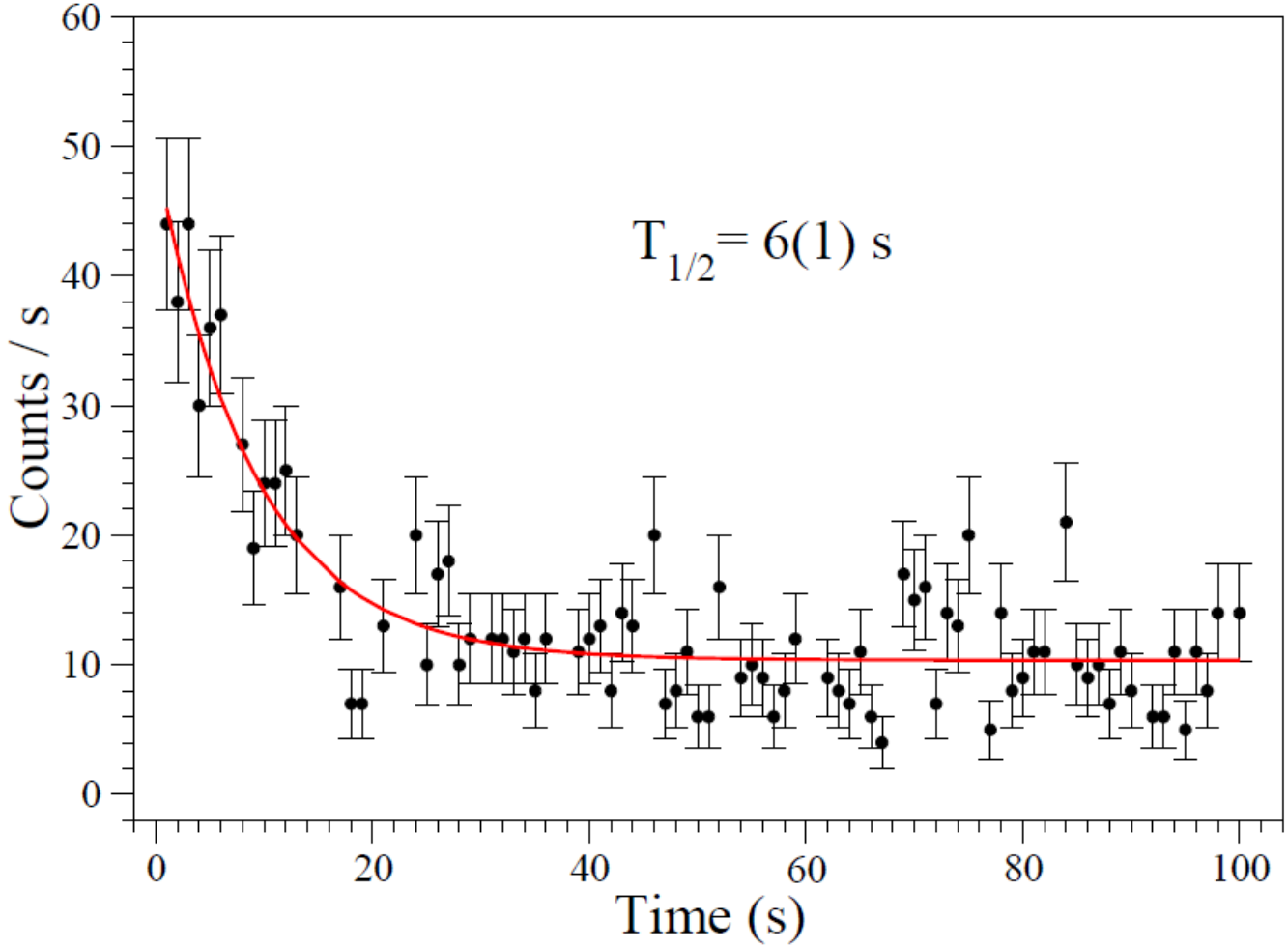


Figure 4.24: Decay time curve for ^{194}Re obtained from the time differences between the implanted ions in the active stopper and their subsequent correlated β particles in the same pixel for fully stripped ions from the summed data.

