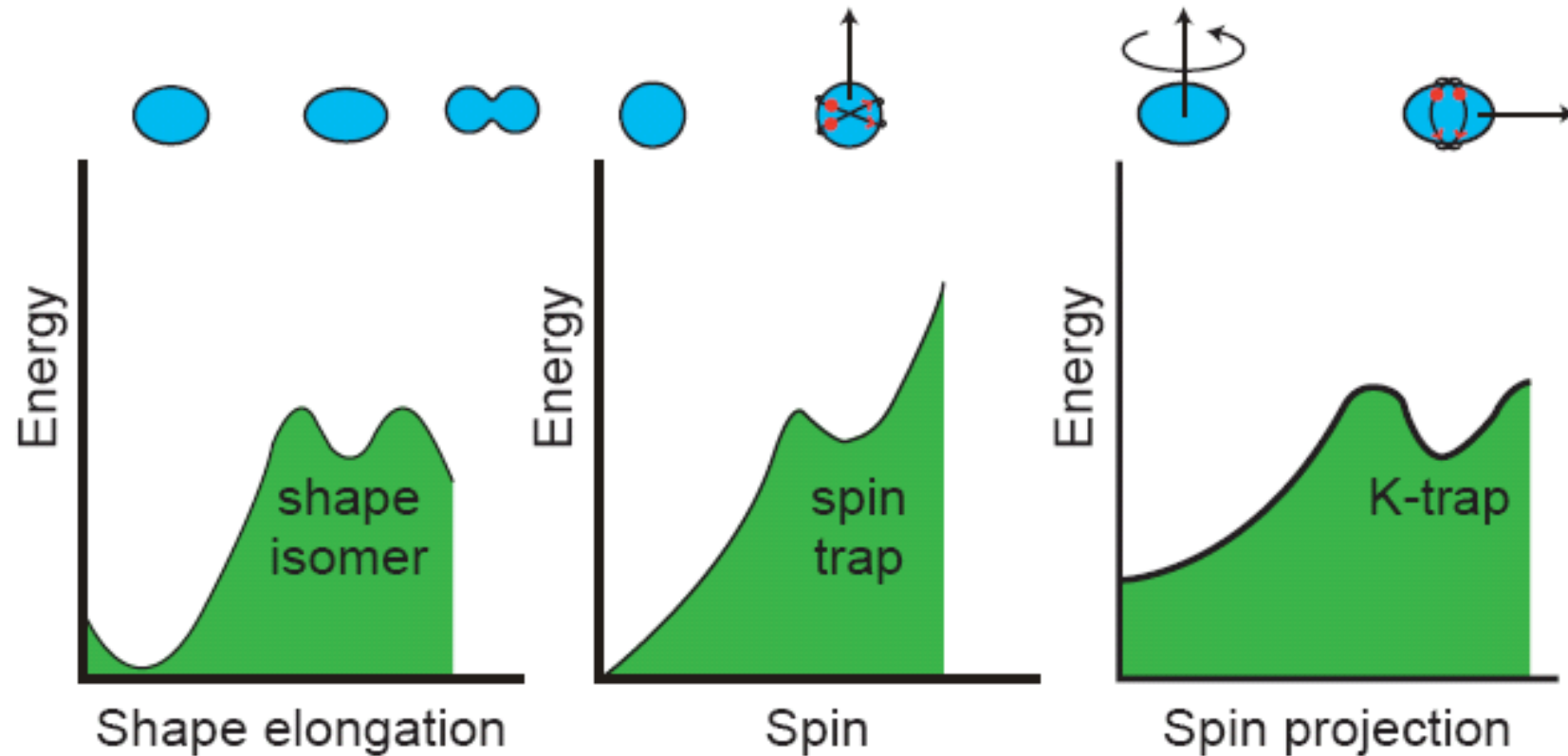


High-K isomer decay rates and the effect of β -deformation changes

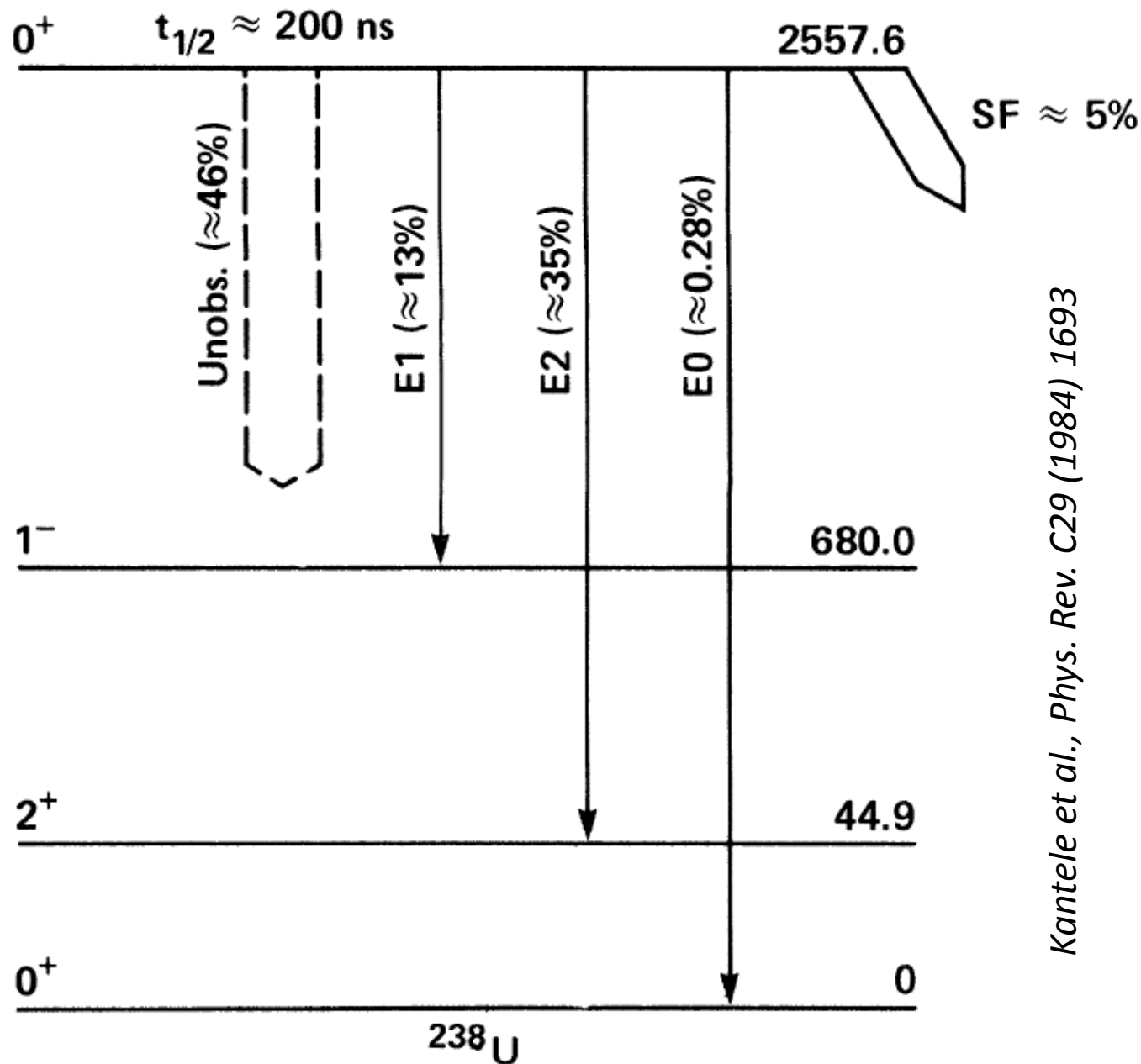
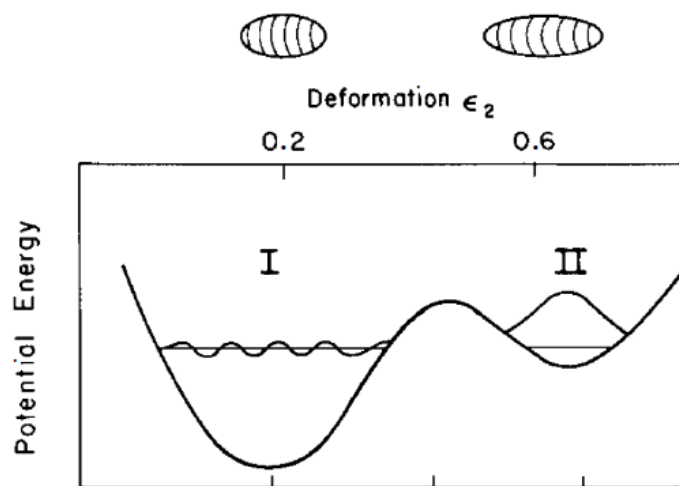
- different isomer types
- shape-isomer examples (^{238}U , ^{238}Pu)
- K-isomer examples (^{172}Dy – ^{188}Pb : N=106)
- combination of K and shape isomerism (^{174}Re)

