Isomers and shape transitions in the n-rich A~190 region:

the influence of angular momentum

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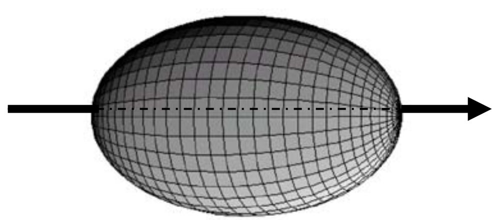
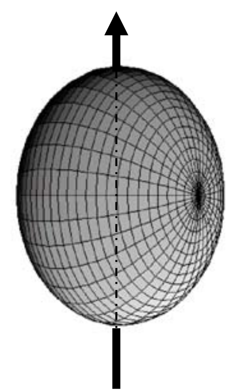
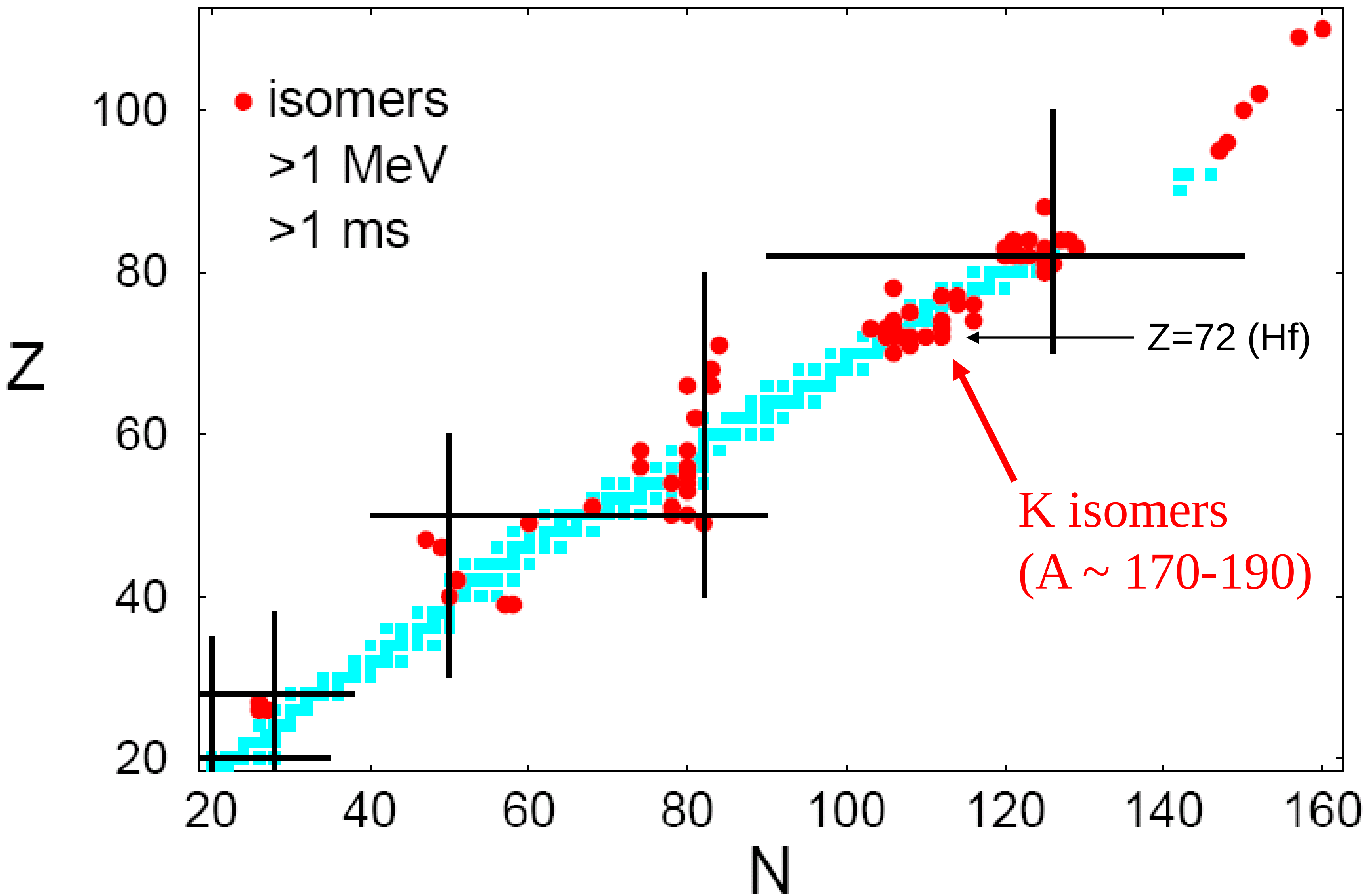
prolate K isomers vs.
oblate collective rotation





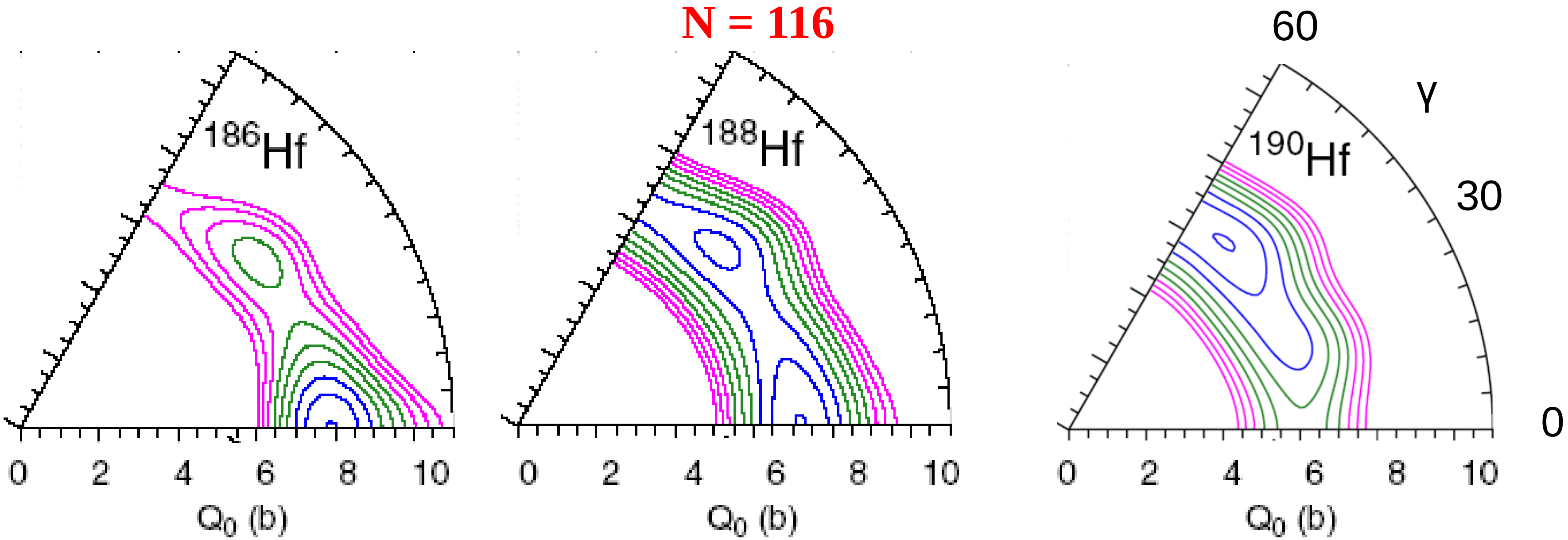


adapted from Walker and Dracoulis, Nature 399 (1999) 35

prolate-oblate shape transition

n-rich hafnium ground states

critical point
N = 116



Robledo et al., *J. Phys. G: Nucl. Part. Phys.* **36**, 115104 (2009).

Band-Crossing Prediction in ^{180}Hf

[PRL43 (1979) 1979]

