Investigation of a high spin structure in 44Ti via discrete and continuum γ spectroscopy with AGATA, PARIS and DIAMANT at GANIL

Spokesmen: P.Bednarczyk, A.Maj

Accepted in 2014- 28UT (8days),

- is it to be performed in 2018 ?

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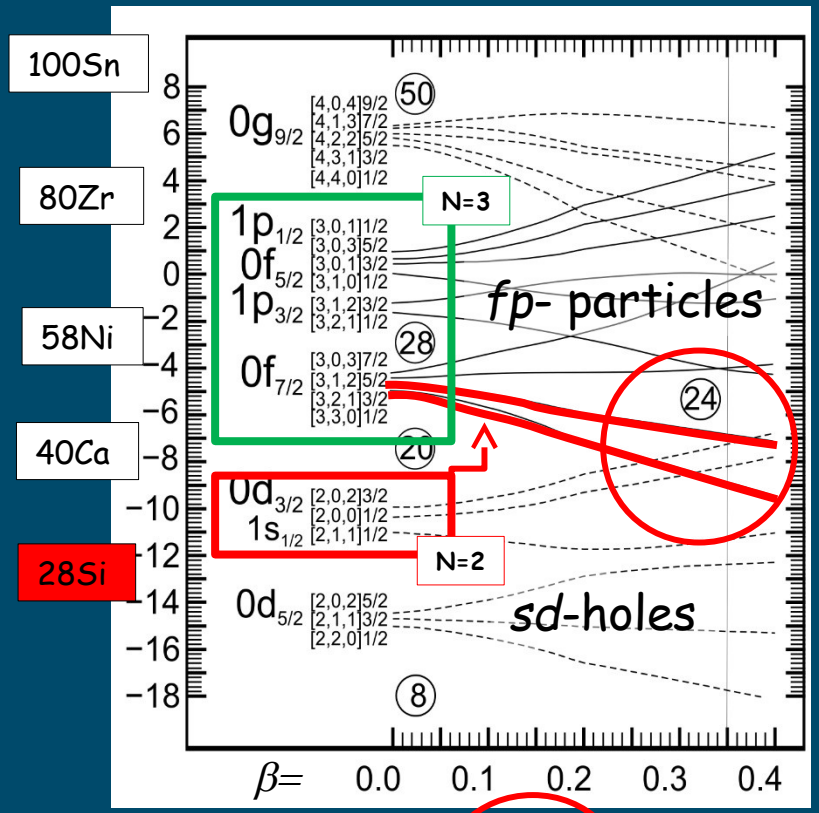
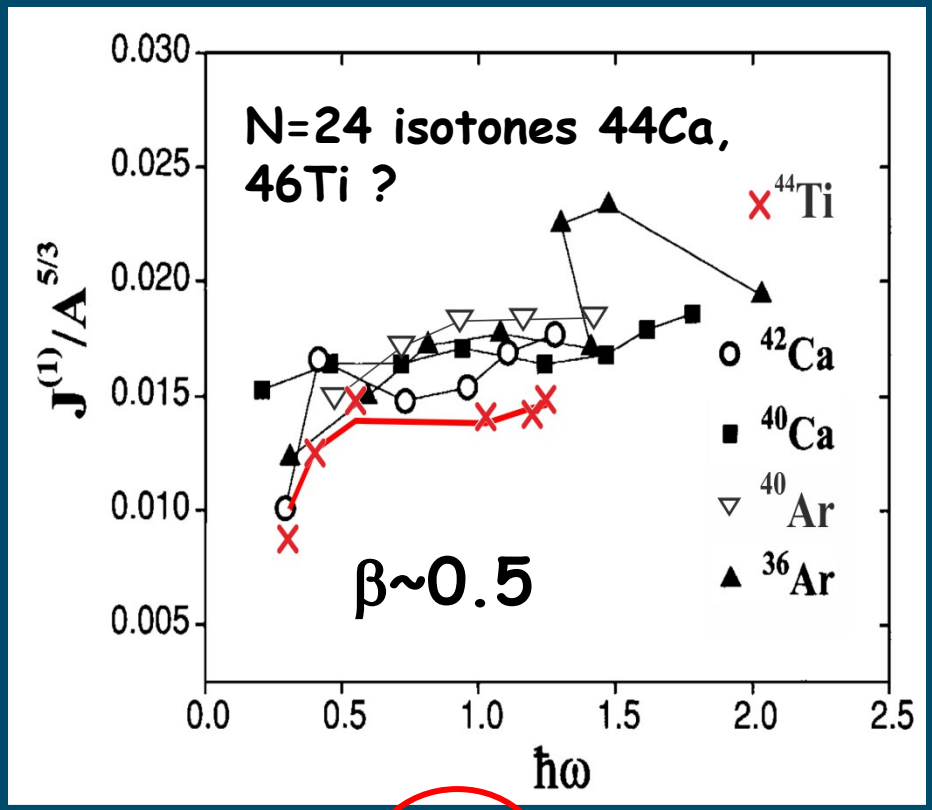
Single particle structure of (super)deformation

48Cr: *(fp) 8 -rotational GS band-* Jmax = 16+

A,Z ≤24 ⟹ SD bands





40Ca(SD): 8p*fp*-8h*sd* **44Ti(SD): 8p*fp*-4h*sd***

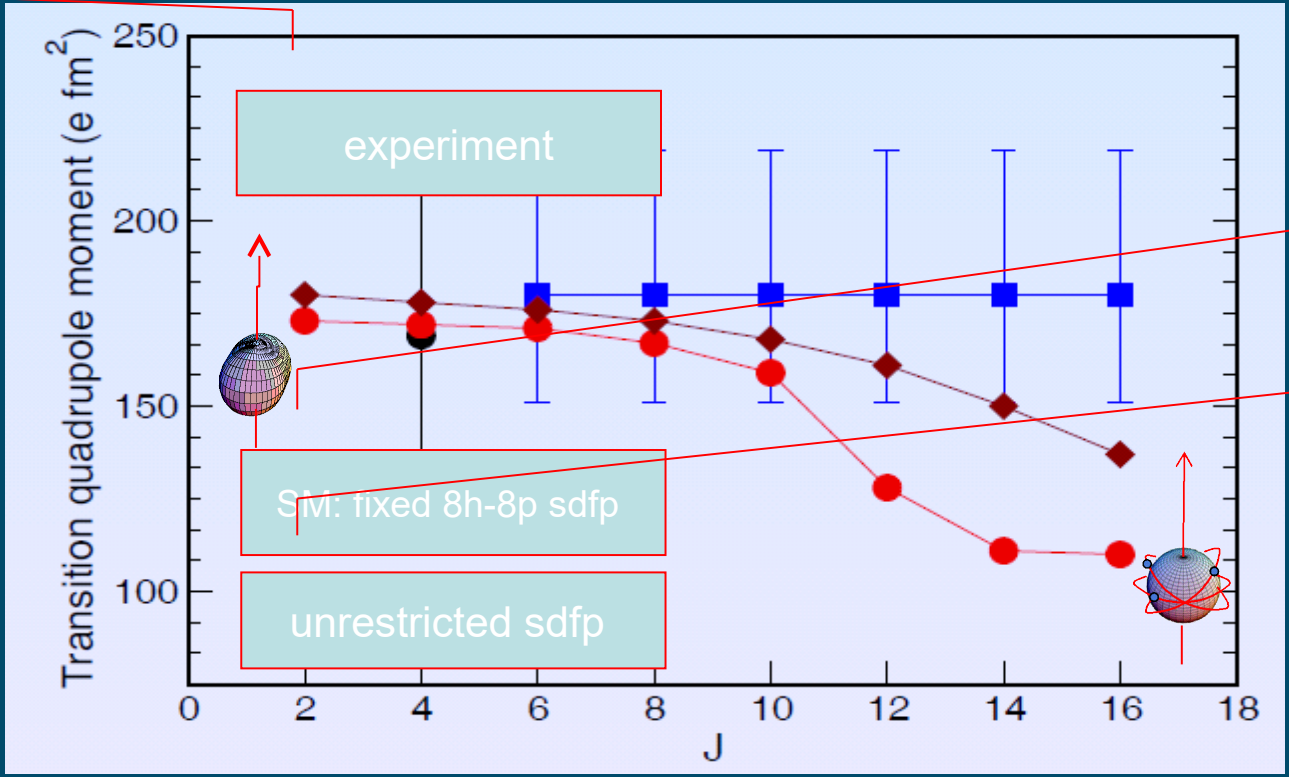
H.Ropke , EPJ A 22, 213 (2004)

48Cr - like

SD in 40Ca- is it a SM effect ?

In 40Ca the 8p-8h SD band seems NOT to lose the collective character (terminate) at high spins

- ***rigid rotor*** ?

