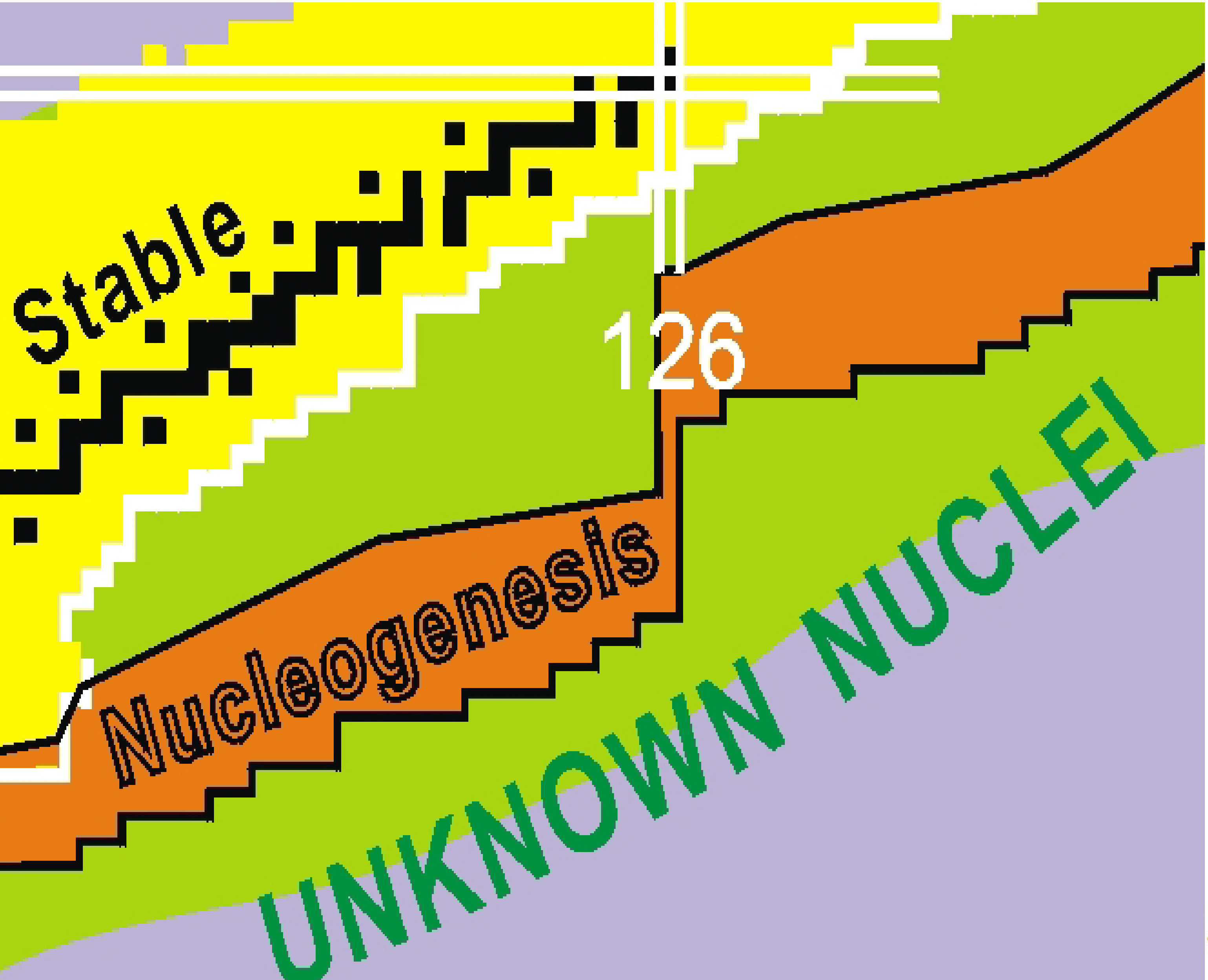
Shell model studies along the N~126 line



