STUDY OF SHAPE COEXISTENCE IN NEUTRON DEFICIENT MERCURY ISOTOPES

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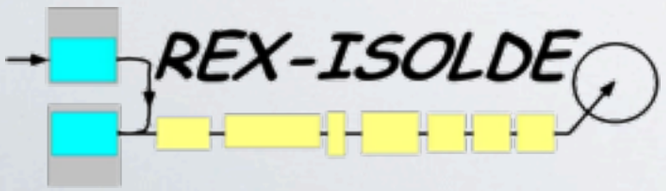

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TALK OUTLINE

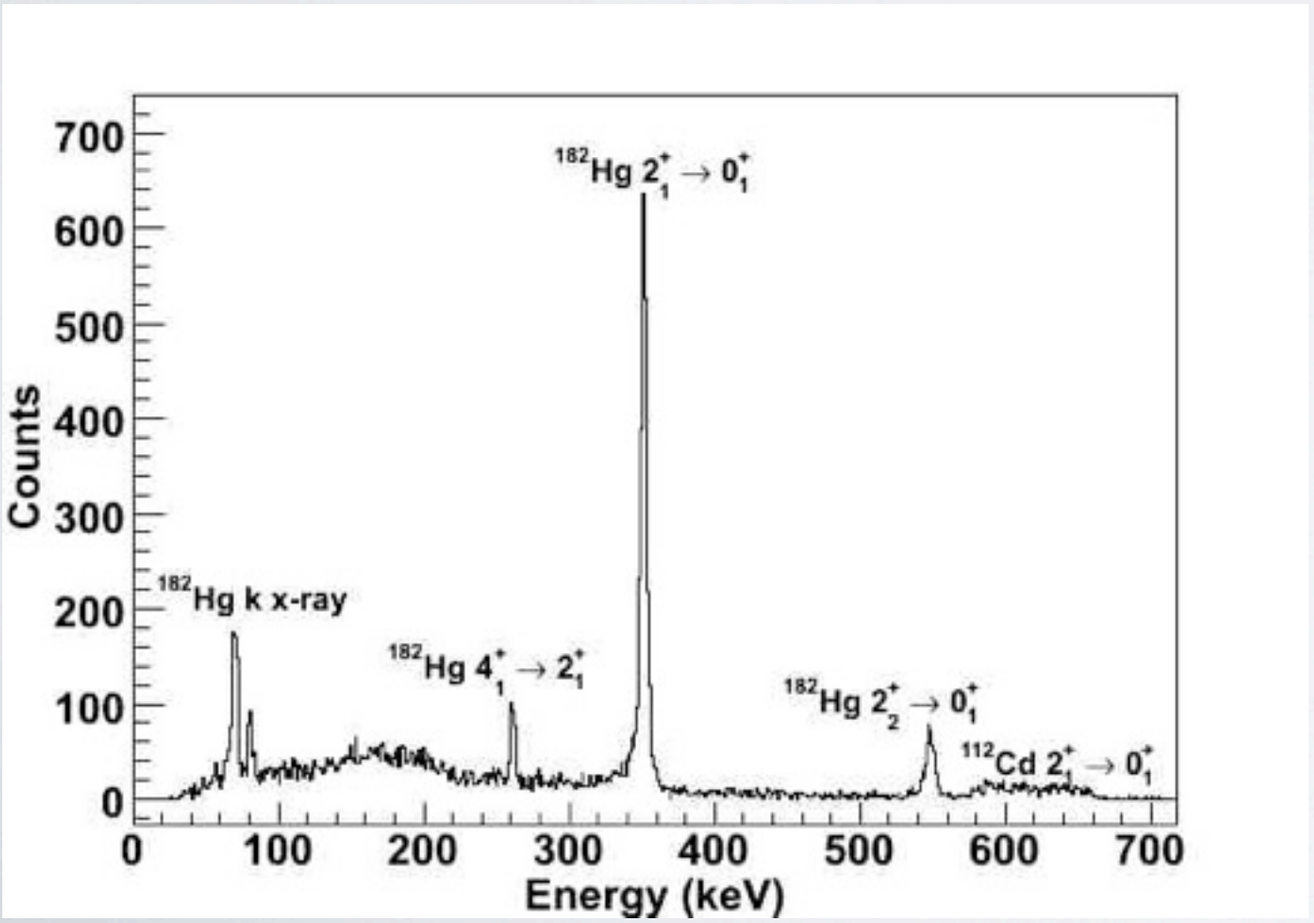
- X-ray analysis
- Effect of E0 component
- Lifetime measurements
- Matrix elements in ^{182,186}Hg
- Future work and conclusions

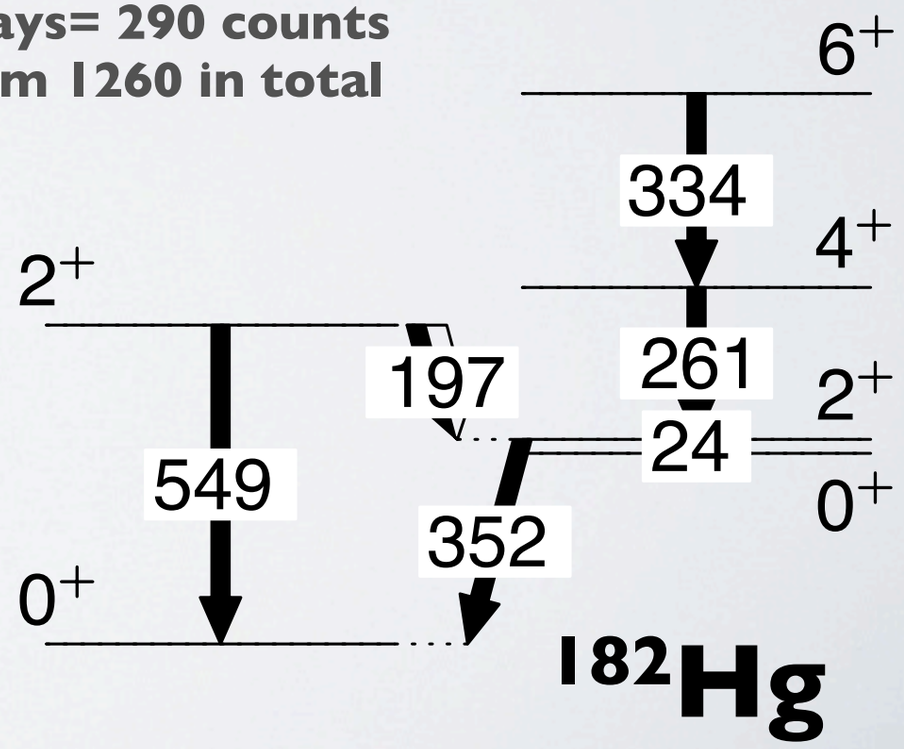
X-RAY ANALYSIS

- Excess of x-rays are seen in ^{182,184}Hg
- Source? - Attributed to E0 transitions
- $2_2^+ \rightarrow 2_1^+$ in coincidence with $2_1^+ \rightarrow 0_1^+$
- Xray = Internal Conversion + E0