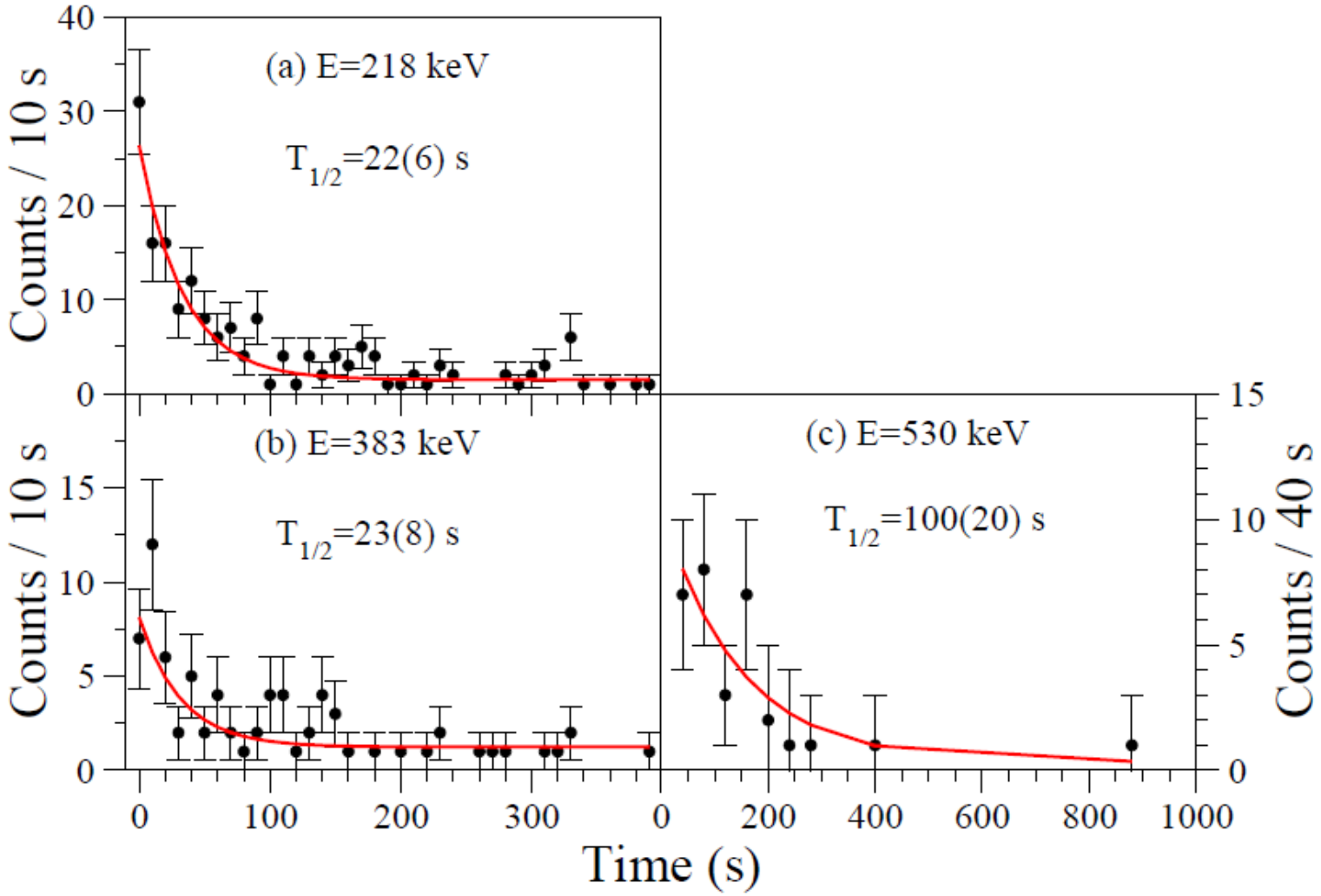


Figure 4.25: β-delayed γ-ray gated time spectrum for previously reported transitions 218, 383 and 530 keV associated with ^{194}Os for different correlation times Δt $(implant - \beta) = 0 \rightarrow 1000$ s from the current work.