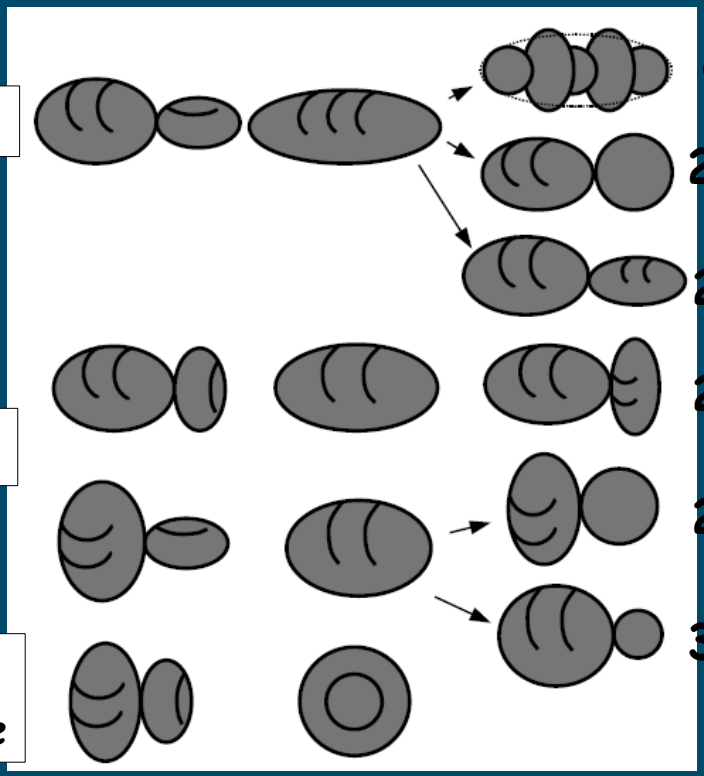


C. J. Chiara et al, Phys.Rev. C 67, 041303 (2003)

E. Caurier et al., PRC 75, 054317(2007)

„Molecular" (collective) states close to 40Ca

24Mg+12C SM



Binary configurations

β =0.15- 1.42

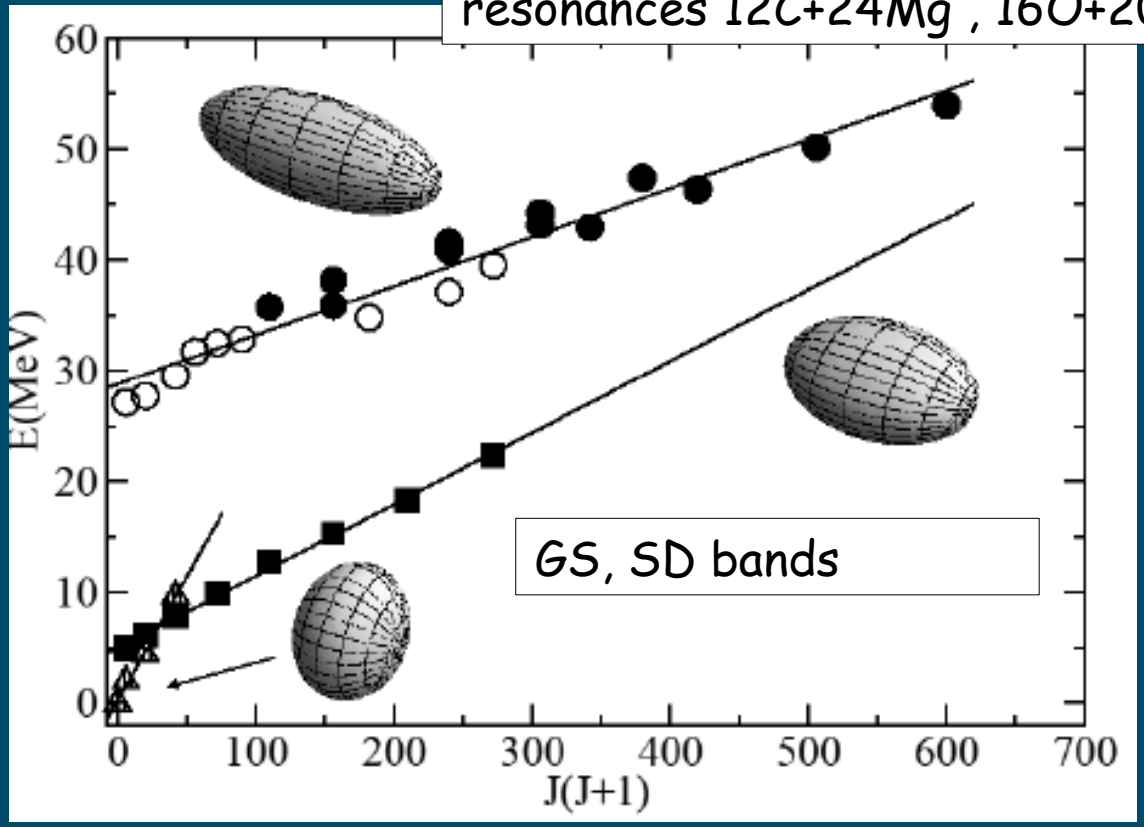
SD(40Ca)- 28Si + 12C
HD(44Ti)- 28Si + 16O

Stable configurations (shape isomers) in 36Ar

J.Darai et al. PRC 80, 034320 (2009) and
EPJ Web of Conferences 17, 16001 (2011)

„Molecular" (collective) states close to 40Ca

resonances 12C+24Mg , 16O+20Ne



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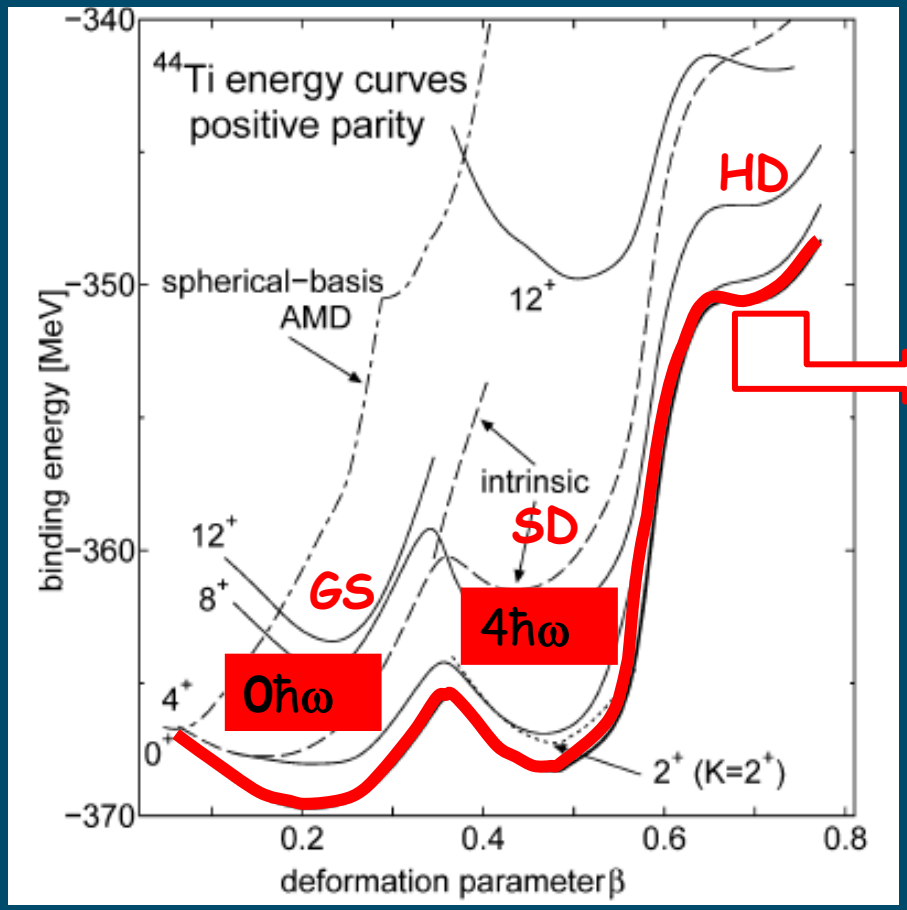
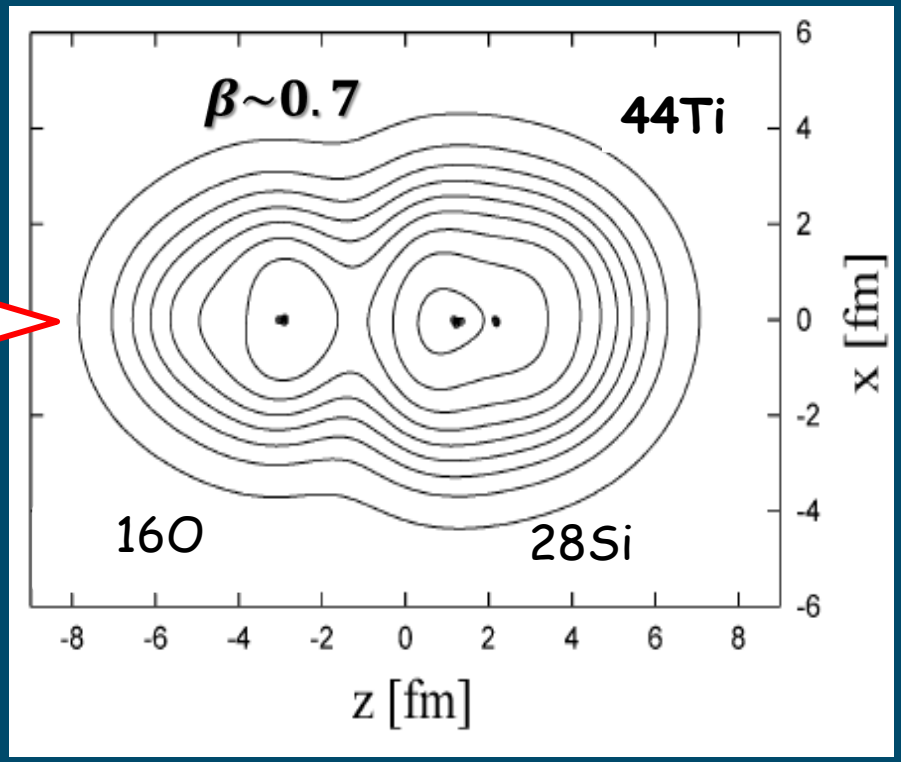
Deformation in 44Ti beyond SM- Cluster Model