Transition	Energy	Counts
Hg $2^+_1 \rightarrow 0^+_1$	351 keV	3591 ± 81
Hg $2^+_2 \rightarrow 0^+_1$	549 keV	510 ± 39
Hg $4^+_1 \rightarrow 2^+_1$	262 keV	321 ± 33
Hg $2^+_2 \rightarrow 2^+_1$	196 keV	101± 29
Hg k X-ray	68 keV	1260 ± 53
Cd $2^+_1 \rightarrow 0^+_1$	605 keV	768 ± 40

maximum internal conversion induced Xrays= 290 counts from 1260 in total





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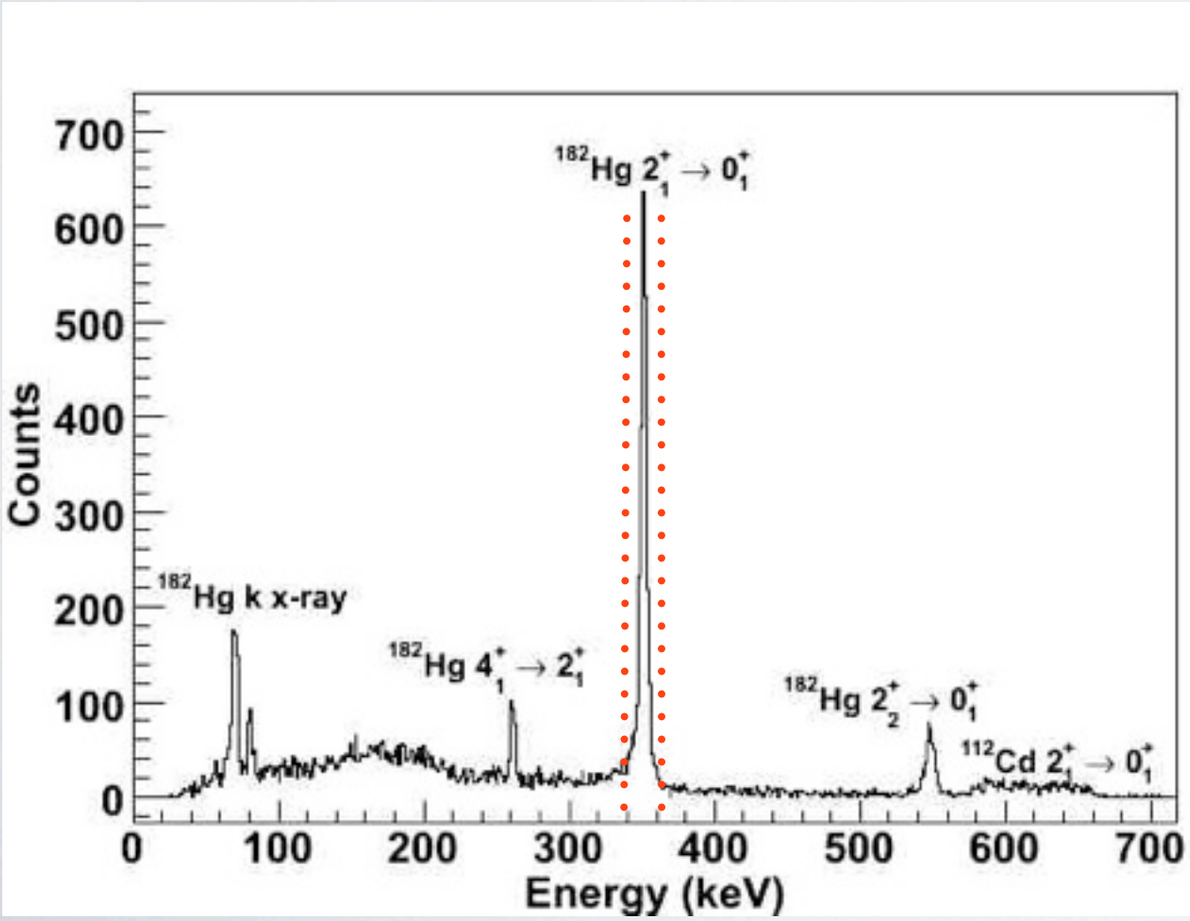
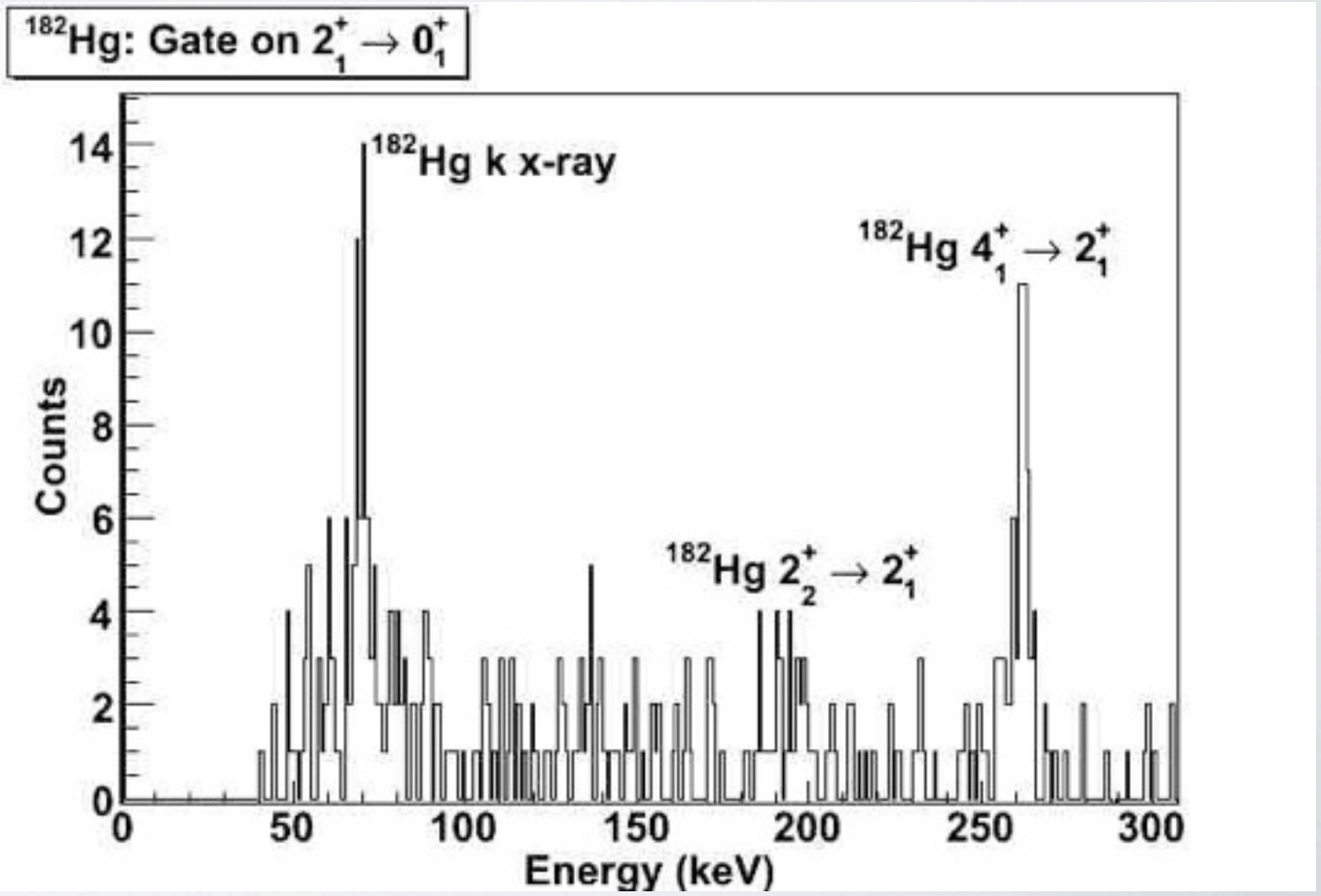
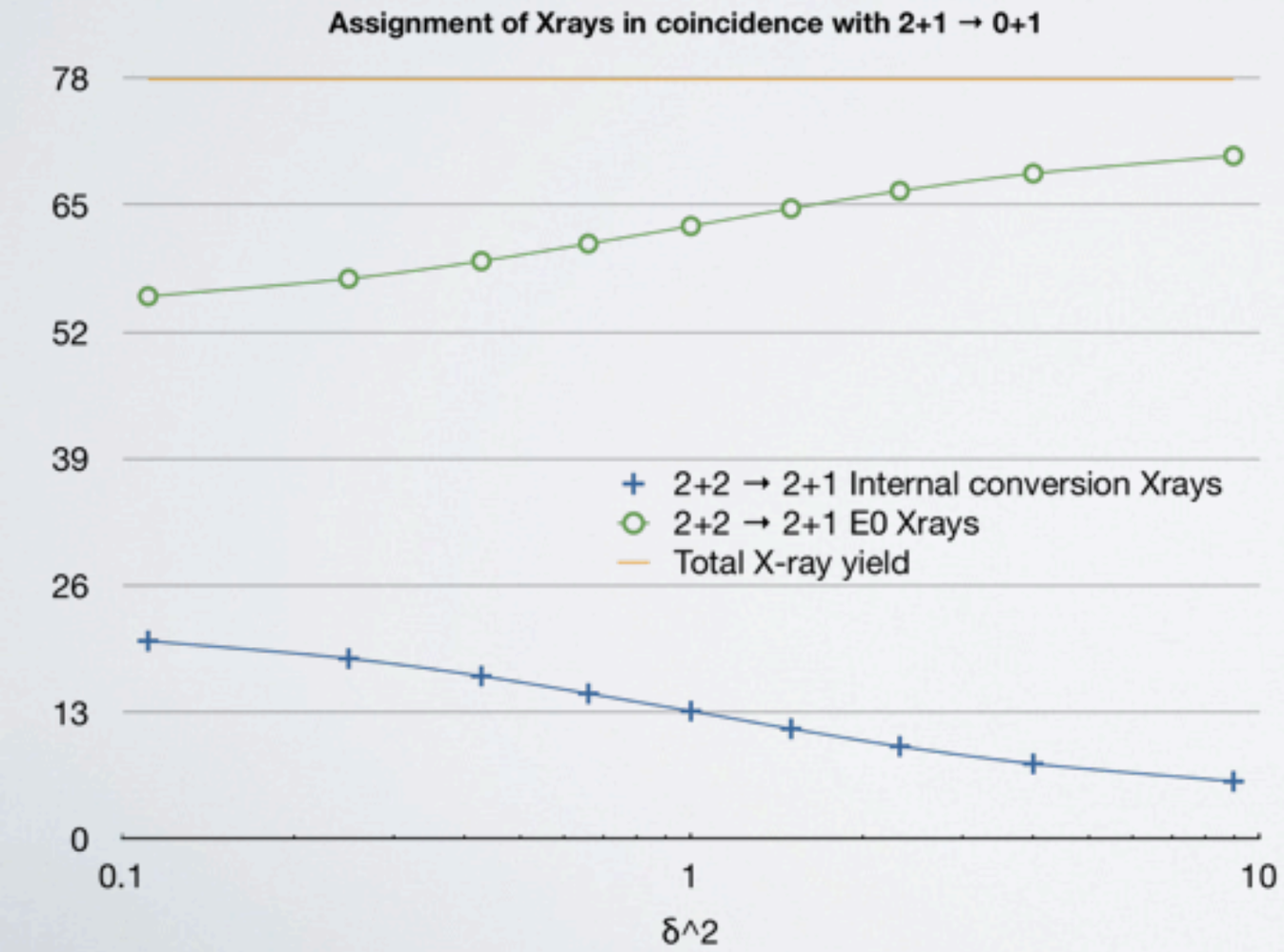
Transition	Energy	Counts
k x-ray	68 keV	78 ± 15
$2^+_2 \rightarrow 2^+_1$	196 keV	23.3 ± 5.2
$4^+_1 \rightarrow 2^+_1$	262 keV	62.9 ± 9.6