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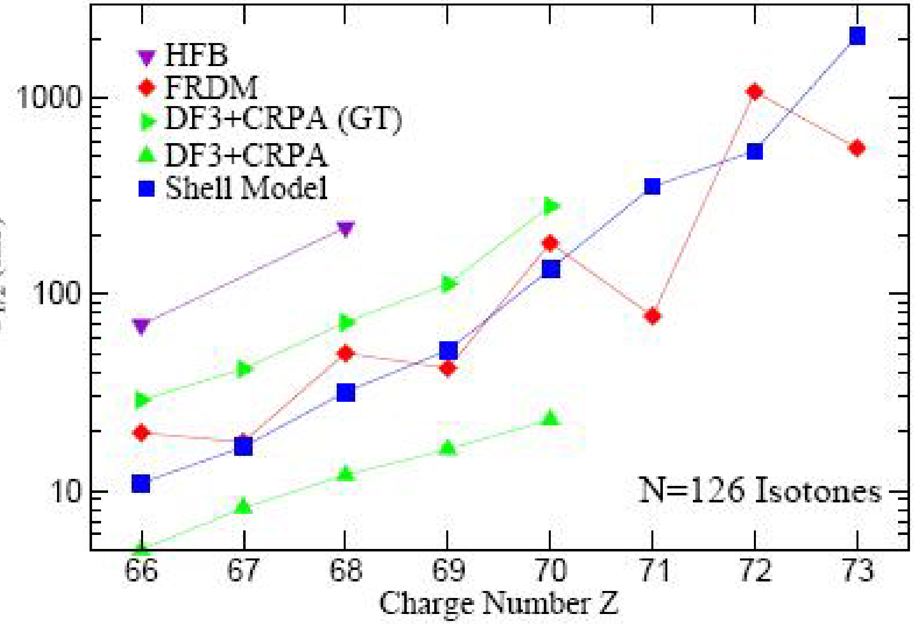
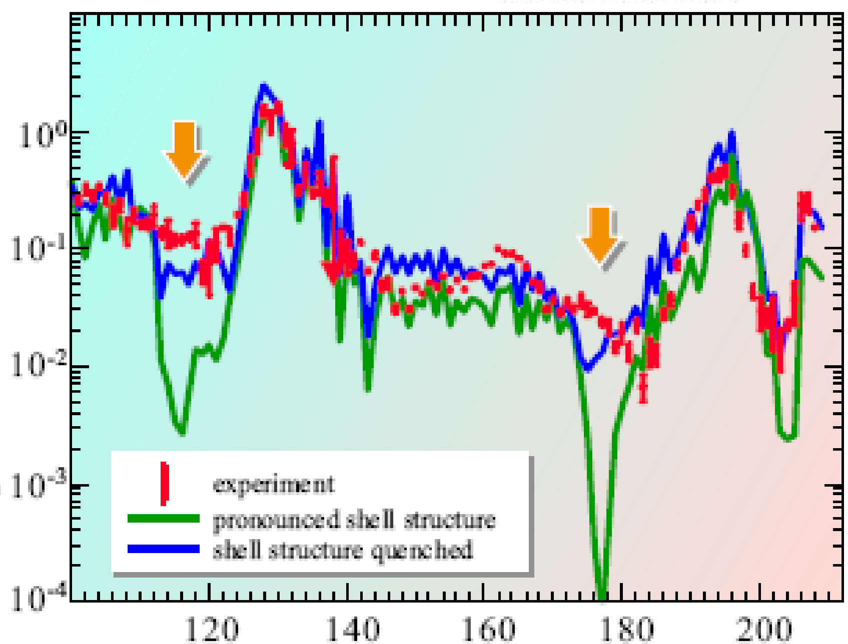
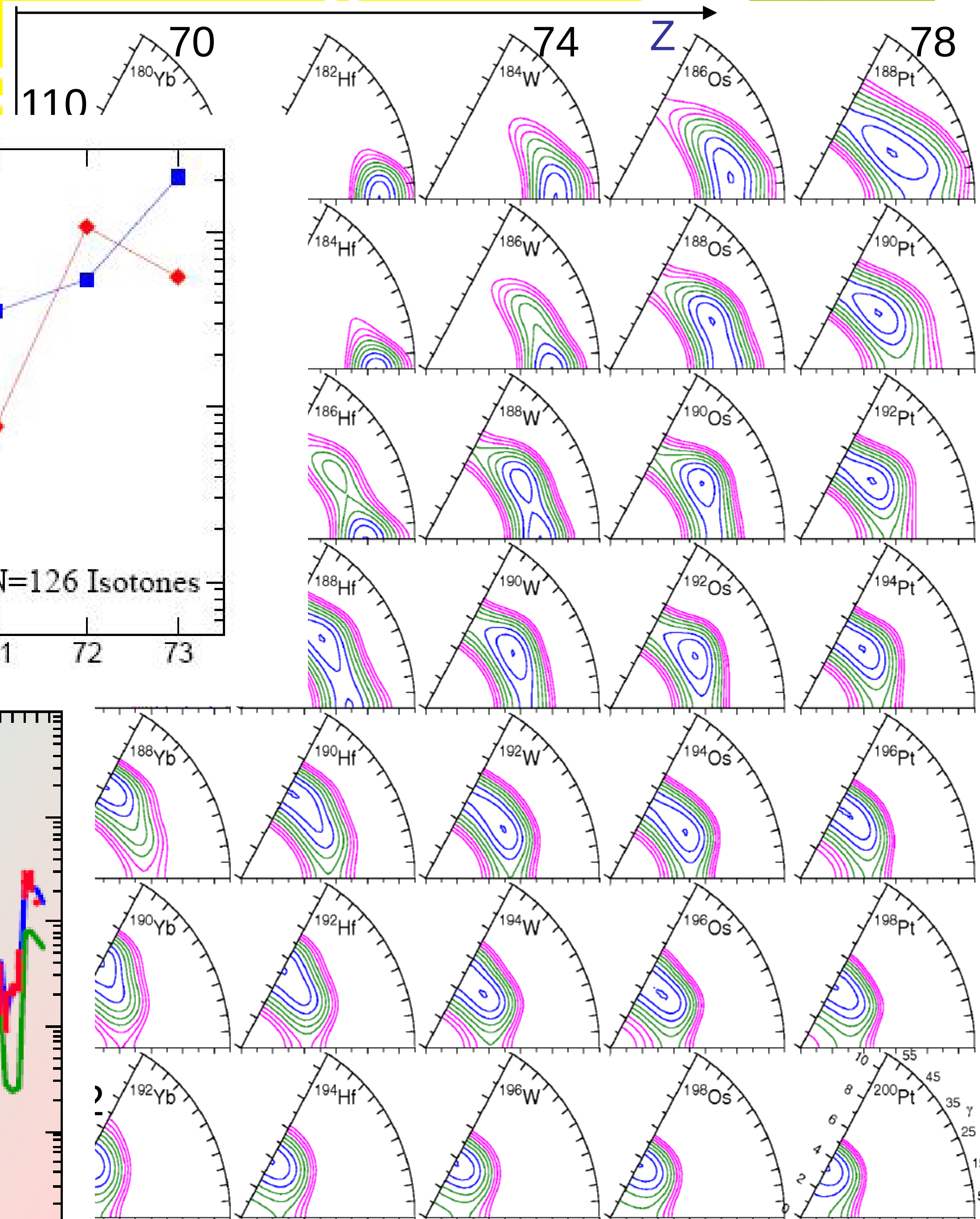
H. Grawe, K. Langanke, G. Martinez-Pinedo, Rep.Progr.Phys.70 (2007)1525.