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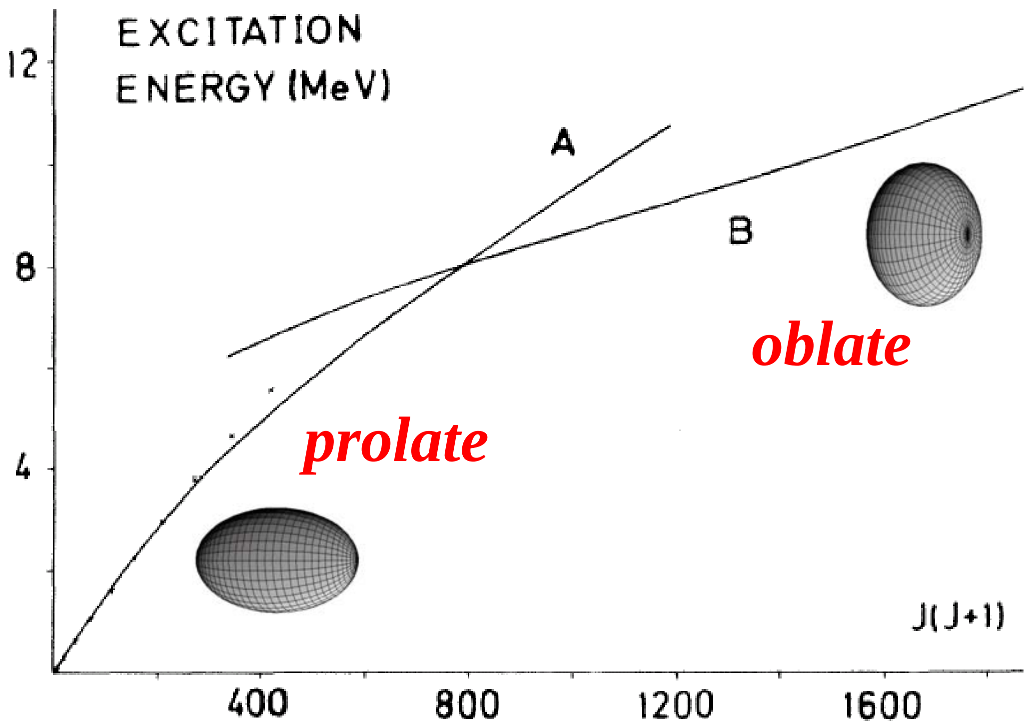
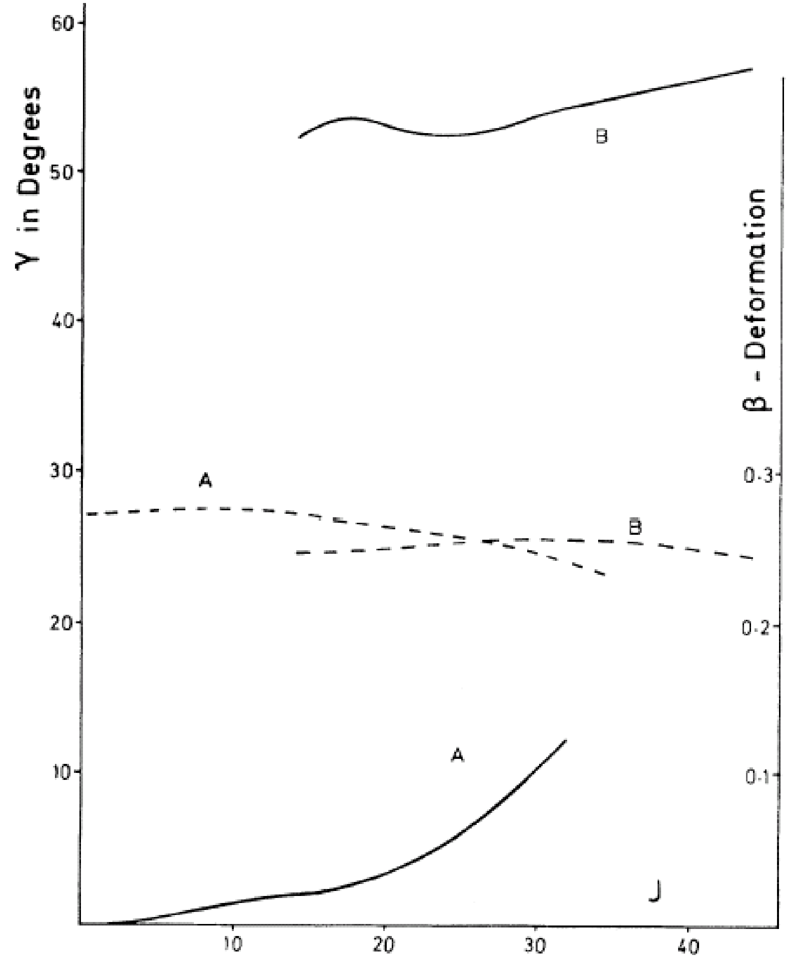
Physik-Department, Technische Universität München, D-8046 Garching, Germany

(Received 6 September 1979)

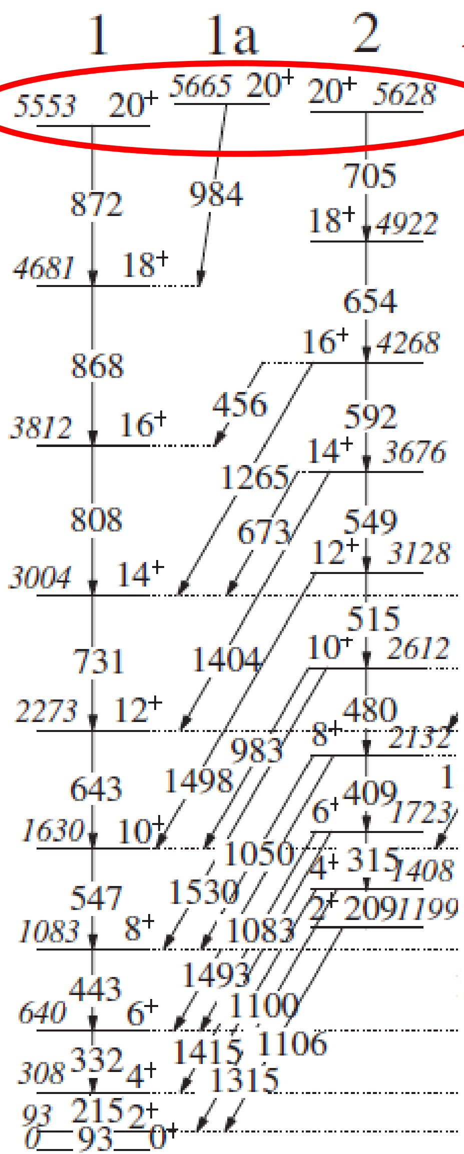
Giant backbending is predicted to occur in ^{180}Hf at $J \approx 26\hbar$. The effect is clearly seen to be the result of the crossing of two bands with very different intrinsic structure.



HFB calculations



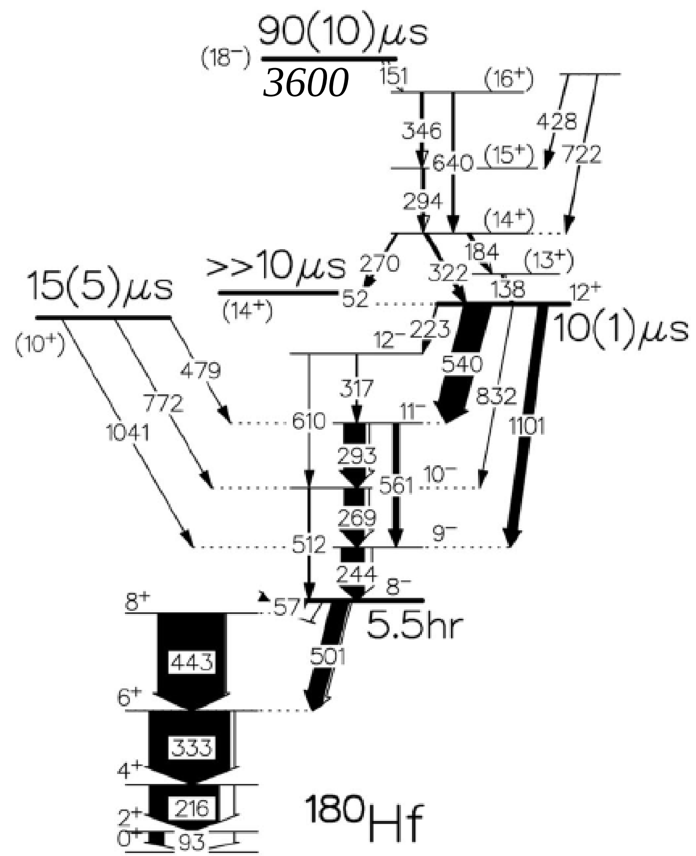
^{180}Hf oblate band?

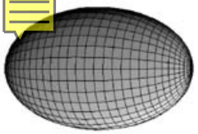


three 20$^+$ states

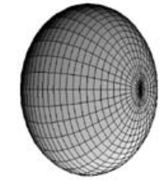
Tandel et al.,
Phys. Rev. Lett. 101
(2008) 182503
with Gammasphere

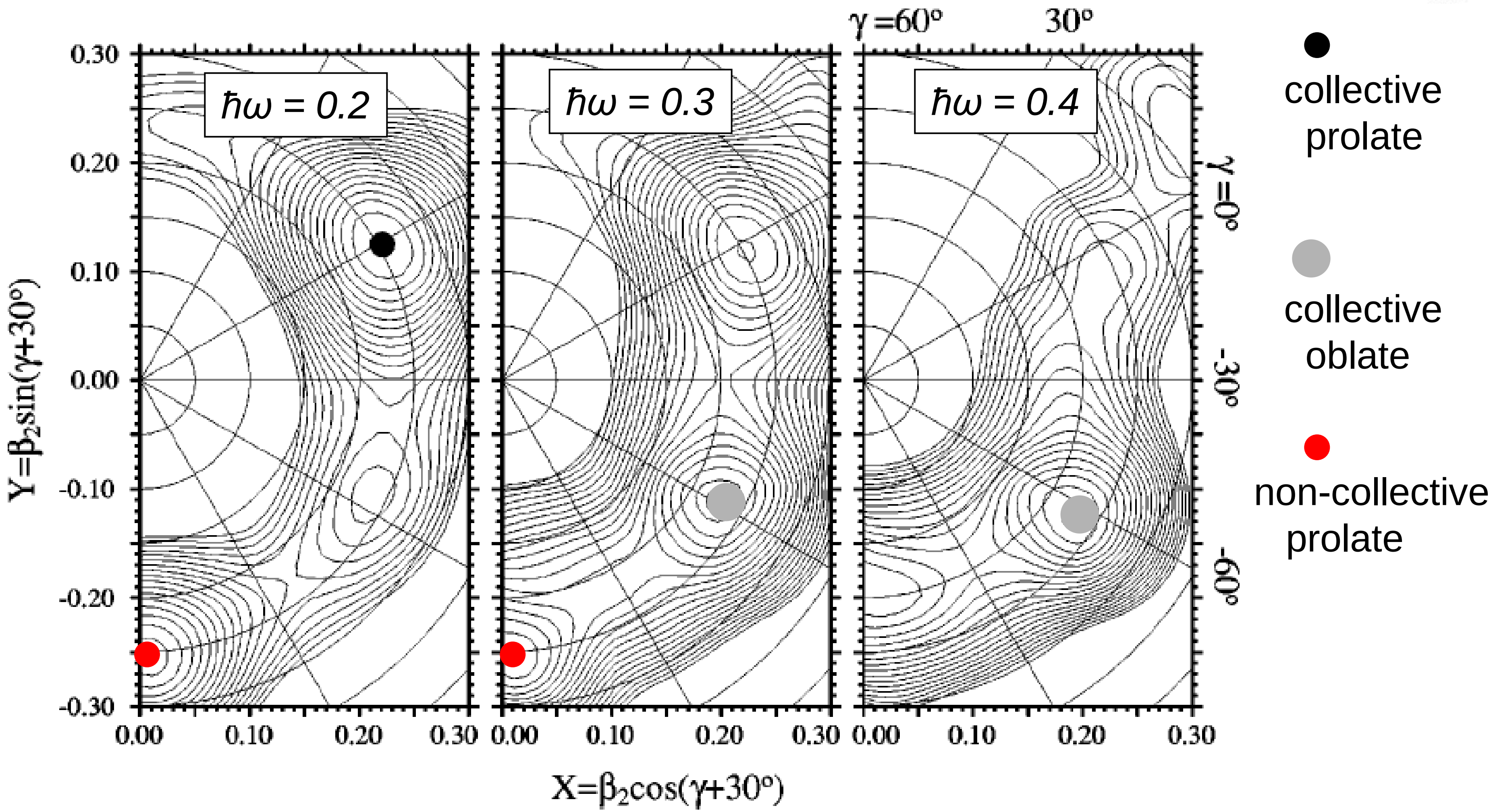
pre-Gammasphere
high-K yrast isomers:
d'Alarcao et al.,
Phys. Rev. C59
(1999) 1227(R)