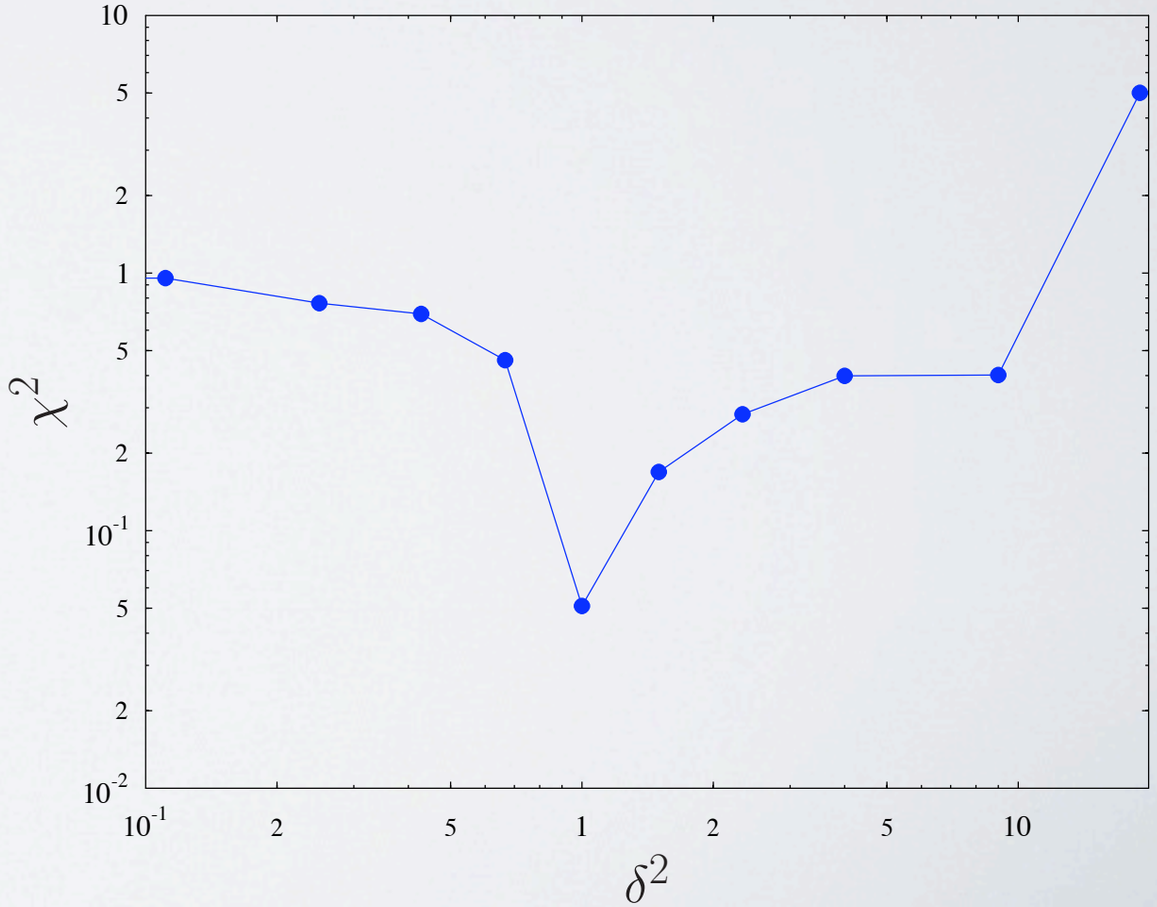




E0 ANALYSIS

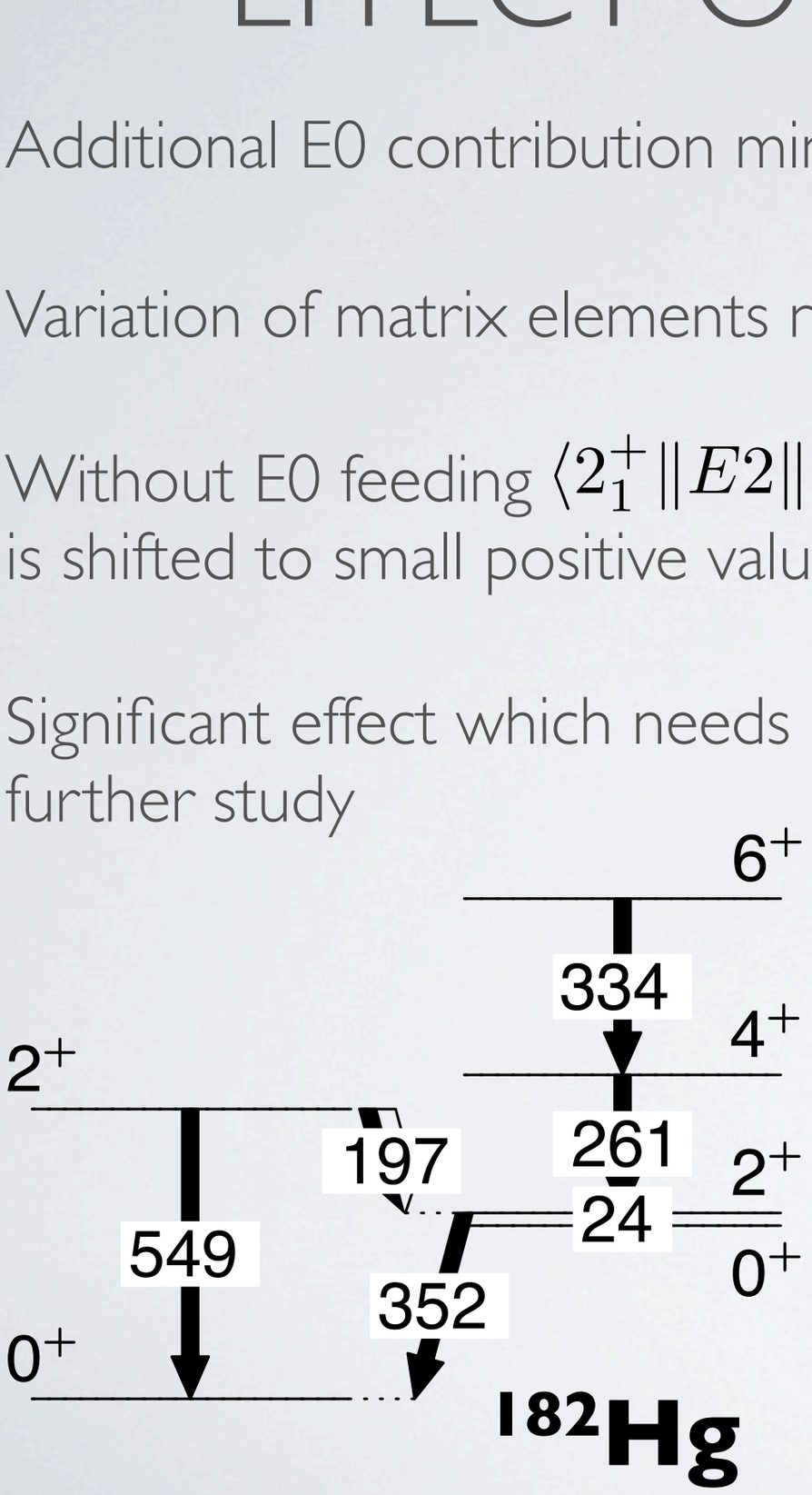
- Internal conversion of $2_2^+ \rightarrow 2_1^+$ depends on ratio of E2/M1, i.e. **δ**
- **δ** is unknown so how do we know the exact contribution?
- One needs to find solution which fits best in Gosia ... [Andrew Petts]

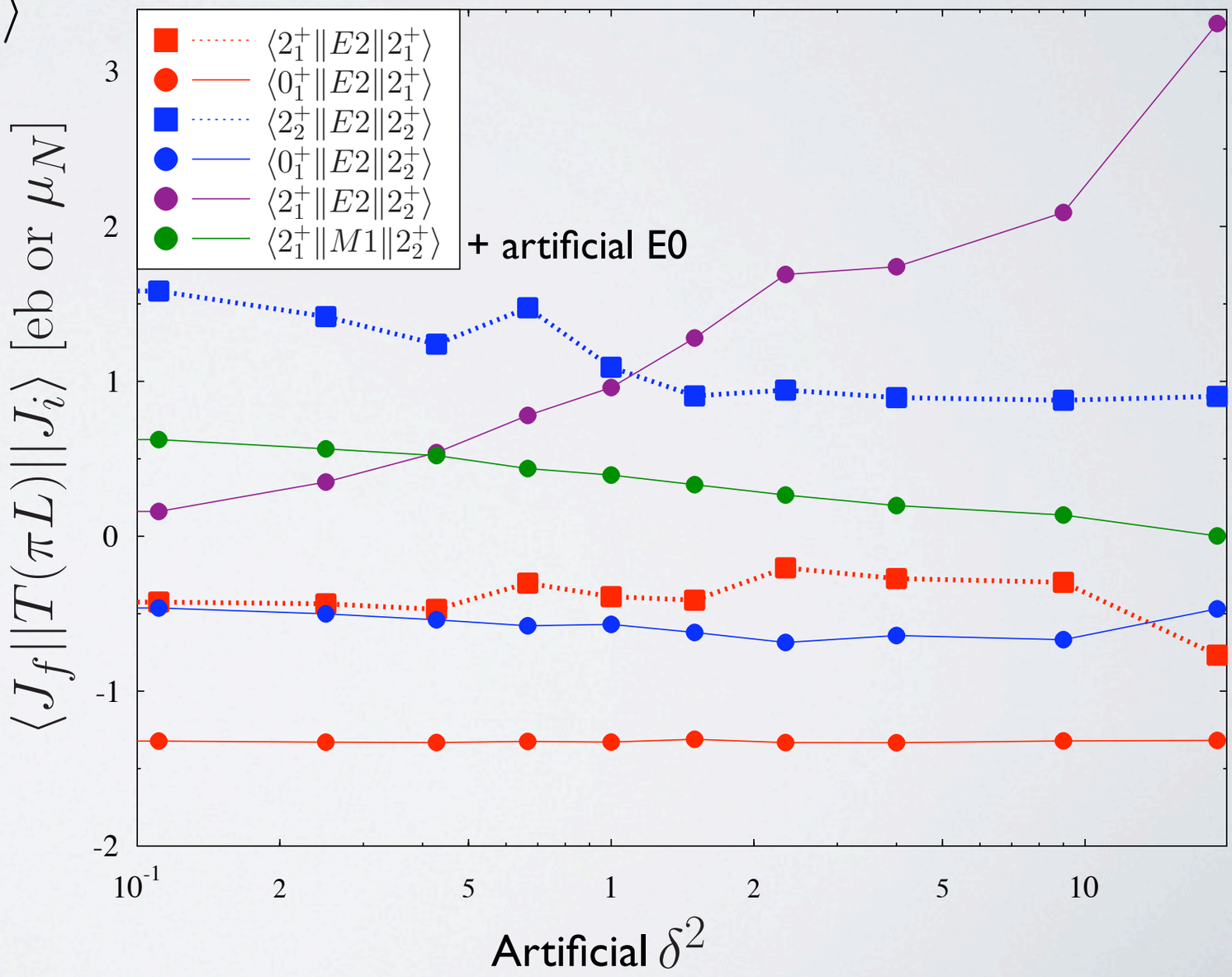




EFFECT OF E0 COMPONENT

- Additional E0 contribution mimicked by artificially increasing M1 component
- Variation of matrix elements not huge with variation of **δ**.
- Without E0 feeding $\langle 2_1^+ \| E2 \| 2_1^+ \rangle$ is shifted to small positive values
- Significant effect which needs further study