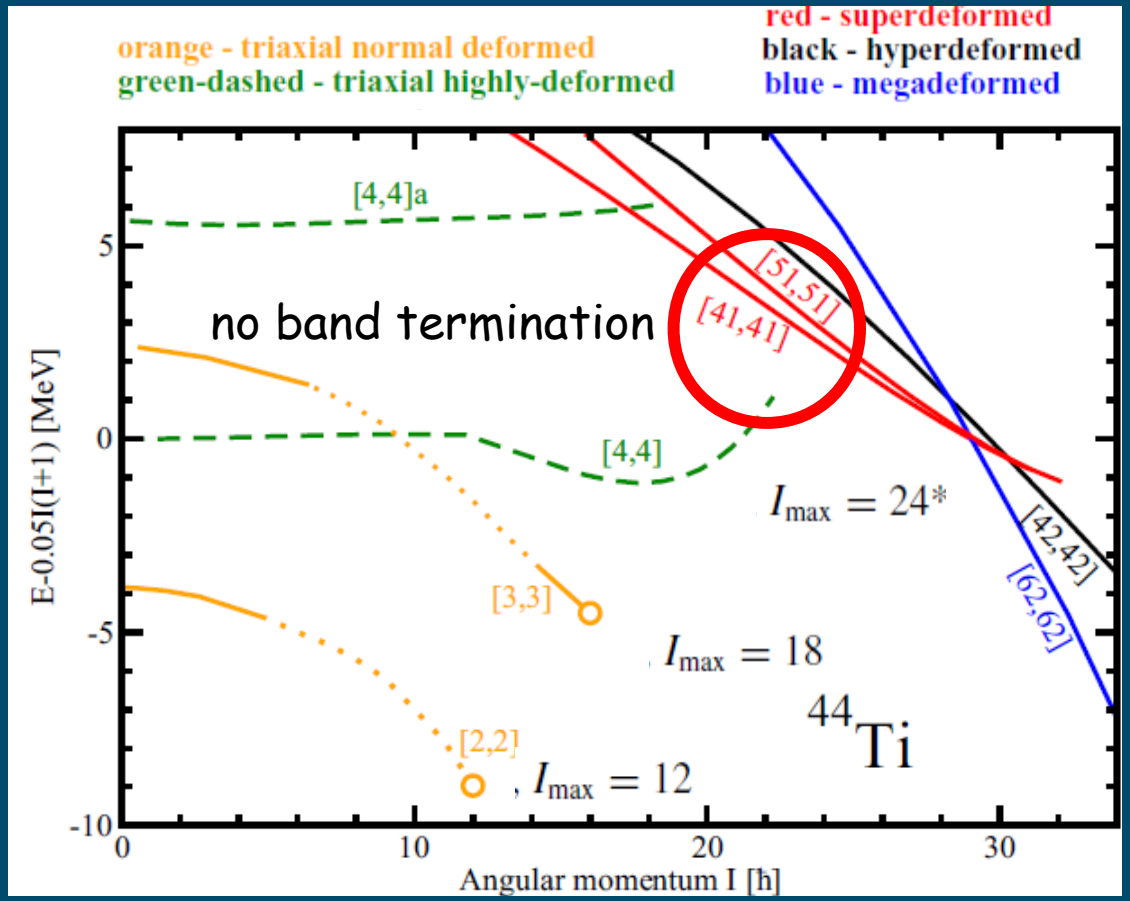
di-nucleus

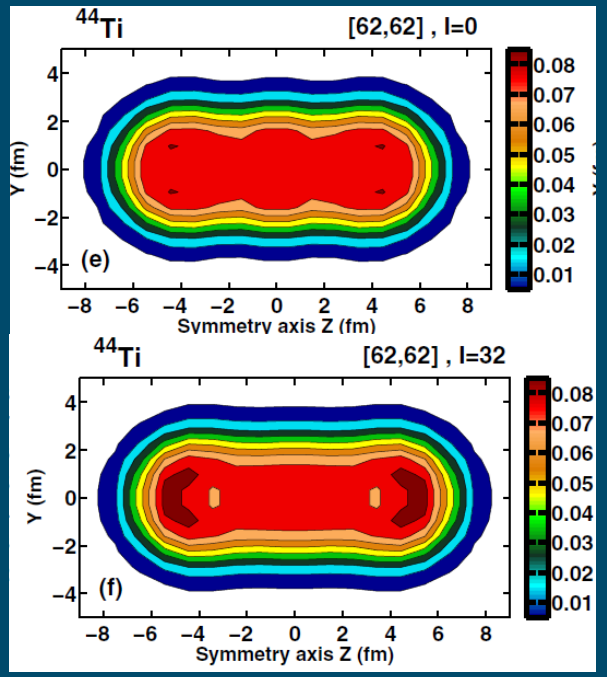


Predicted at E*~20 MeV

M.Kimura, H.Horiuchi **NPA 767 58 (2006)**

Cranked Relativistic Mean-Field CRMF

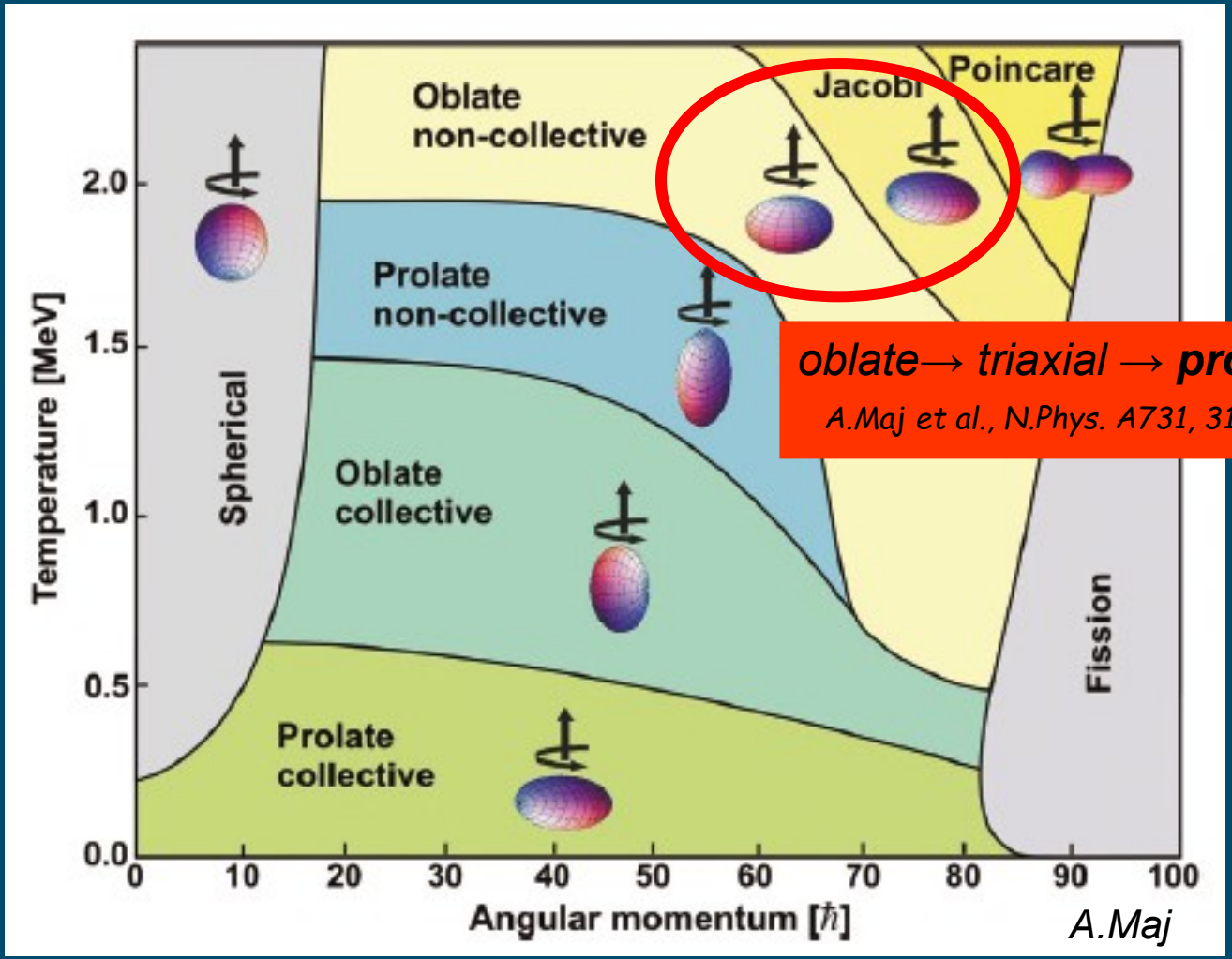




deformed „cluster states" <u>favoured</u> at high spin

D. Ray, A. V. Afanasjev, PRC 94, 014310 (2016)