cranked n-rich hafnium: 3 well-deformed minima

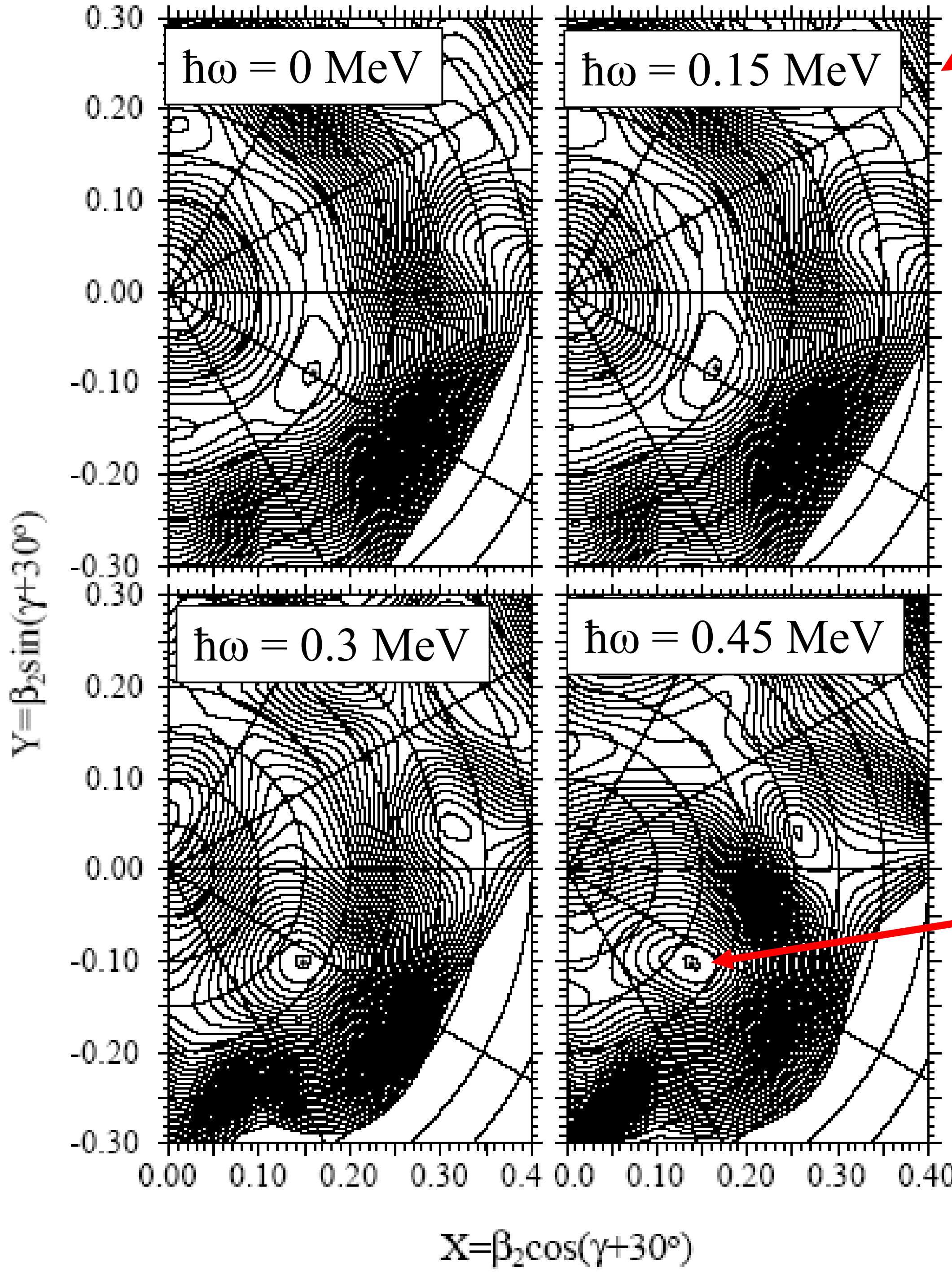




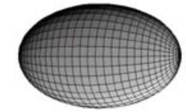
^{182}Hf example: Xu, Walker and Wyss, Phys. Rev. C62 (2000) 014301