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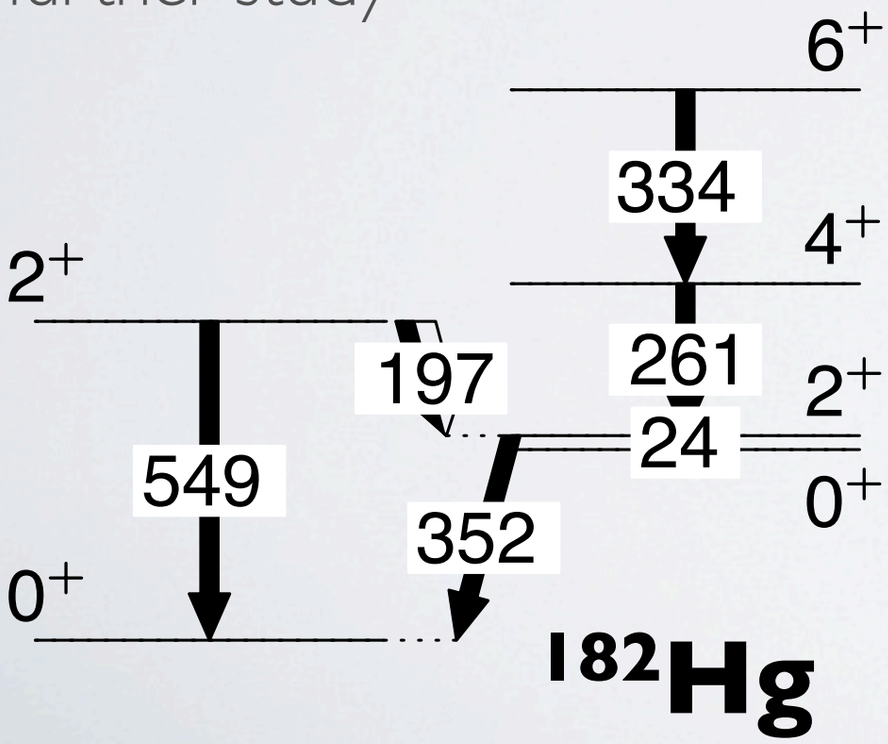
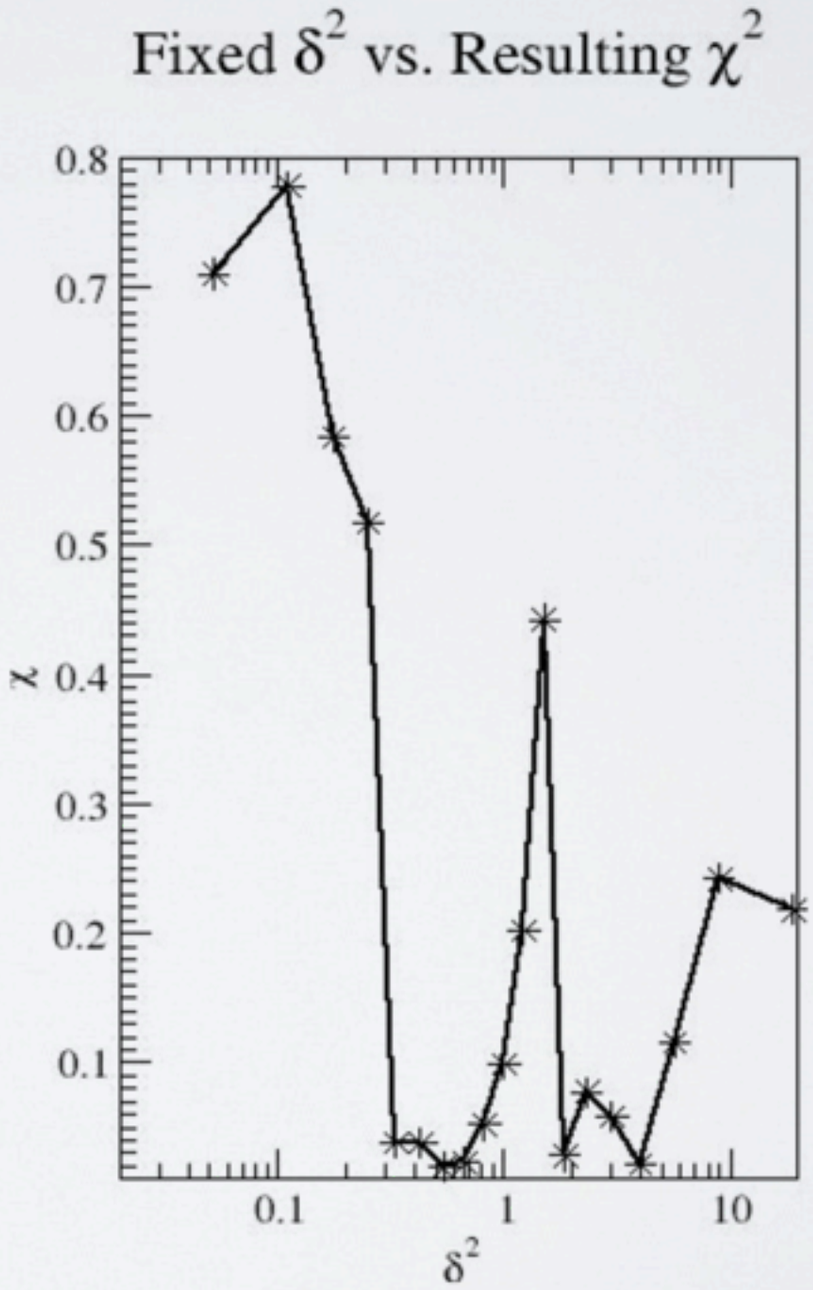
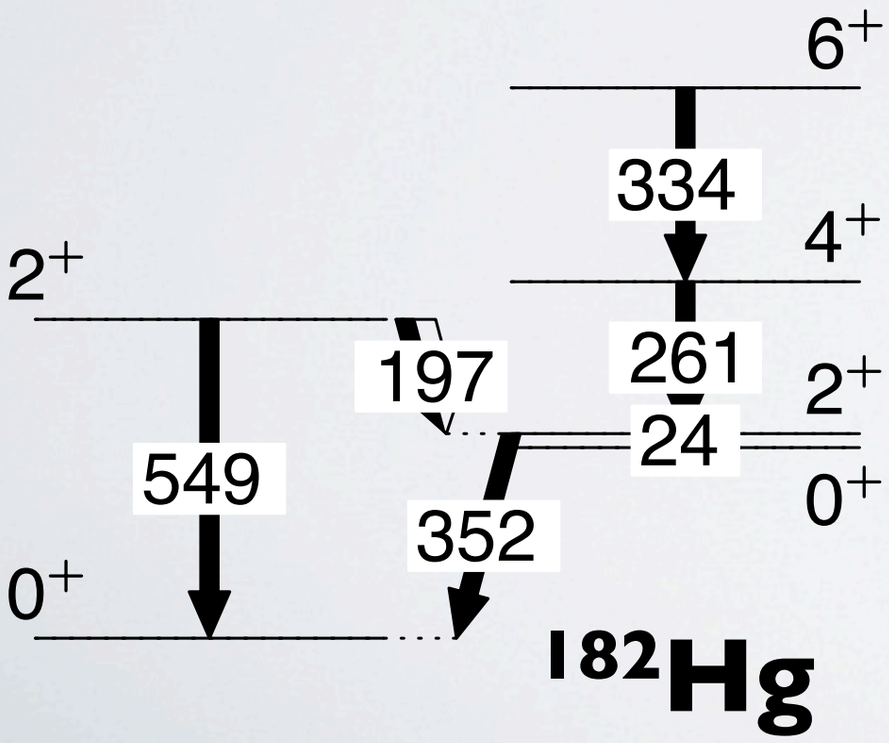