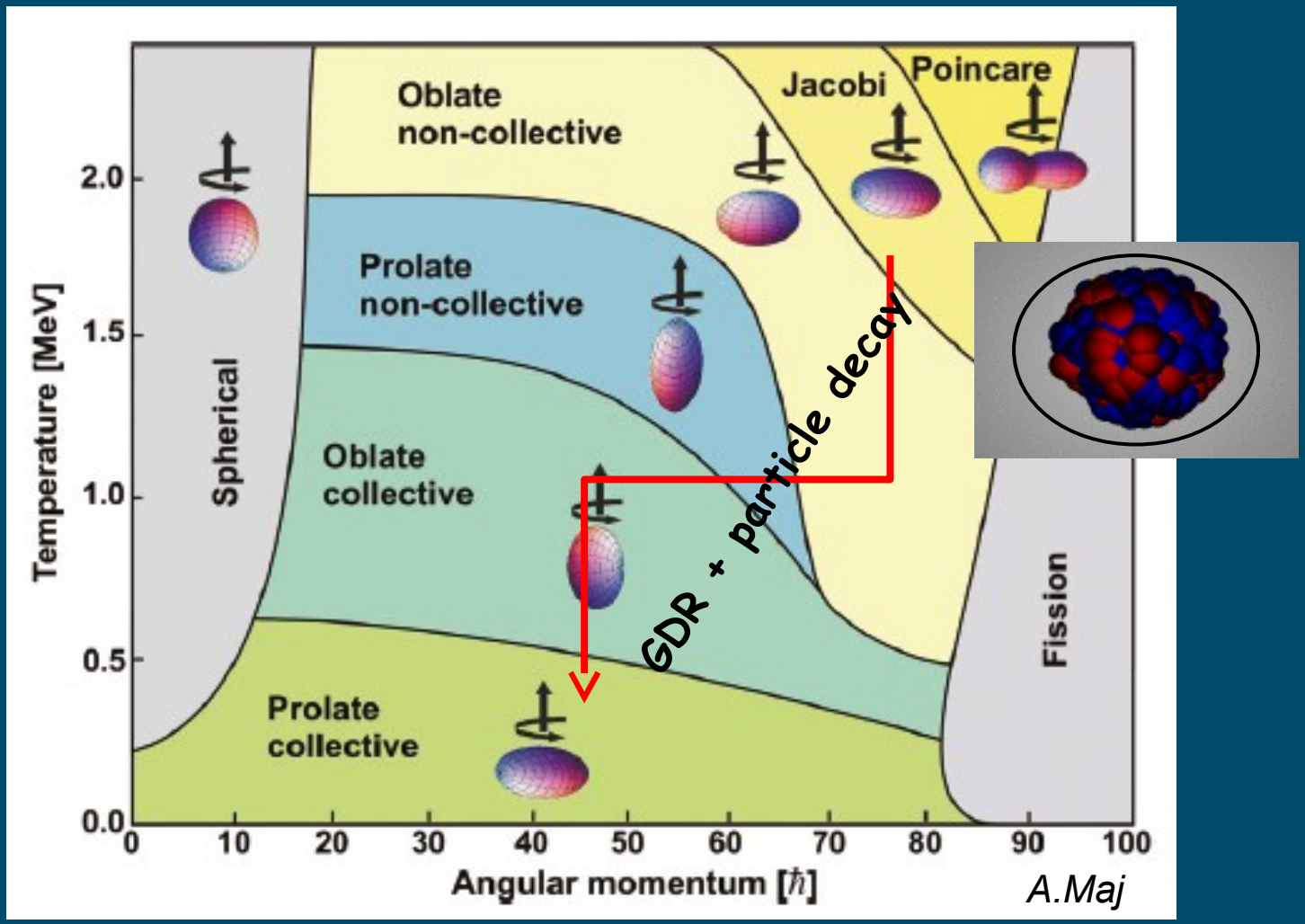
Jacobi Shape Transition in 46Ti



oblate→ triaxial → ***prolate***

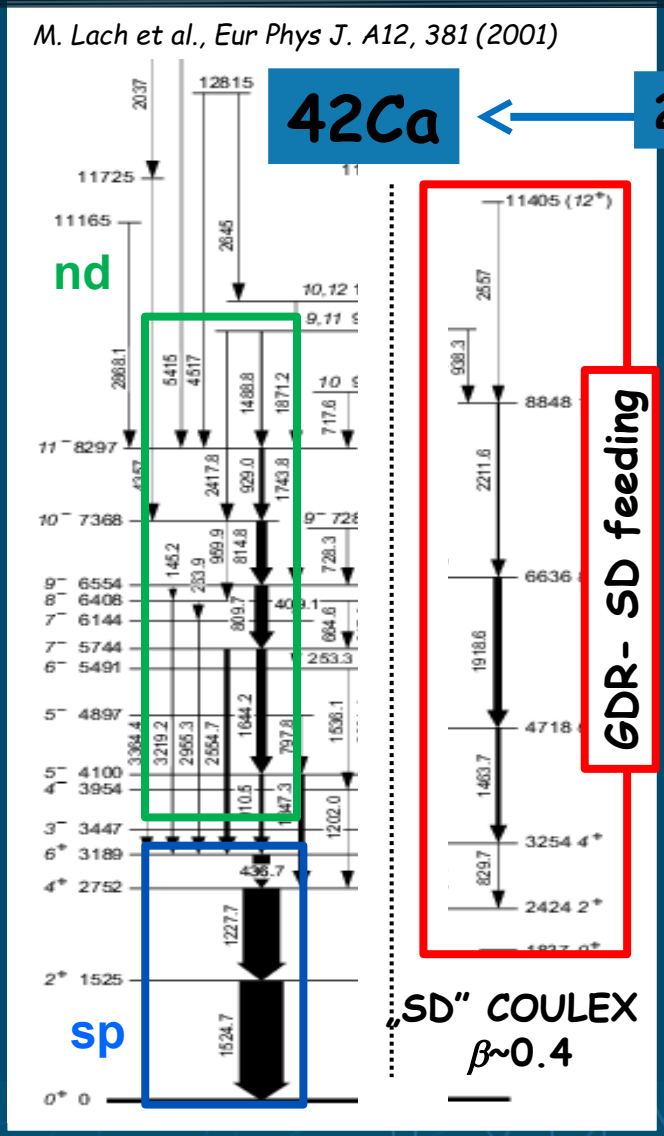
A.Maj et al., N.Phys. A731, 319 (2004)

Jacobi Shape Transition in 46Ti



Survival of large deformation in 46Ti (CN)

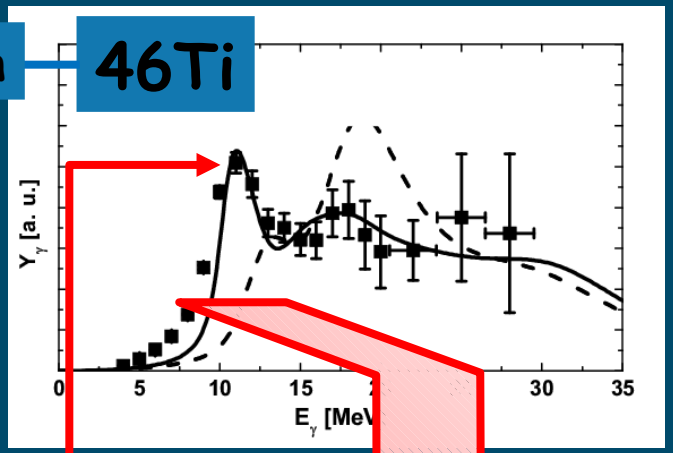
M. Lach et al., Eur Phys J. A12, 381 (2001)

