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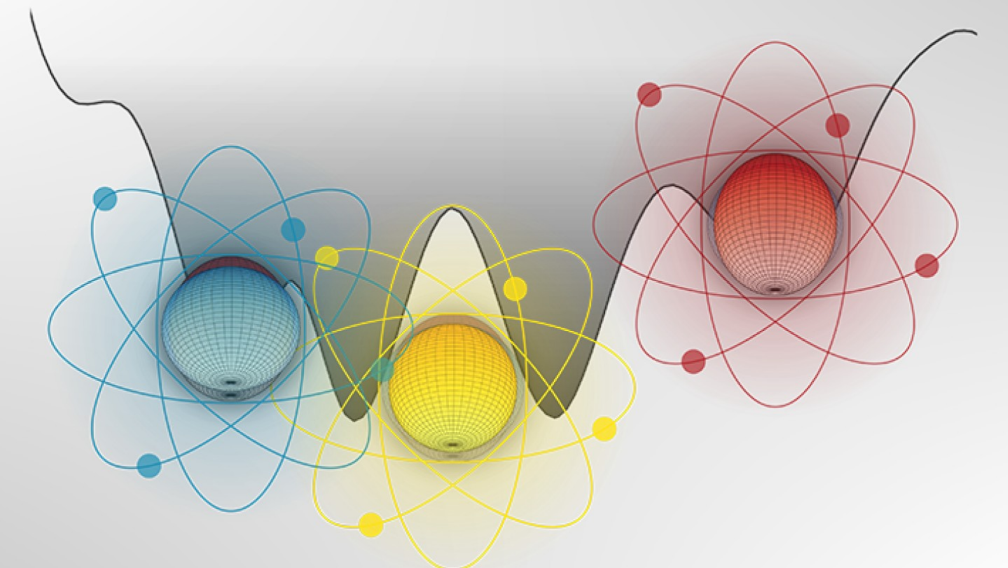
UNIVERSITY OF JYVÄSKYLÄ

Shape coexistence in mid-shell of Pb isotopes and beyond

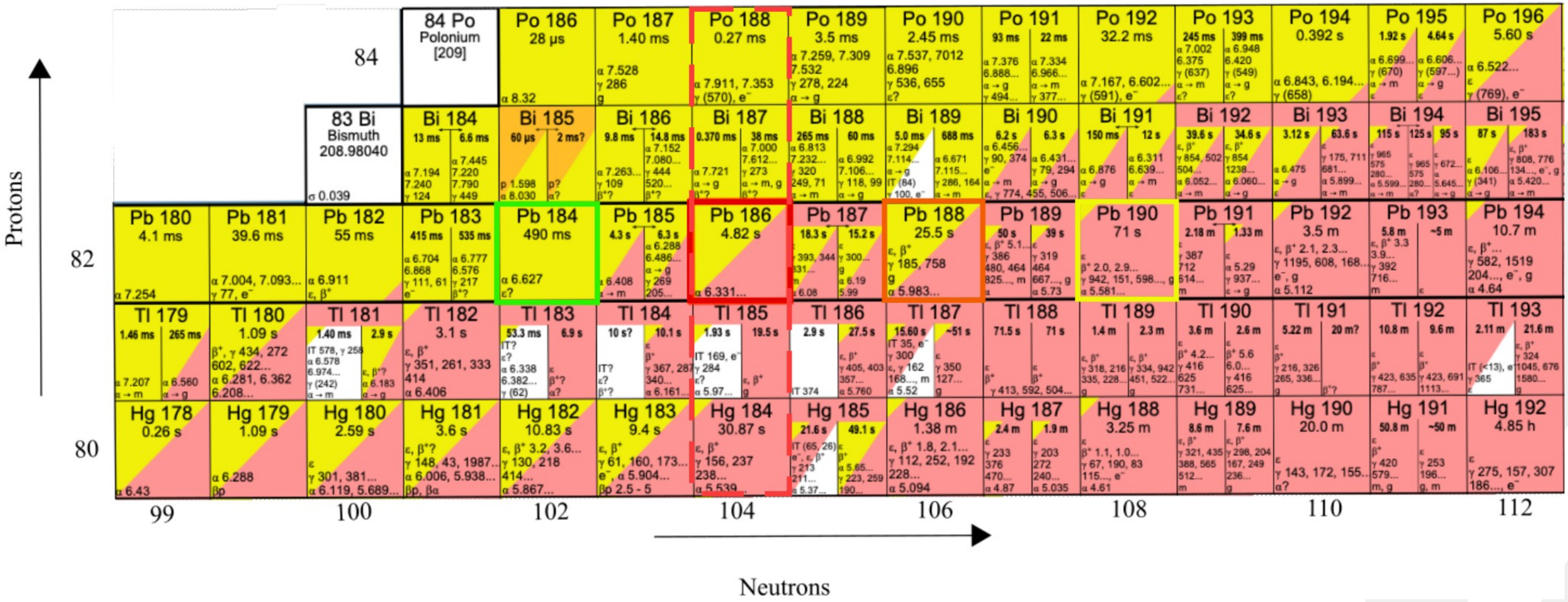
Presenter Joonas Ojala

Shape coexistence in neutron-deficient Pb isotopes

- The shape coexistence phenomenon has been under study for several decades in Pb region
- Shape coexistence appears close to the neutron-midshell $N \approx 104$
- In addition to the spherical ground state, the intruder structures have been identified to be as following shapes, prolate π(4p-4h) and oblate π(2p-2h), in neutron-deficient Pb isotopes



Shape coexistence in neutron-deficient Pb isotopes



communications physics

ent Pb

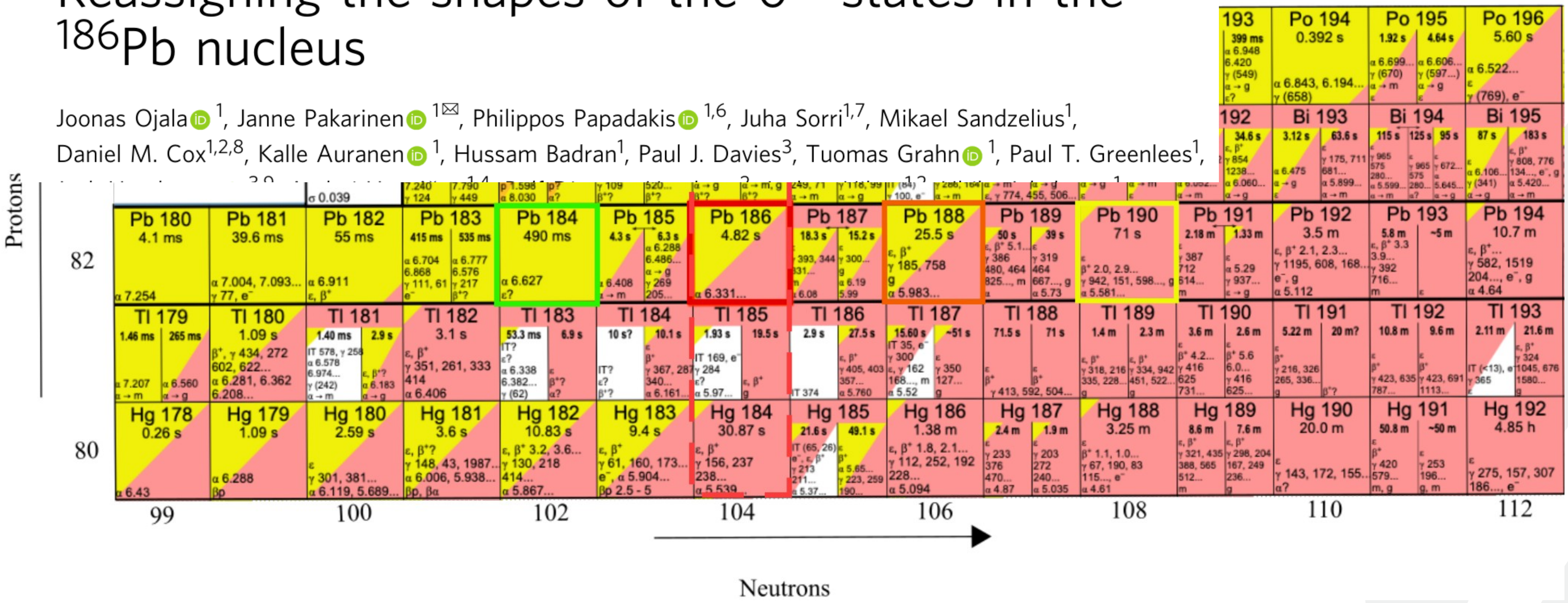
2022

ARTICLE

https://doi.org/10.1038/s42005-022-00990-4 OPEN

Reassigning the shapes of the 0^+ states in the ^{186}Pb nucleus

Joonas Ojala[1], Janne Pakarinen[1✉], Philippos Papadakis[1,6], Juha Sorri[1,7], Mikael Sandzelius[1], Daniel M. Cox[1,2,8], Kalle Auranen[1], Hussam Badran[1], Paul J. Davies[3], Tuomas Grahn[1], Paul T. Greenlees[1],