LIFETIME ANALYSIS

- Lifetimes of yrast states have been recently measured in ^{180,182}Hg
- ^{184,186,188}Hg RDDS measurement took place recently at ANL using Gammasphere
- States $J^{\pi} \geq 2^+$ in ^{180,182}Hg have similarly structured wavefunctions
- Similar for $J^{\pi} \geq 4^+$ in ^{184,186}Hg, indicating a difference between $J^{\pi}=2^+$ and $J^{\pi}=4^+$



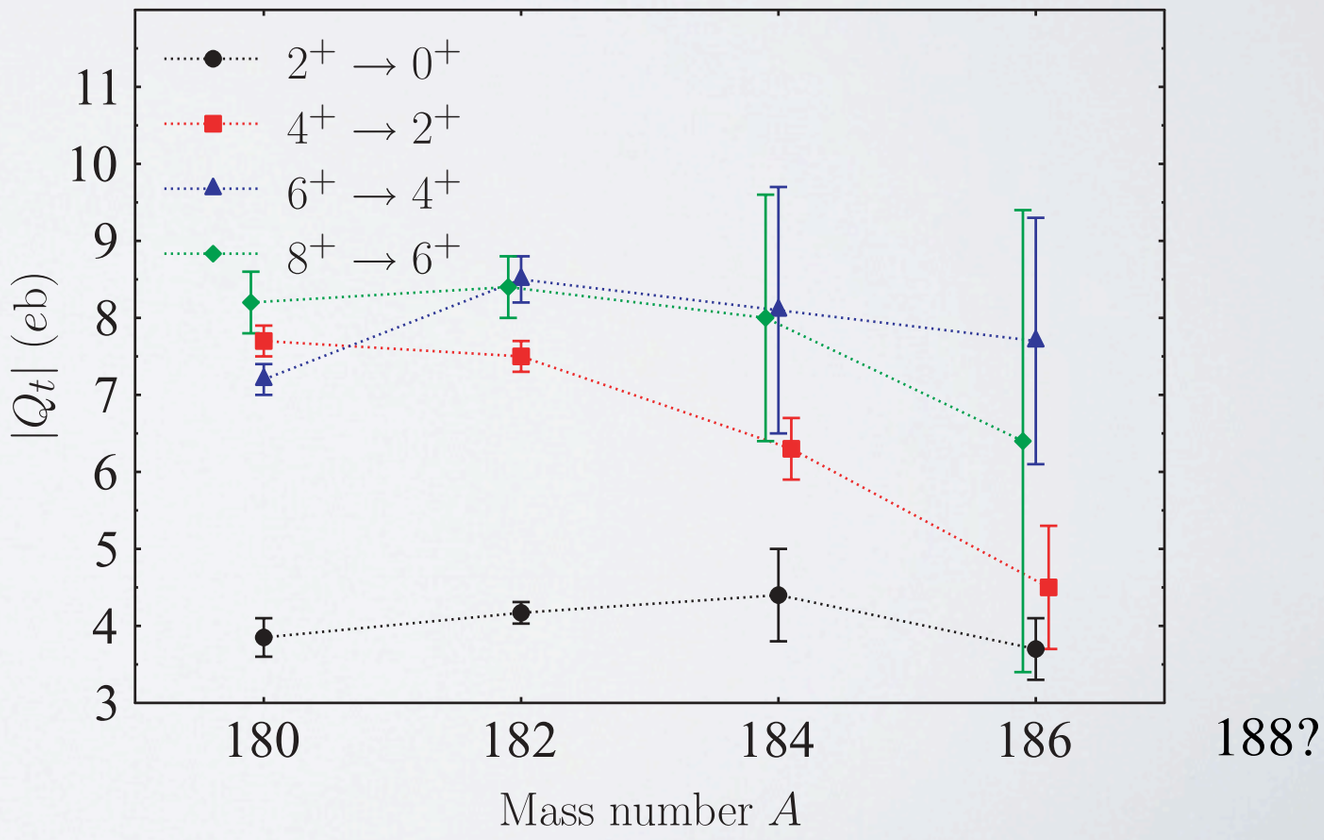
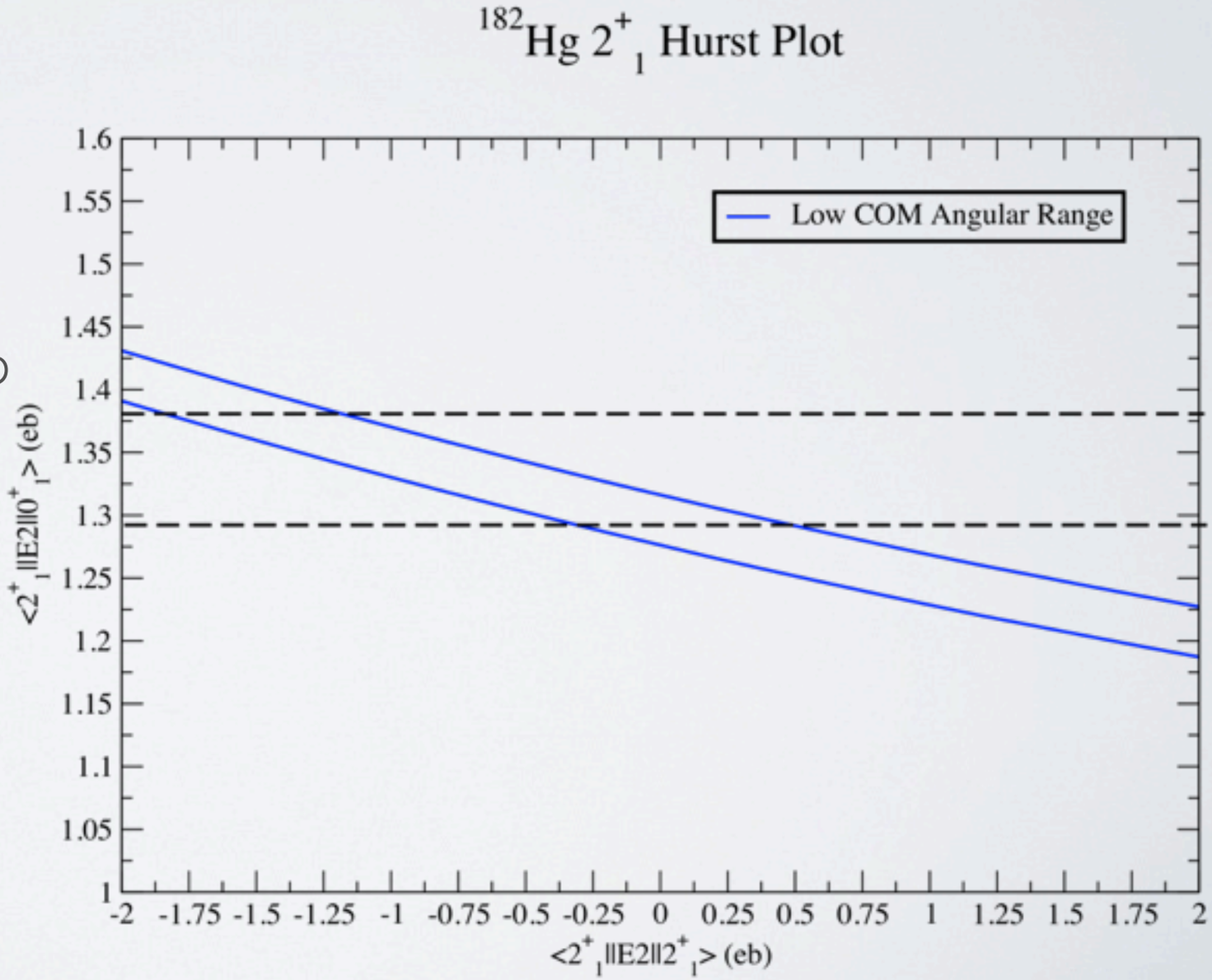