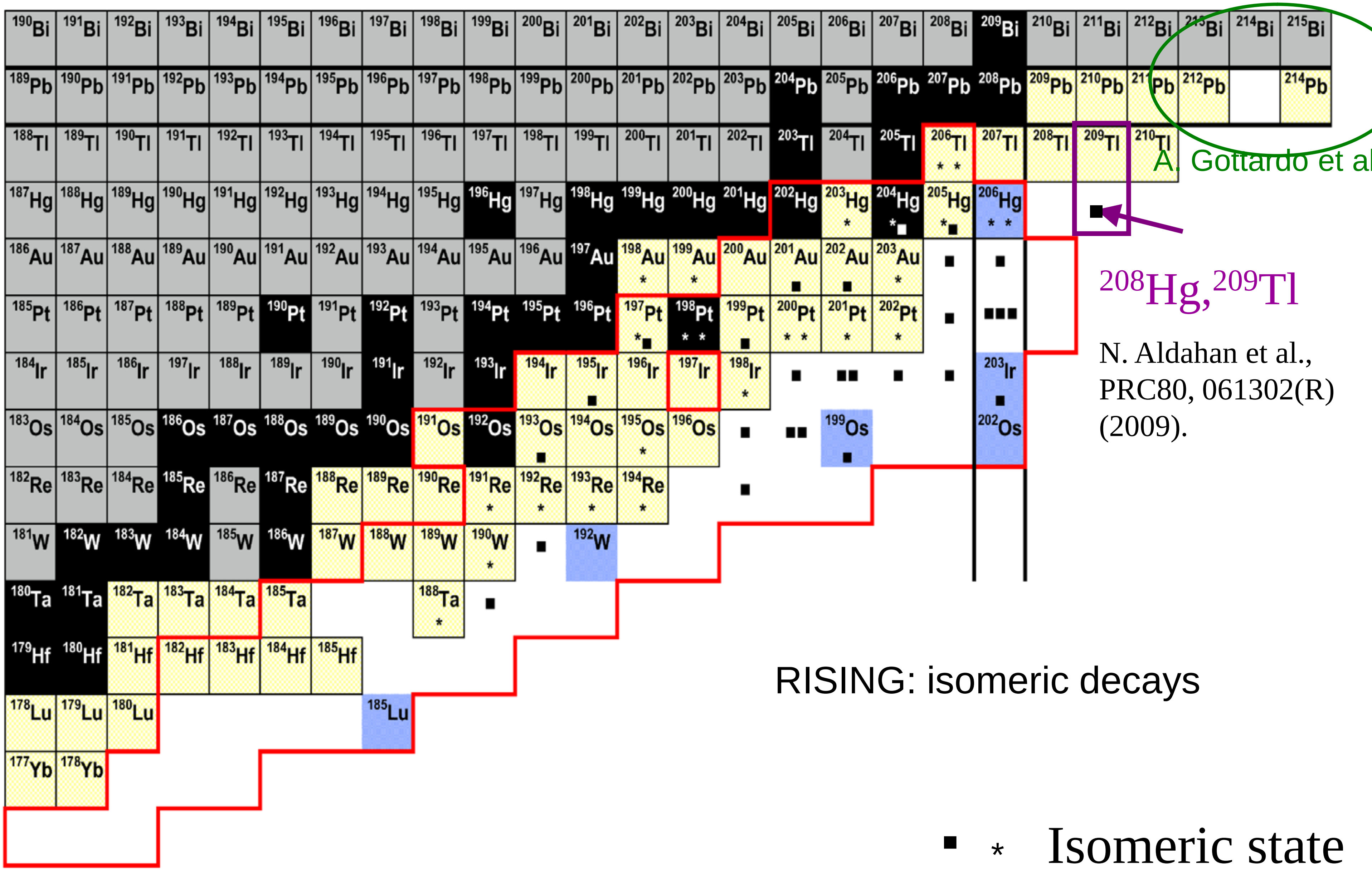






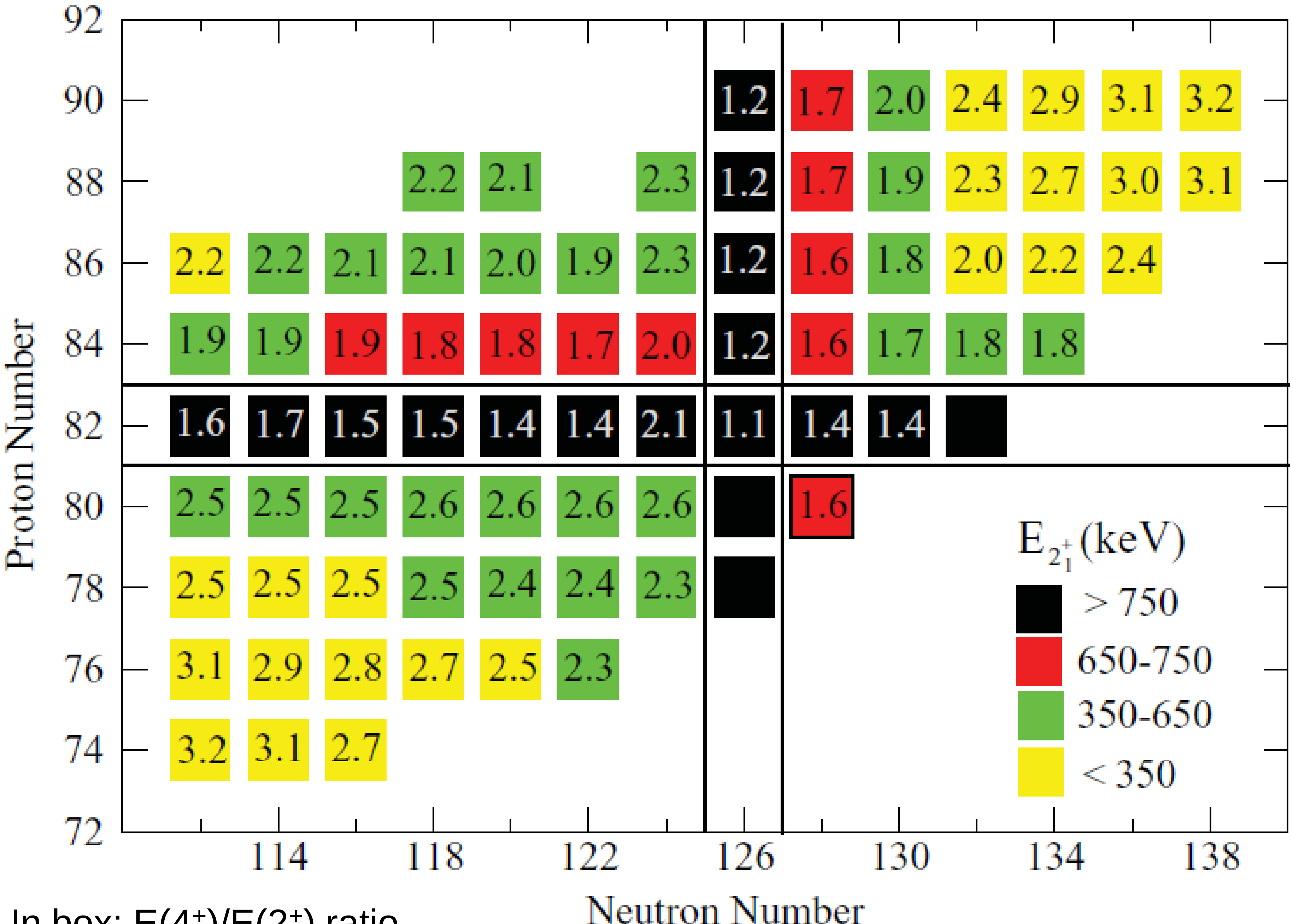
. Robledo et al., J. Phys. G. 36, 115104 (2009).

