

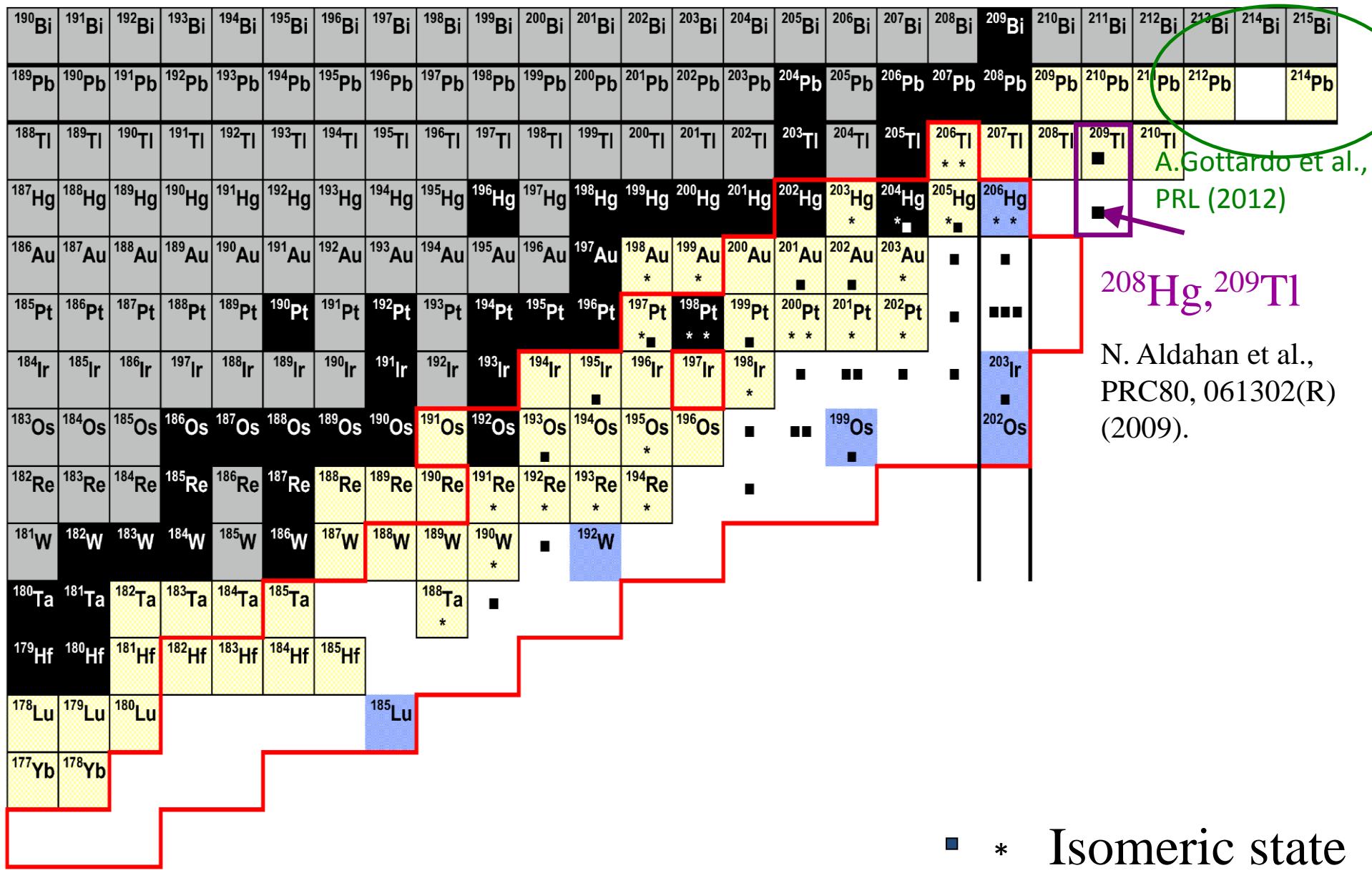
# Coulomb excitation of the two proton-hole nucleus $^{206}\text{Hg}$