Nuclear isomers: energy traps

excited state half-lives ranging from nanoseconds to years

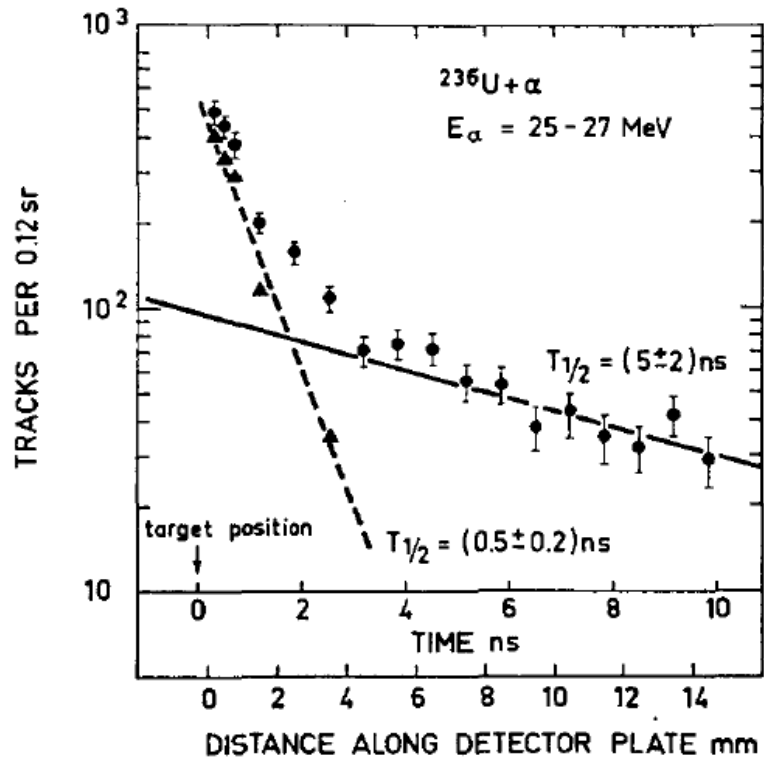


example of
 shape isomer
 (fission isomer
 with back-decay)
 ^{238}U

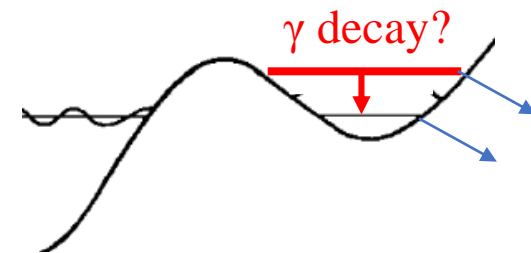
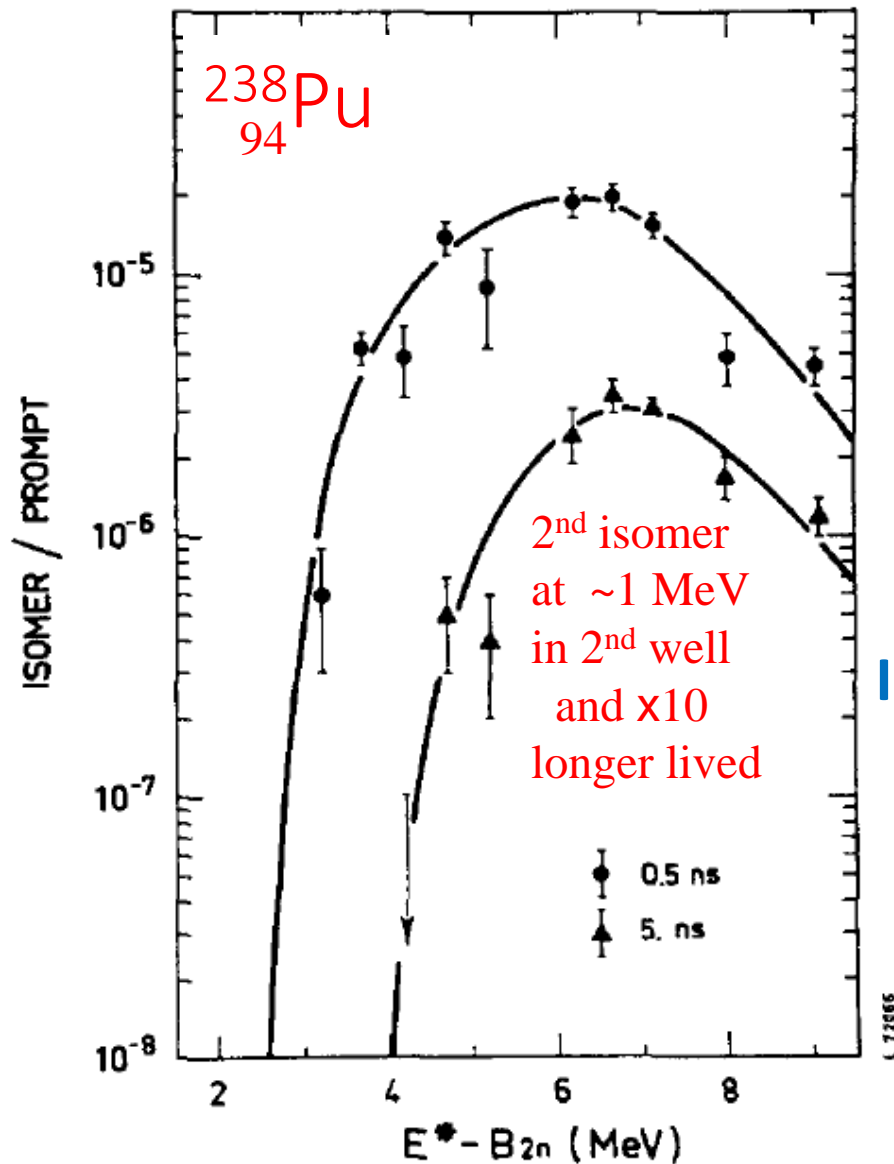