Isomeric states around ^{208}Pb

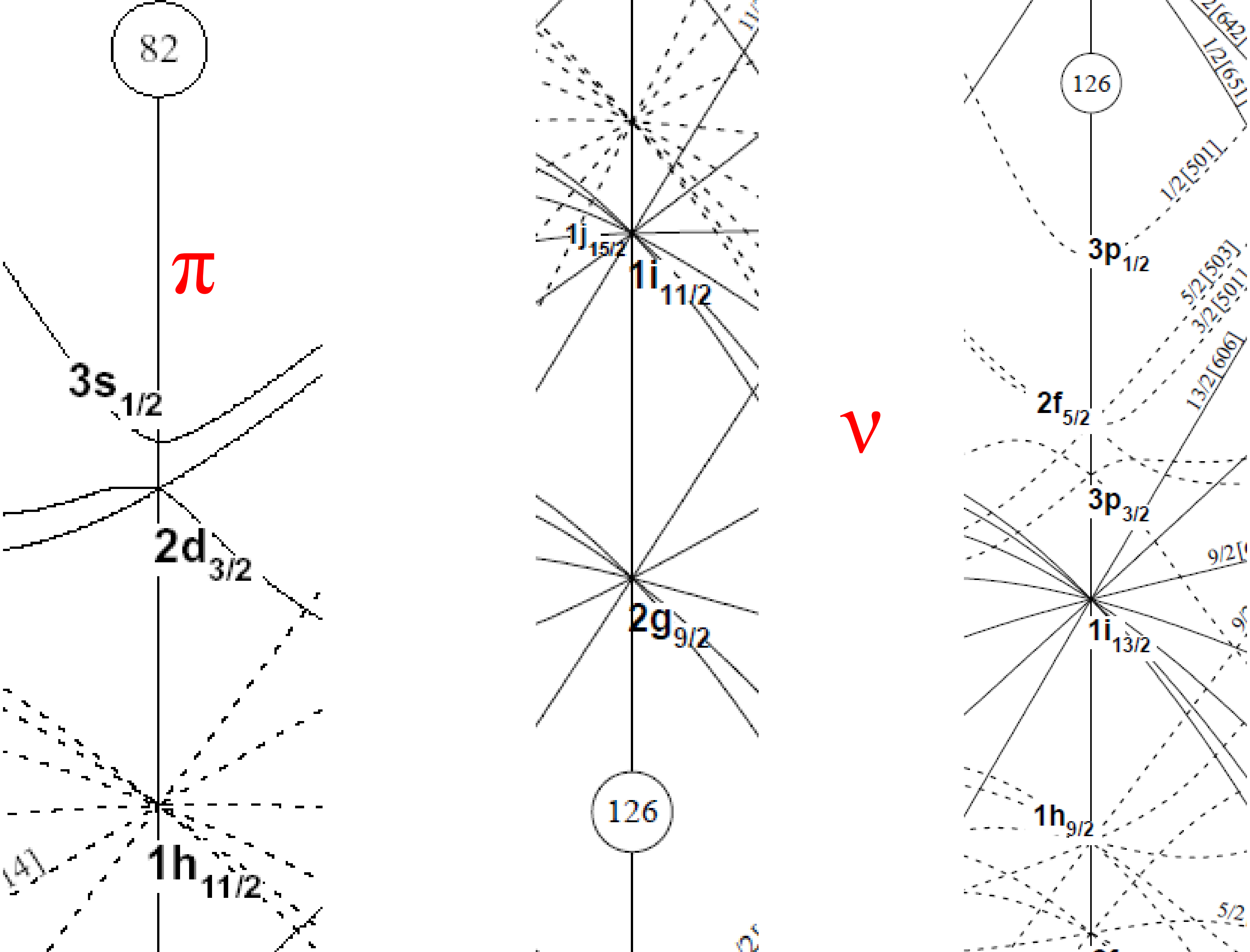


S. Steer et al., Int. J. Mod. Phys. E18, 759 (2009) and to be published

Even-even nuclei around ^{208}Pb



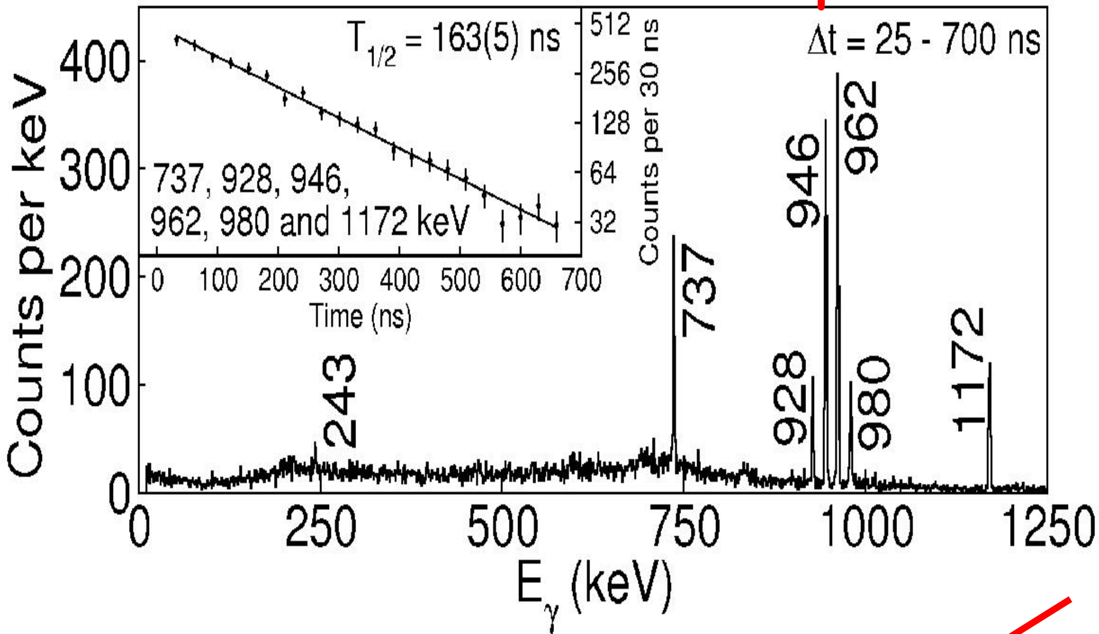
In box: $E(4^+)/E(2^+)$ ratio



In the beta decay of the r-process path nuclei:

The FF $\nu\ i_{13/2} \rightarrow \pi h_{11/2}$ dominates; also GT $\nu h_{9/2} \rightarrow \pi h_{11/2}$

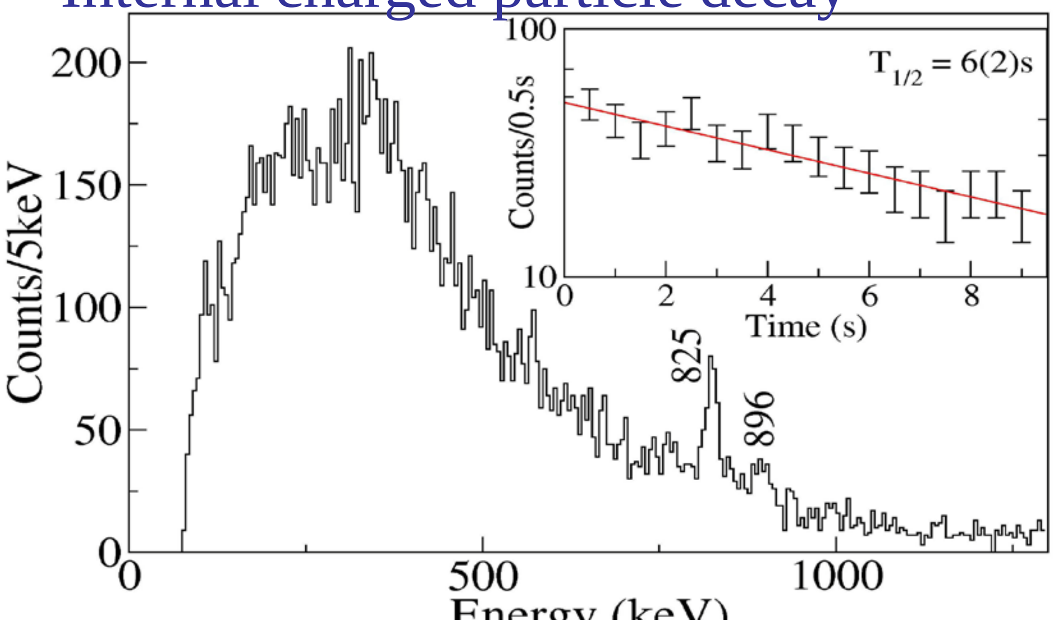
^{205}Au: three proton-hole nucleus



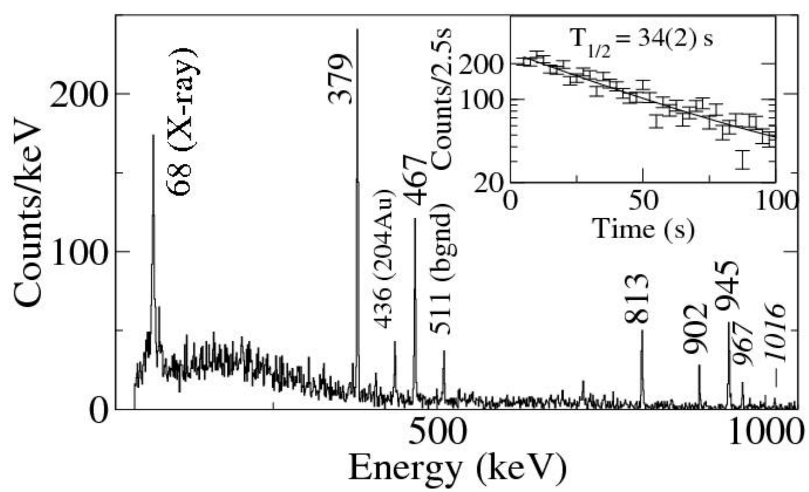
Internal gamma decay

AIDA will do much better with conversion electrons

Internal charged particle decay



Gammas following beta decay



Zs. Podolyák et al., Phys. Lett. B 672 (2009) 116.

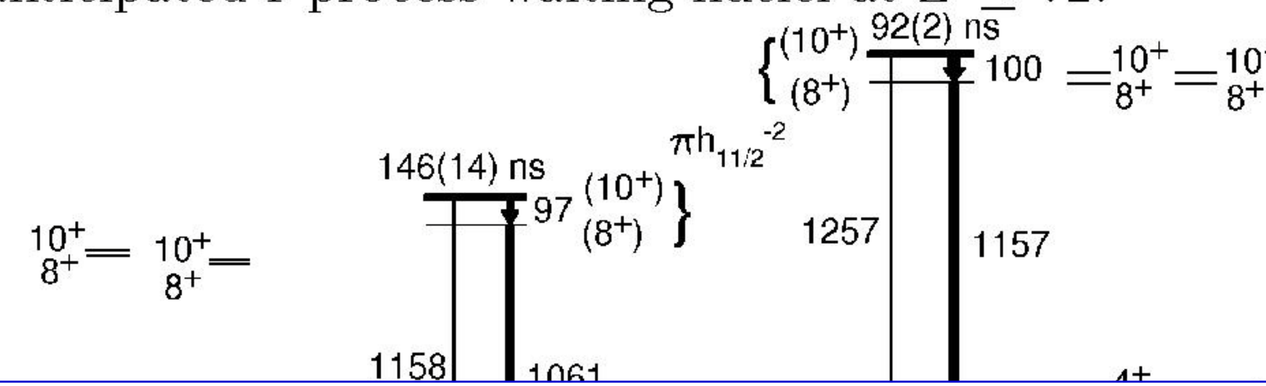
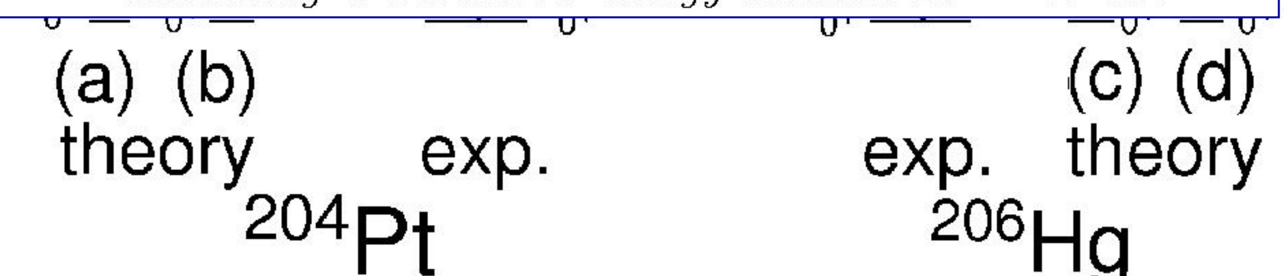


TABLE I: Transition strengths for experiment, the Rydström [24] shell model (SM) and the new TBMEs (SM_{mod}), see text, in ^{204}Pt. Effective charges of 1.5 and 2.0 e for $E2$ and $E3$, respectively were assumed, which were chosen to reproduce the ^{206}Hg $10^+ \to 8^+$ $E2$ and $10^+ \to 7^-$ $E3$ transitions [9].