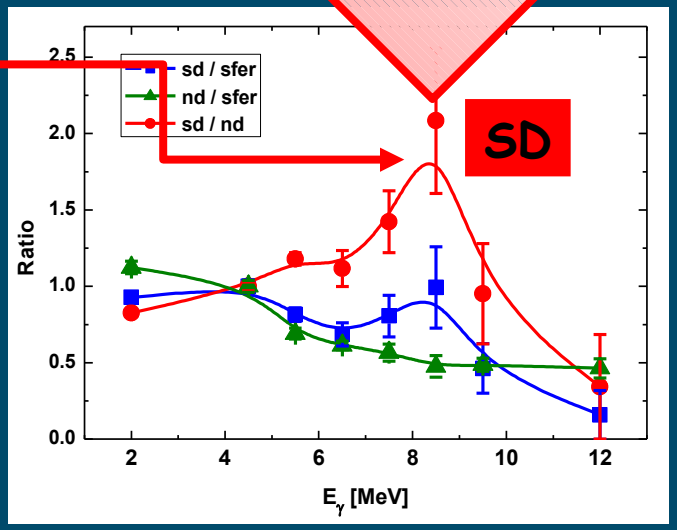


GDR- SD feeding

2p2n

46Ti





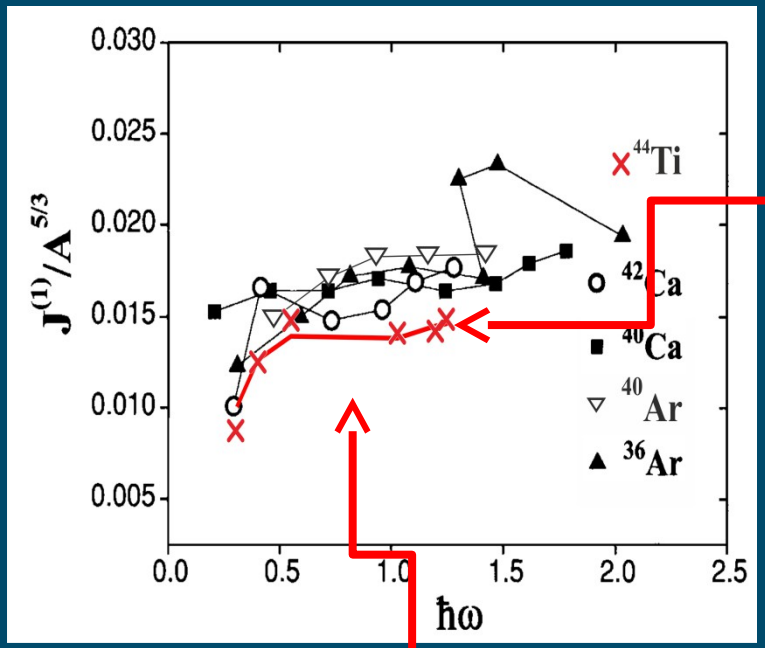
105 MeV 18O + 28Si ⇒ 46Ti*

EUROBALL + HECTOR

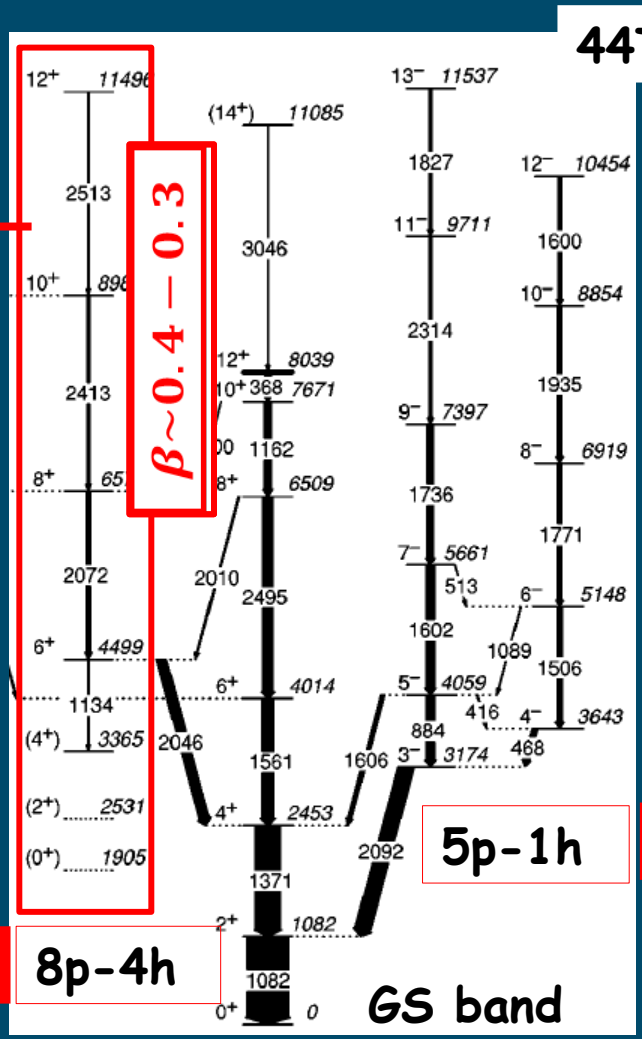
M. Kmiecik et al., Acta Phys. Pol. B36 1169 (2005)

K. Hadyńska-Klęk, et al. PRL 117, 062501 (2016)

Bands in 44Ti and the cluster model



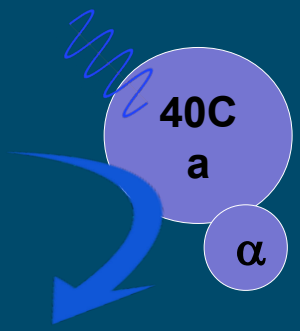
SD: α 36Ar α



N.Antonenko- priv. comm.

C.D.O'Leary et al., PRC61,064314(2000)

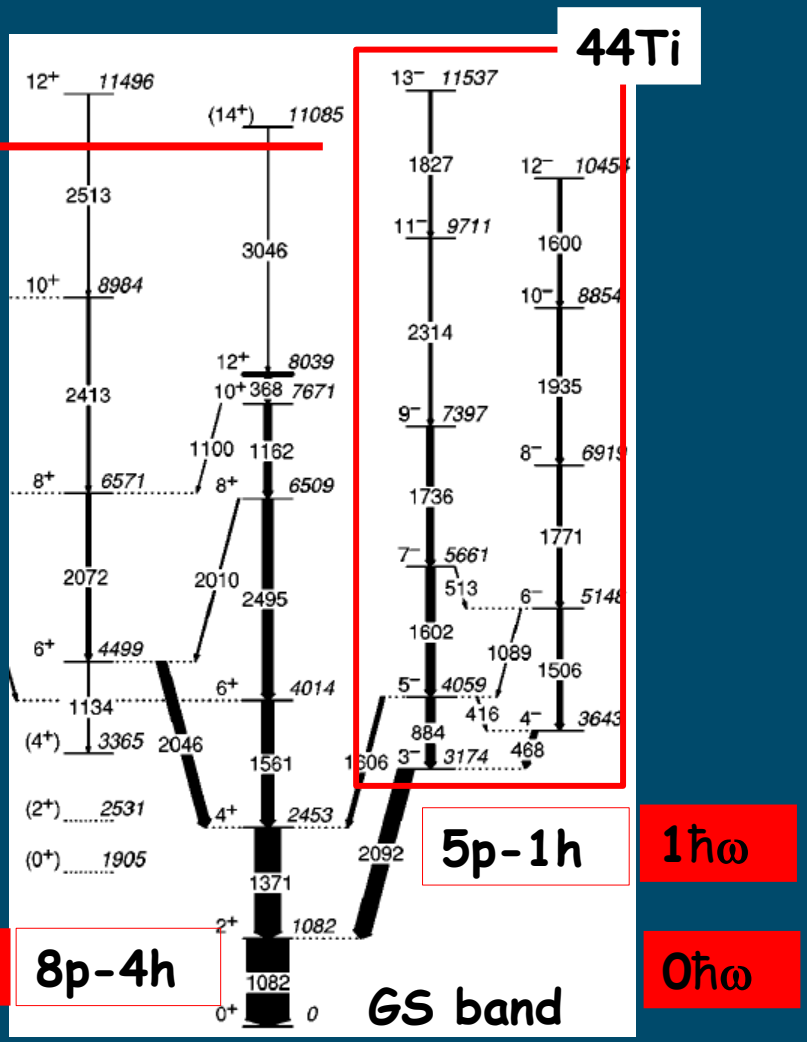
Bands in 44Ti and the cluster model



Reflection asymmetric

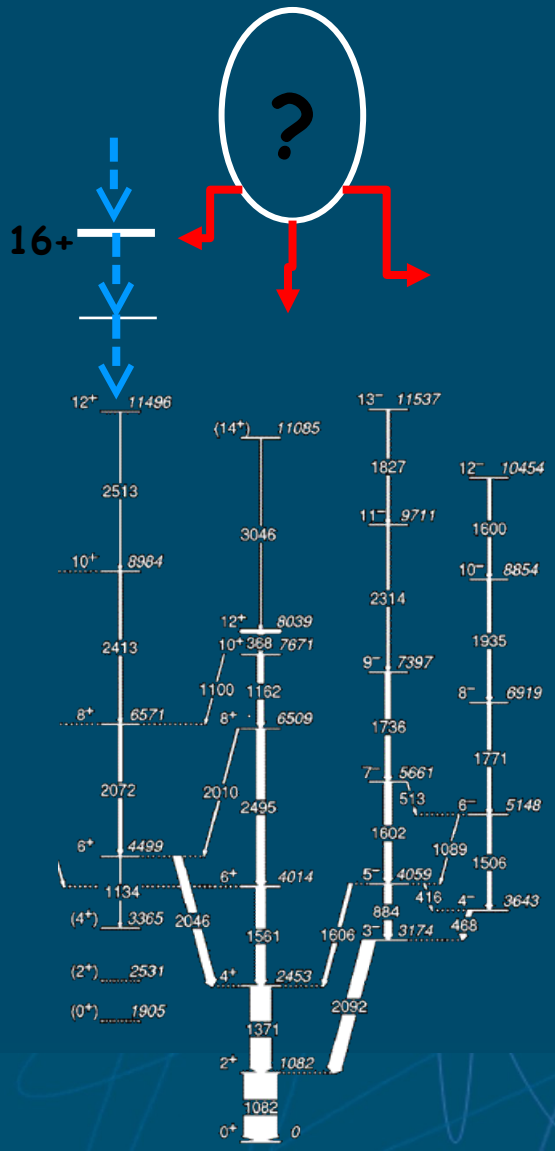
Centrifugal barrier (J=21-)
-competing γ and α emission at high spin ?