^{190}Hf TRS oblate rotor

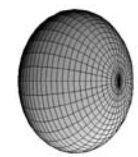
beyond the critical point



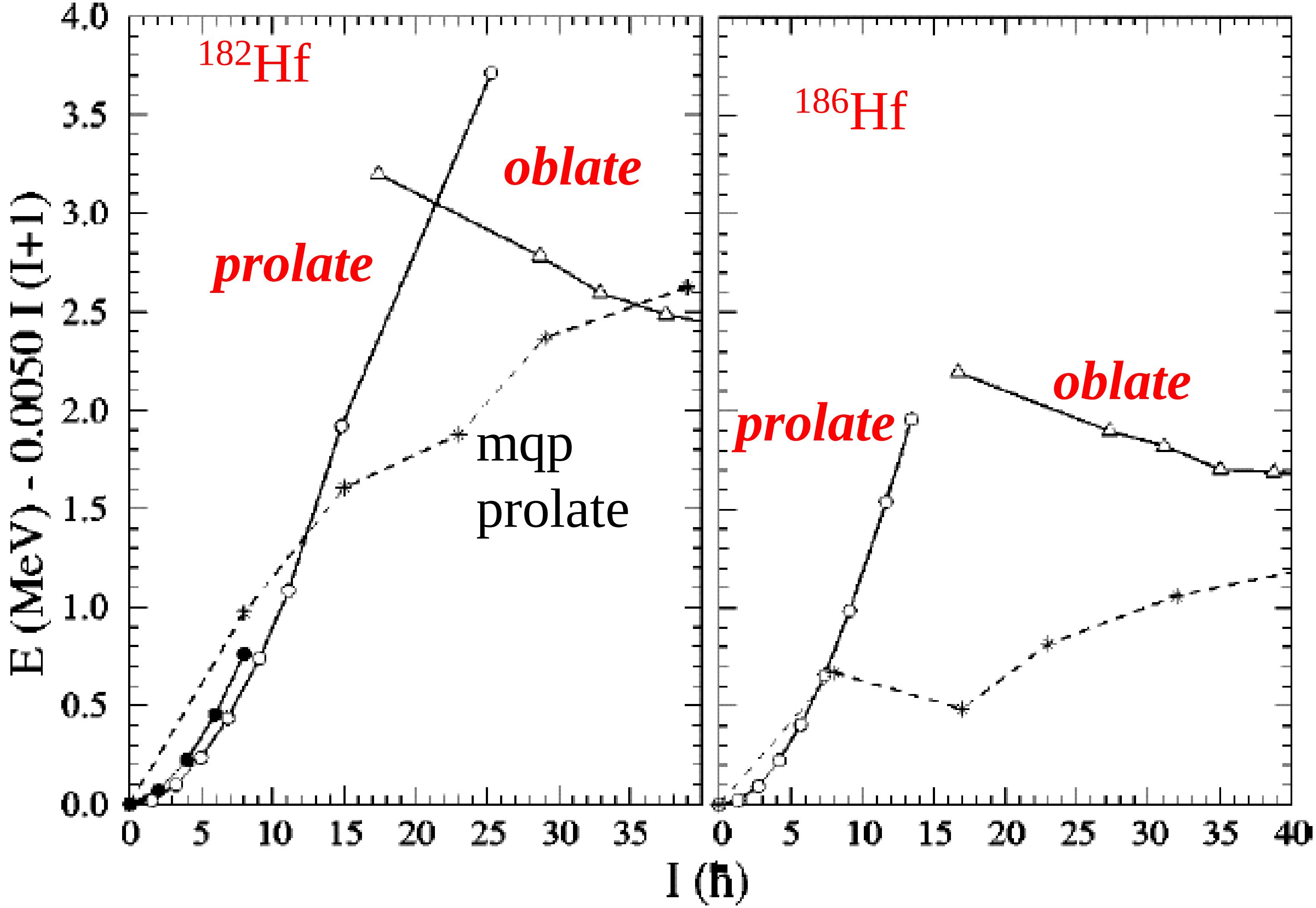
prolate



oblate

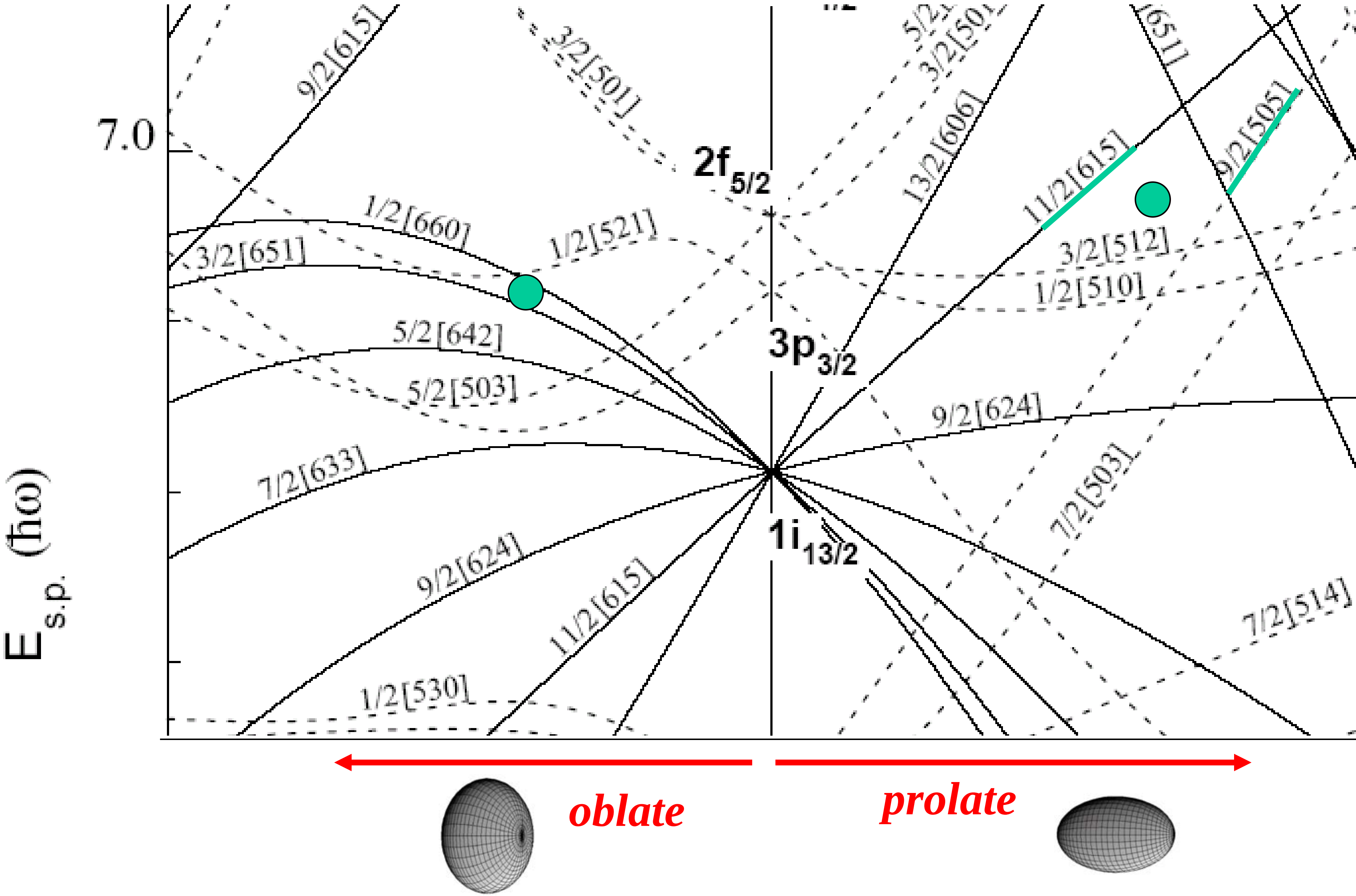


Xu et al., unpublished



[Xu et al., Phys. Rev. C62 (2000) 014301]

Nilsson single-particle diagram ● N = 116 (^{188}Hf, ^{190}W, ^{192}Os)



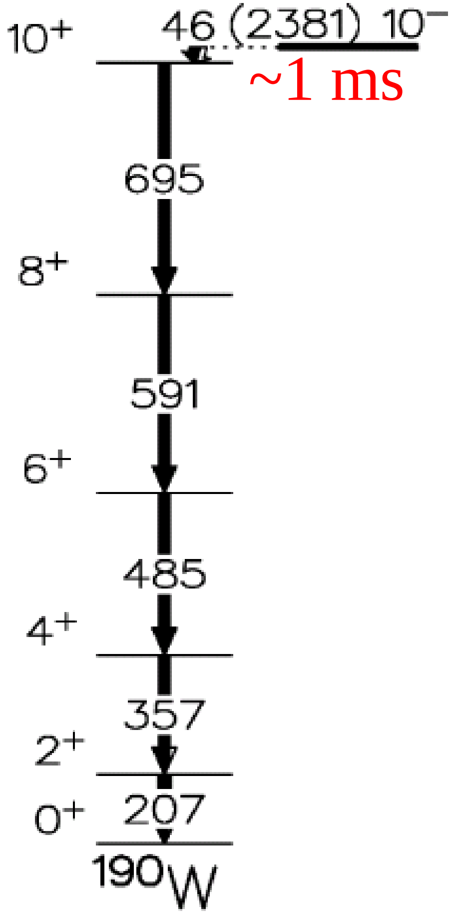
data for even-even A~190 nuclei

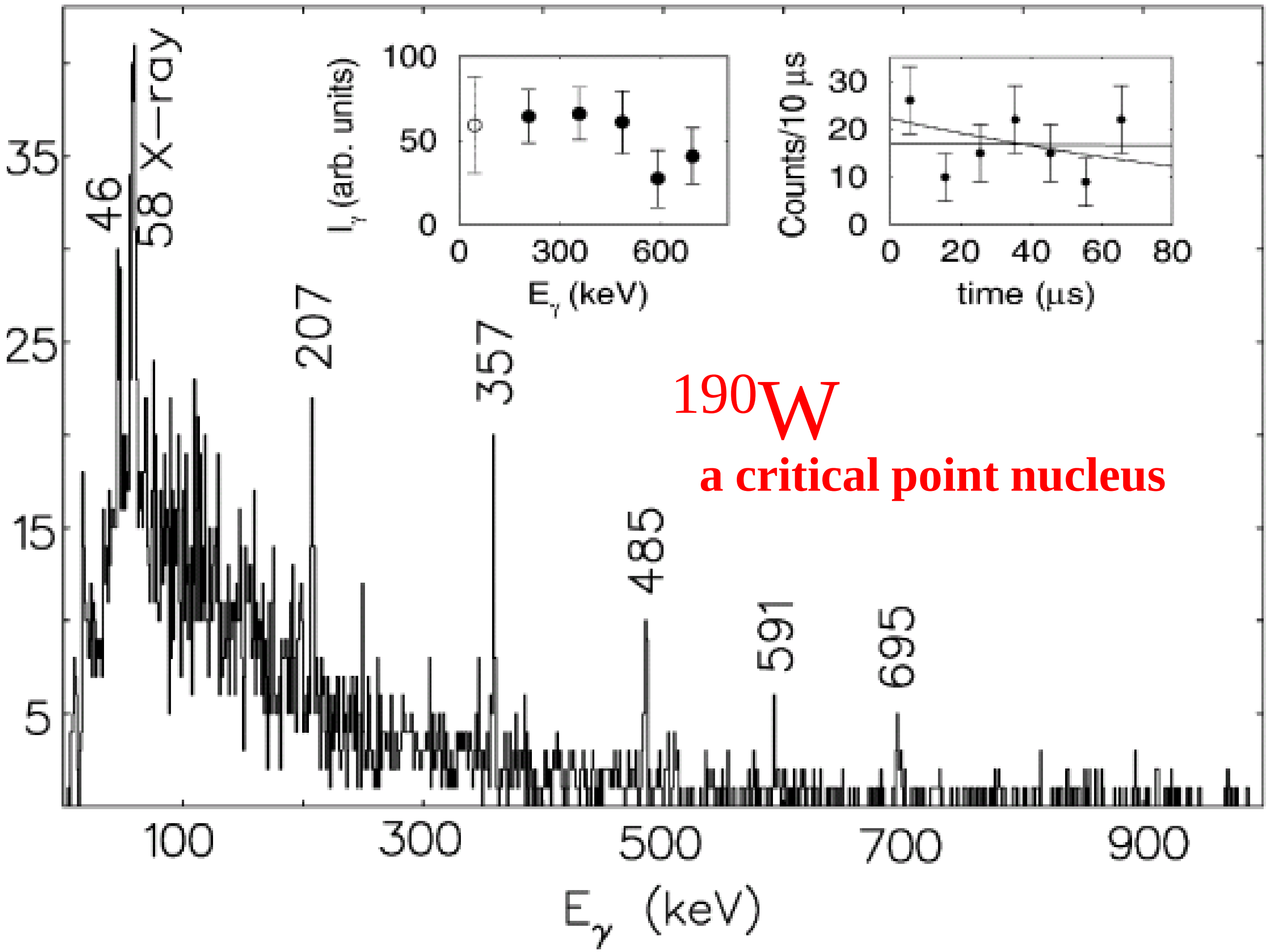
	N = 110	112	114	**116**	
	^{186}Os 7^- 8ns	^{188}Os 7^- 14ns	^{190}Os 10^- 10m	^{192}Os 10^- 6s	Z=76
	^{184}W 15 0.2μs 5^- 8μs	^{186}W 16^+ >3ms 7^- 20μs	^{188}W	^{190}W 10^- ~1ms ?	Z=74
	^{182}Hf 13^+ 40μs 8^- 62m	^{184}Hf new data 8^- 48s	^{186}Hf new data	^{188}Hf	Z=72