Phys. Lett. B 858 (2024) 139048

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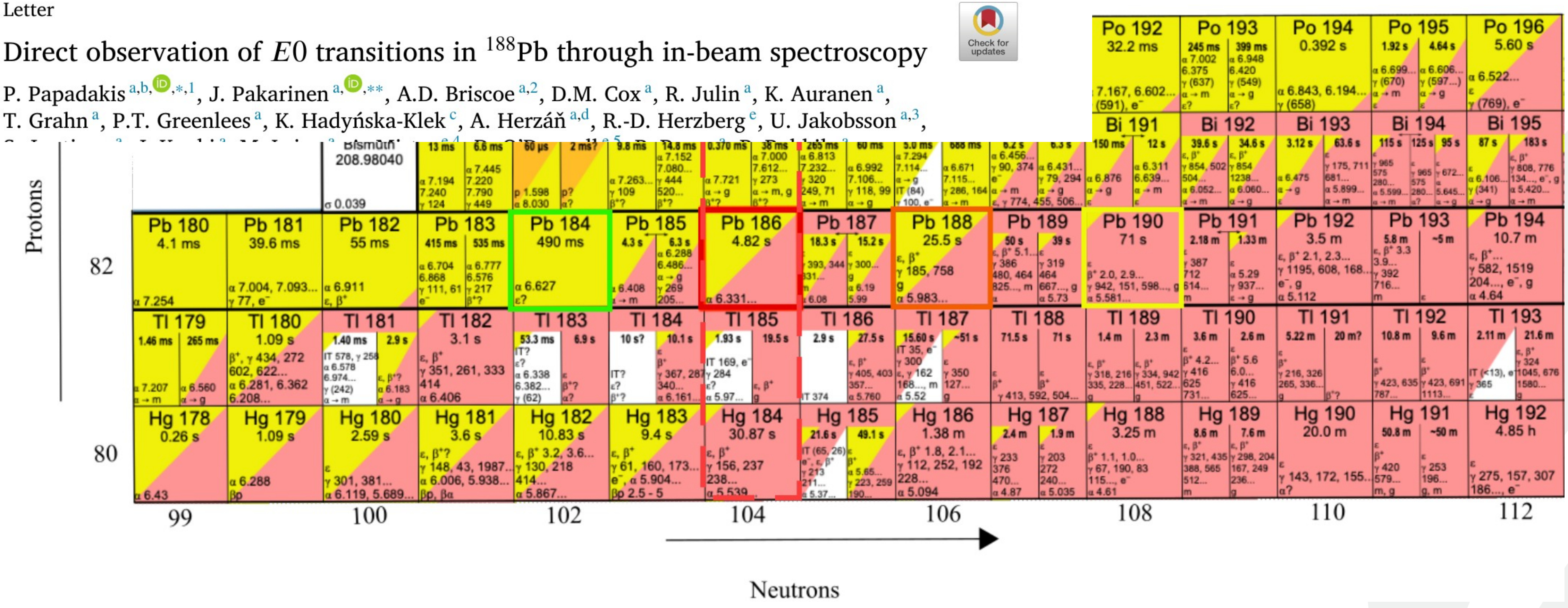
2024

Letter

Direct observation of $E0$ transitions in ^{188}Pb through in-beam spectroscopy

P. Papadakis[a,b,*,1], J. Pakarinen[a,**], A.D. Briscoe[a,2], D.M. Cox[a], R. Julin[a], K. Auranen[a], T. Grahn[a], P.T. Greenlees[a], K. Hadyńska-Klek[c], A. Herzáň[a,d], R.-D. Herzberg[e], U. Jakobsson[a,3],



communications physics

Article

https://doi.org/10.1038/s42005-024-01928-8

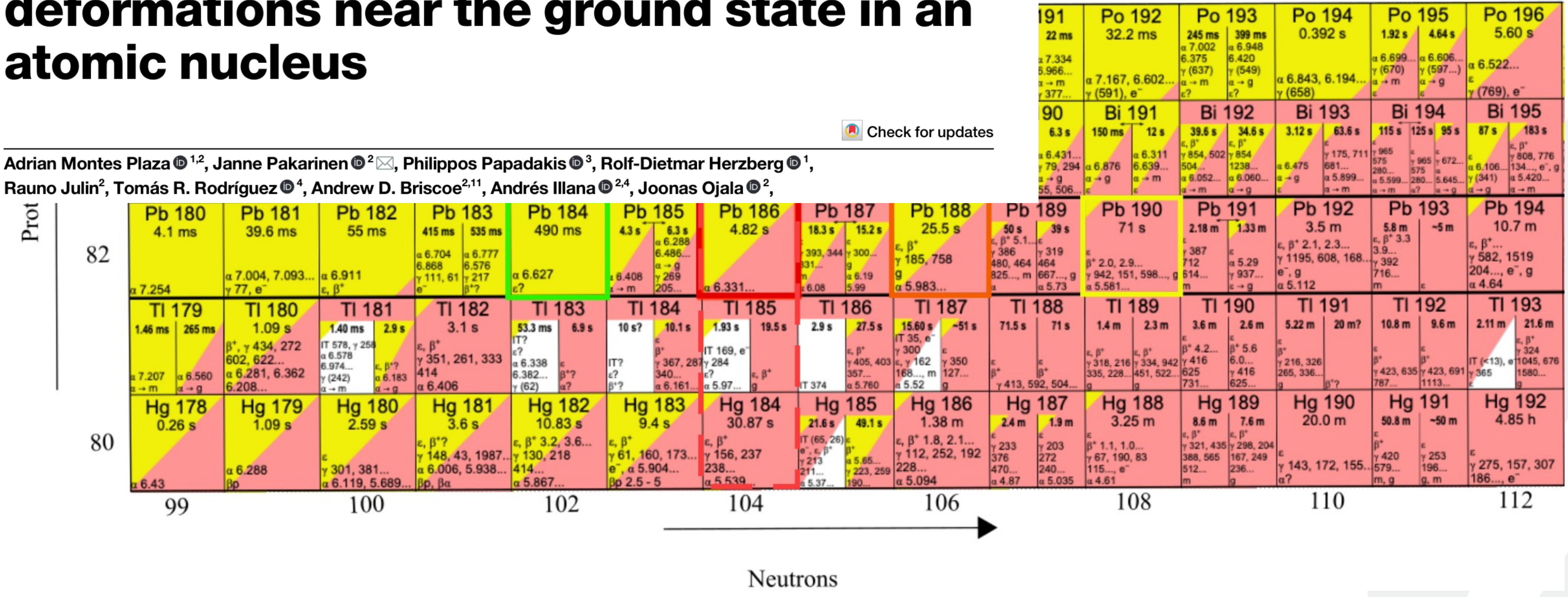
deficient Pb

2025

Direct measurement of three different deformations near the ground state in an atomic nucleus

Check for updates

Adrian Montes Plaza[1,2], Janne Pakarinen[2], Philippos Papadakis[3], Rolf-Dietmar Herzberg[1], Rauno Julin[2], Tomás R. Rodríguez[4], Andrew D. Briscoe[2,11], Andrés Illana[2,4], Joonas Ojala[2],



Shape coexistence in neutron-deficient Pb isot…

2025

Phys. Lett. B 867 (2025) 139601

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Letter

Competing structures in the beyond neutron N = 104 midshell nucleus ^{184}Pb

J. Ojala [a,*], J. Pakarinen [a,*], R. Wadsworth [b], H. Badran [a], D.M. Cox [a], A.D. Briscoe [c], A. Brown [b], T. Calverley [a,c], T. Grahn [a], P.T. Greenlees [a], J. Hilton [a,c], R. Julin [a], J. Konki [a], R. Llewellyn [b], S. Juutinen [a], M. Leino [a], P. Papadakis [a], J. Partanen [a,1], P. Rahkila [a], M. Sandzelius [a], J. Sarén [a], C. Scholey [a], S. Stoltze [a], J. Uusitalo [a], B. Wallis [b]

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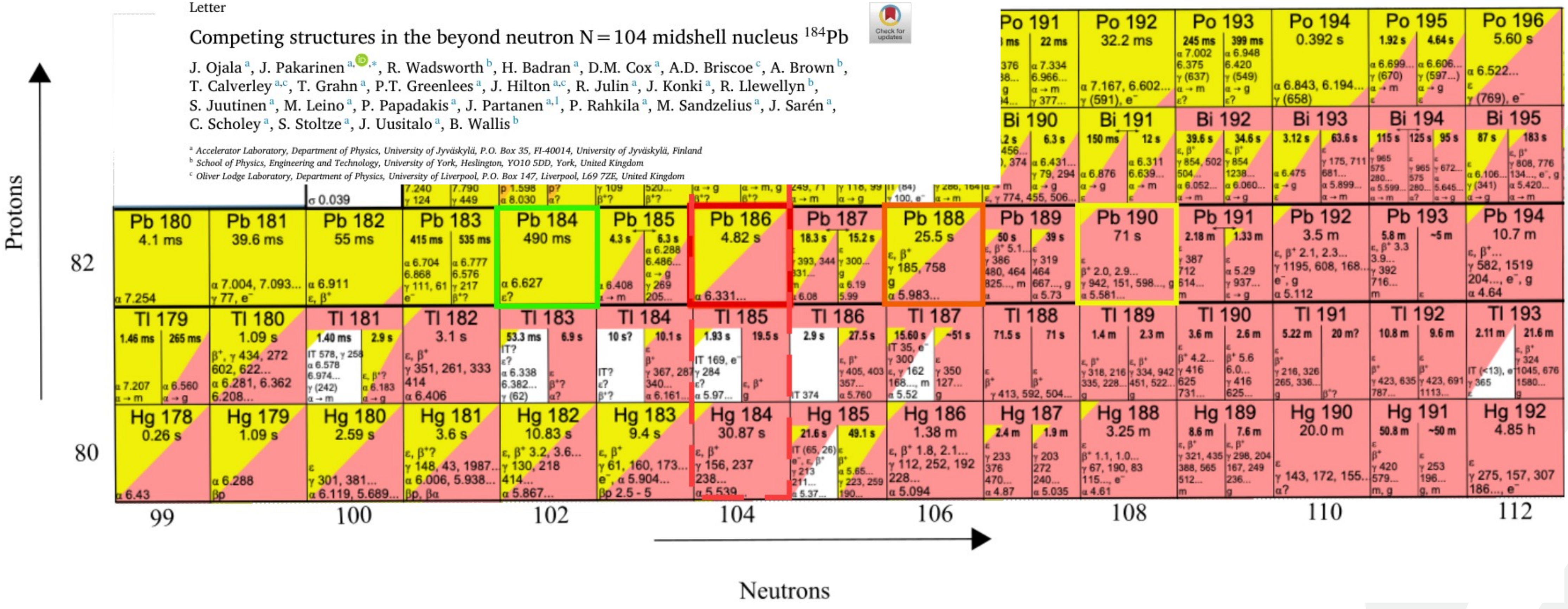
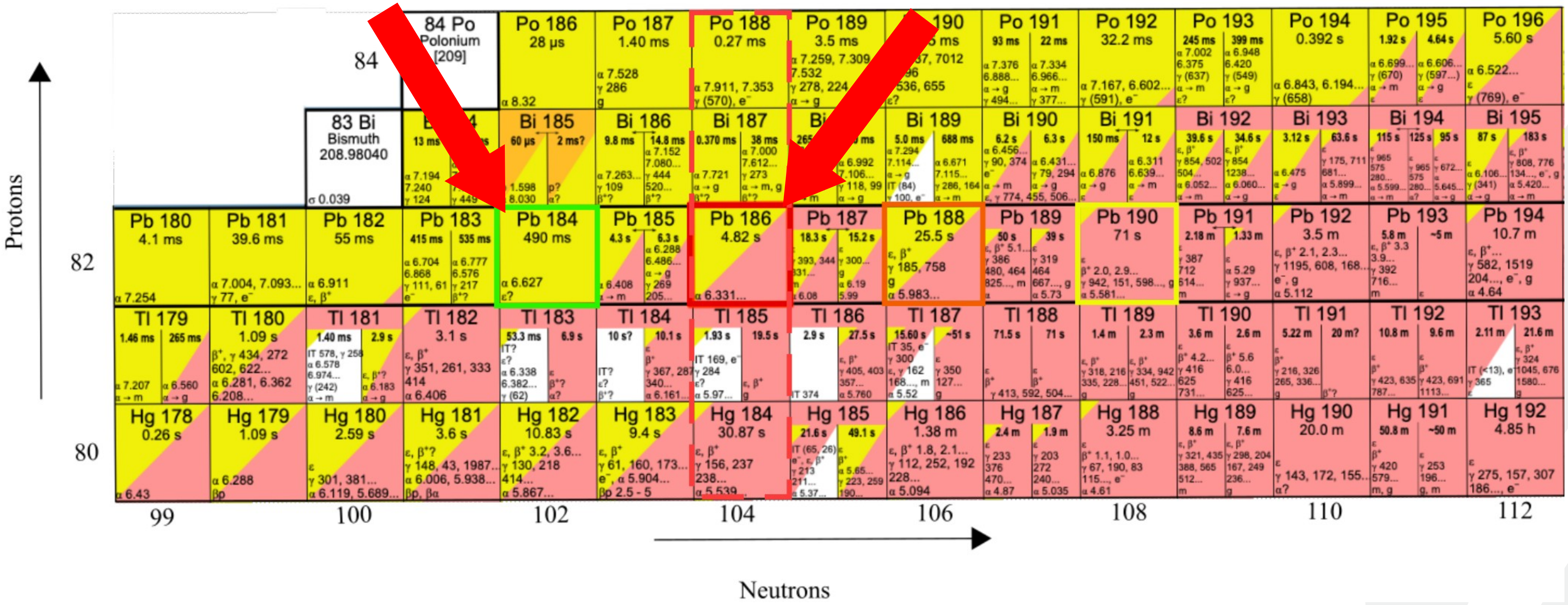
[c] Oliver Lodge Laboratory, Department of Physics, University of Liverpool, P.O. Box 147, Liverpool, L69 7ZE, United Kingdom