Kantele et al., Phys. Rev. C29 (1984) 1693

example of K isomer in the 2nd well: ²³⁸Pu

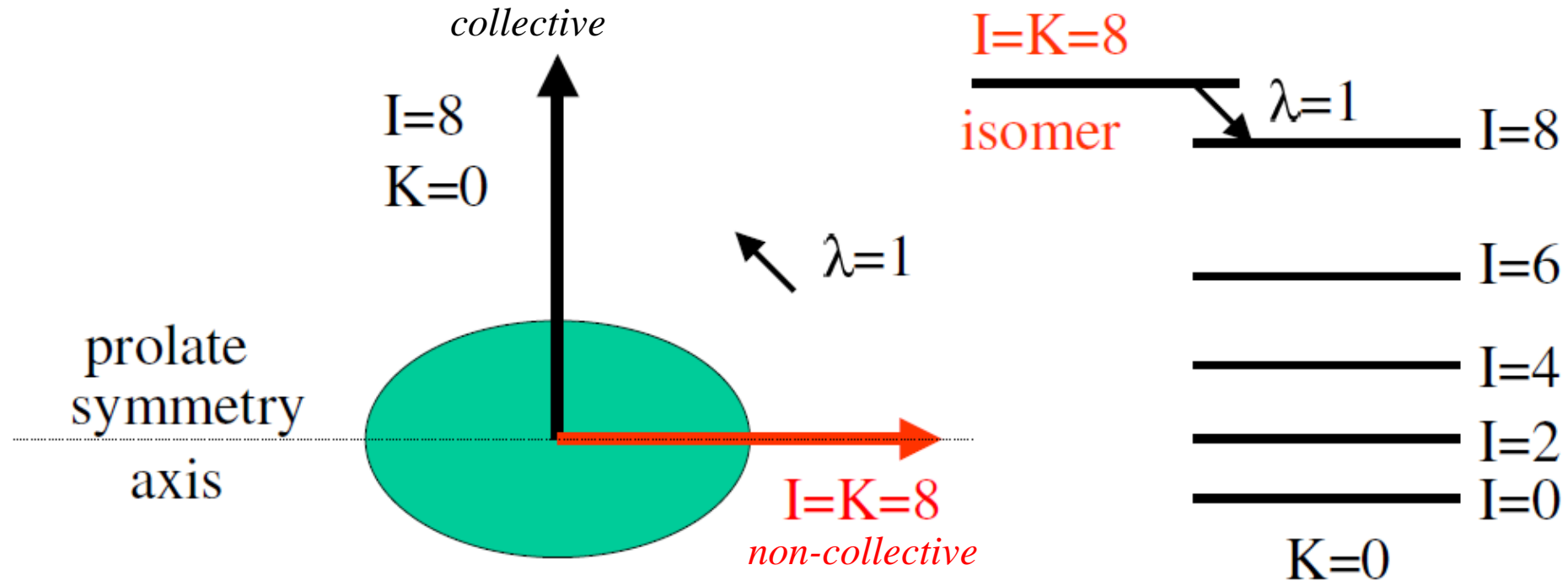


Limkilde and Sletten, NPA199 (1973) 504



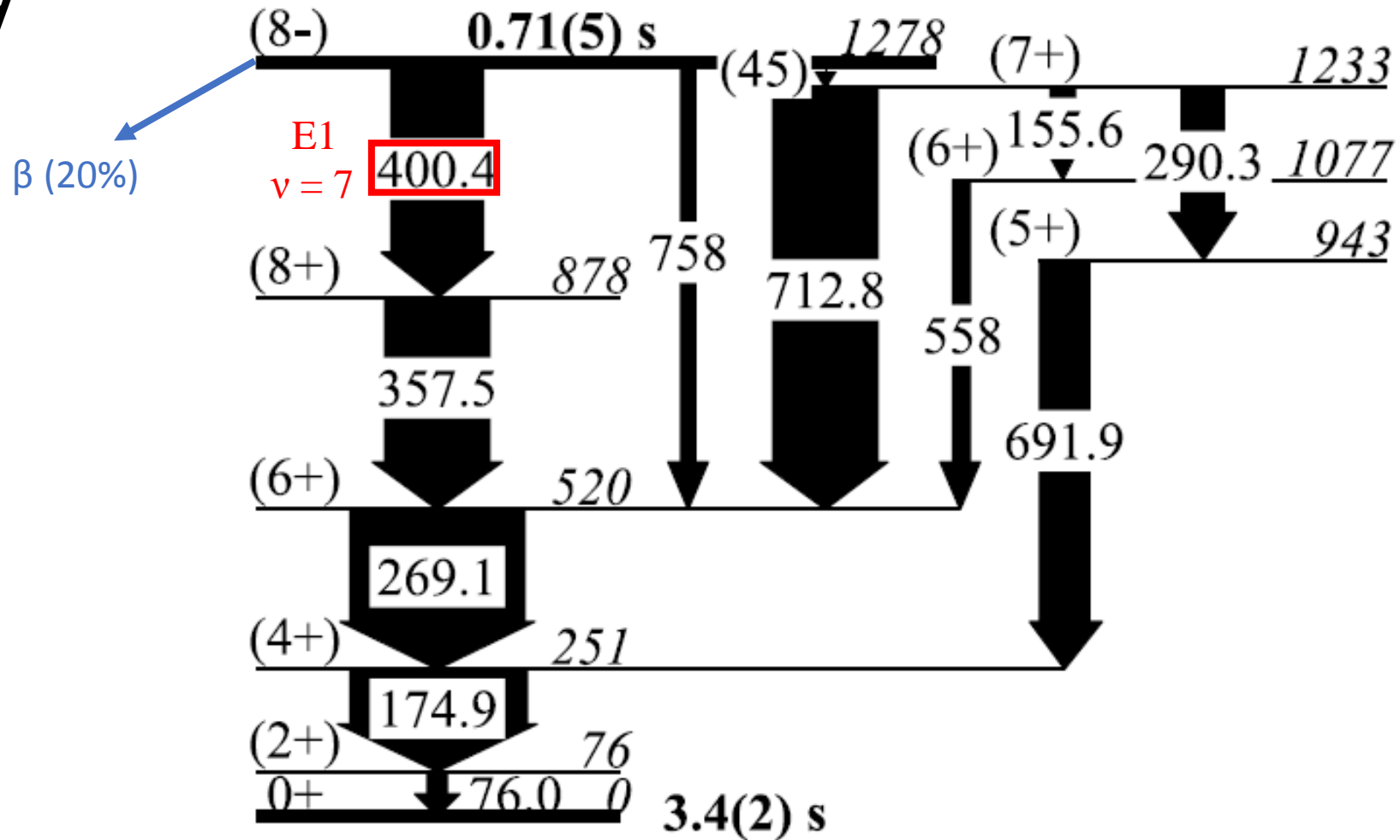