critical point

Zs. Podolyák et al. / Physics Letters B 491 (2000) 225–231

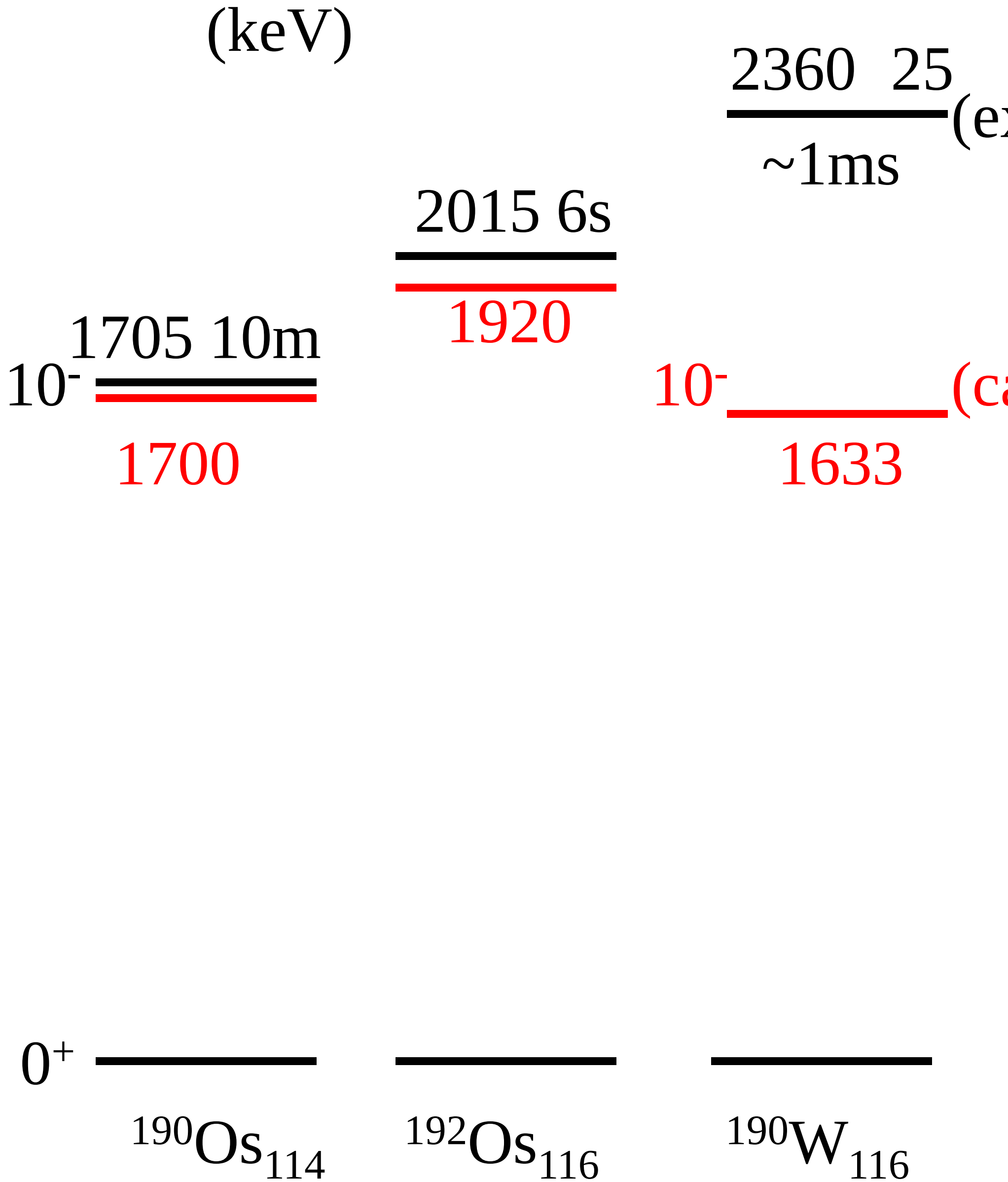
delayed gamma rays from ^{208}Pb fragmentation at 1 GeV per nucleon