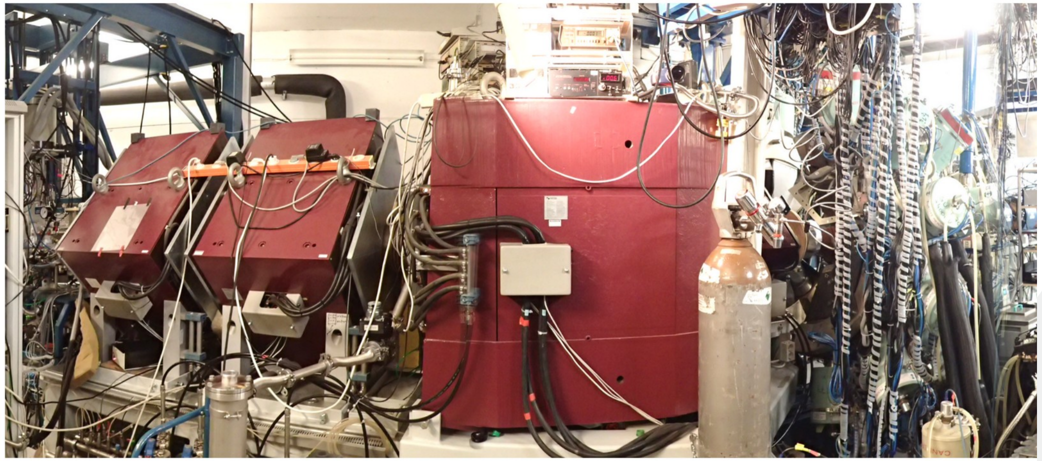


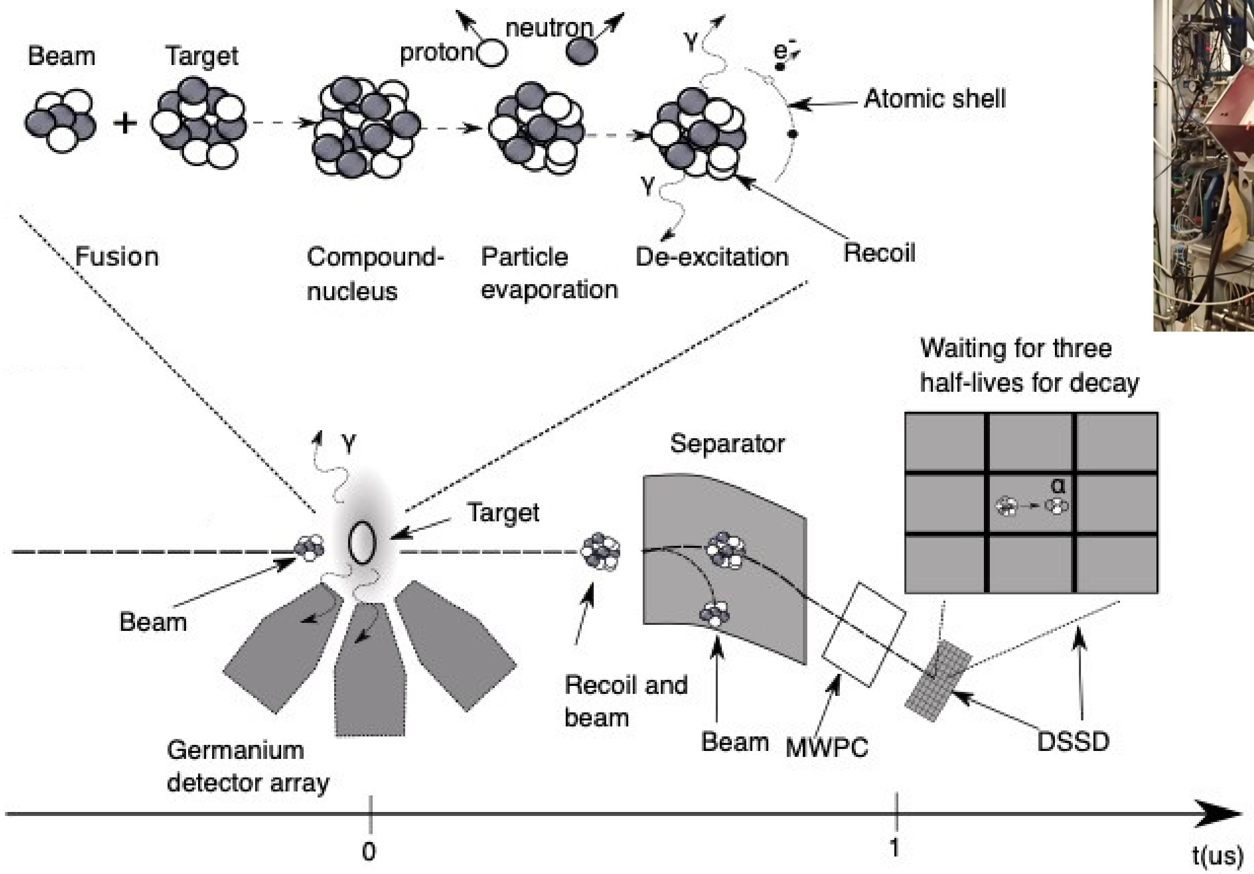
Shape coexistence in neutron-deficient Pb isotopes



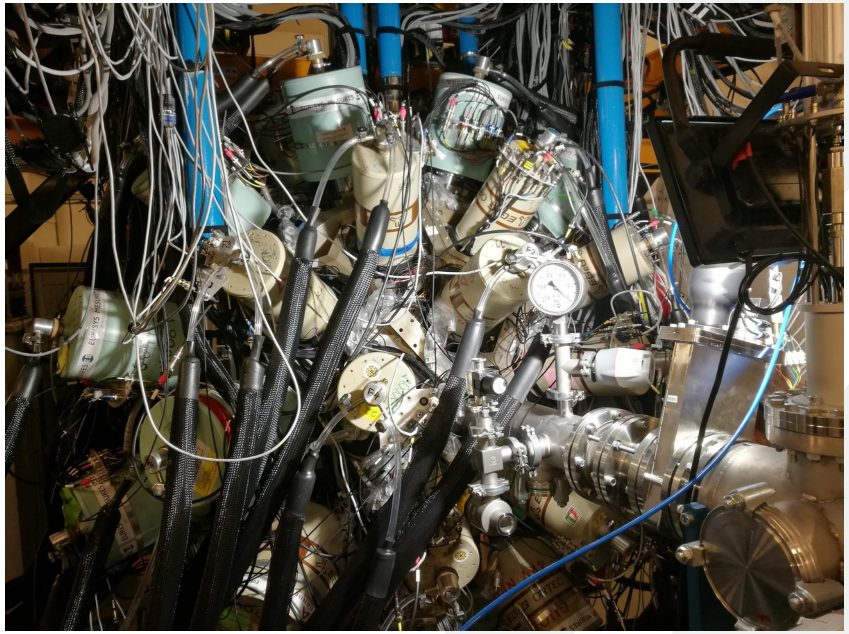
Recoil-decay tagging(RDT)