G. G. Adamian et al., PRC **92**, 054319 (2015)



C.D.O'Leary et al., PRC61,064314(2000)

Structures in 44Ti at HS



- High energy (>5MeV) γ-rays (E1, GDR) feeding the discrete bands
- Gamma-α particle correlations

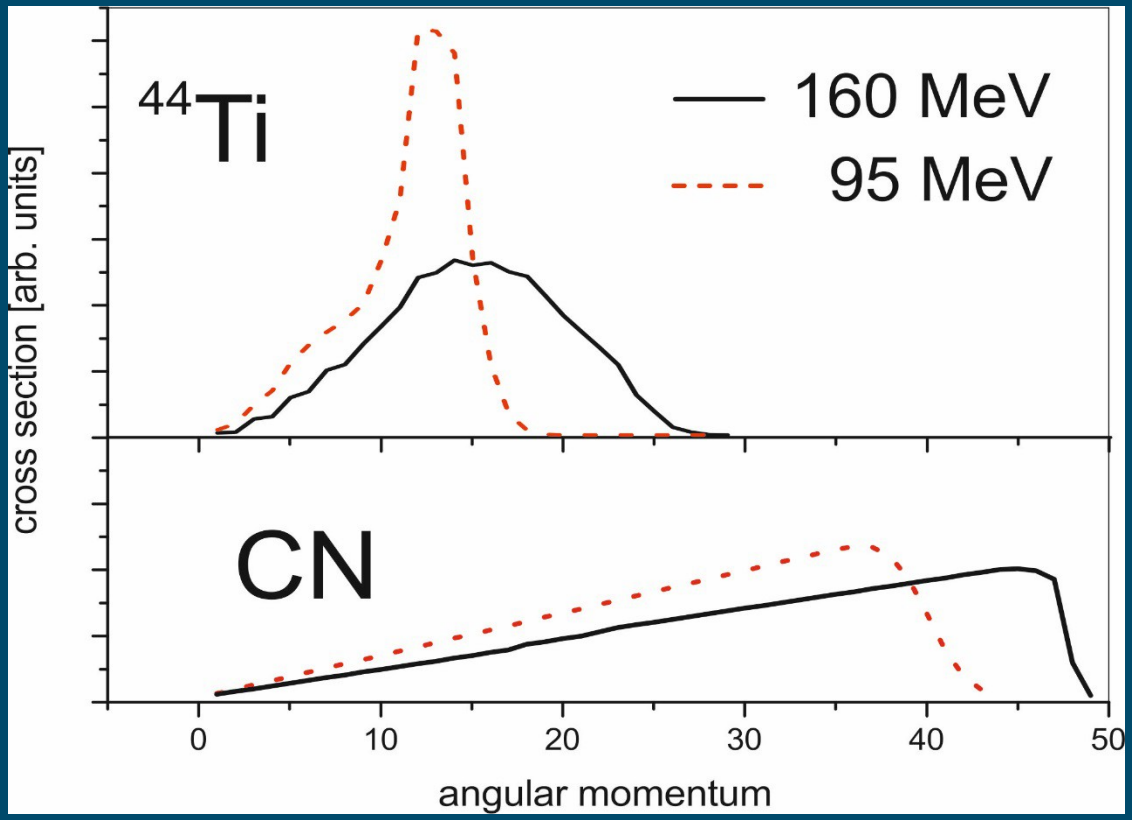
- Extension/termination of rot. bands (by disrete γ-rays)

Experiment: high-spin excitation in 44Ti

Reaction:

28Si(24Mg, α2p2n) at ~160MeV; σ =50-60 mb

28Si(24Mg, 2α) at ~95MeV; σ =10-20 mb



HIVAP, GEMINI, PACEIV

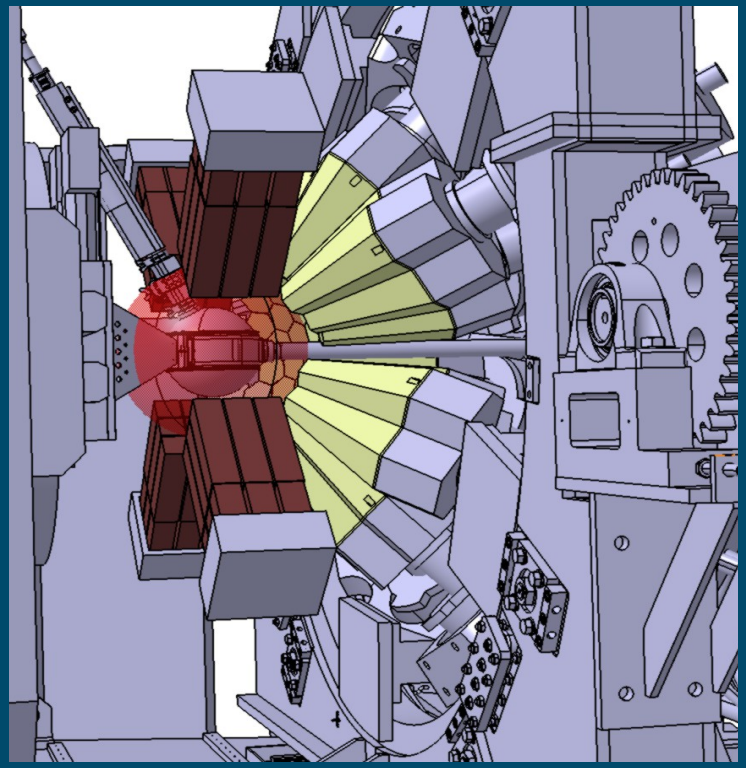
Goals of the measurement

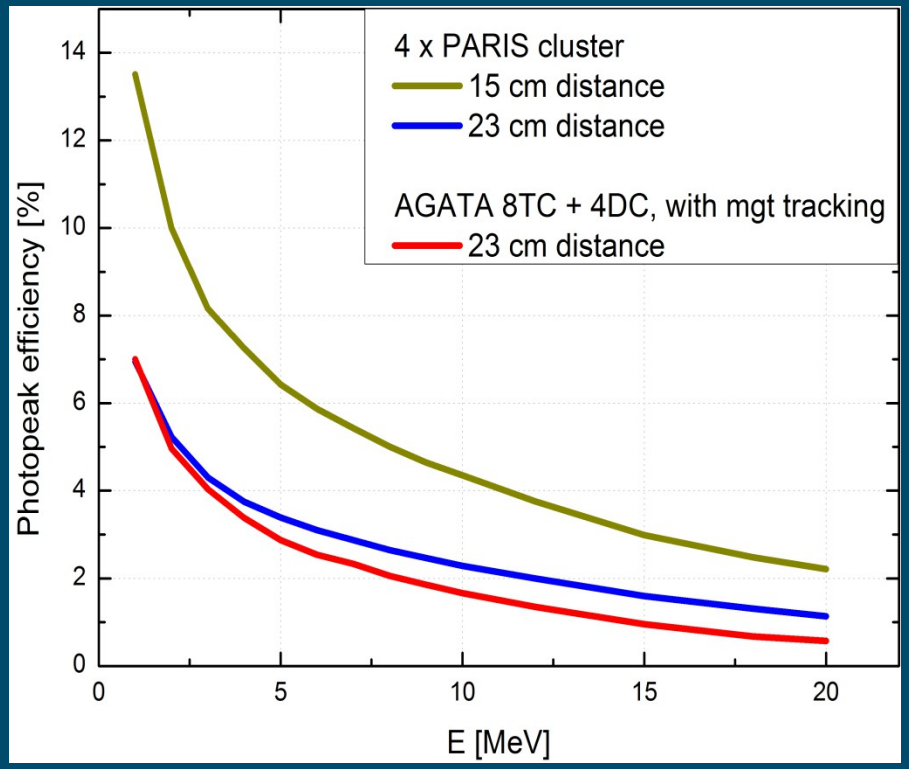
- Extension of the SD band in 44Ti –AGATA
- Measurement of high energy- E1 γ-rays and the GDR strength function -PARIS
- Search for correlations between the structures at high and low temperatures AGATA-PARIS
- Correlation with particles (angular distr.) DIAMANT