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# Isomeric states

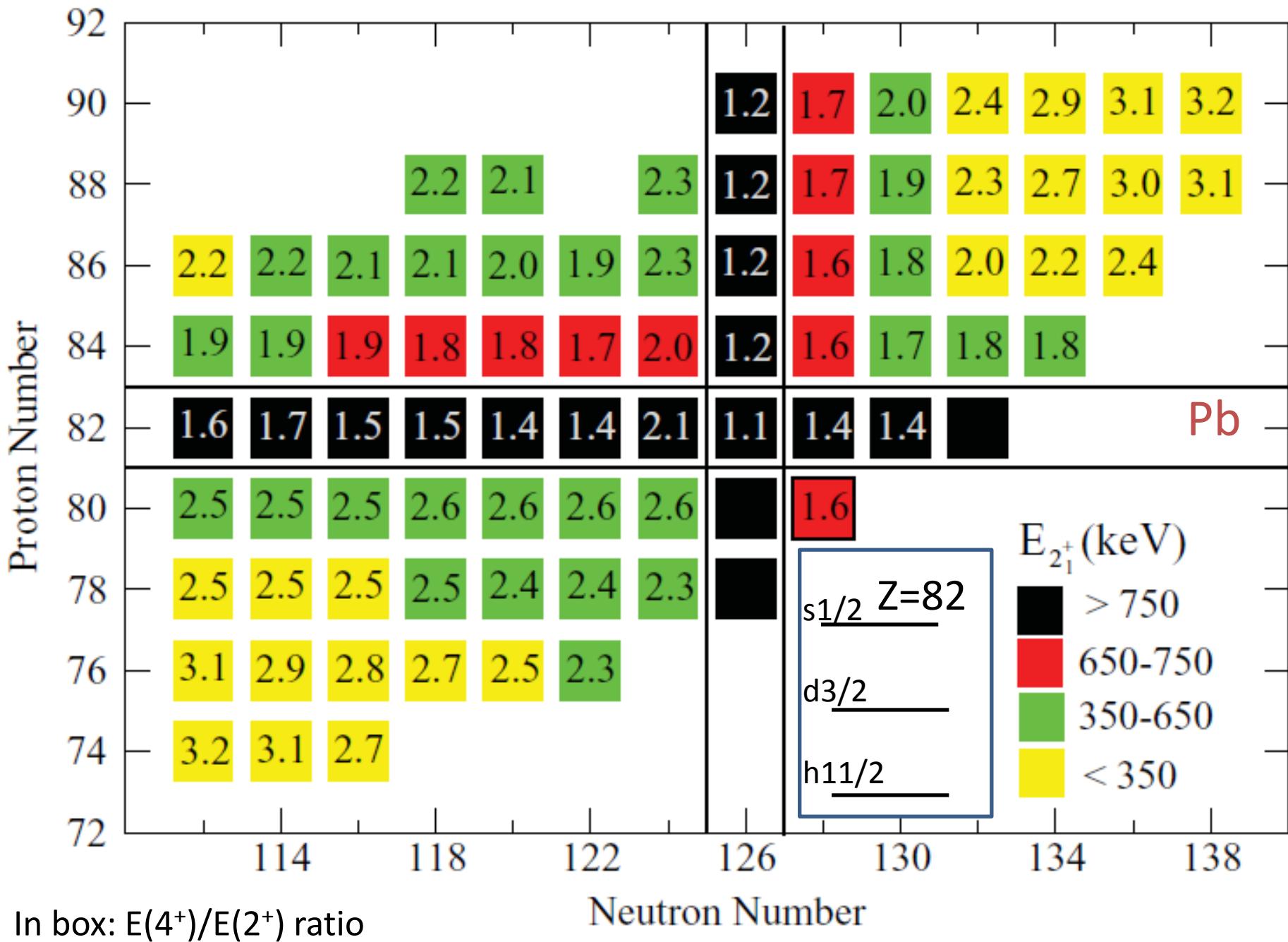


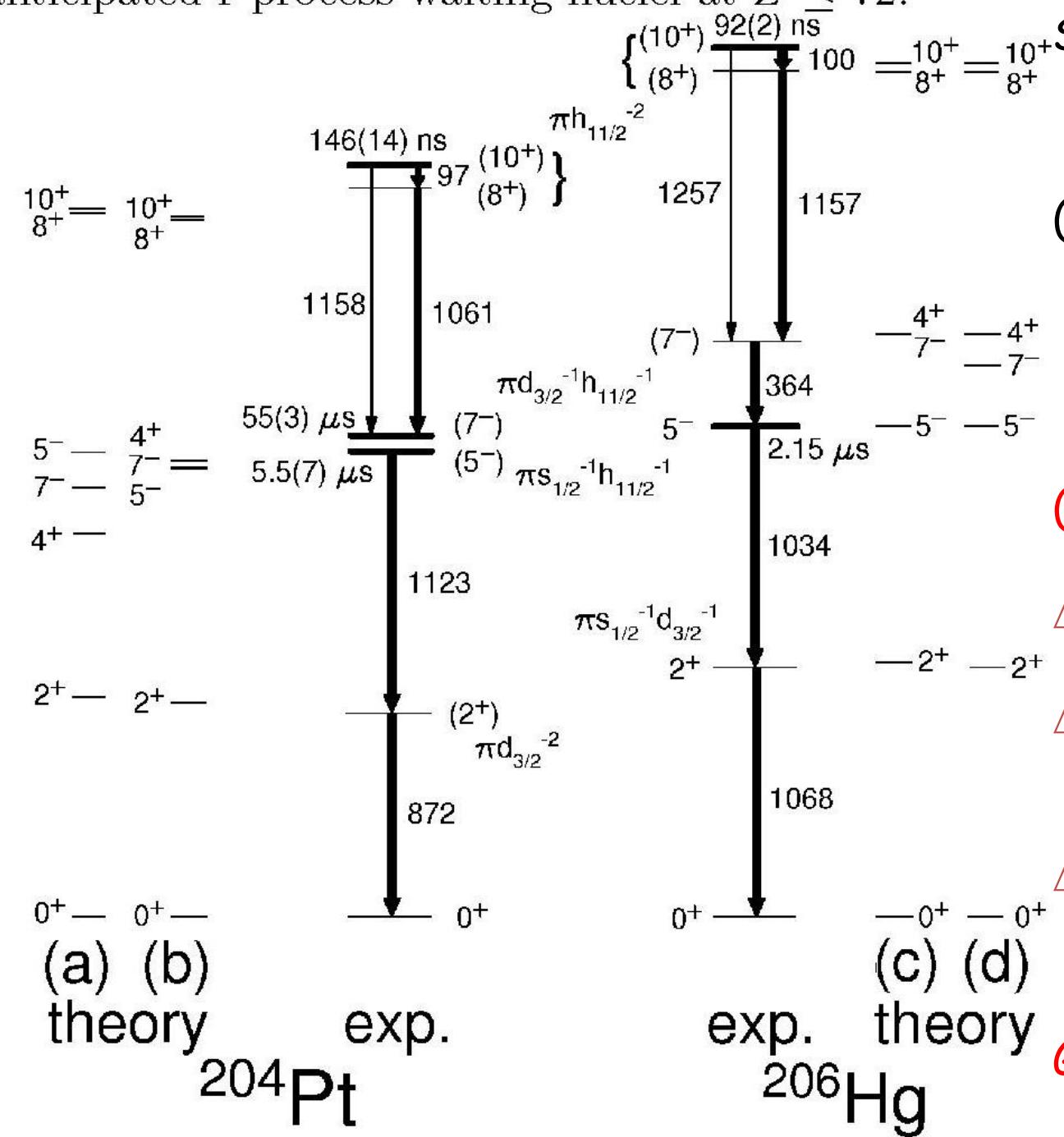
A. Gottardo et al.,  
PRL (2012)

$^{208}\text{Hg}, ^{209}\text{Tl}$

N. Aldahan et al.,  
PRC80, 061302(R)  
(2009).

# Even-even nuclei around $^{208}\text{Pb}$





# Shell-model calculations (M.Górnska, 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

$$\Delta(d_{3/2} h_{11/2}; d_{3/2} h_{11/2})_7 = +135 \text{ keV}$$

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

$\Delta(d_{3/2} h_{11/2}; s_{1/2} h_{11/2})_6$   
 changed to +0.160 MeV  
 (fit for  $B(E2)$ )

## Good description of energies and B(EL)s

# Transition strengths in $^{206}\text{Hg}$ and $^{204}\text{Pt}$

Nucleus	Transition	Exp. (W.u.)	SM <sub>standard</sub> (W.u.)	SM <sub>mod</sub> (W.u.)
$^{206}\text{Hg}$	B(E3;10+ $\rightarrow$ 7-)	0.25(3)	0.17	0.21
$^{206}\text{Hg}$	B(E2;10+ $\rightarrow$ 8+)	0.94(15)	0.87	0.87
$^{206}\text{Hg}$	B(E3;5- $\rightarrow$ 2+)	0.18(2)	1.17	0.90
$^{204}\text{Pt}$	B(E3;10+ $\rightarrow$ 7-)	0.19(3)	0.21	0.22
$^{204}\text{Pt}$	B(E2;10+ $\rightarrow$ 8+)	0.80(8)	2.64	1.22
$^{204}\text{Pt}$	B(E2;7- $\rightarrow$ 5-)	0.017-0.0034	1.21	0.0037
$^{204}\text{Pt}$	B(E3;5- $\rightarrow$ 2+)	0.039(5)	0.713	0.612

Effective charges: 1.5e (E2) and 2.0e (E3)