RITU

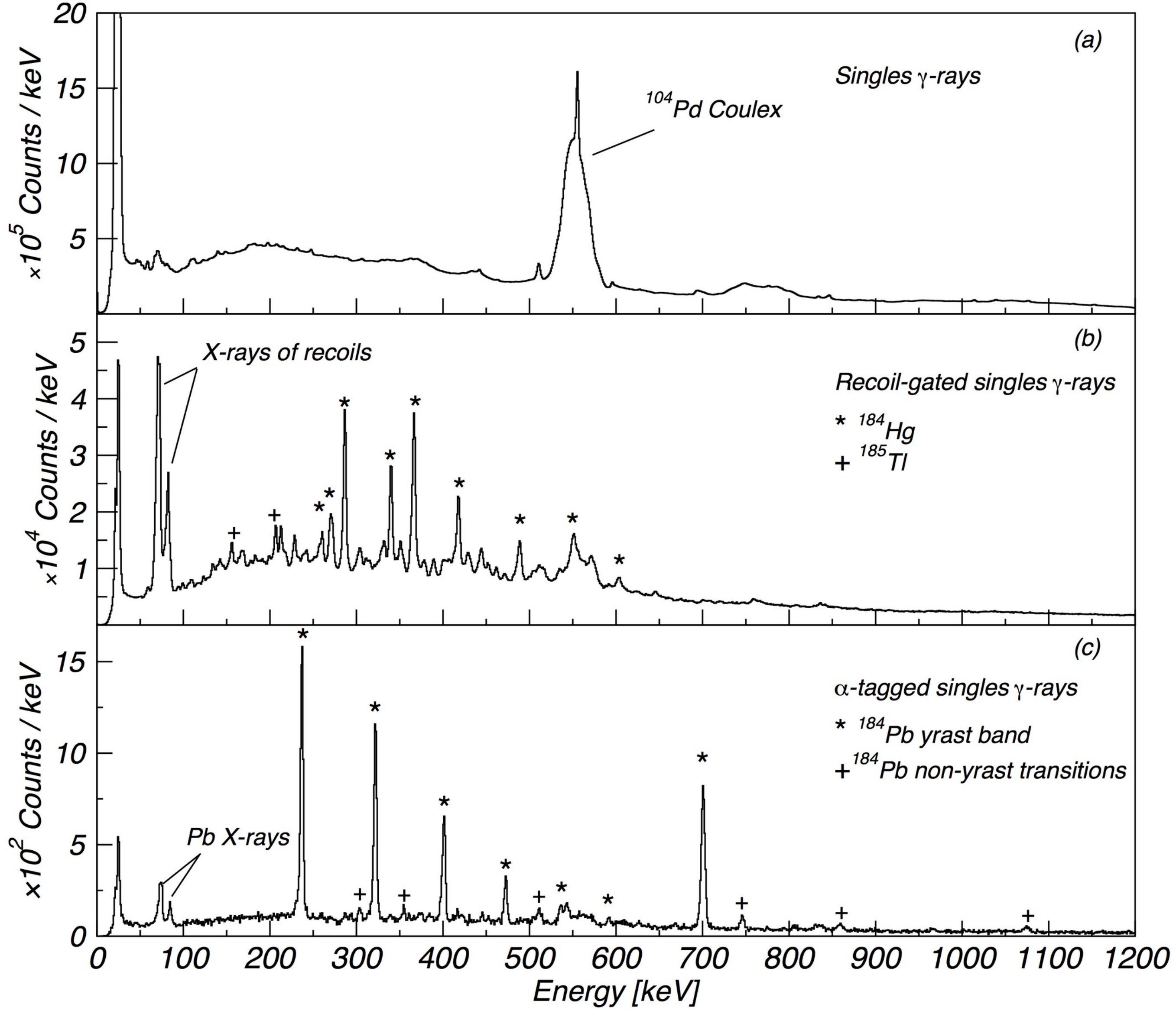




JUROGAM 3



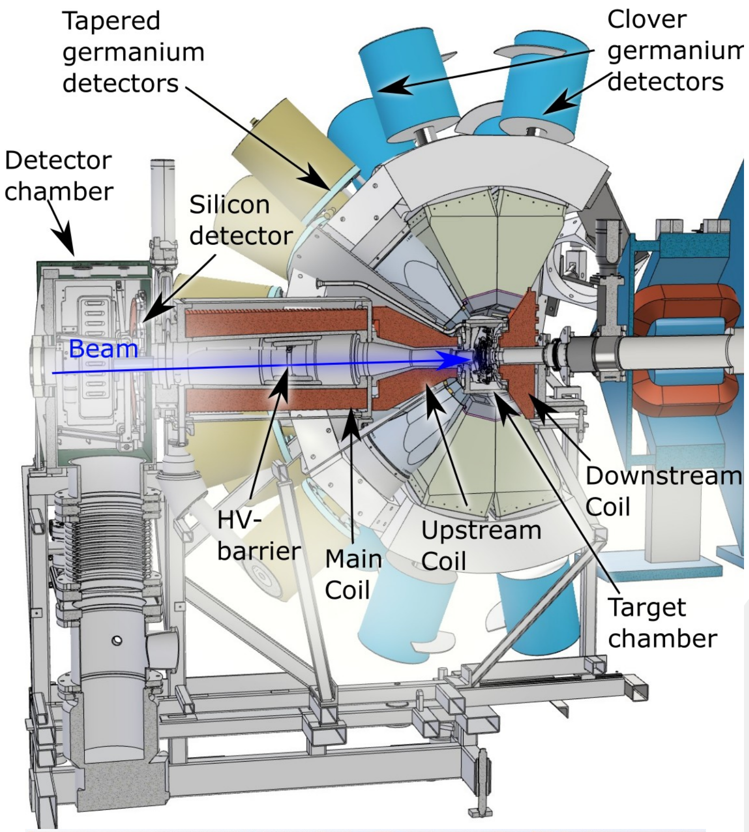
Recoil-decay tagging(RDT)

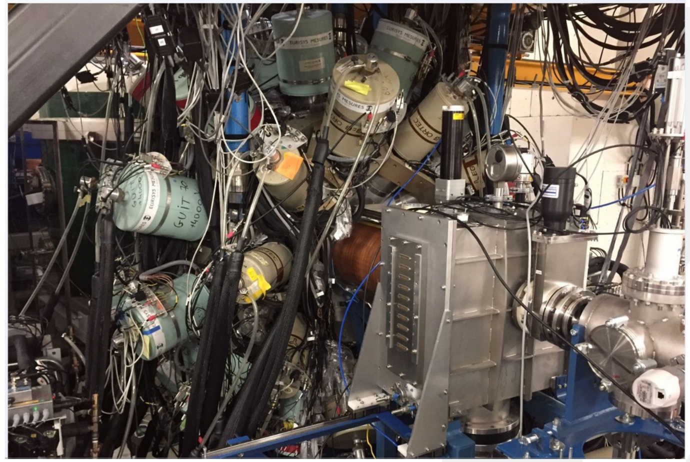


^{186}Pb

Simultaneous γ-ray and conversion-electron spectrometer SAGE

- 10 Tapered and 24 Clover type germanium detectors
- The SAGE silicon detector is positioned upstream of the target
- Conversion electrons are transported using the solenoid magnets from the target to the silicon detector (800A)
- HV-barrier inside solenoid is needed to prevent the low-energy delta-electrons reaching the silicon detector





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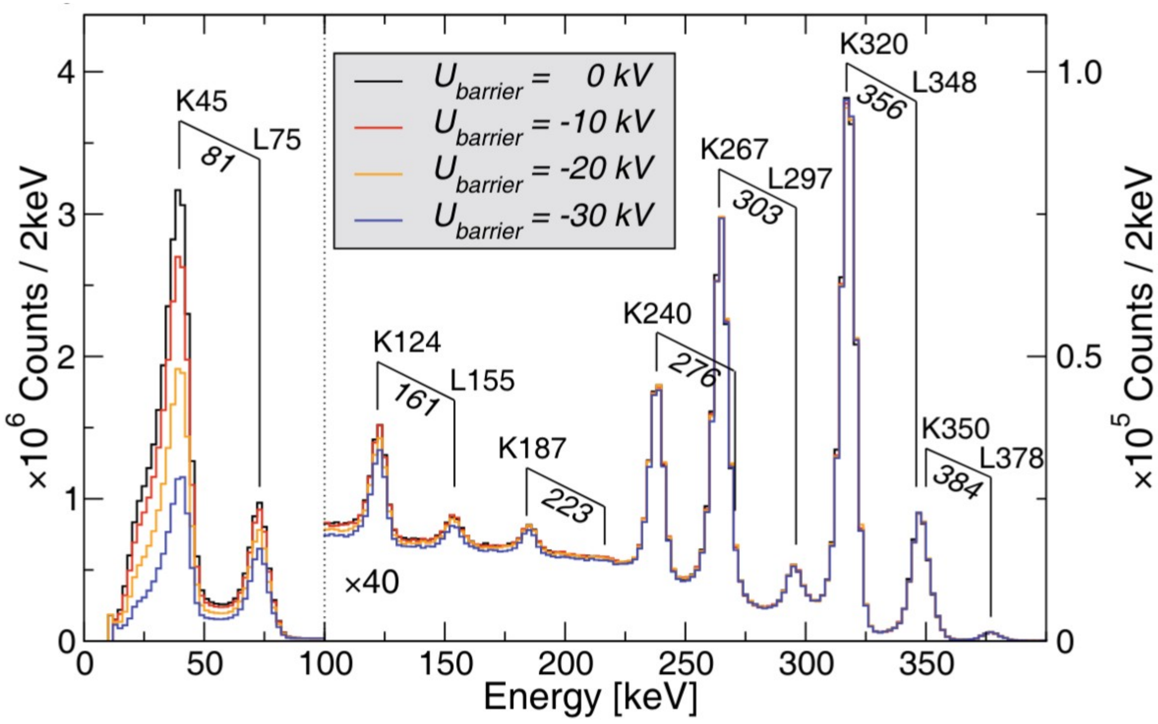
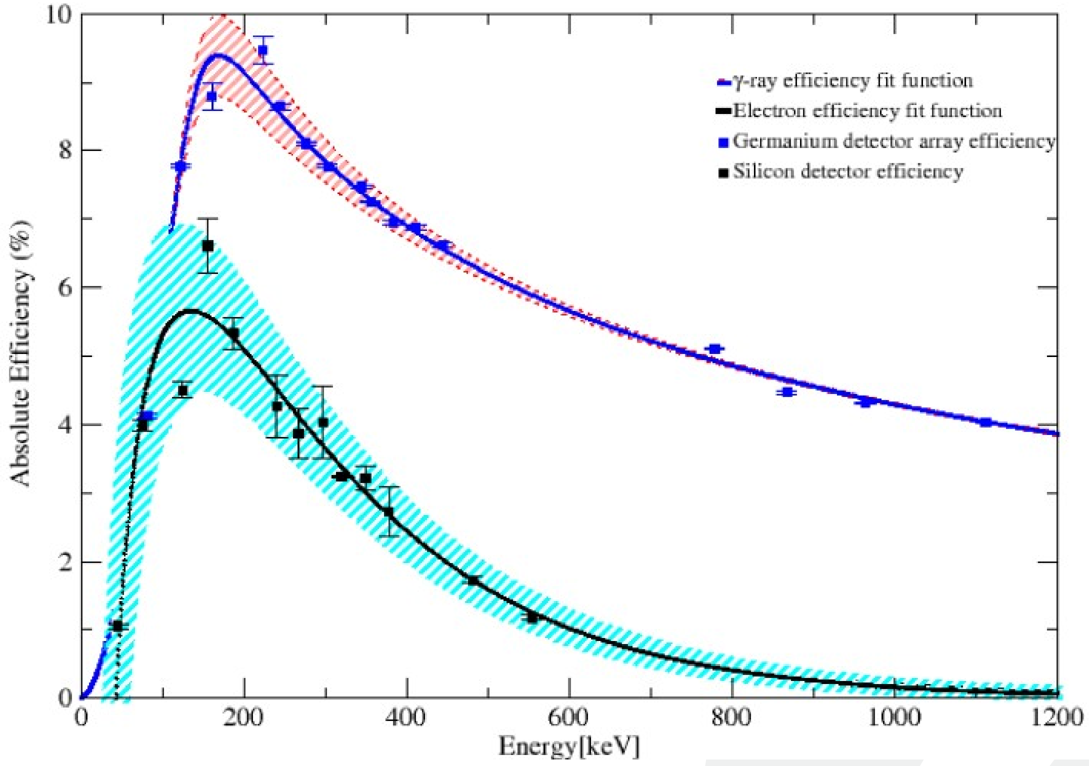
Science & Technology Facilities Council