Transition	EL	$B(EL)$ (W.u.)		
		exp.	SM	SM_{mod}
$10^+ \to 8^+$	$E2$	0.80(8)	2.64	1.22
$10^+ \to 7^-$	$E3$	0.19(3)	0.21	0.22
$7^- \to 5^-$	$E2$	$0.017 \to 0.0034^a$	1.21	0.0037
$5^- \to 2^+$	$E3$	0.039(5)	0.713	0.612

[a] *Assuming a transition energy between 10 → 78 keV*



S.Steer et al., Phys. Rev C78 (2008) 061302(R)

Shell-model calculations (M.Górska, H.Grawe, H. Maier, A.Brown)

(a)and (d): TBME from L.Rydstrom et al, NPA512(1990)217 (based on Kuo-Brown interaction)

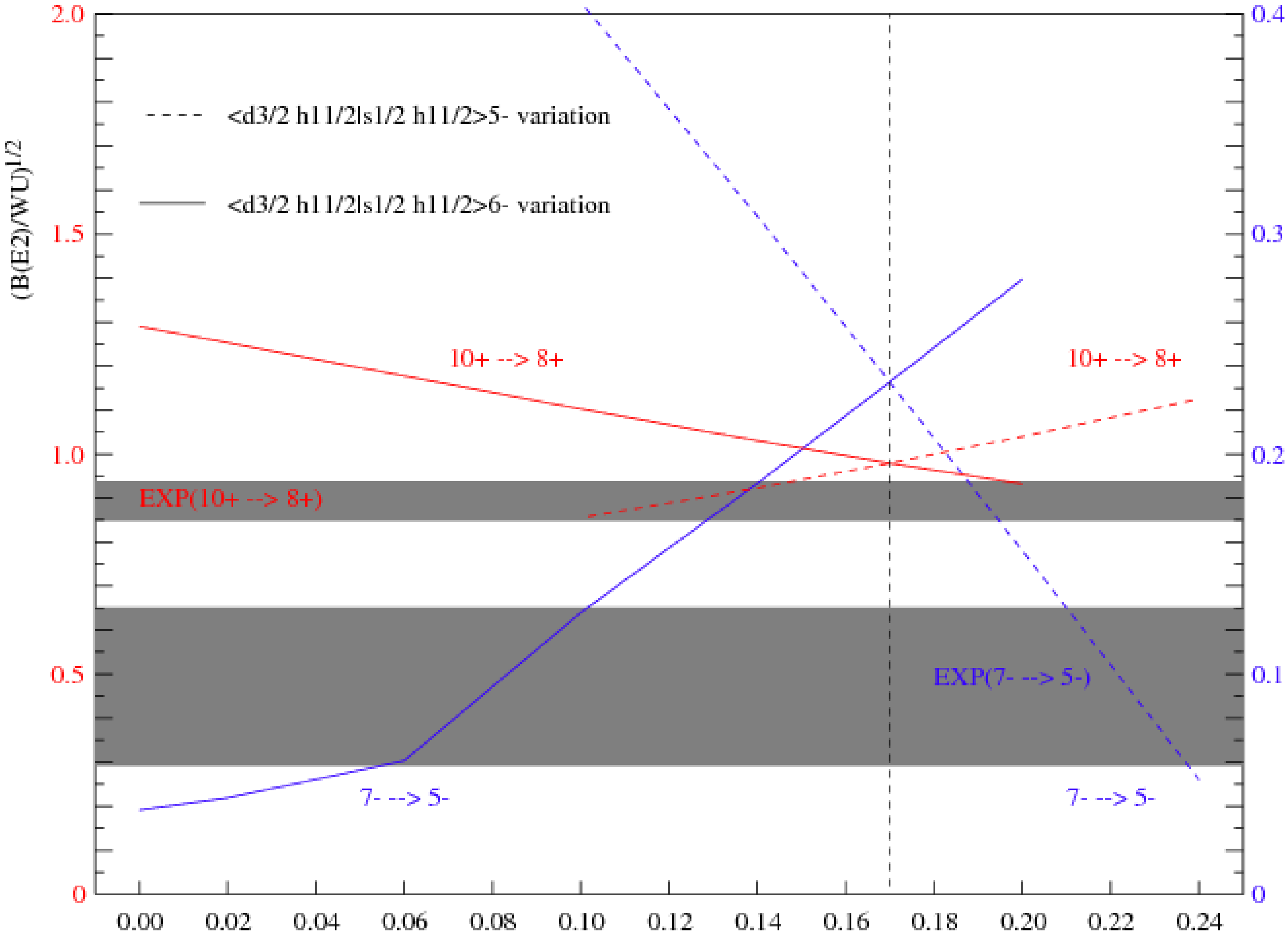
(b) and (c): three TBMEs modified

$\Delta(d_{3/2}\, h_{11/2};\, d_{3/2}\, h_{11/2})_{7-}$ = +135 keV

$\Delta(s_{1/2}\, d_{5/2};\, s_{1/2}\, d_{5/2})_{2+,3+}$ =+230 keV (monopole only)