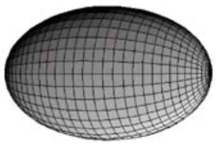


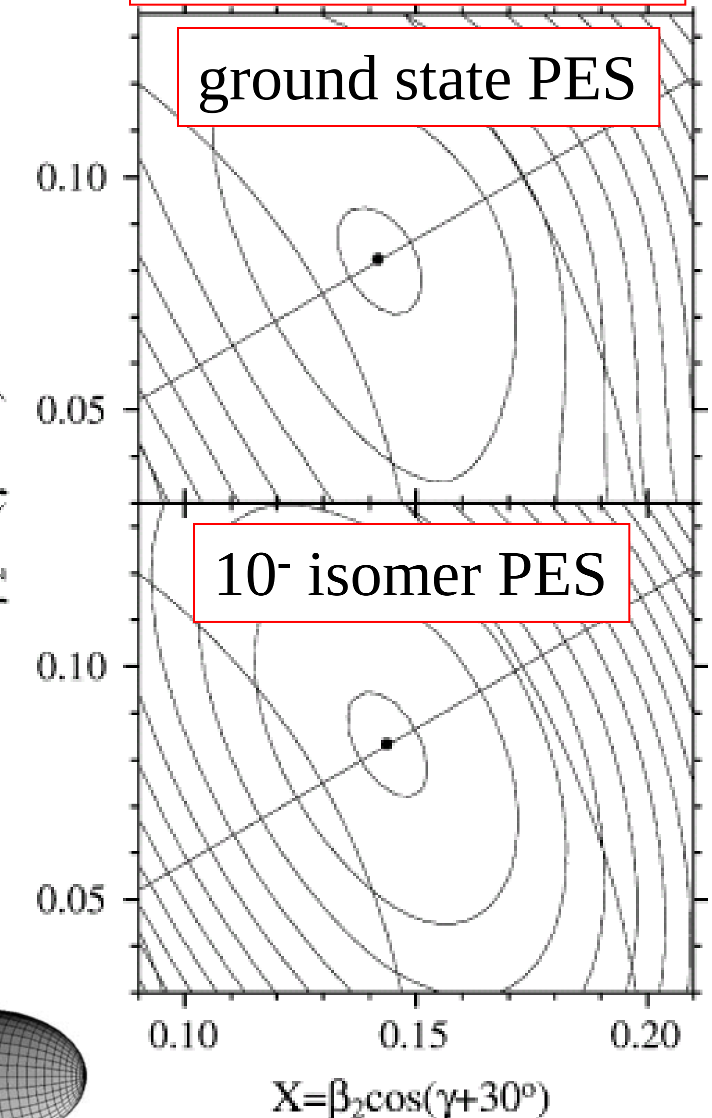


isomer energies, potential energy surfaces

^{190}W: prolate

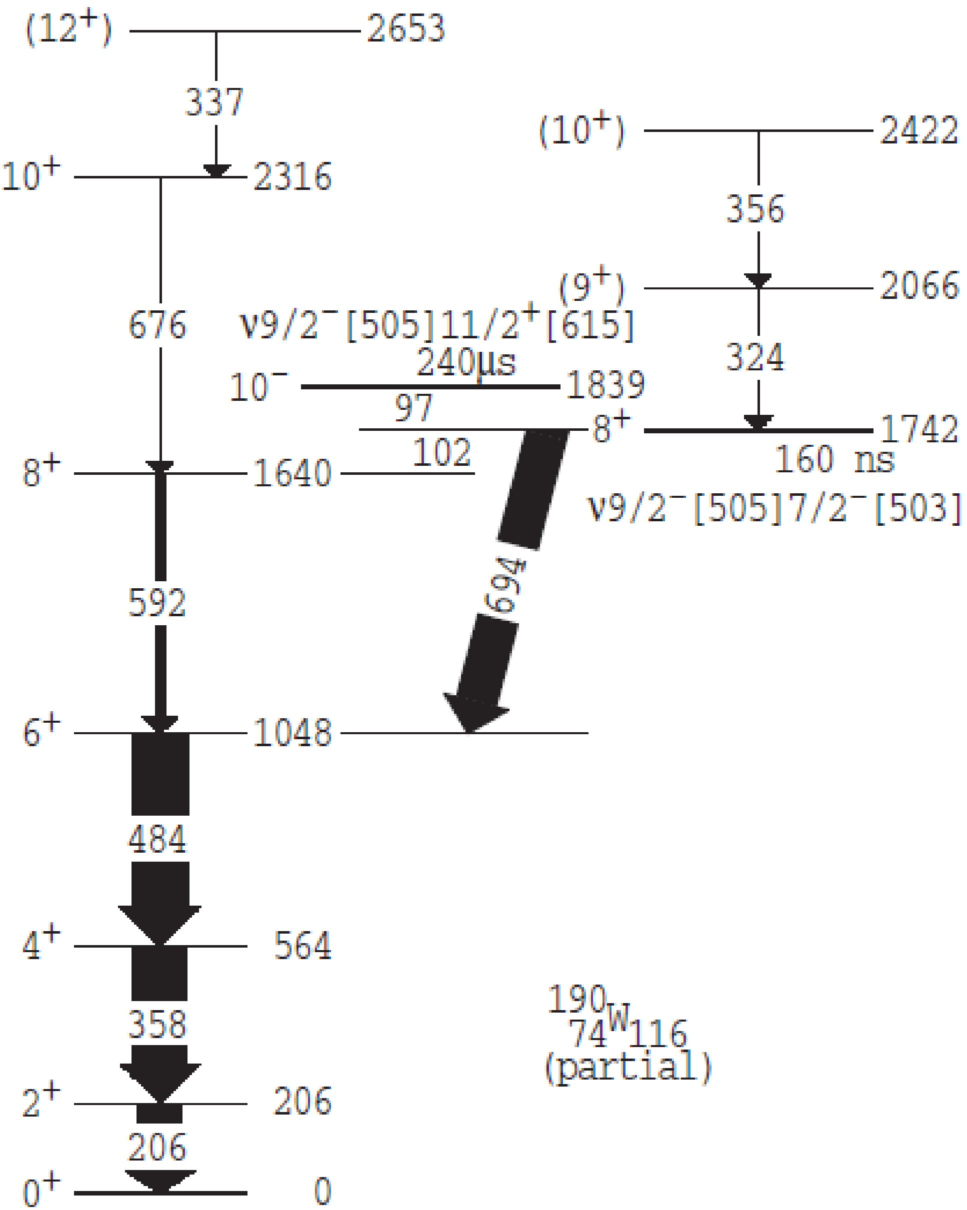






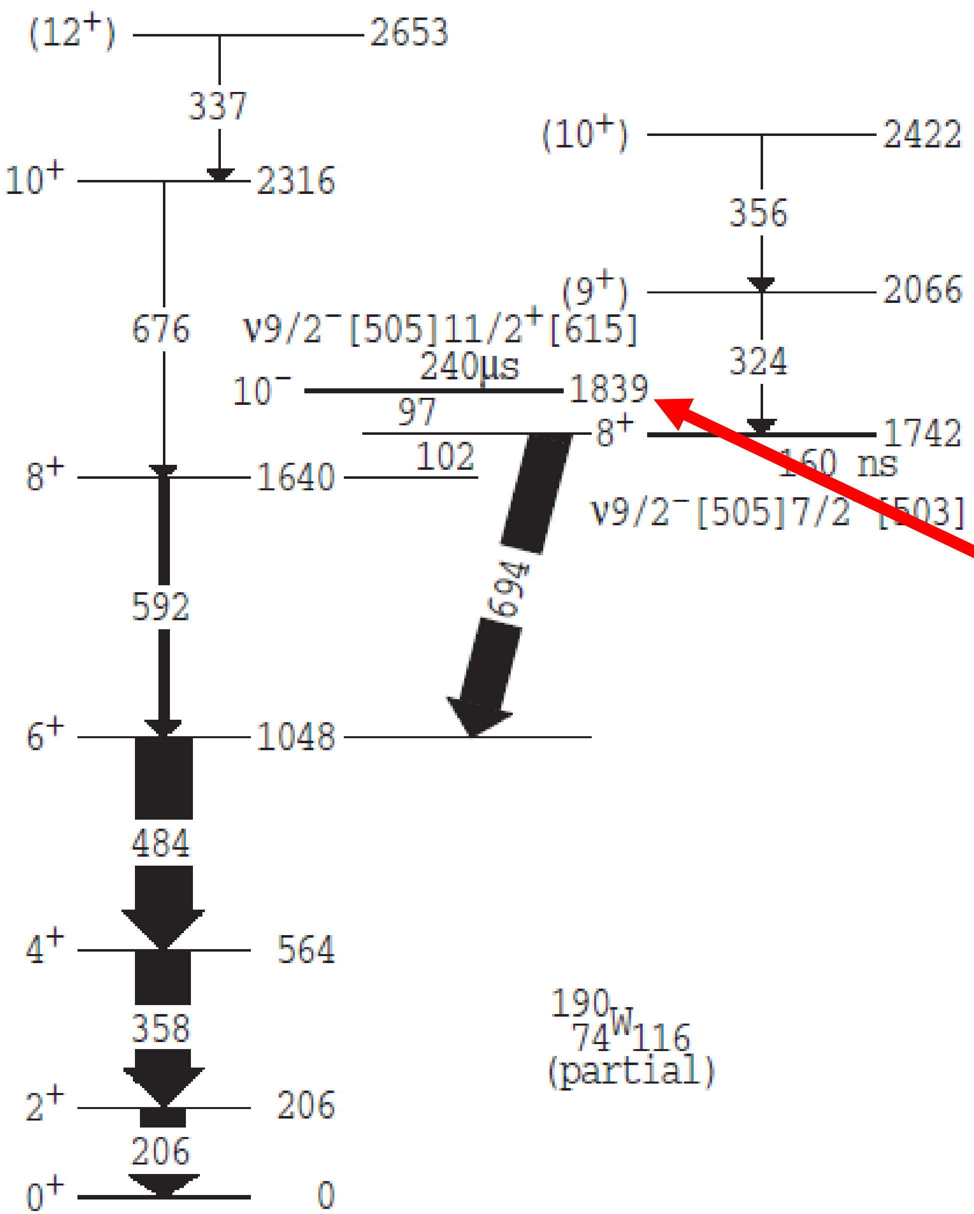
[Walker and Xu, PLB636 (2006) 286]

^{190}W with Gammasphere



Lane et al.,
Phys. Rev. C82
(2010) 051304

^{190}W with Gammasphere

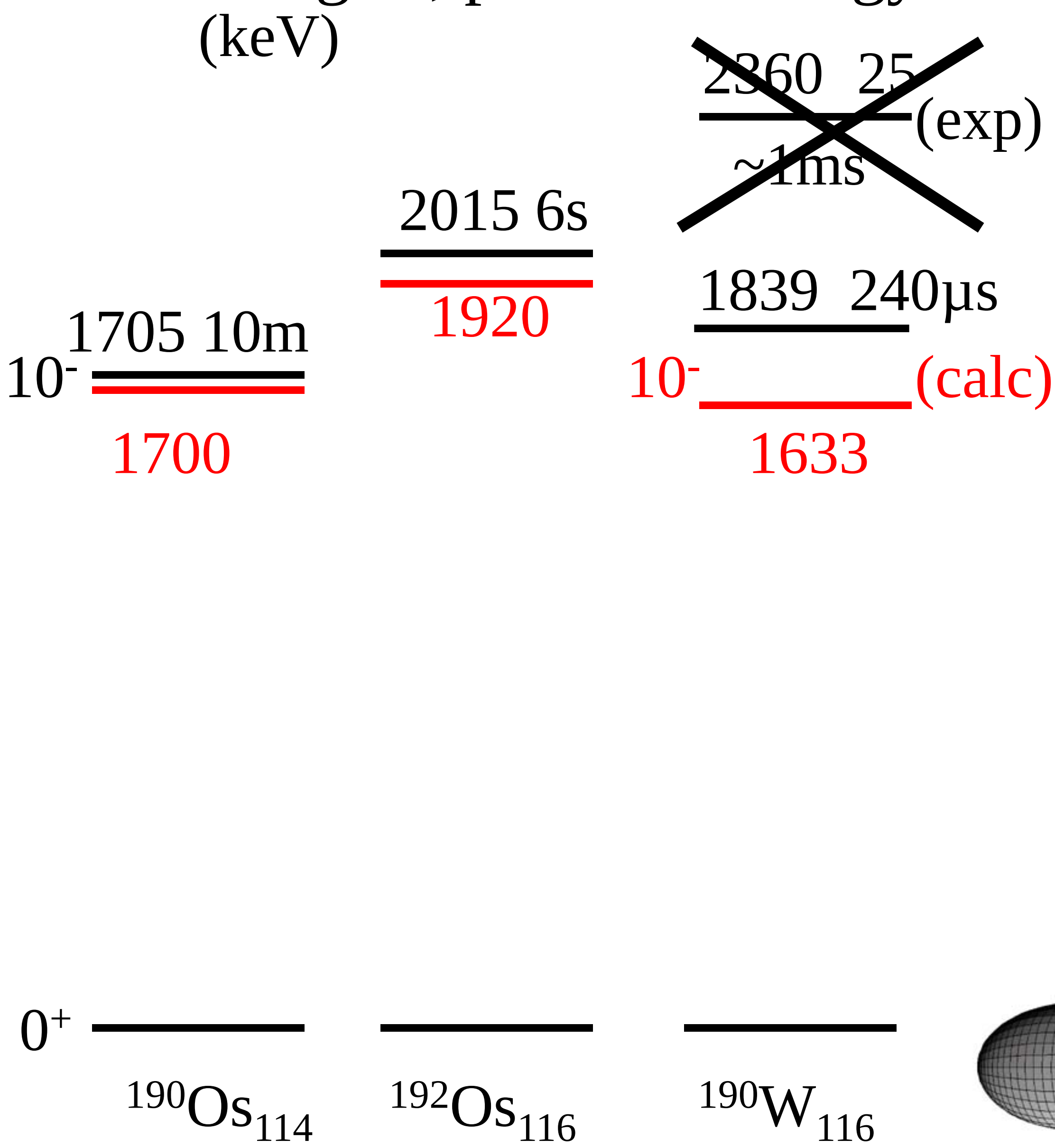


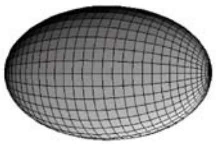
Lane et al.,
Phys. Rev. C82
(2010) 051304