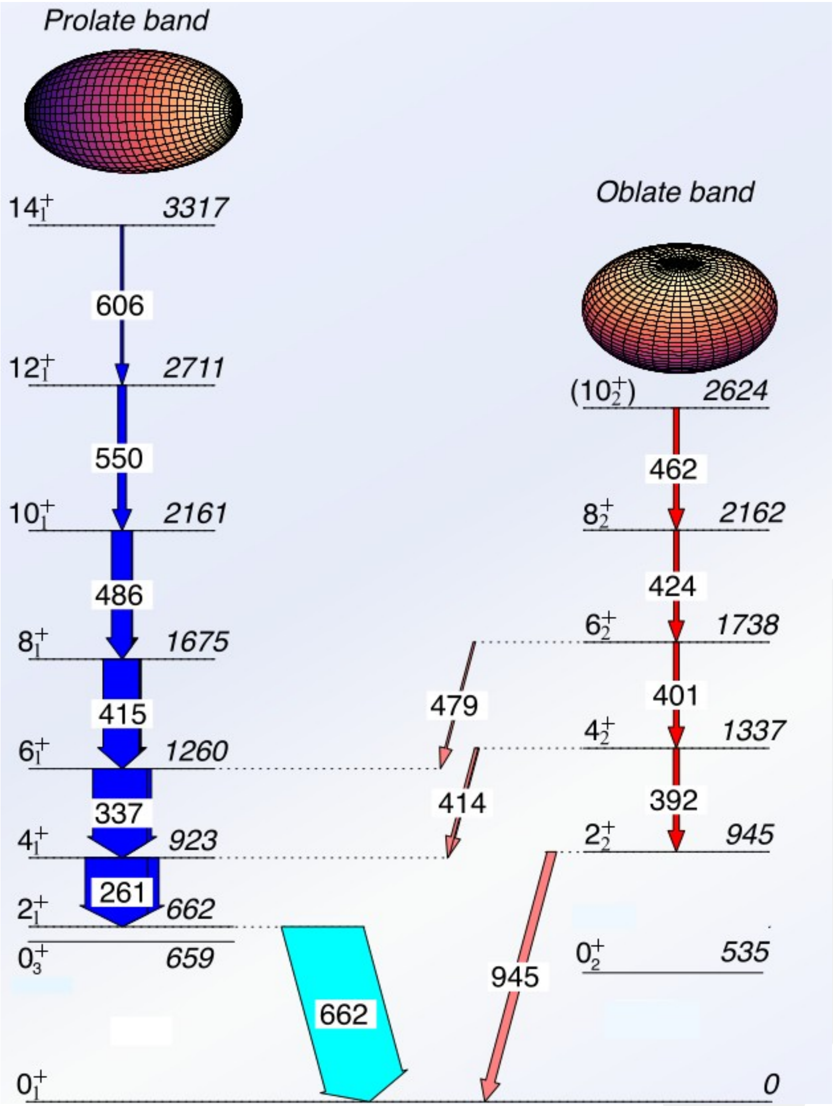
Simultaneous γ-ray and conversion-electron experiment SAGE





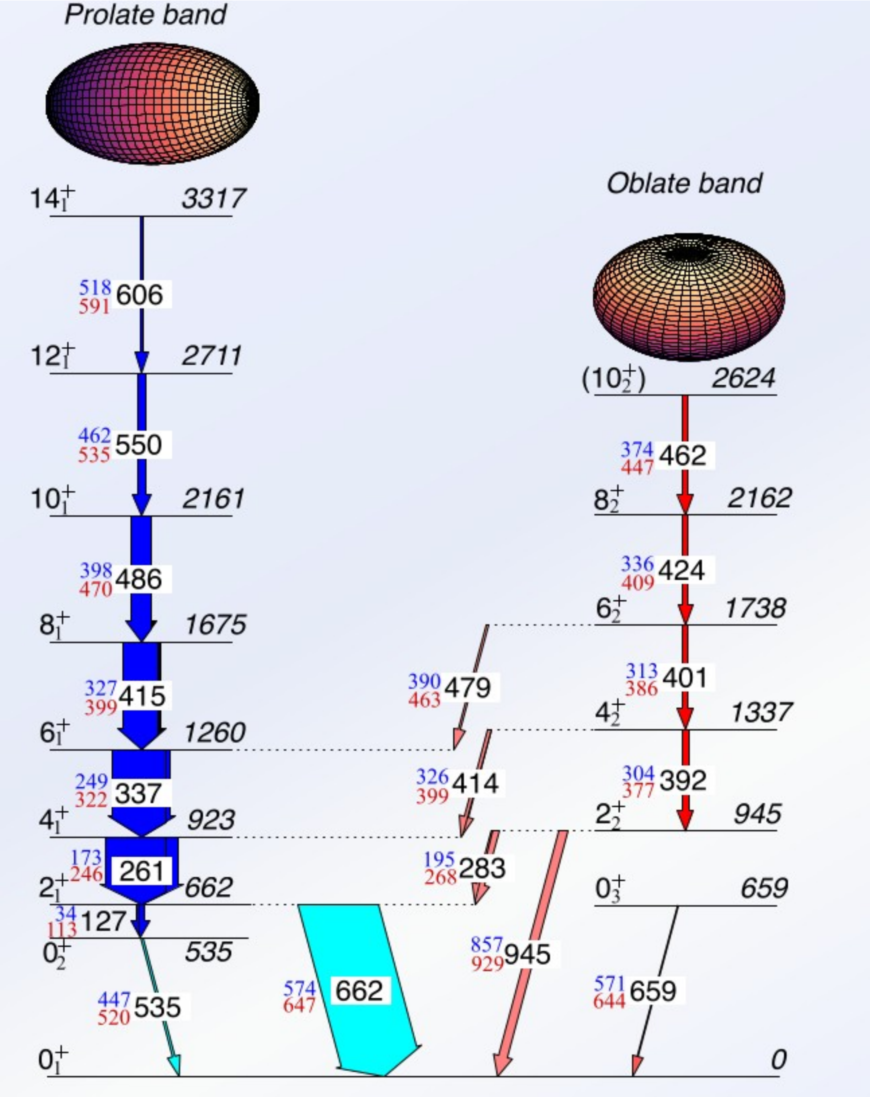
Previously known about ^{186}Pb

- The excited 0^+ states were observed for the first time at α-decay study of ^{190}Po
- The γ-ray spectroscopy study has shown rotational yrast and non-yrast band
- The lifetime measurement has been performed for the yrast band