Is there K-isomer decay within the 2nd well?

K-forbidden γ -ray transitions



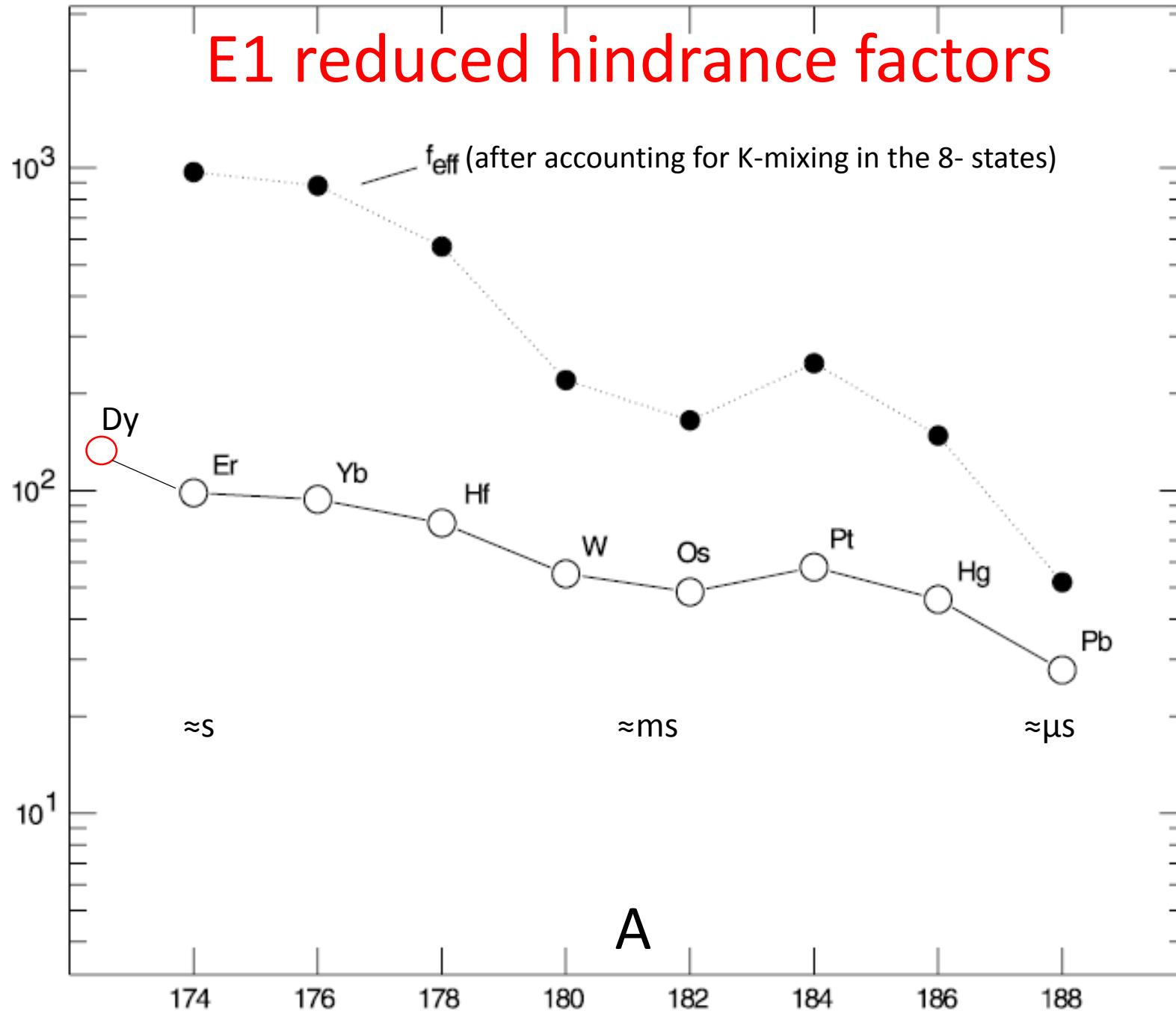
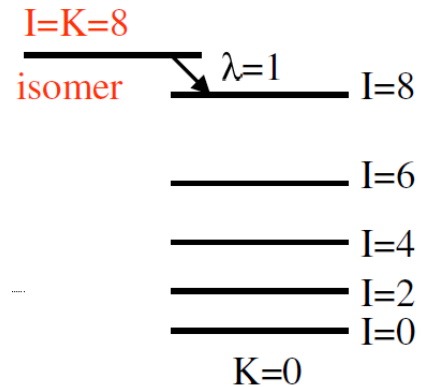
$\lambda = 1$ transition is 7-fold K-forbidden: $\nu = \Delta K - \lambda = 7$