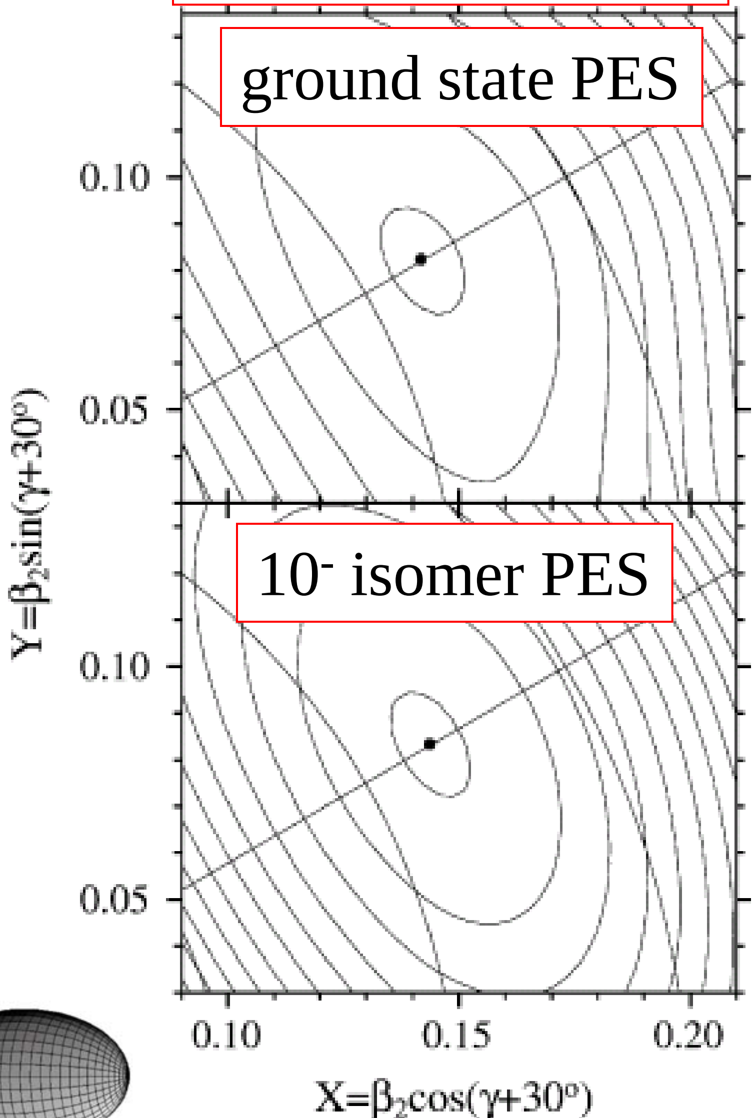
10^{-} isomer at 1839 keV

isomer energies, potential energy surfaces

^{190}W: prolate

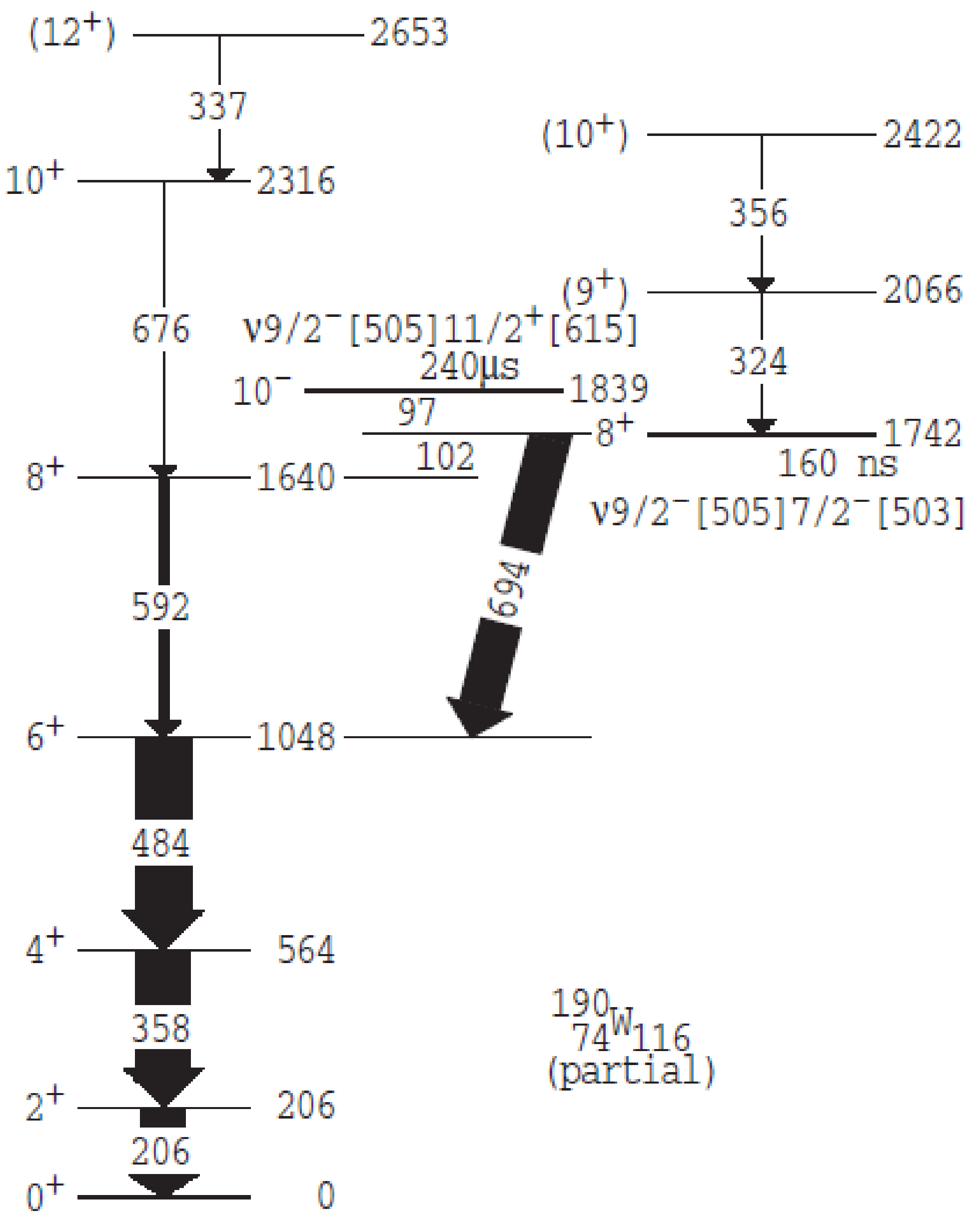






[Walker and Xu, PLB636 (2006) 286]

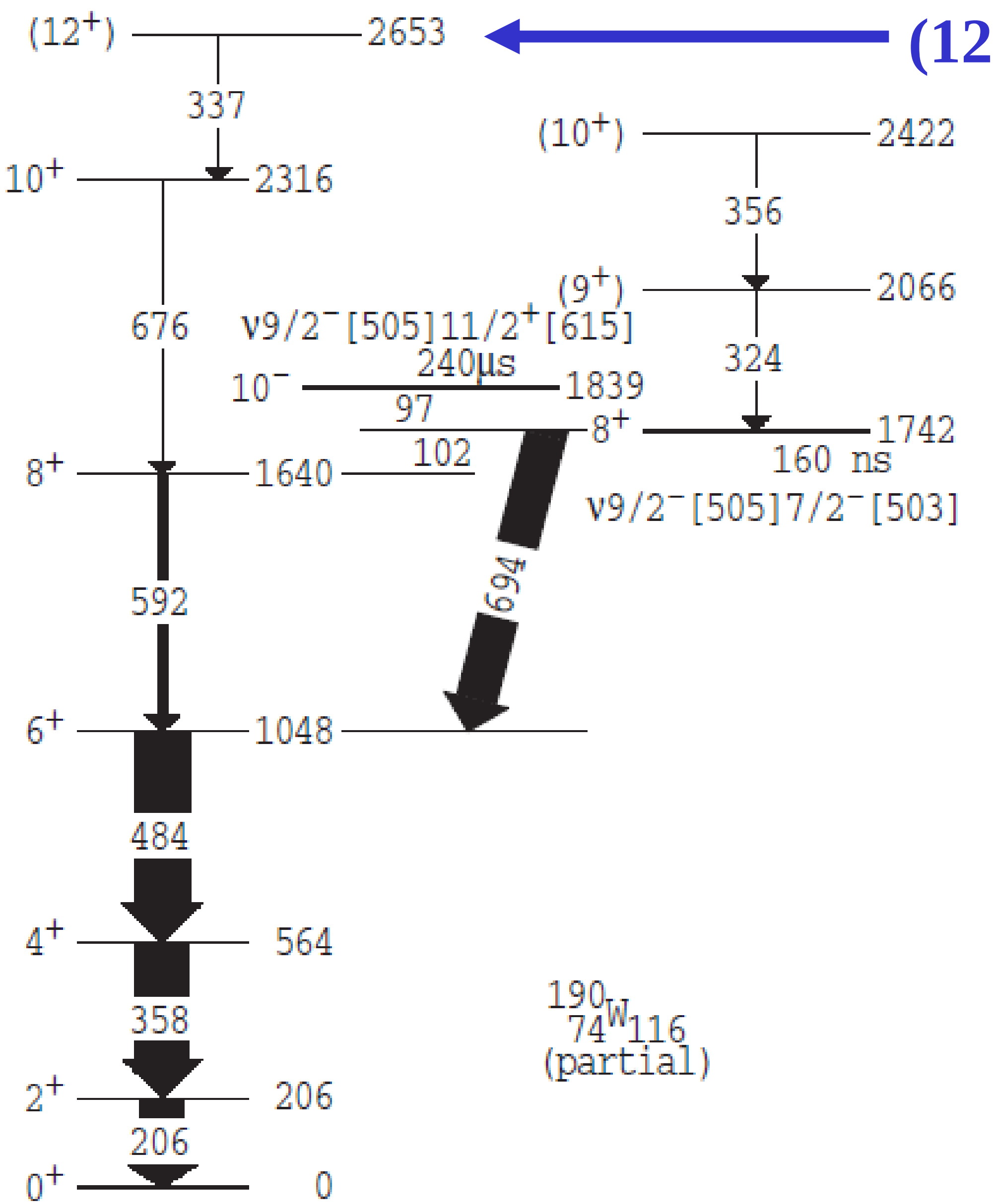
^{190}W with Gammasphere



Lane et al.,
Phys. Rev. C82
(2010) 051304

That was the high-K isomer. What about the oblate rotation?