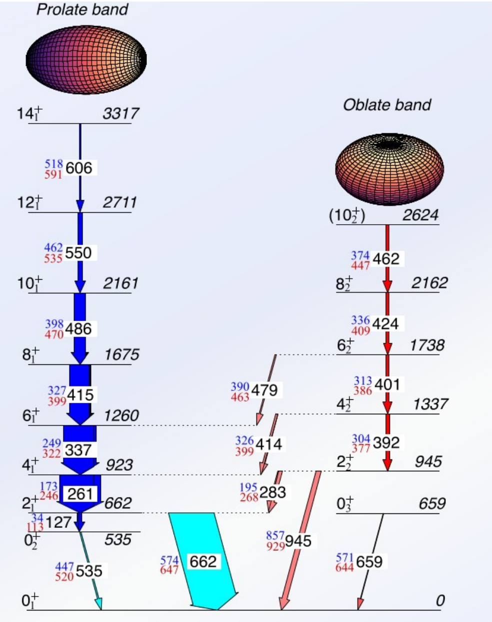


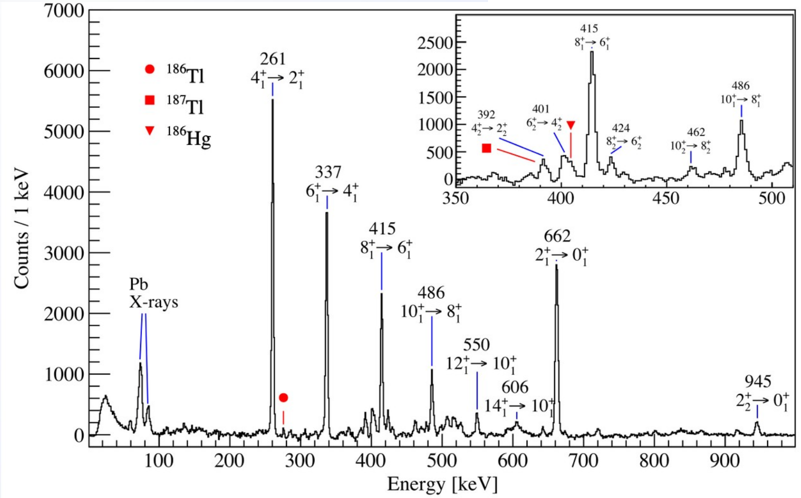
SAGE experiment for ^{186}Pb

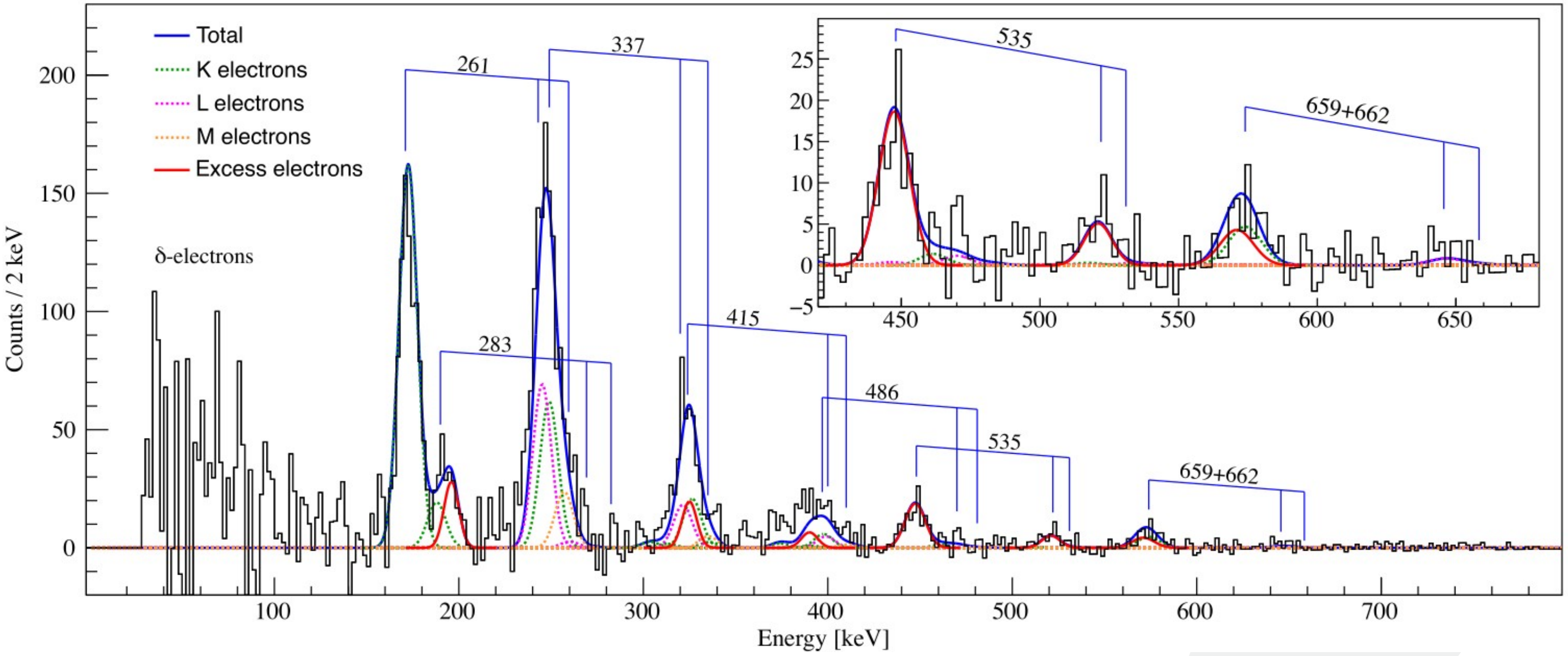
- Performed in the Accelerator laboratory of Jyväskylä
- SAGE+RITU+GREAT+TDR
- ^{106}Pd(^{83}Kr,3n)^{186}Pb
- Recoil-decay tagging method
- Observed feeding of 0_2^+ state
- $0_2^+ \rightarrow 0_1^+$ and $0_3^+ \rightarrow 0_1^+$ transitions were obseved
- $2_2^+ \rightarrow 2_1^+$ and $4_2^+ \rightarrow 4_1^+$ interband transitions' E0 component were identified



SAGE experiment for ^{186}Pb

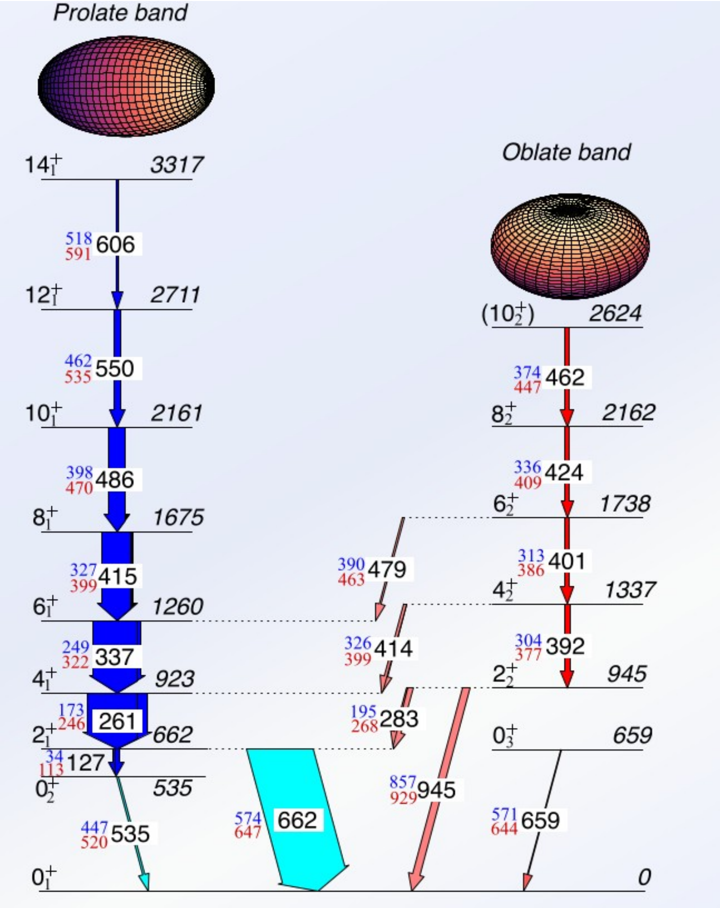


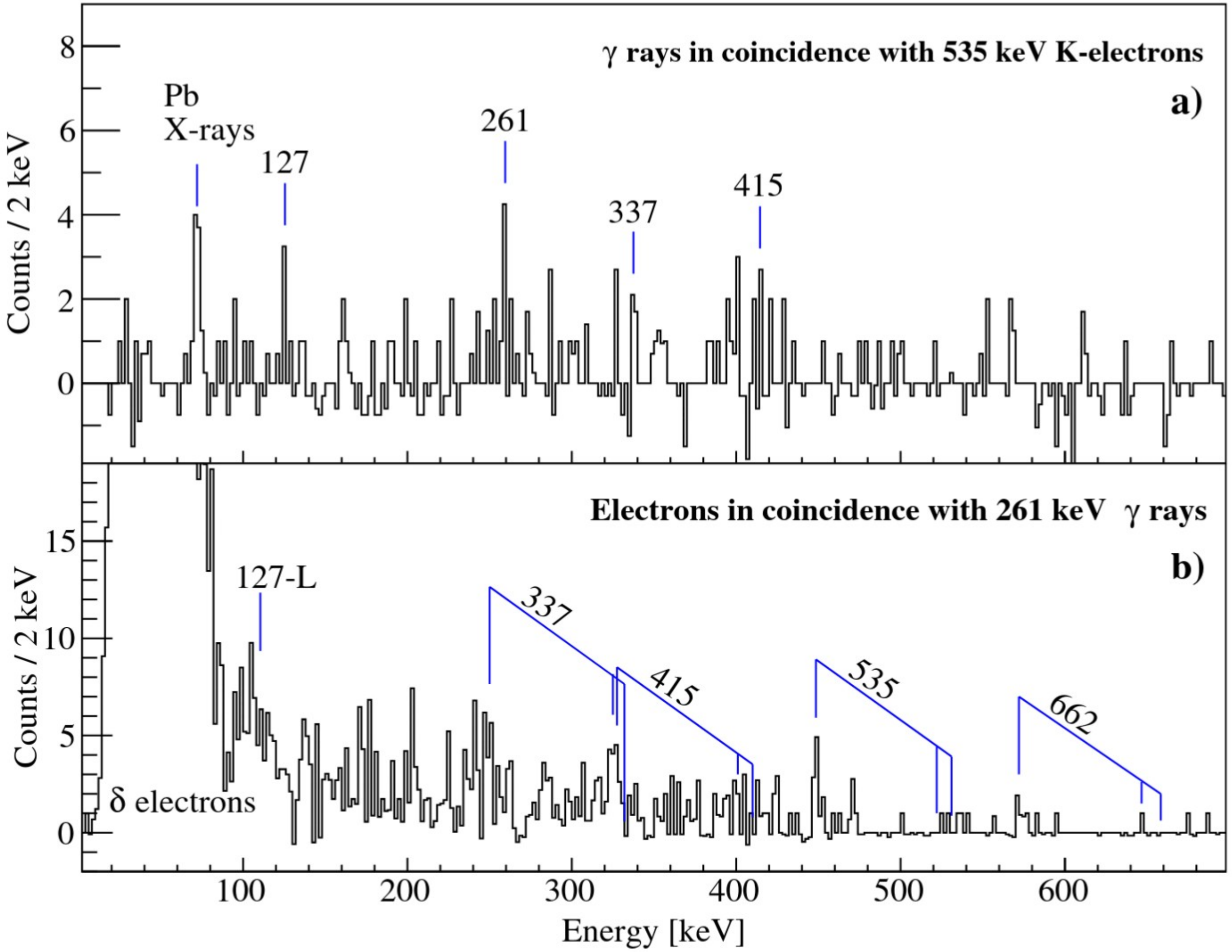




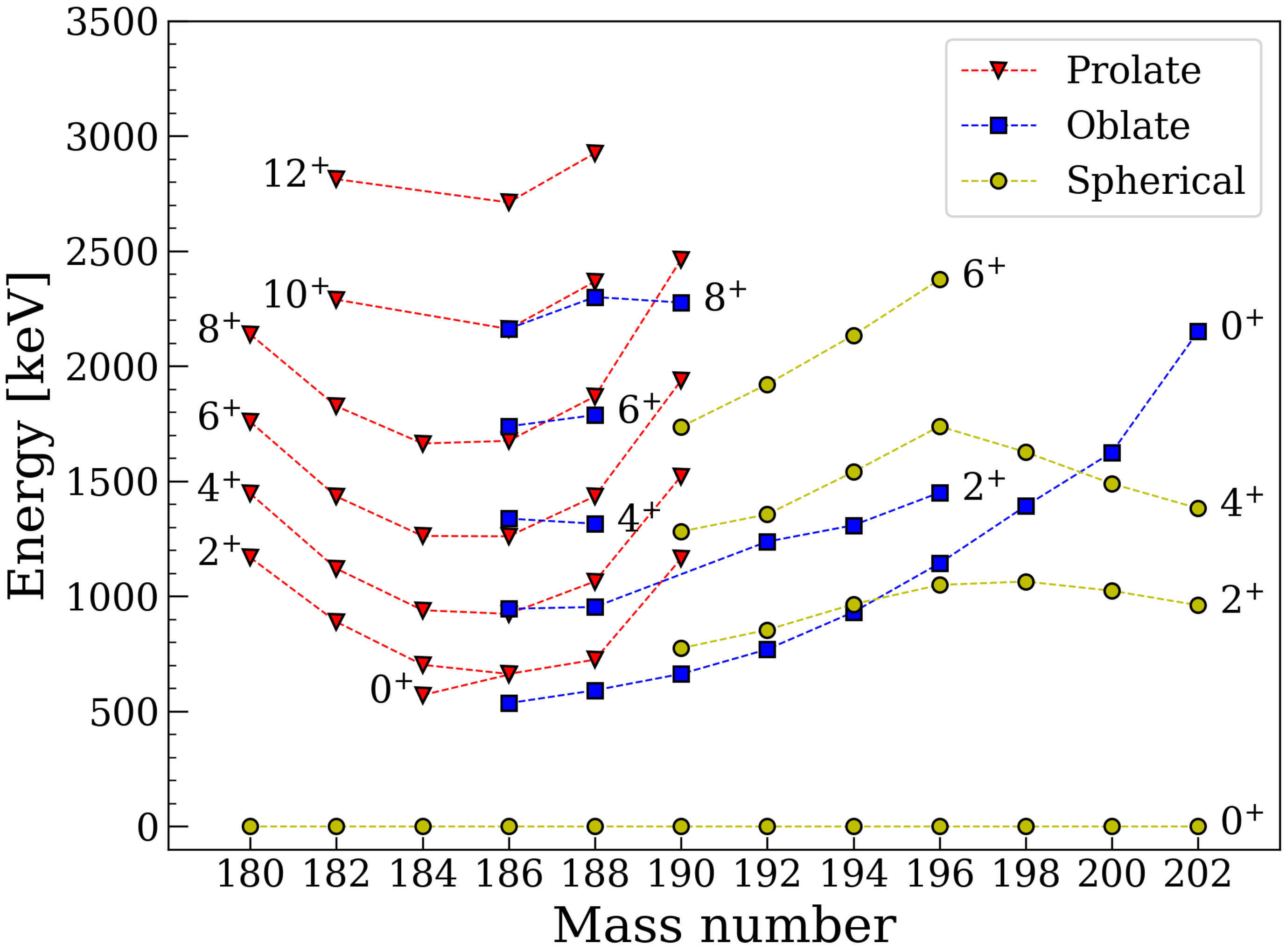
Ojala, J., *et al.*, *Comm. Phys.*, *5*(1). (2022).