$^{172}_{66}\text{Dy}$



data from
EURICA
(RIKEN)

E1 reduced hindrance factors



$K^{\pi}=8^{-}$
isomers
 $N=106$

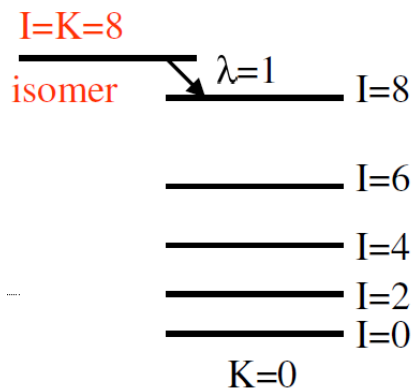
$\{v9/2[624], v7/2[514]\}$

$$F_W = T_{1/2}^{\gamma} / T_{1/2}^W$$

$$\nu = \Delta K - \lambda$$

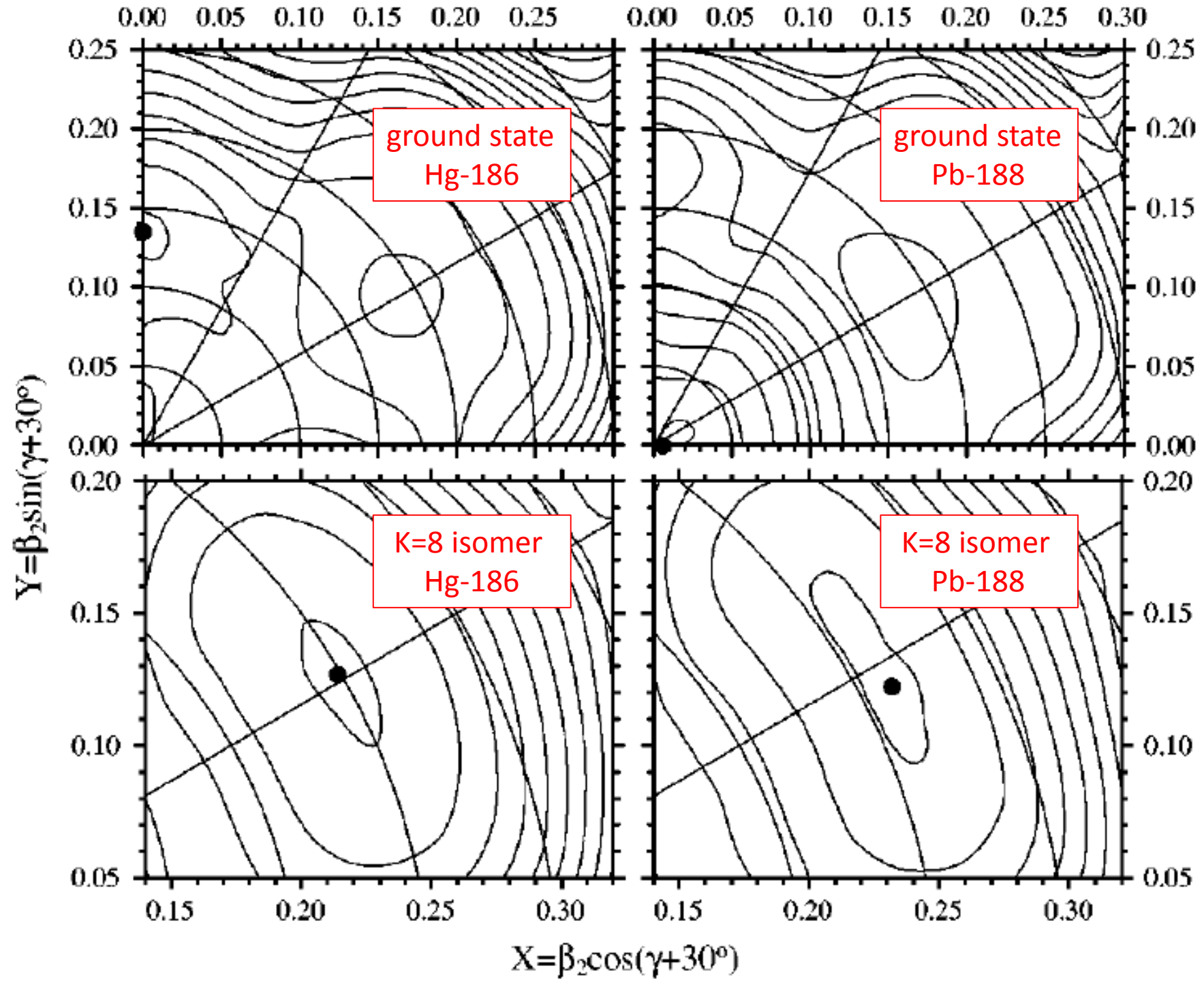
$$f_{\nu} = (F_W)^{1/\nu}$$

Dracoulis et al.
PRC 79 (2009)
061303(R);
Watanabe et al.
PLB 760 (2016) 641
[172Dy]