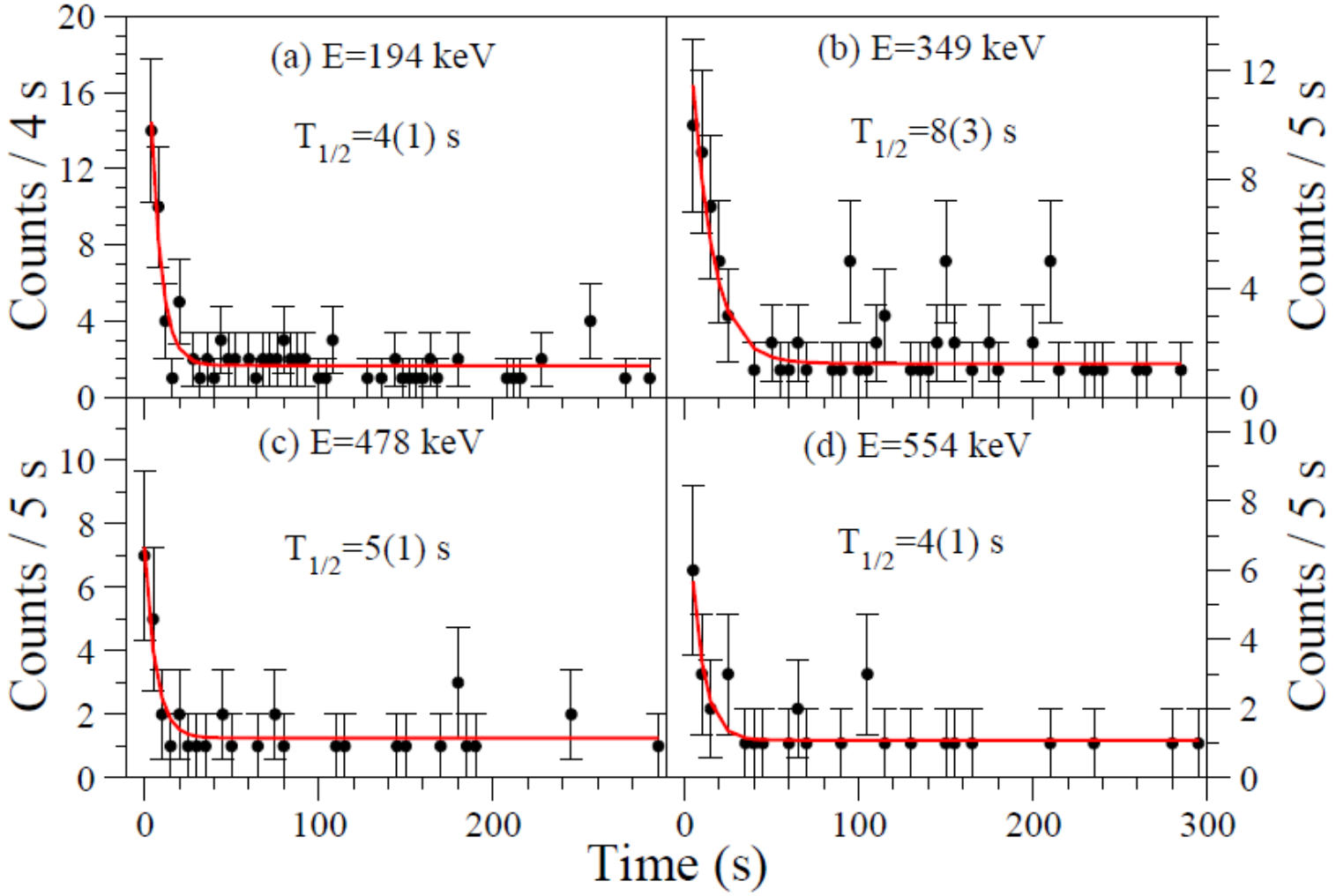


Figure 4.26: β-delayed γ-ray gated time spectra for the previously unreported transitions 194, 349, 478 and 554 keV associated with decay in ^{194}Os for different correlation times $\Delta t(implant - \beta) = 0 \rightarrow 300$ s from the current work.