# Collective octupole excitations

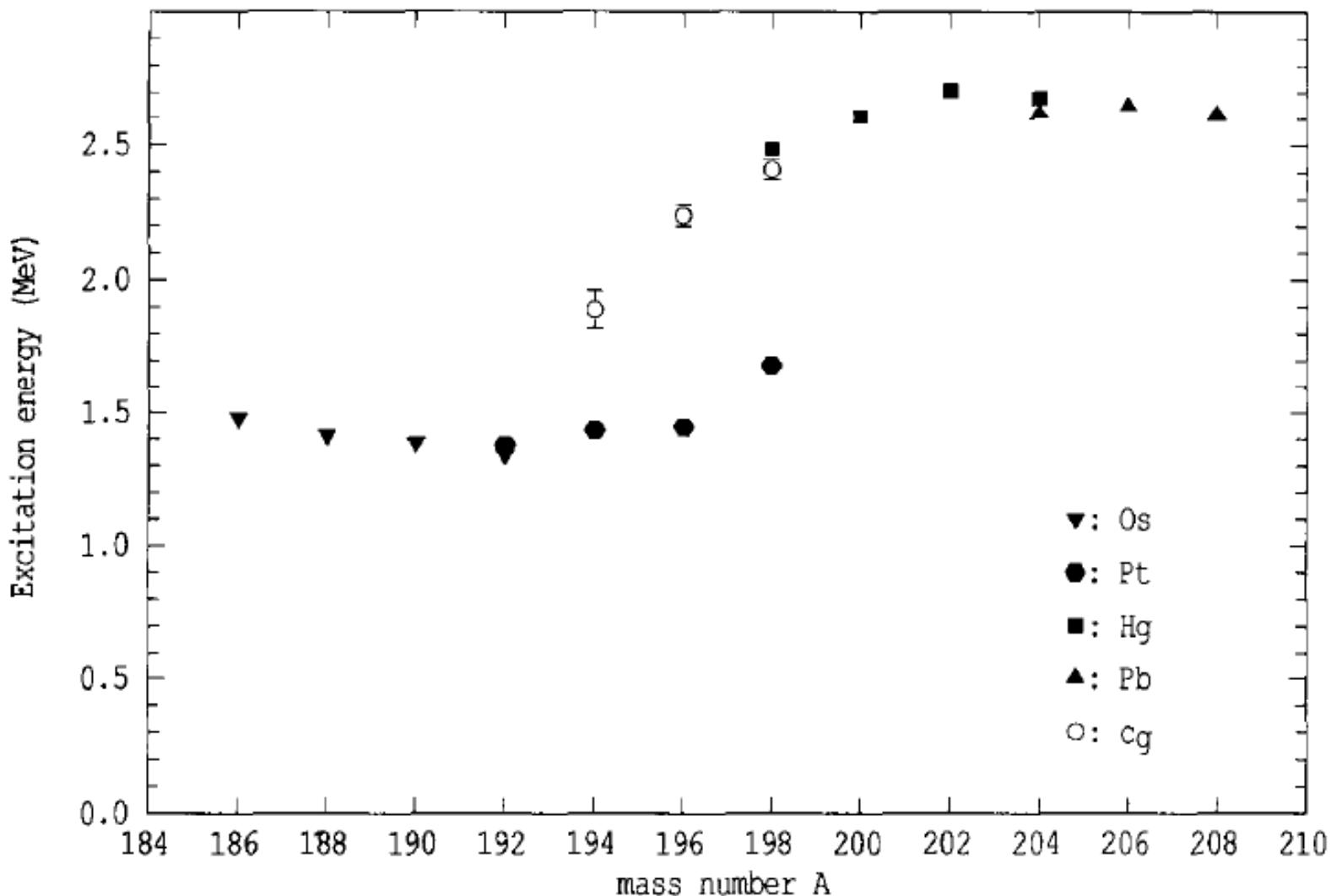


Fig. 1. Excitation energies of the  $3_1^-$  state for all the stable even-mass Os, Pt, Hg and Pb isotopes up to  $^{208}\text{Pb}$  [ref. <sup>4</sup>)] and centres of gravity for the Pt nuclei,  $c_g$ , as calculated by Cottle *et al.* <sup>2</sup>) using eq. (2).