Figure: T. Grahn, A. Petts, M. Scheck et. al, Phys. Rev. C **80**, 014324 (2009)

^{182}Hg MATRIX ELEMENTS

- $\langle 2_1^+ \| E2 \| 2_1^+ \rangle$ varied and yield reproduced by matching $\langle 2_1^+ \| E2 \| 0_1^+ \rangle$
- Overlap region of 1 sigma suggests slightly -ive DME.
- GOSIA minimisation:
- $\langle 2_1^+ \| E2 \| 0_1^+ \rangle$ = (1.33 ± 0.06) eb
- $\langle 2_1^+ \| E2 \| 2_1^+ \rangle$ = -(0.39 ± 0.42) eb
- Suggestive of prolate
- Sensitivity restricts error bar



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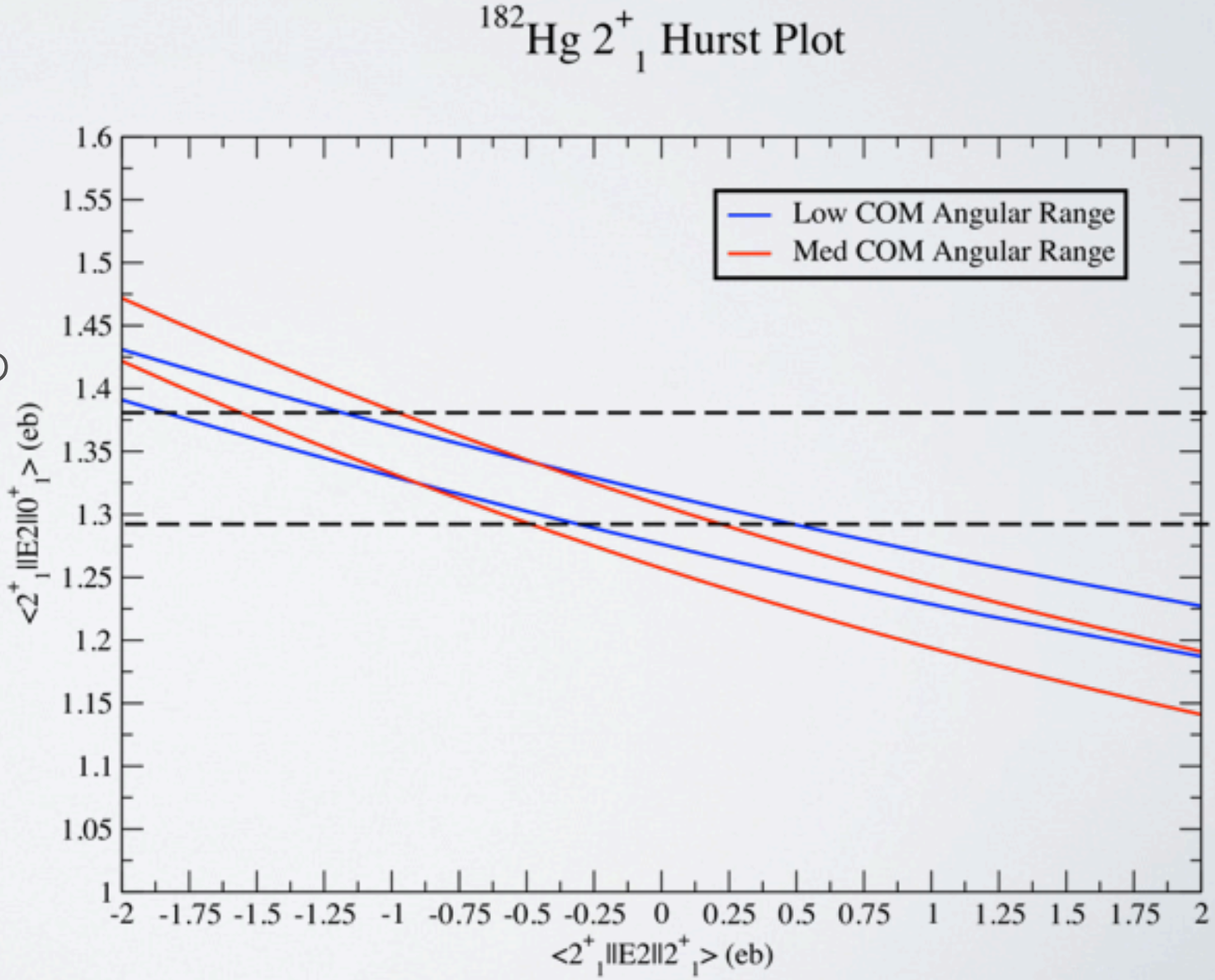