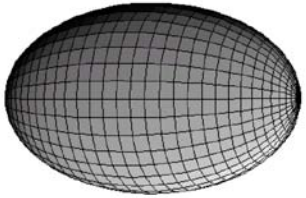
^{190}W with Gammasphere



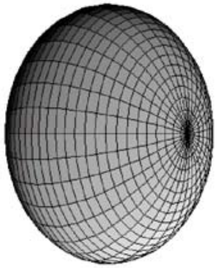
(12$^+$) yrast at 2653 keV

Lane et al.,
Phys. Rev. C82
(2010) 051304

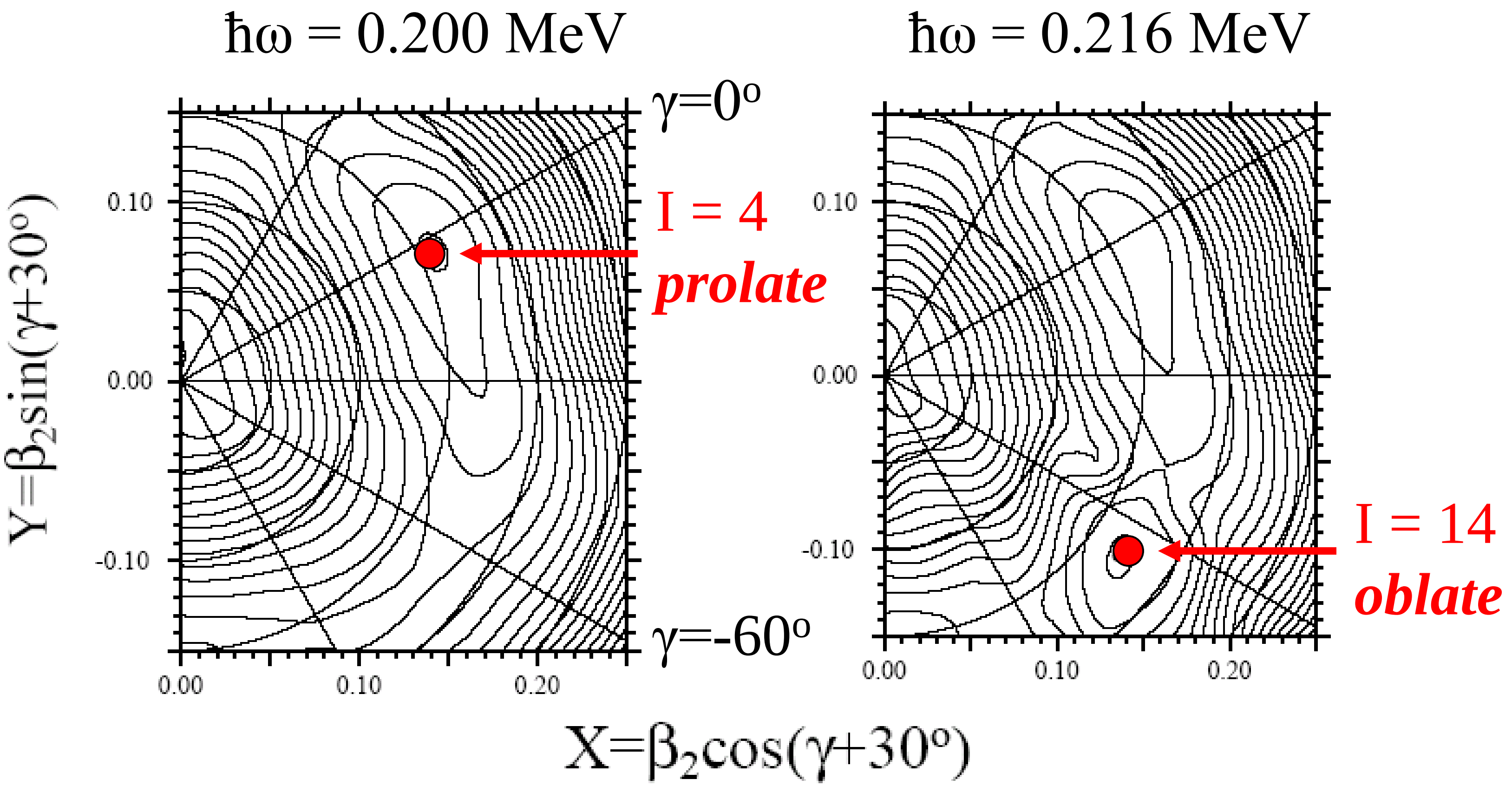
That was the high-K isomer. What about the oblate rotation?



^{190}W TRS: prolate to oblate

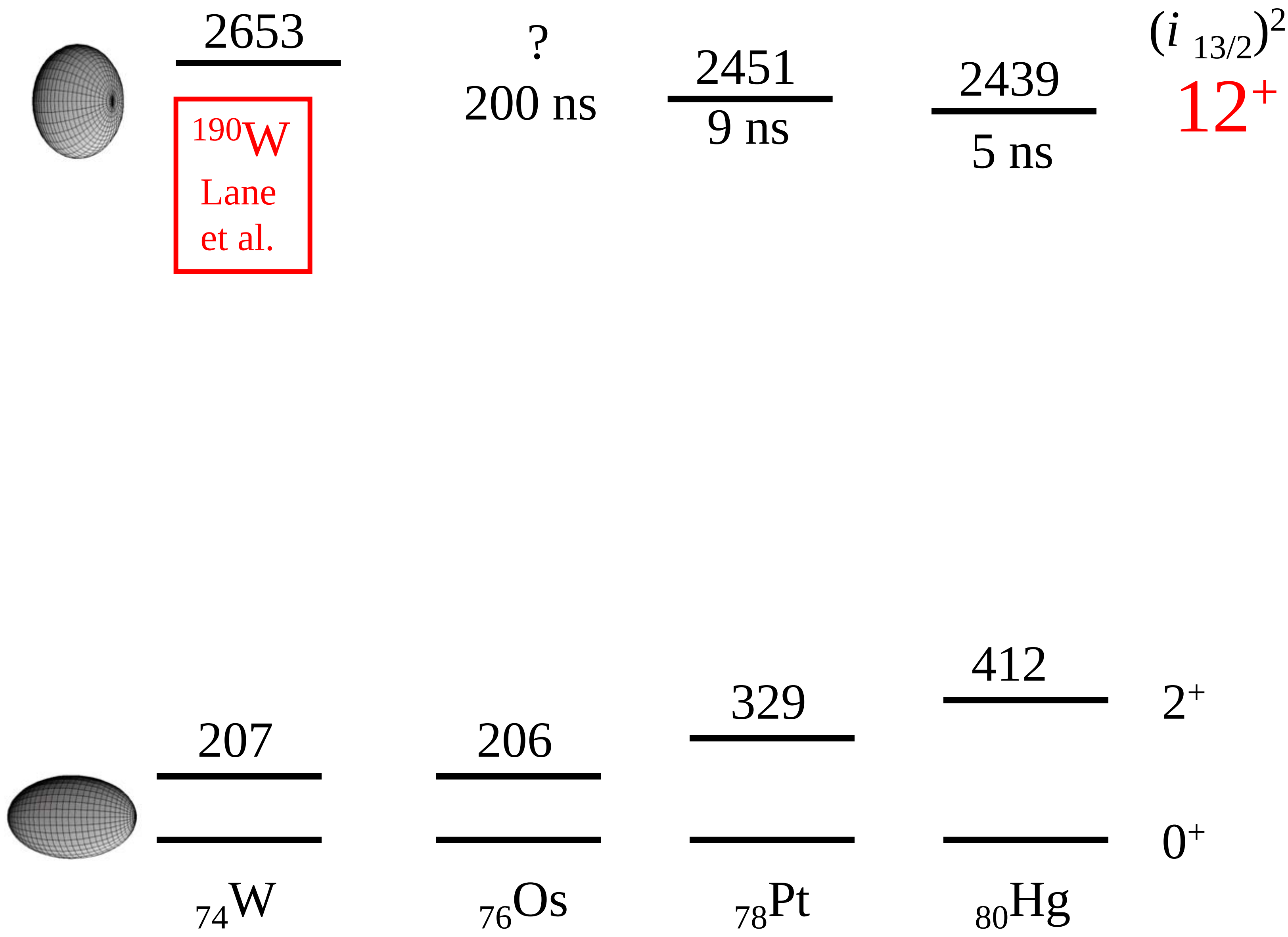


rotation alignment of 2 $i_{13/2}$ neutrons with oblate shape



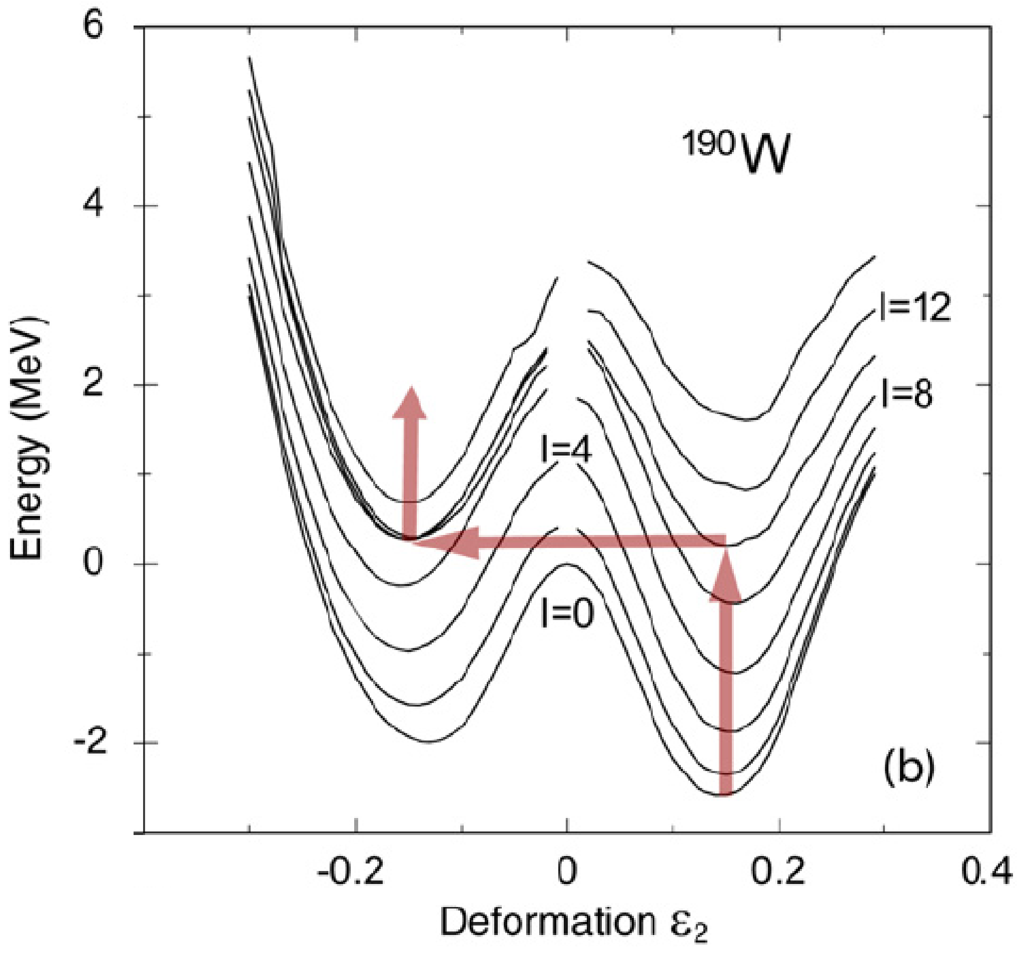
[Walker and Xu, PLB636 (2006) 286]

N=116 experimental energies, spins and half-lives



^{192}Os: *Valiente-Dobon et al., Phys. Rev. C69 (2004) 024316*
^{194}Pt and ^{196}Hg: *Levon et al., Nucl. Phys. A764 (2006) 24*

projected shell model
(angular momentum basis)



Sun et al., PLB659 (2008) 165

summary

- ***oblate-prolate*** competition in N = 116 ^{188}Hf – ^{190}W – ^{192}Os
- ***N = 116*** seems to be the ***critical-point*** neutron number
- focus on angular momentum effects
- 10^- prolate K isomers
- 12^+ isomers: bandheads of collective oblate bands??
- giant backbending candidates: *cf. Hilton and Mang 1979*
- ***oblate rotation becomes yrast over a wide spin range***
- ***more data needed!! (^{188}Hf, ^{190}W and/or ^{192}Os)***