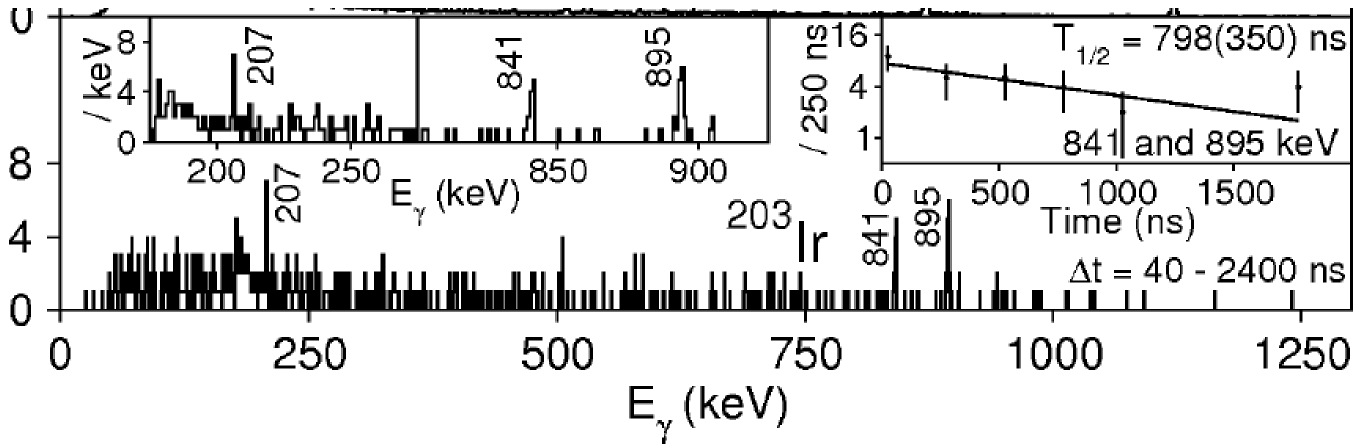
$\Delta(d_{3/2}\, h_{11/2};\, s_{1/2}\, h_{11/2})_{6-}$ changed to +0.160 MeV (fit for B(E2)

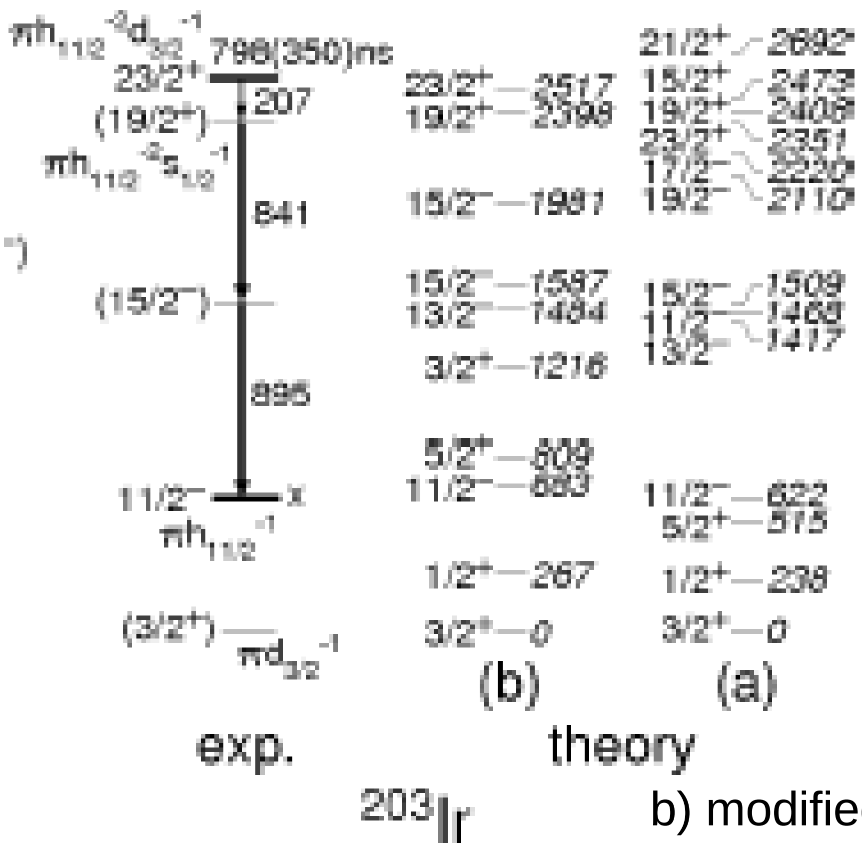
Good description of energies and B(EL)s



Variation of key non-diagonal TBME to fit E2 strengths. The effective proton charge used in the SM is 1.35 e which is smaller than the adopted value of 1.5 e. Note that the upper experimental limit for the 7- → 5- is increased by a factor of about five if the (unknown) transition energy is below the Pt M edge. The vertical dashed line represents the adopted TBME value, which is given in MeV.