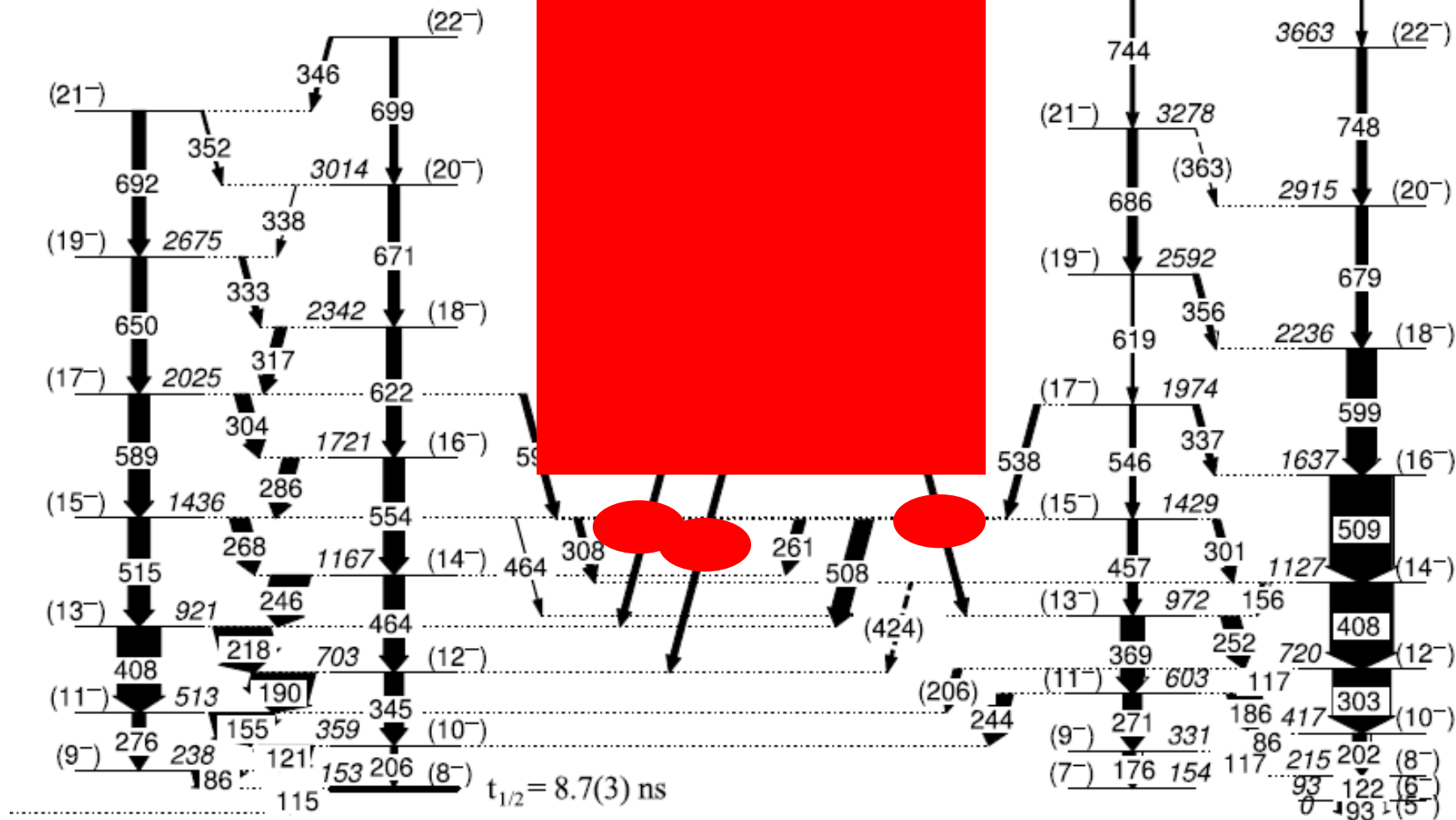


$K^\pi=8^-$
isomers
 $N=106$

$\{v9/2[624], v7/2[514]\}$



$^{174}_{75}\text{Re}$



Band 2
K=8

Isomer band
K=14

Band 1
K=3

*R.J. Carroll et al.
to be published*

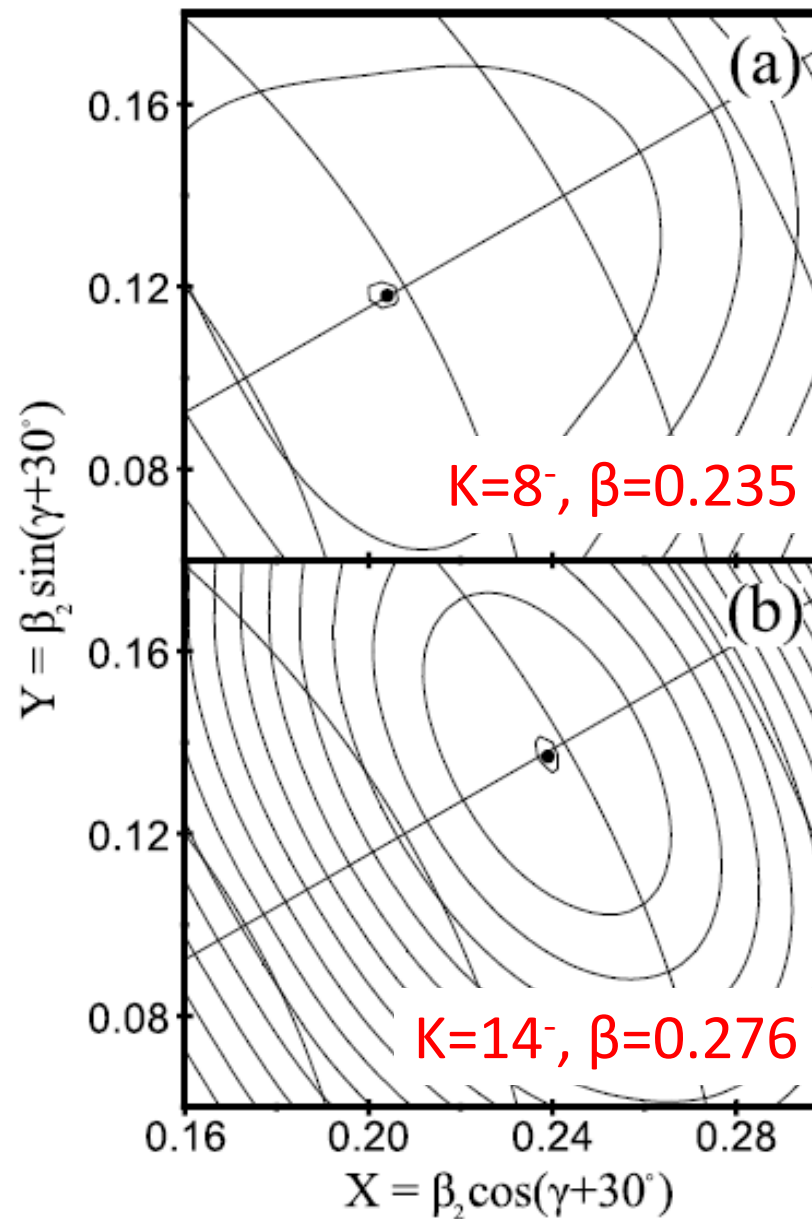