=> Expected collective  $3^-$  state at  $\sim 2.7$  MeV in  $^{206}\text{Hg}$

# Systematics of B(E3) transition strengths

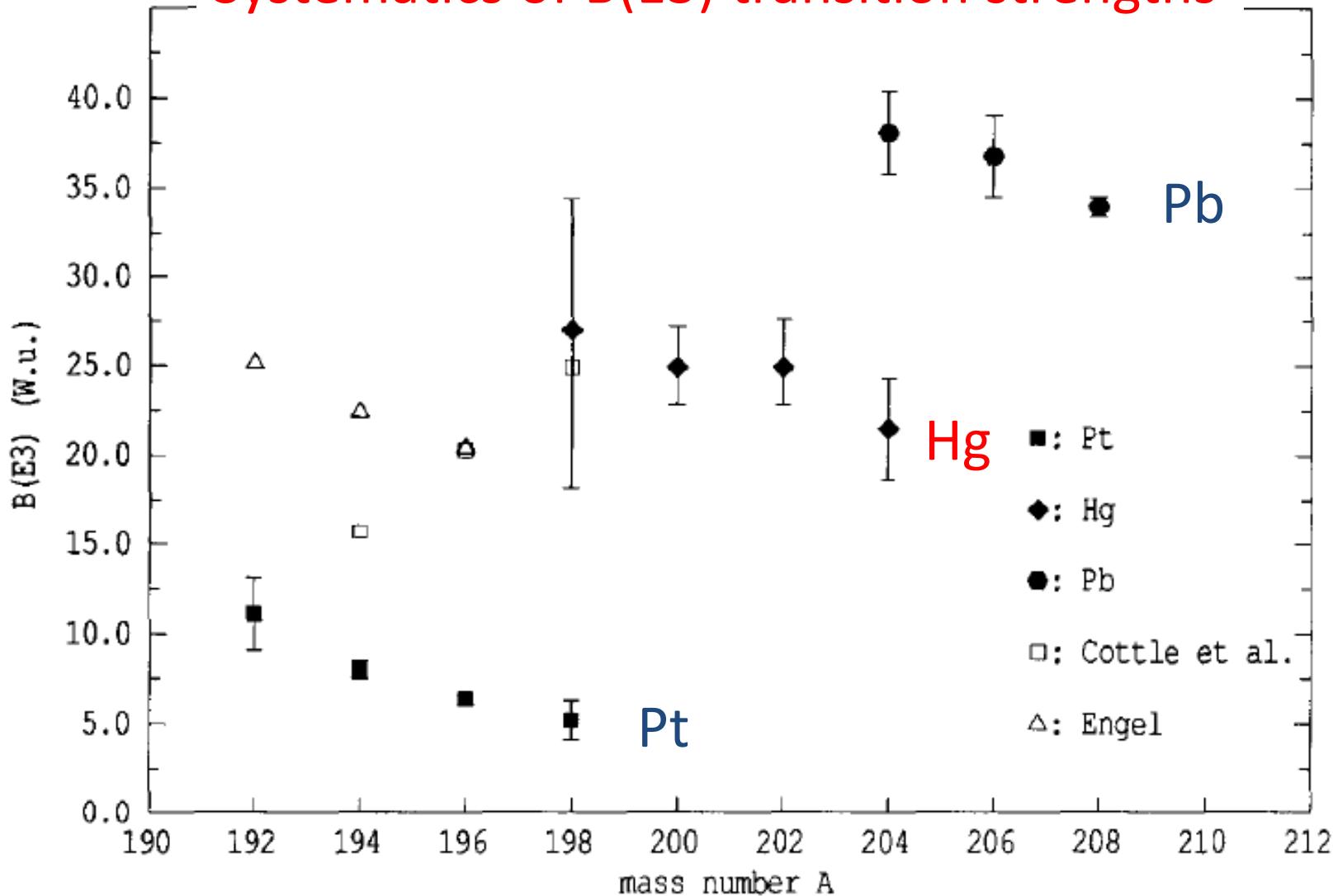
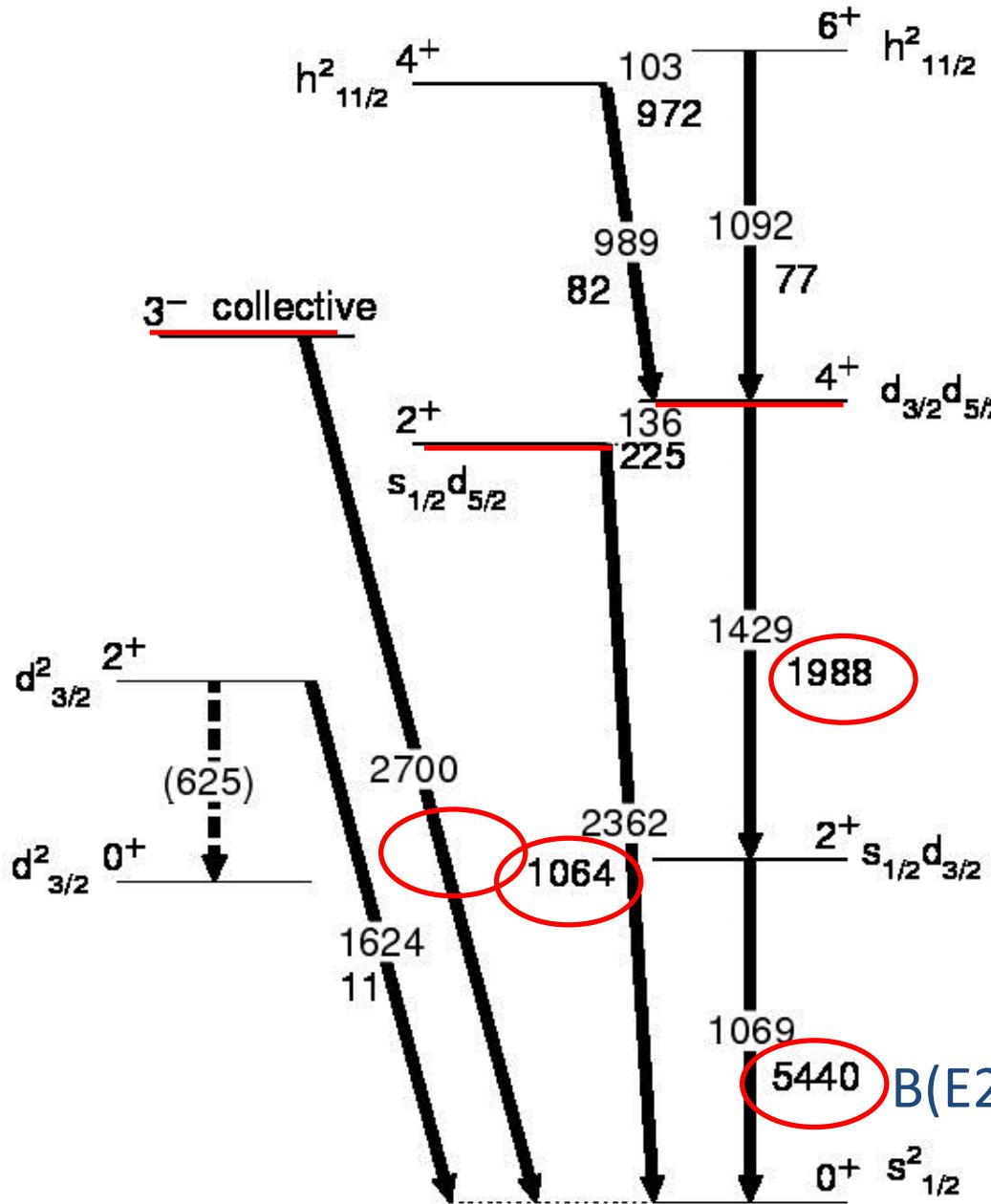