- Two beam energies :
  - high vs moderate entry-spin distribution,
  - 2α (cluster) emission vs 5 particle evaporation

Experimental set-up at GANIL

- Triple-γ AGATA
- Double-γ AGATA-PARIS

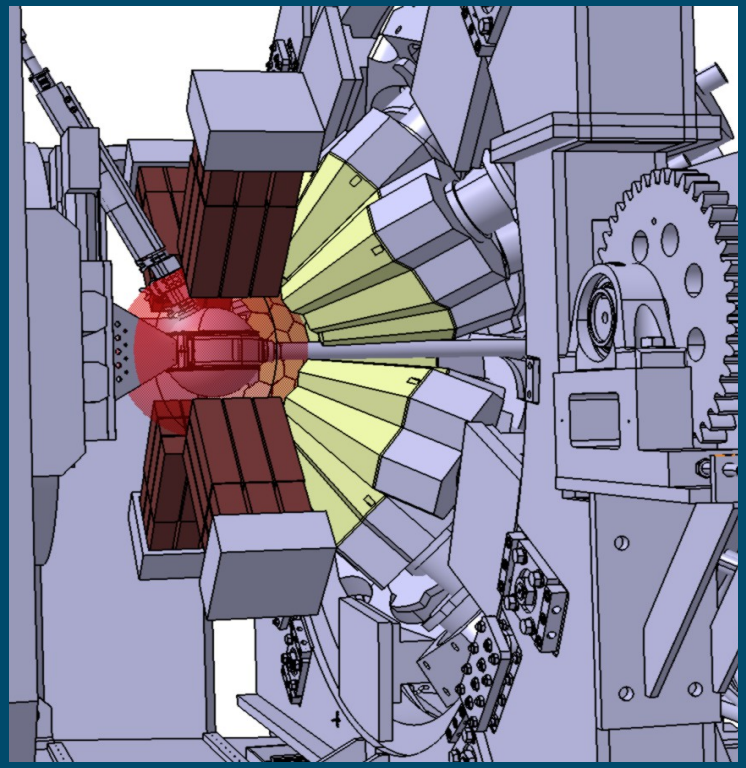


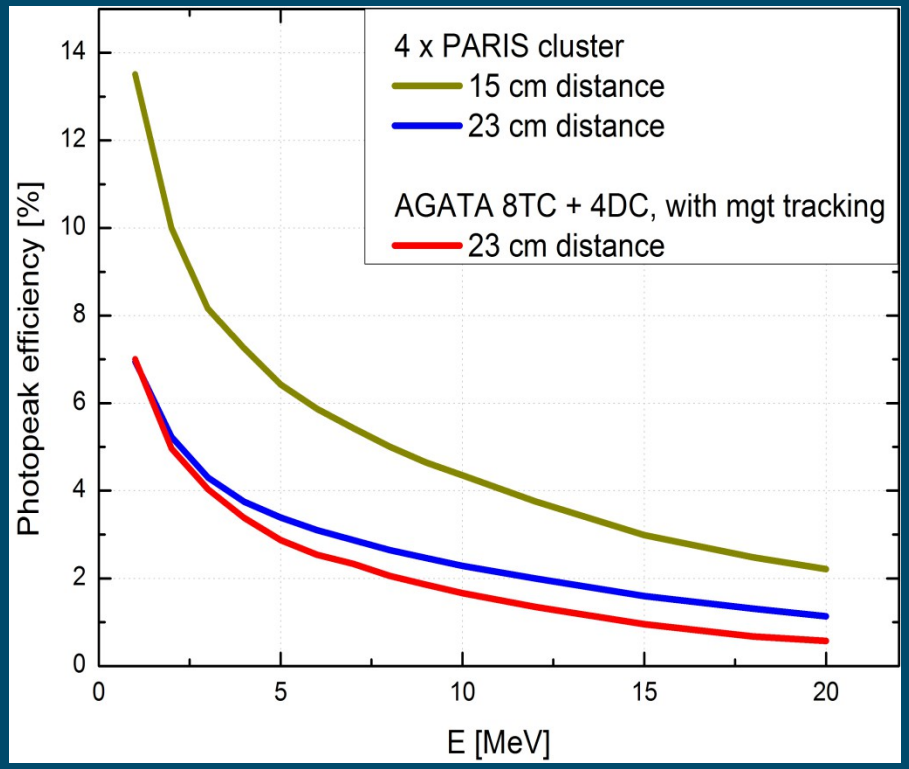


Experimental set-up at GANIL

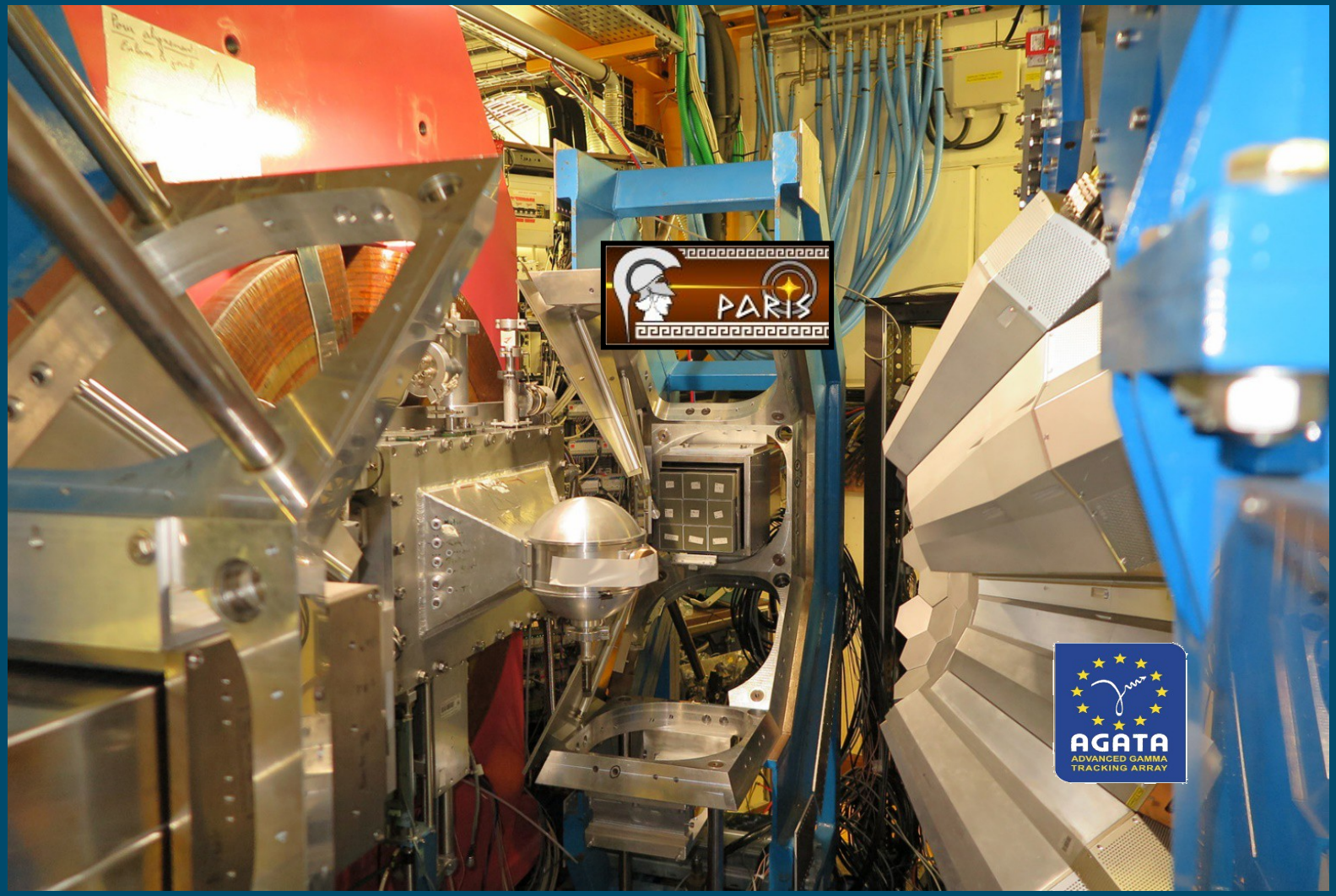
- Triple-γ AGATA
- Double-γ AGATA-PARIS

- Reaction channel selection and particle ang. distr. DIAMANT



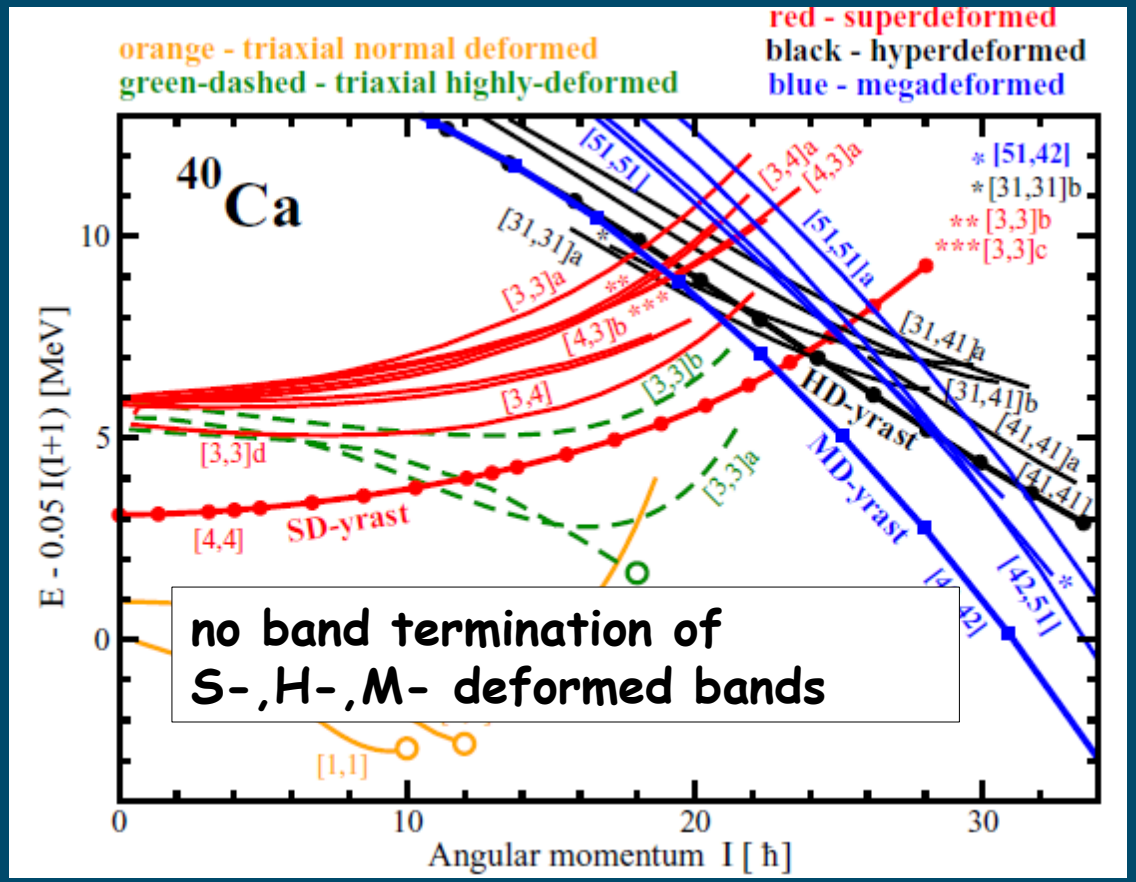