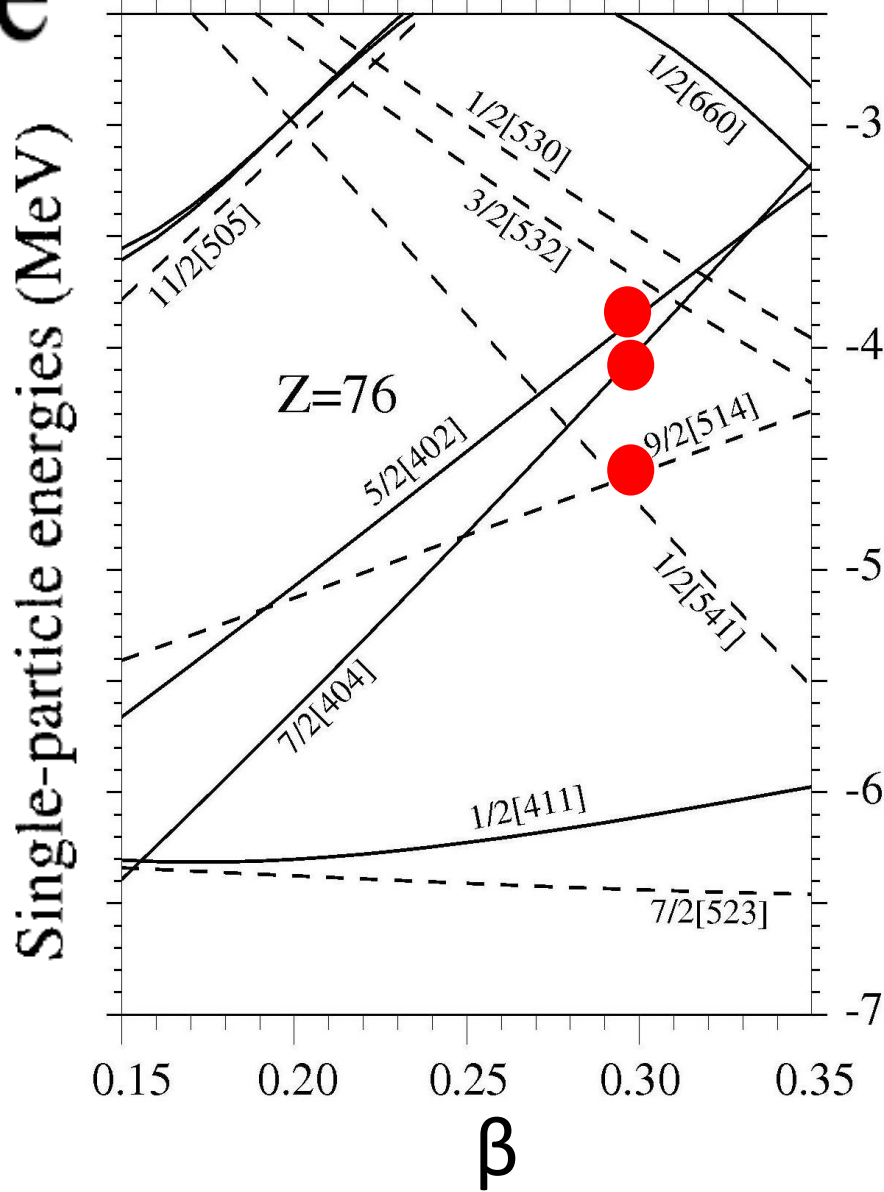
Data from ANU
Canberra
(CAESAR array)

*Guo et al. PRC86
(2012) 014323*

$^{174}_{75}\text{Re}$

^{174}Re K=14 deformation is as large as any yet calculated for a K isomer in this mass region

(same as for ^{176}Yb K=8)