Fig. 3. Experimental values (table 5) of the E3 transition strengths in W.u. for the  $3_1^-$  states,  $|M(E3)|^2$ , for all the stable even-mass Pt, Hg and Pb isotopes up to  $^{208}\text{Pb}$ . The total transition strengths for all attributed  $3^-$  states in the Pt isotopes deduced by Cottle *et al.*<sup>2)</sup> from analysis of  $(p, p')$  data, and those calculated by Engel<sup>27)</sup>, are also shown by open squares and open triangles, respectively.

C.S. Lim, W.N. Catford, R.H. Spear, Nucl. Phys. A 522, 635 (1991)

# Theoretical calculations



To be determined:

$$B(E2; 0^+ \rightarrow 2^+)$$

$$B(E2; 2^+ \rightarrow 4^+)$$

$$B(E2; 0^+ \rightarrow 2^+_3)$$

$$B(E3; 0^+ \rightarrow 3^-)$$

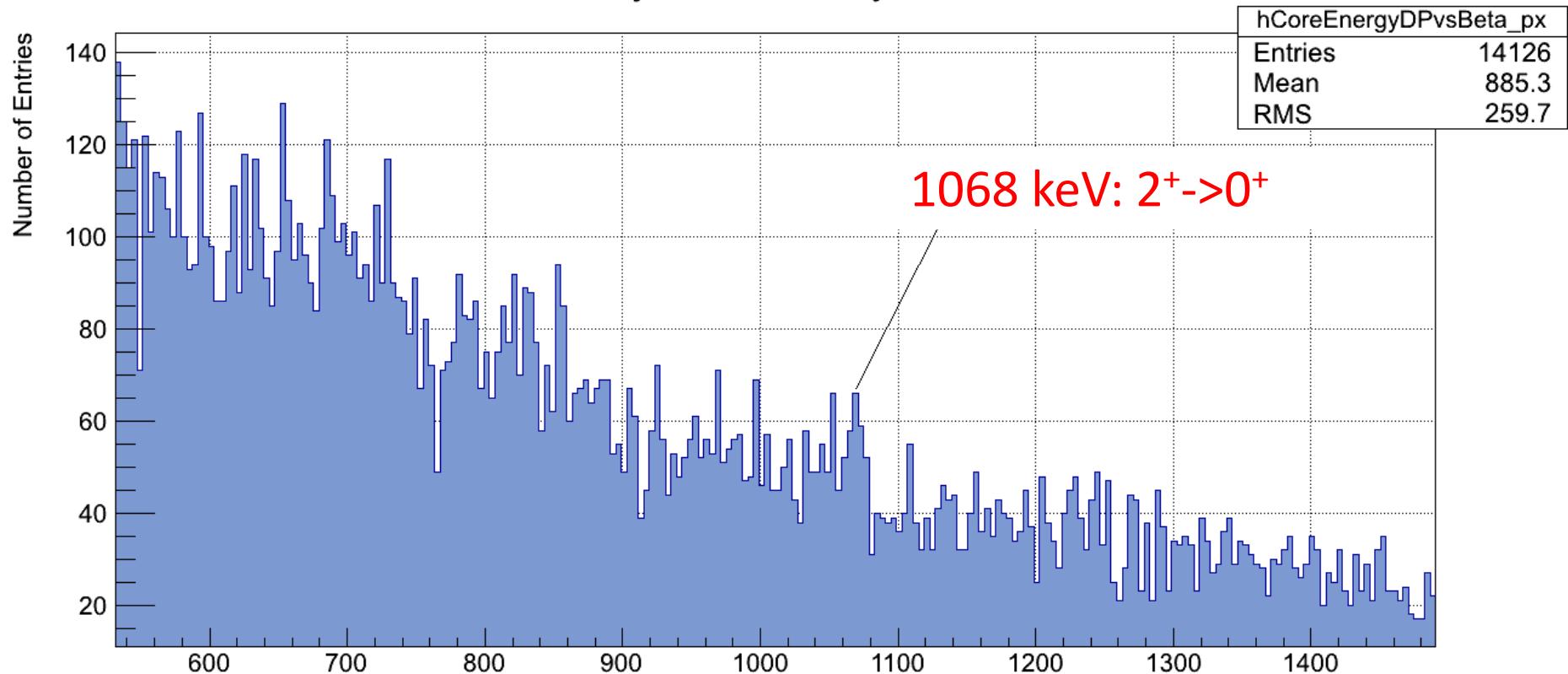
$$E(4^+)$$

$$E(2^+_3)$$

$$E(3^+)$$

# Coulex of $^{206}\text{Hg}$ at relativistic energies (GSI, October 2012)

ProjectionX of biny=208



Difficulty: isomeric beams also present  