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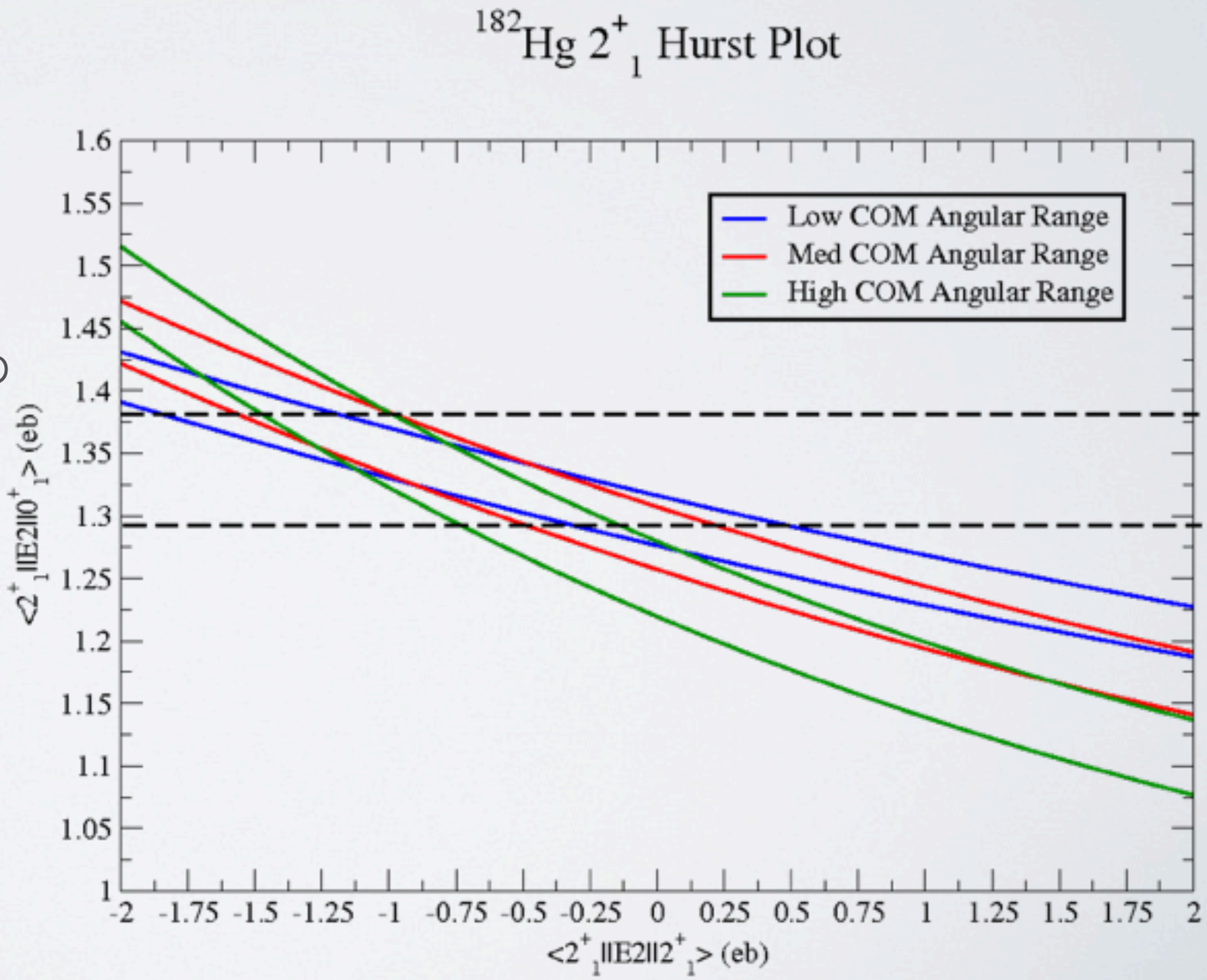
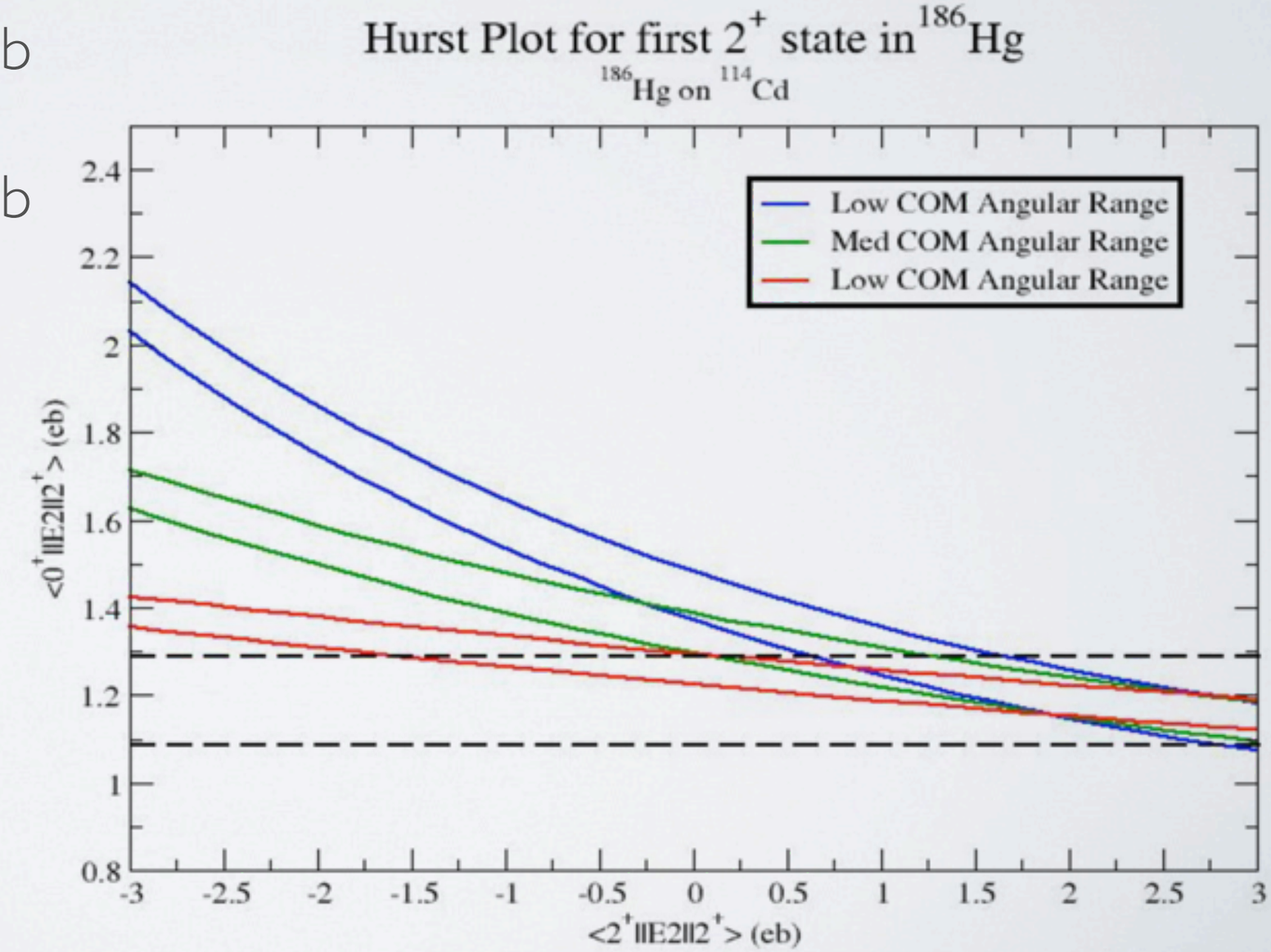


^{186}Hg MATRIX ELEMENTS

- More definitive positive DME suggested from simple view
- Gosia minimisation:
- $\langle 2_1^+ \| E2 \| 0_1^+ \rangle$ = (1.17 ± 0.08) eb
- $\langle 2_1^+ \| E2 \| 2_1^+ \rangle$ = (1.89 ± 0.64) eb
- Oblate deformation
- Supported by lifetime analysis



FUTURE WORK / CONCLUSIONS

- Diagonal and transitional matrix elements extracted in ^{182}Hg and ^{186}Hg by Andrew Petts from Coulex experiment with MINIBALL at REX-ISOLDE

- RDDS lifetime measurements in ^{184,186,188}Hg at Argonne just taken place using Köln plunger coupled with Gammasphere Ge array.

- E0 component to be studied using gamma-electron coincidences at Jyväskylä with the electron spectrometer, SAGE and the JUROGAM Ge array.

- Further analysis of Coulex data, reducing errors with new measurements.

COLLABORATORS

A. Petts[1], N. Bree[2], P.A. Butler[1], P. Van Duppen[2], A. Andreyev[2], B. Bastin[2], A. Blazhev[3], B. Bruyneel[3], M. Carpenter[4], J. Cederkäll[5], E. Clement[6], T.E. Cocolios[2], J. Diriken[2], J. Eberth[3], L. Fraile[5], C. Fransen[3], L.P. Gaffney[1], T. Grahn[1], M. Guttormsen[7], K. Hadynska[8], R.-D. Herzberg[1], M. Huyse[2], D.G. Jenkins[9], R. Julin[10], S. Knapen[2], Th. Kröll[11], R. Krücken[11], A.C. Larsen[7], P. Marley[9], P.J. Napiorkowski[8], J. Pakarinen[1], N. Patronis[2], P.J. Peura[10], E. Piselli[6], P. Reiter[3], M. Scheck[1], S. Siem[7], I. Stefanescu[2], J. Van de Walle[6], D. Voulot[6], N. Warr[3], D. Weisshaar[3], F. Wenanders[6], M. Zielinska[9]

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MIXING ANALYSIS

$$|u\rangle = \alpha|\text{oblate}\rangle + \beta|\text{prolate}\rangle$$

^{182}Hg		β(yrast)
0^+ states:	α-hinderance	16%
	energy levels	7%
2^+ states:	lifetimes	80%
	energy levels	70%
^{184}Hg		
0^+ states:	α-hinderance	18%
	energy levels	5%
	E0 strength mixing	0.2%
2^+ states:	energy levels	3%
^{186}Hg		
0^+ states:	energy levels	3%
	E0 strength mixing	>4%
2^+ states:	energy levels	8%
	E2 matrix elements	<10%

References:

Wauters et al. 1993, 1994
Richards et al. 1997
Grahn et al. 2009
NNDC