SAGE experiment for ^{186}Pb

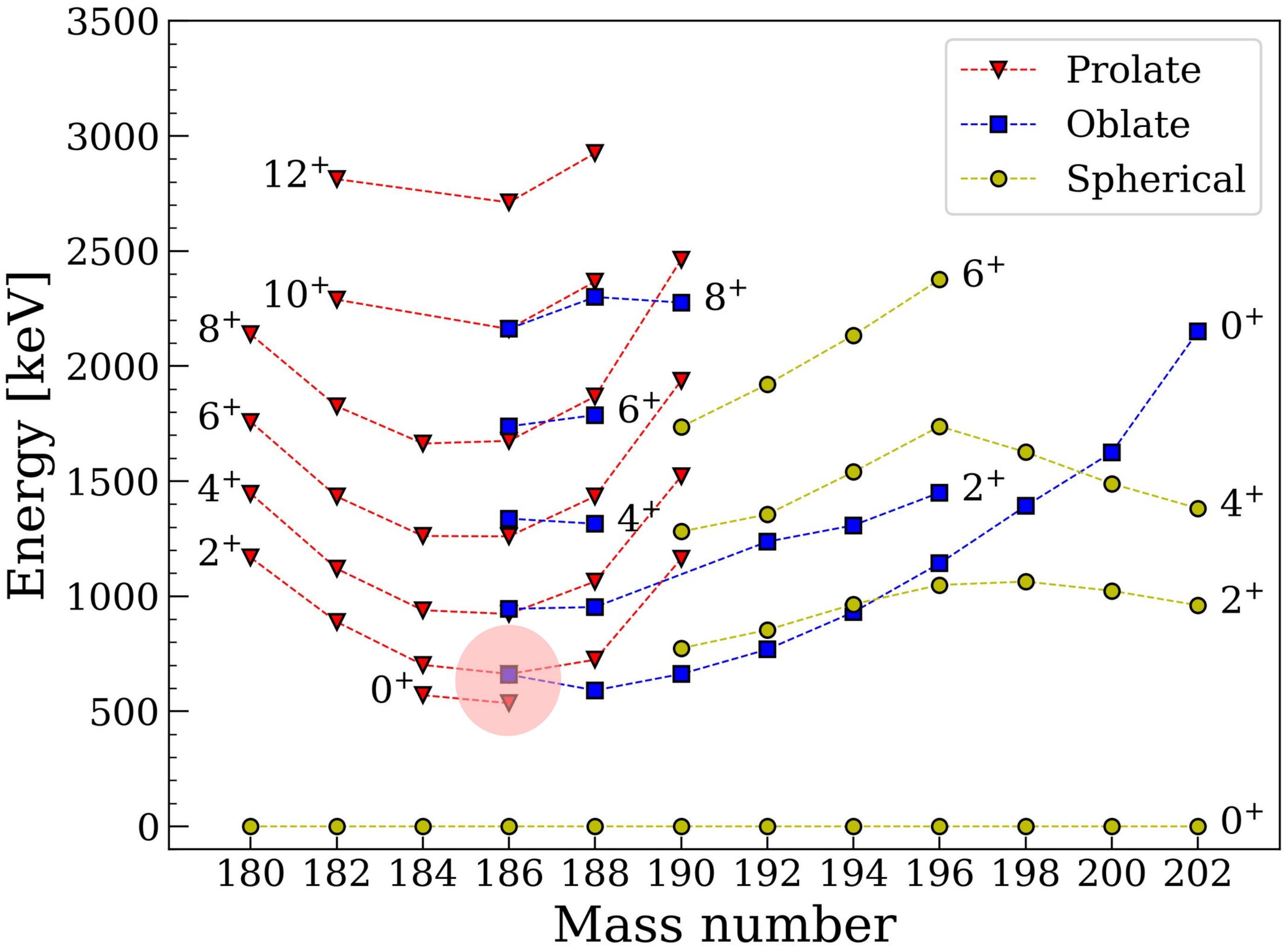




The interpretation of level energy systematics of Pb isotopes before 2021



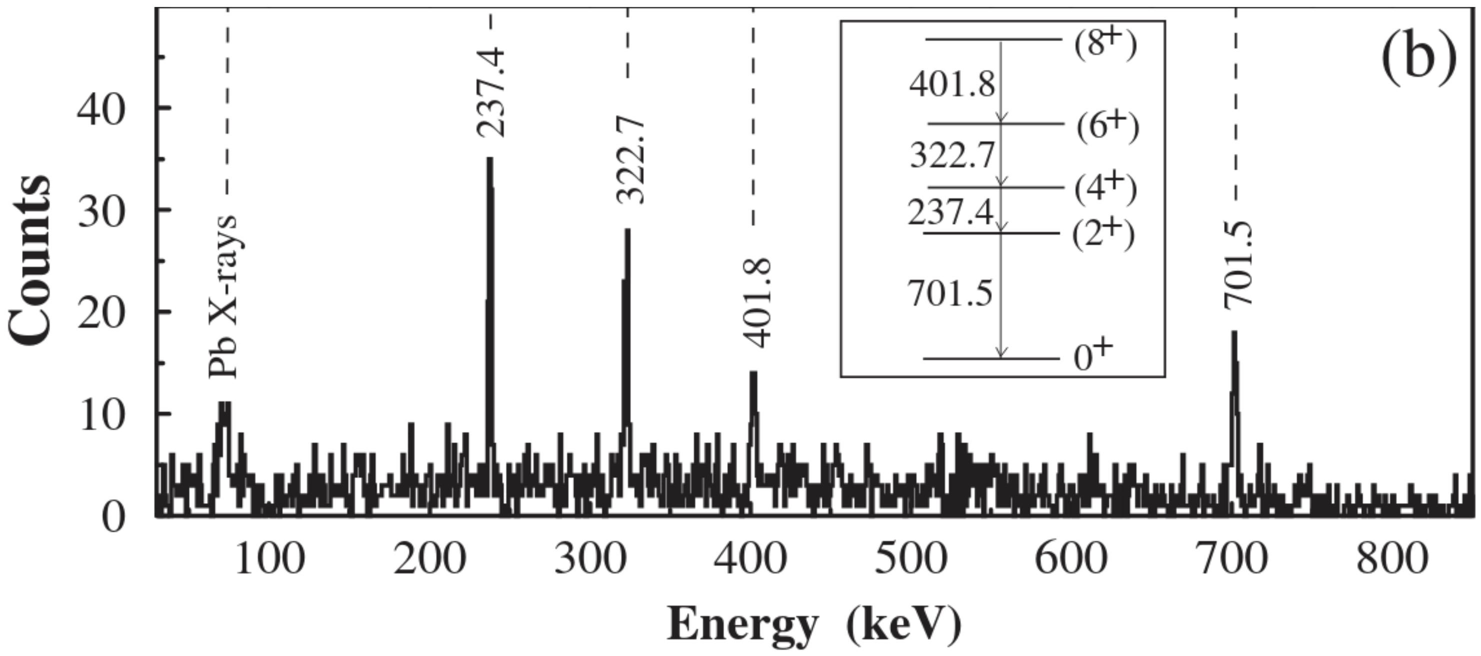
SAGE experiment: Pb-186



^{184}Pb

Previously known about ^{184}Pb

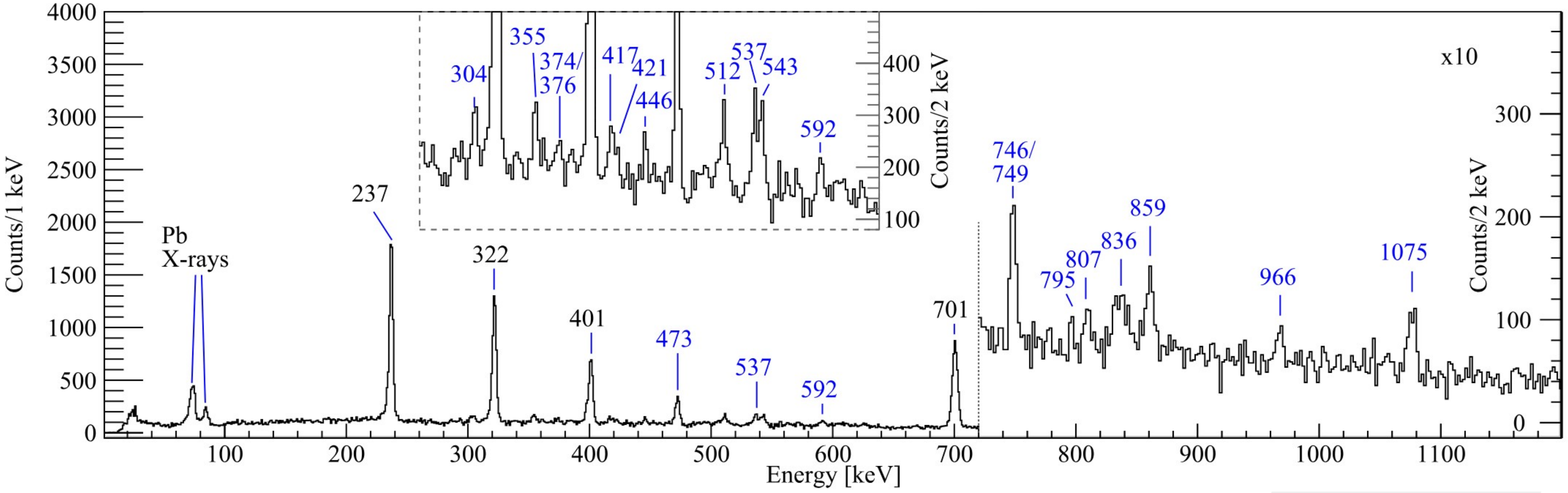
- The excited 0^+ state at 570(30) keV were observed for the first time at α-decay study of ^{188}Po
- The γ-ray spectroscopy study has shown yrast states up to 8^+ state.