(the amount of the isomeric  $0^+_2$  cannot be determined)

# Yield calculations

## Using GOSIA and Shell Model results

Beam from molten lead target:  $^{206}\text{Hg}$  (~50%) and  $^{206}\text{Pb}$  (~50%)

Average available  $^{206}\text{Hg}$  beam intensity:  $1.2 \times 10^6$  pps

$E_{\text{beam}} = 845 \text{ MeV}$  (4.1 MeV/u)

Target:  $^{120}\text{Sn}$  2 mg/cm<sup>2</sup>

MINIBALL (8% efficiency) + CD Si detector (16-53°)

In order to reduce rate on Si, we consider

$^{206}\text{Hg}$  beam:  $2 \times 10^5$  pps (much below what is available)

Yields:

$2^+ \rightarrow 0^+$  9000/day

$4^+ \rightarrow 2^+$  170/day

$3^- \rightarrow 0^+$  45/day

$2^+_3 \rightarrow 0^+$  50 /day

**Requested beam-time: 15 shifts (5 days)**

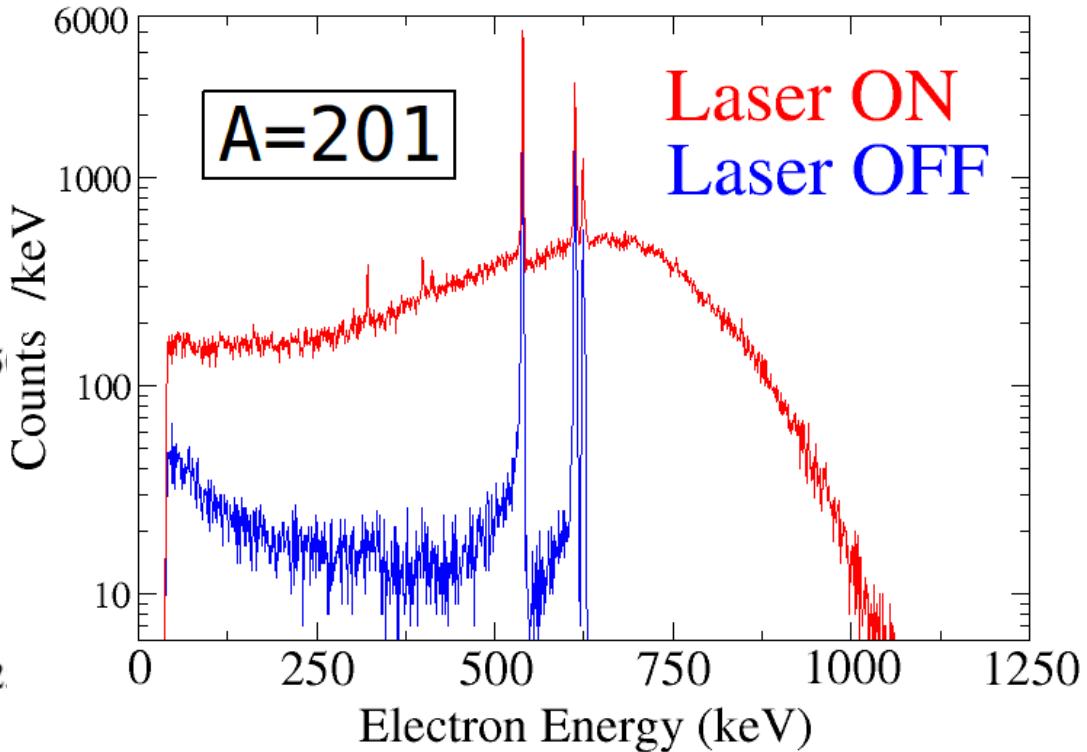
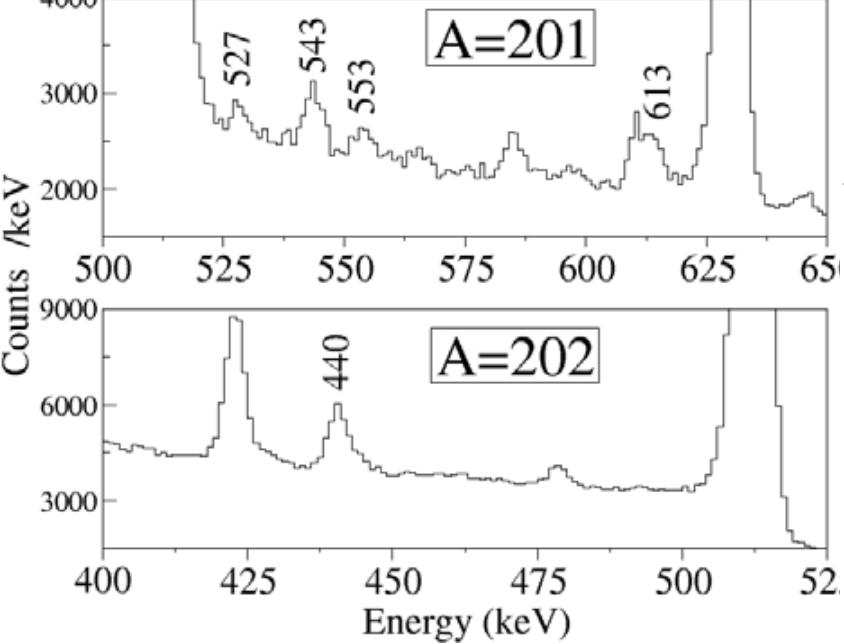
**IS447:** Along the N=126 closed shell: study of  $^{201,203,205}\text{Au}$  through its  $\pi\text{h}_{11/2}^{-1}$  isomeric decay