PARIS and AGATA, GANIL 2017

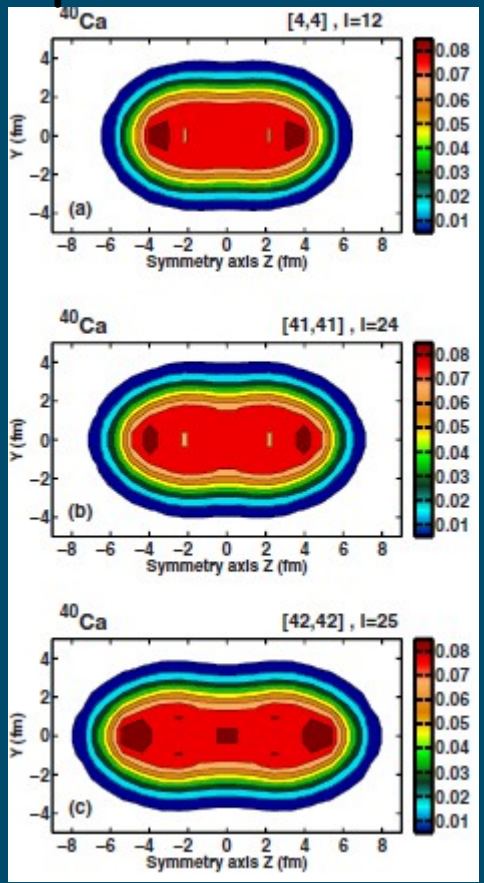


Expected High spin deformed bands in 40Ca

Cranked Relativistic Mean-Field (CRMF) → deformed „cluster states" favoured at high spin



proton densities



D. Ray, A. V. Afanasjev, PRC 94, 014310 (2016)

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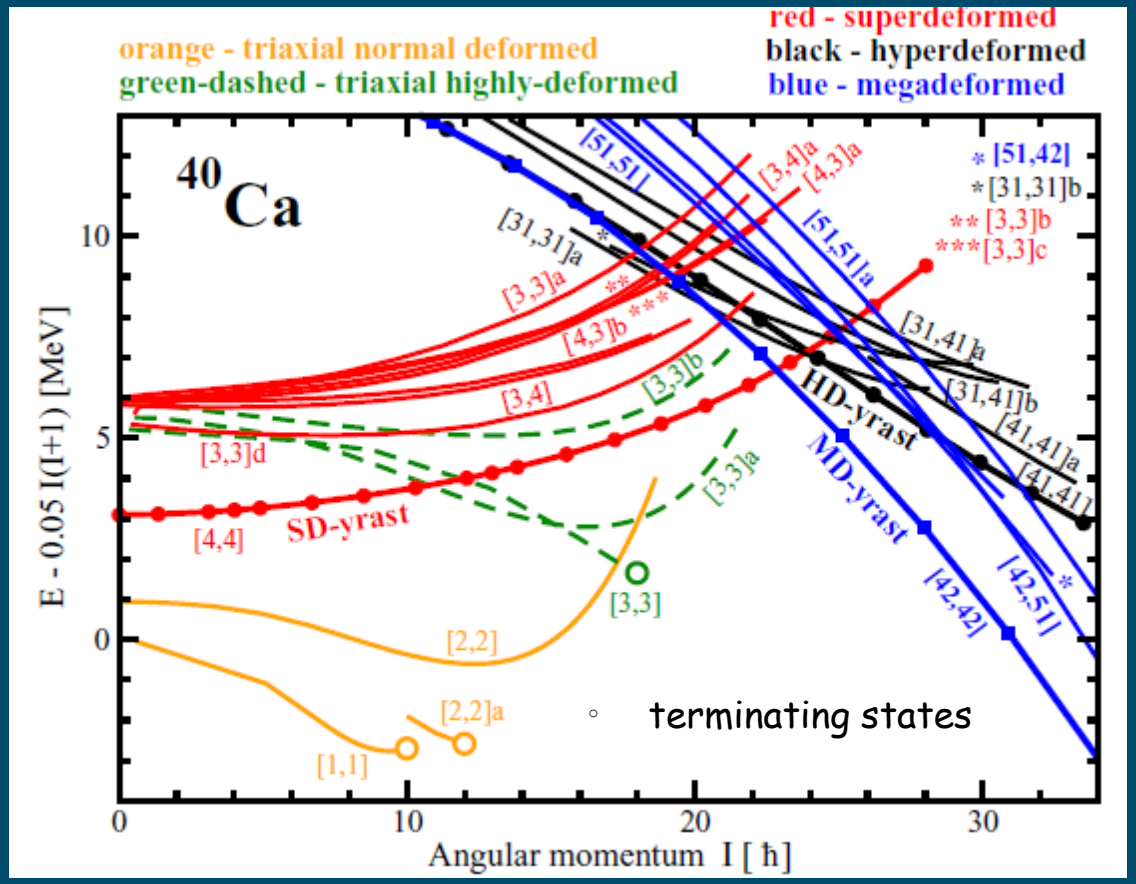

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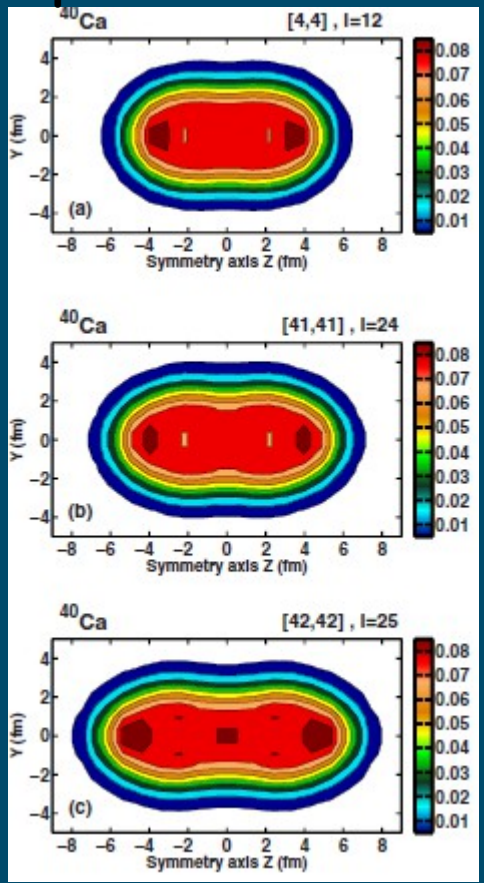

D. Ray, A. V. Afanasjev, PRC 94, 014310 (2016)