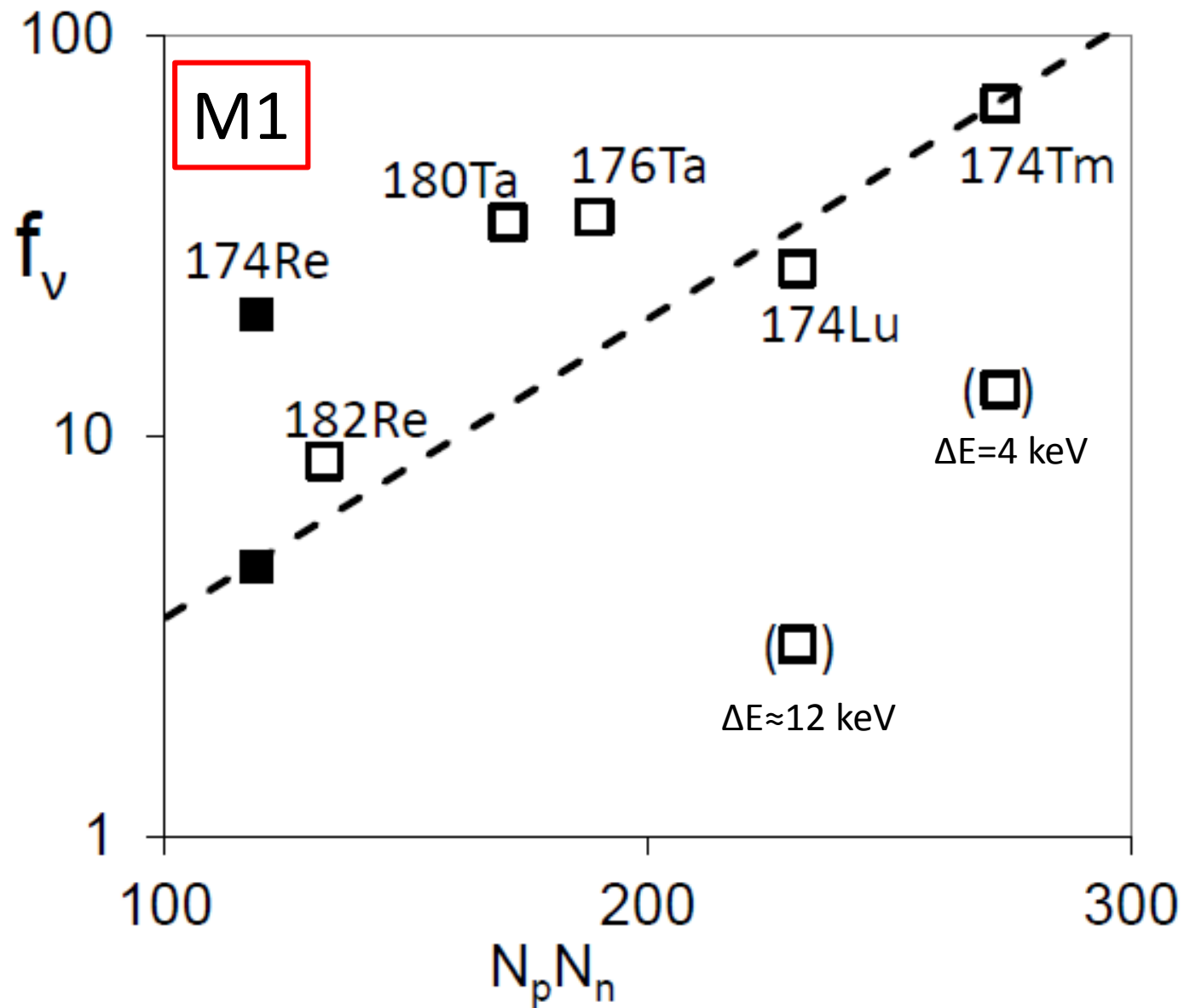
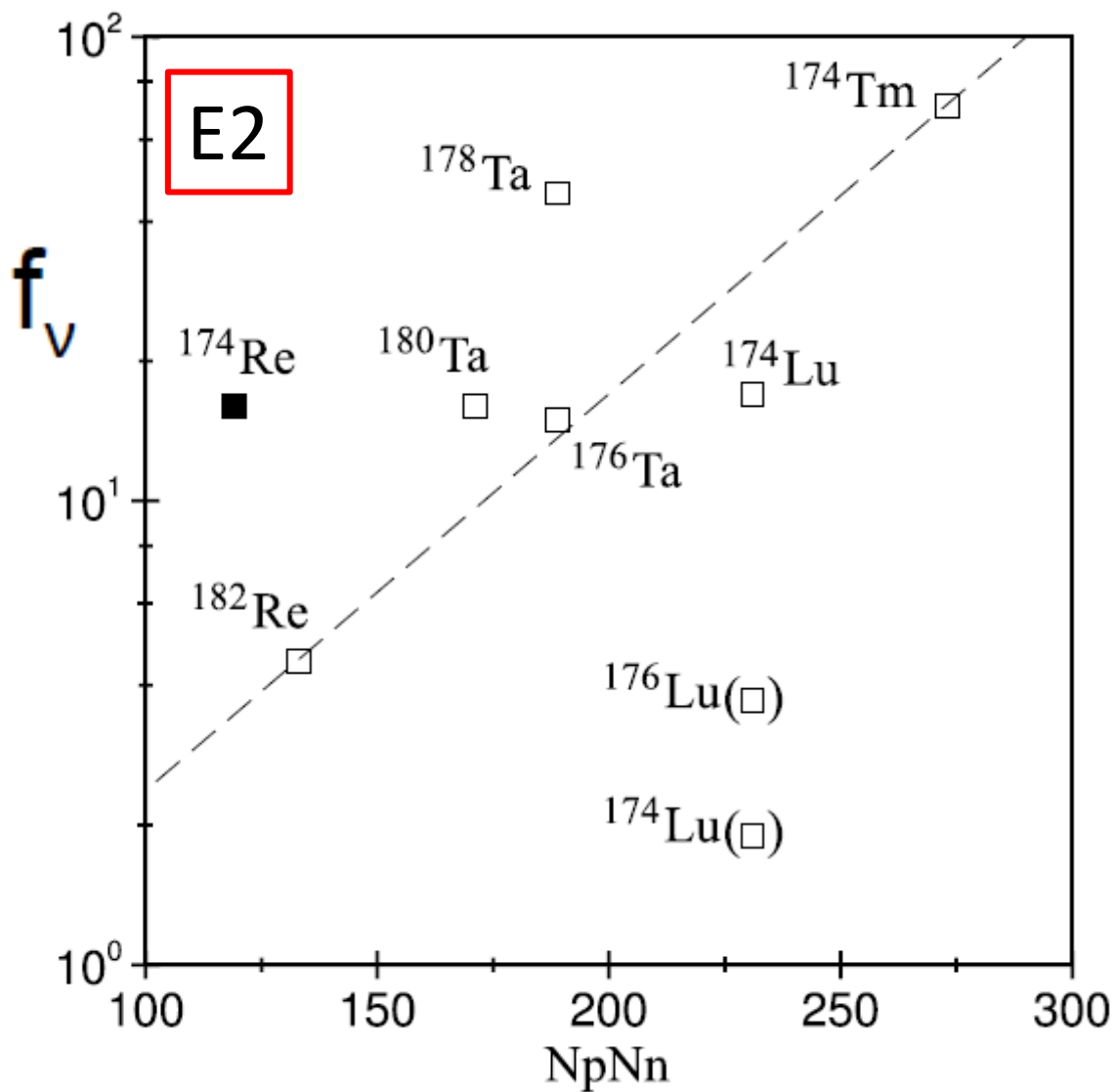


*R.J. Carroll et al.
to be published*

largest calculated β_2 change for any well-deformed nucleus

$3^-: \beta=0.251$

E2 and M1 reduced hindrance factors for $\Delta K \geq 6$ transitions from 4qp isomers in odd-odd nuclei



Summary

Combination of shape and K isomerism is hard to pin down

^{174}Re 4-qp isomer decay could provide a good example:

- largest calculated β_2 change, with large f_v
- competition from larger- v decay with smaller f_v
- smaller f_v decay has smaller calculated β_2 change

Thanks to ^{174}Re collaborators:

R.J. Carroll, G.J. Lane, M.W. Reed, A. Akber, J.J. Carroll, D.M. Cullen, A.C. Dai, H.M. David, C. Fahlander, M. Gerathy, S.S. Hota, G. Lotay, T. Kibedi, V. Margerin, A.J. Mitchell, N. Palalani, T. Palazzo, Z. Patel, R. Shearman, A.E. Stuchbery, F.R. Xu