Performed in 2008 and Sept. 2010

$^{201}\text{Au}$  yield:  $\sim 6 \times 10^4$

$^{202}\text{Au}$  yield:  $\sim 2 \times 10^3$

(for 1.6  $\mu\text{A}$  proton beam)



A.Y. Deo et al., *Structures of  $^{201}\text{Po}$  and  $^{205}\text{Rn}$  from EC/ $\beta^+$ -decay studies*,  
Phys. Rev. C 81, 024322 (2010)

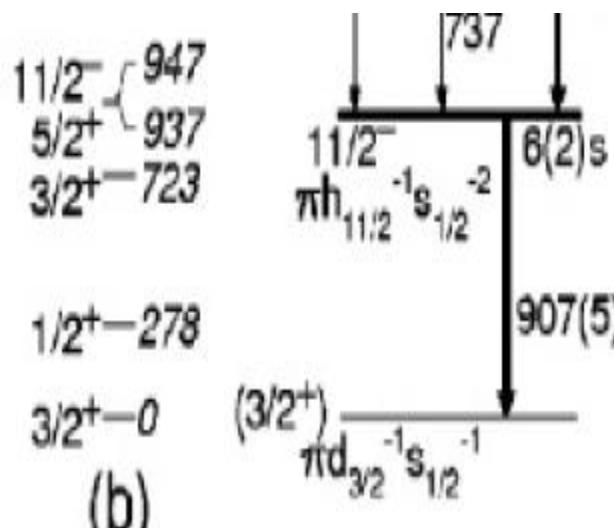
A.Y. Deo et al., *EC/ $\beta^+$  decay studies across  $N = 126$ :  $^{213}\text{Fr}$  and  $^{213}\text{Rn}$* ,  
in preparation

M. Bowry, *First extraction of neutron-rich gold isotopes at ISOLDE*,  
ISOLDE newsletter, Spring 2011.

IS447: Along the N=126 closed shell: study of 201,203,205Au through its  $\pi h_{11/2}^{-1}$  isomeric decay

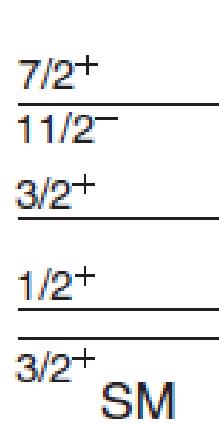
Performed in 2008 and Sept. 2010

19/2<sup>-</sup>

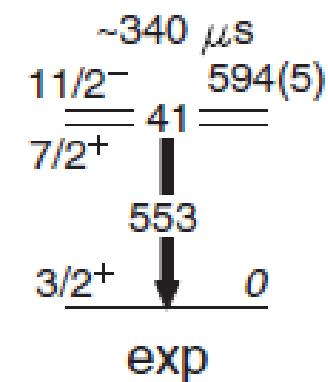


205Au

15/2<sup>-</sup>



203Au



201Au



P-340	MINIBALL + CD-only	15	206Hg		safety file of MINIBALL + only CD	Safety: no comments	... Pb-403 + VD5 source. 8e7/muC, 0.5muA p max, 50% 206Pb from target OK	ok	3% overall efficiency slightly optimistic (considering unknown transmission of supercond linac and high charge state 49+)	Which energy required exactly (min 4.1 MeV/u?)?
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