I^{π}	Neutron orbital (ν)	Proton orbital (π)	Energy[b] (keV)	V_R^c (keV)	Net[d] (keV)
1^+	$1/2^+[660]\uparrow$	$1/2^+[411]\downarrow$	64	+70	134
0^+			64	-70	-6
2^+	$1/2^+[660]\uparrow$	$3/2^+[402]\downarrow$	2	+70	72
1^+			2	-70	-68
3^+	$3/2^+[651]\uparrow$	$3/2^+[402]\downarrow$	174	+70	244
0^+			174	-70	104
1^-	$1/2^+[660]\uparrow$	$1/2^-[550]\uparrow$	0	-70	-70
0^-			0	+70	+70
2^-	$3/2^+[651]\uparrow$	$1/2^-[550]\uparrow$	173	-71	102
1^-			173	+71	244

[a] $\varepsilon_2 = -0.158$, $\varepsilon_4 = 0.033$ for the oblate deformation.

[b] Energy of the state

[c] Empirical Residual interactions.

[d] Sum of Energy and V_R (keV)

I^{π}	Neutron orbital (ν)	Proton orbital (π)	Energy[b] (keV)	V_R^c (keV)	Net[d] (keV)
6^+	$3/2^-[501]\uparrow$	$9/2^-[514]\uparrow$	22		(22)
3^+					
7^+	$13/2^+[606]\uparrow$	$1/2^+[411]\downarrow$	91	+70	161
6^+			91	-70	21
9^+	$13/2^+[606]\uparrow$	$5/2^+[402]\uparrow$	24	-84	-60
4^+			24	+84	108
10^+	$13/2^+[606]\uparrow$	$7/2^+[404]\downarrow$	337	+63	400
3^+			337	-63	274
2^-	$3/2^-[501]\uparrow$	$1/2^+[411]\downarrow$	67		(67)
1^-					
4^-	$3/2^-[501]\uparrow$	$5/2^+[402]\uparrow$	0		(0)
1^-					
5^-	$5/2^-[503]\downarrow$	$5/2^+[402]\uparrow$	264		(264)
0^-					
11^-	$13/2^+[606]\uparrow$	$9/2^-[514]\uparrow$	46	-71	-25
2^-			46	+71	117
12^-	$13/2^+[606]\uparrow$	$11/2^-[505]\uparrow$	304	-71	233
1^-			304	+71	375

[a] $\varepsilon_2 = 0.125$, $\varepsilon_4 = 0.067$ for the prolate deformation;

[b] Energy of the state

[c] Empirical Residual interactions.

[d] Sum of Energy and V_R (keV)

Neutron-Proton Interactions in Heavy Self-Conjugate Nuclei

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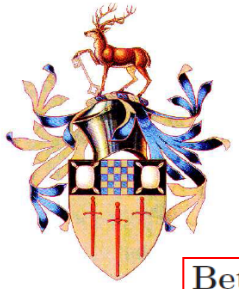
September 2007

Gamma- and beta-decay spectroscopy of ^{190}W, ^{205}Au and ^{203}Au.

Gregory Francis Farrelly



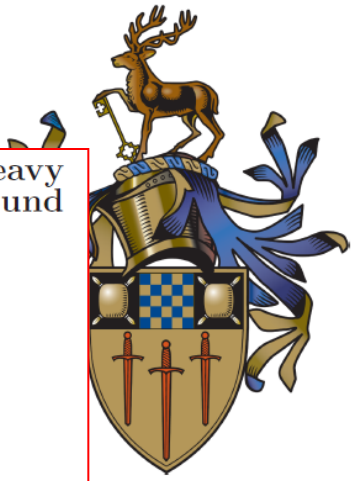
Department of Physic
University of Surrey

A thesis submitted for the degree of D

March 17, 2010

Isomer Decay Spectroscopy of $N \leq 126$ Neutron-Rich Nuclei

Steven John Steer



he degree of Doctor of Philosophy

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gineerings and Physical Sciences,
niversity of Surrey.

October 2008

Beta Decay Studies of Heavy Neutron-Rich Nuclei Around A=190

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January 2010

Isomer and β-delayed gamma-ray spectroscopy for structure studies of heavy, neutron-rich nuclei

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