203Ir





b) modified; a) original

Transition strengths in N=126 nuclei

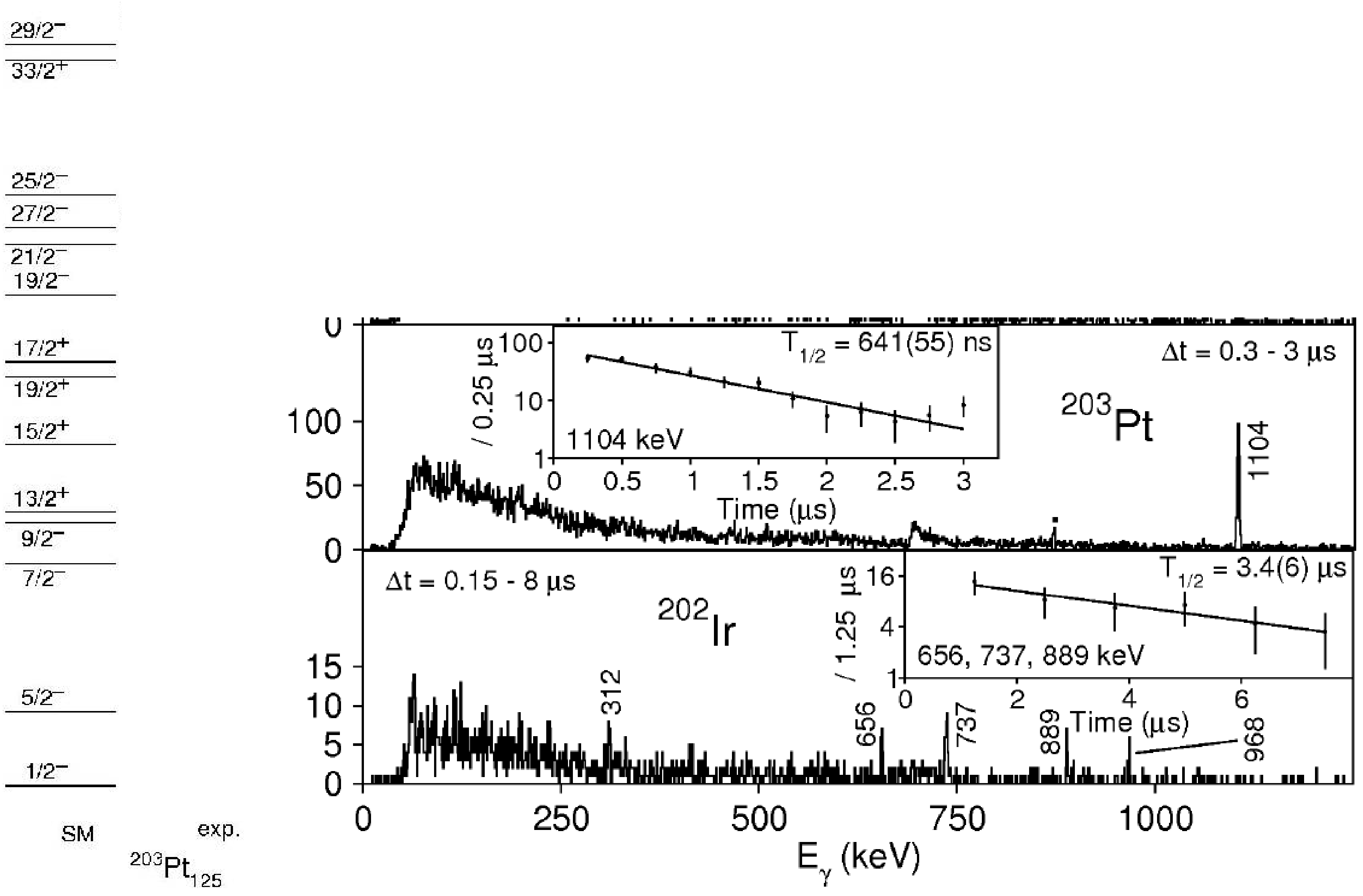
Nucleus	Transition	B(EL) (W.u.) exp.	SM	SM_{mod}
^{206}Hg	$B(E3:10^+ \to 7^-)$	0.25(3)	0.17	0.21
^{204}Pt	$B(E3:10^+ \to 7^-)$	0.19(3)	0.21	0.22
203Ir	B(E2:23/2+->19/2+)	0.02(1)[b)]	3.58	0.013
^{206}Hg	$B(E3:5-^+ \to 2^+)$	0.18(2)	1.17	0.91
^{204}Pt	$B(E3:5-^+ \to 2^+)$	0.039(5)	0.713	0.612
^{206}Hg	$B(E2:10^+ \to 8^+)$	0.94(15)	0.87	0.87
^{204}Pt	$B(E2:10^+ \to 8^+)$	0.80(8)	2.64	1.22
^{205}Au	$B(E2:19/2^+ \to 15/2^+)$	1.2(2)	3.1	1.7
^{204}Pt	$B(E2:7-^+ \to 5^-)$	0.017+ →0.0034[a)]	1.21	0.0037

Effective charges: 1.5e for E2 and 2.0e for E3 (to reproduce 206Hg)

[a)] Assuming a transition energy between 10→78 keV.

⇒ Good description of N=126 nuclei
after small modifications of TBMEs

N=125; Z=78 ^{203}Pt



Conclusions

Structure:

N=126 nuclei (^{205}Au, ^{204}Pt, ^{203}Ir)

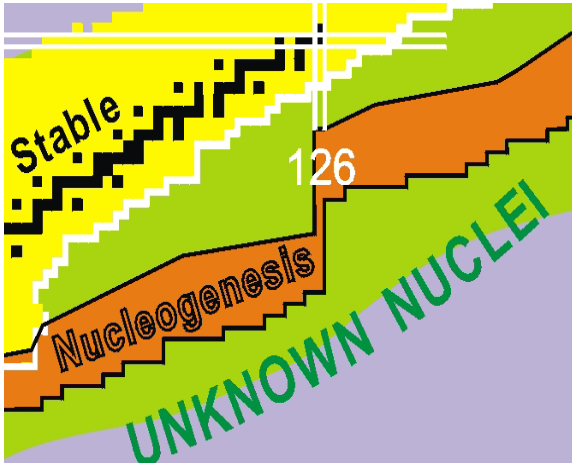
changes in TBME helps/needed

N=128 nuclei (^{208}Hg,^{209}Tl)

agreement with shell model

N<126 nuclei (^{203}Pt etc)

shell model has difficulties

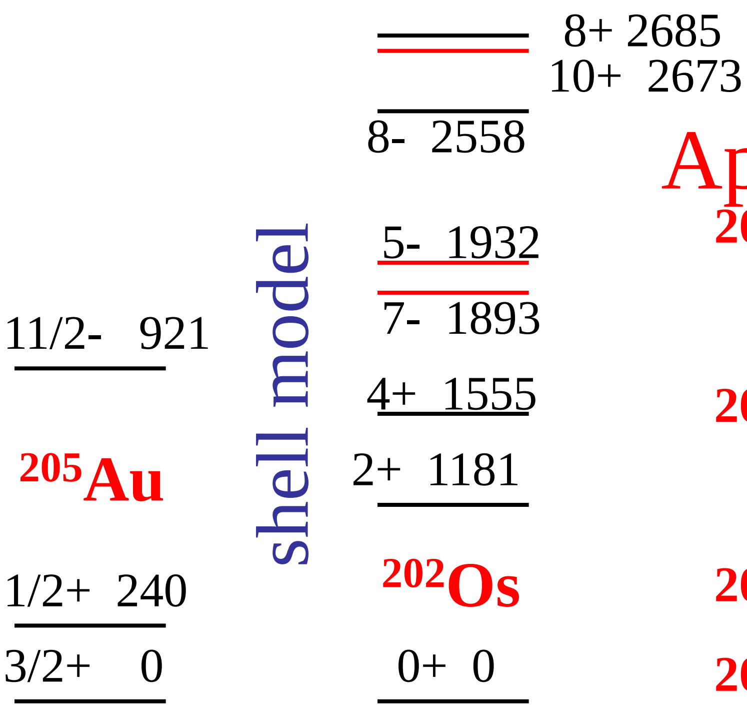


Future

+fast-timing measurements:

^{206}Hg: $7^- \rightarrow 5^-$ ~1.2ns(1W.u.)

...



Approved experiment on the book

^{205}Au: beta decay from ^{205}Pt

=> will fix the $\pi s_{1/2}$ orbital

^{203}Ir: beta decay from ^{203}Os ($\nu g_{9/2}$)

=> will fix the $\pi d_{3/2}, \pi s_{1/2}, \pi h_{11/2}$

^{202}Os: isomeric decay I=(5),(7),(10)

^{202}Os: beta decay of ^{203}Ir ($\nu g_{9/2}$)