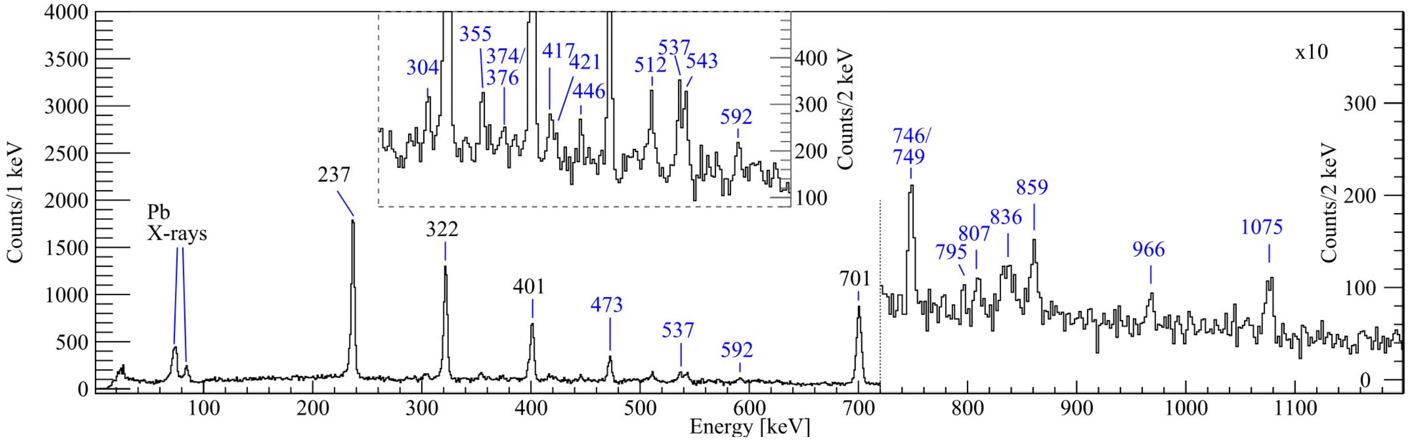
Cocks, J.F. C., *et al., EPJA 3 17-20 (1998)*

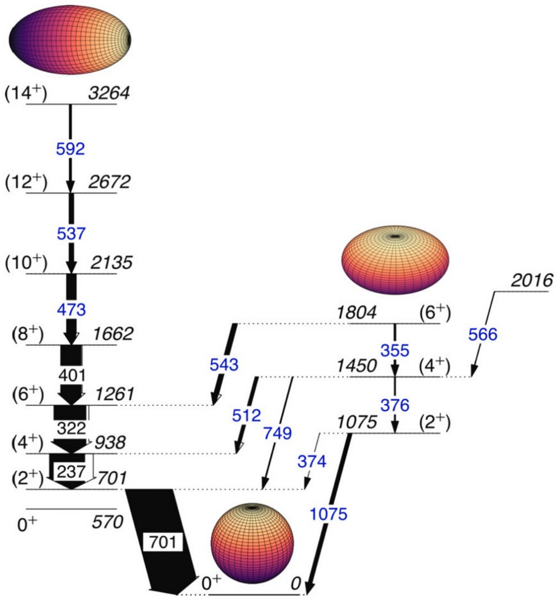
JUROGAM II experiment: ^{184}Pb

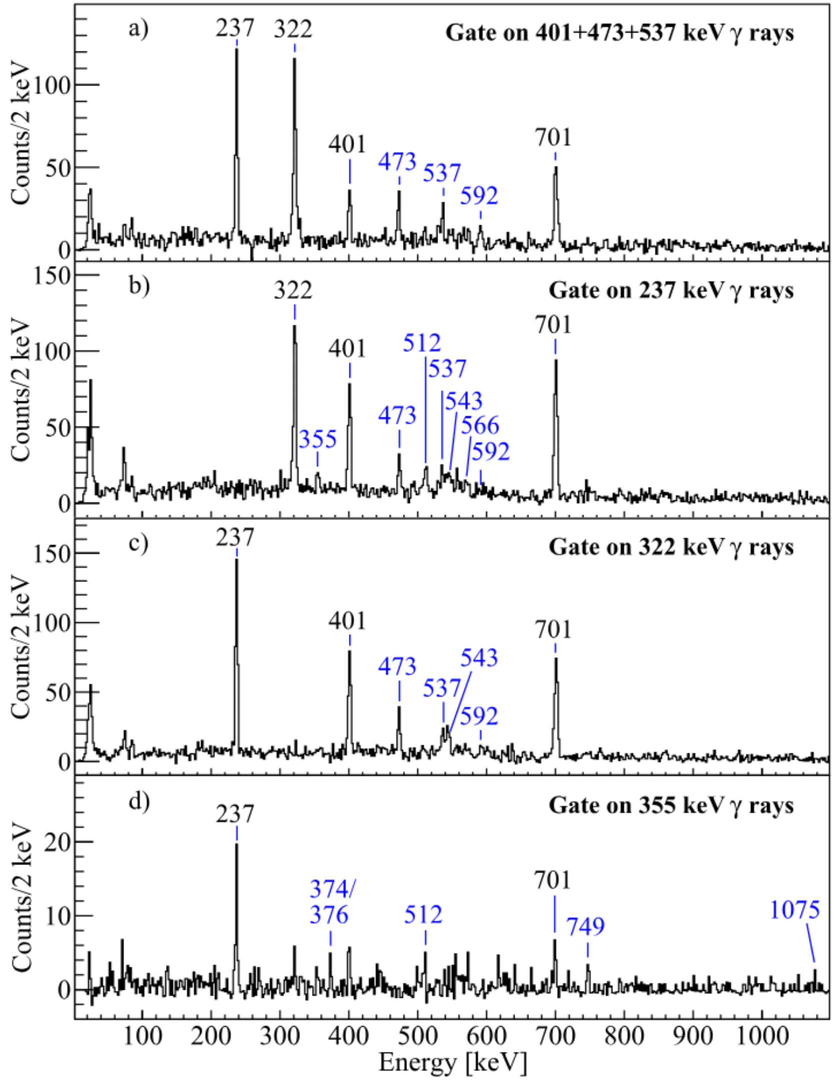
- JUROGAMII+RITU+GREAT +TDR
- ^{104}Pd(^{83}Kr,3n)^{184}Pb
- RDT-method was used
- Were able to identify candidates for non-yrast structure



JUROGAM II experiment: ^{184}Pb

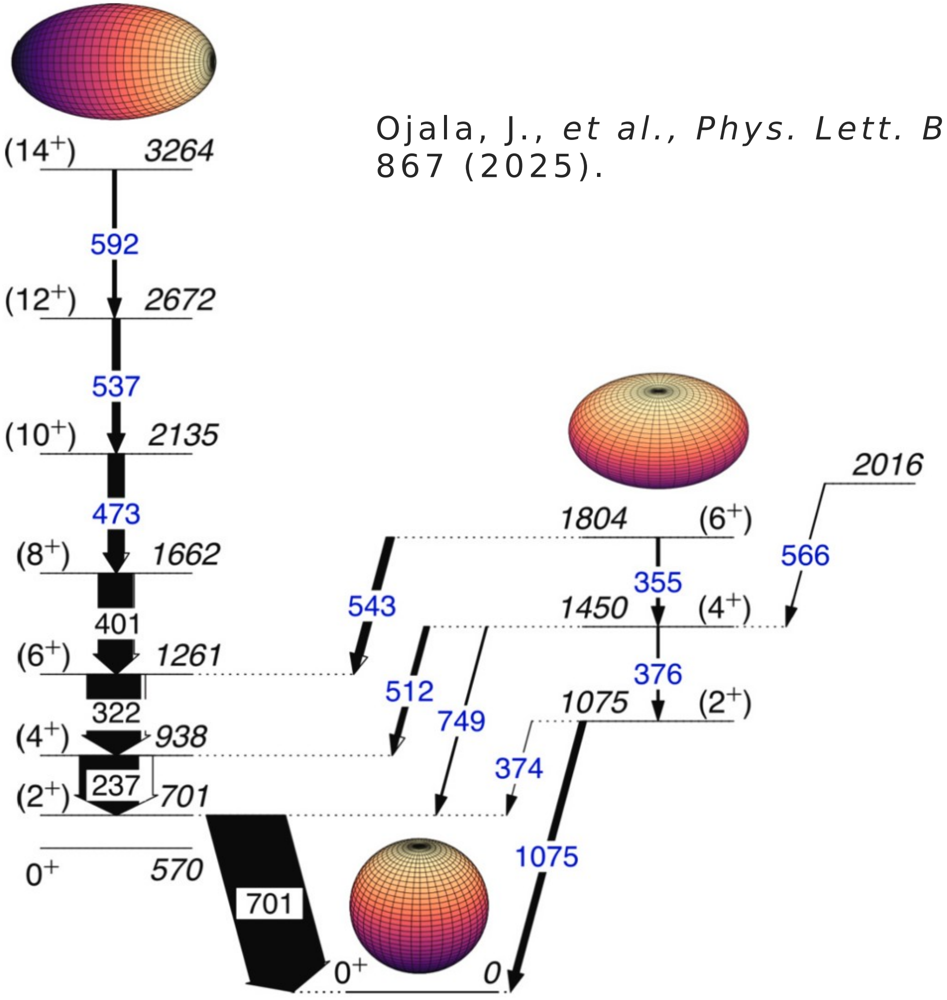






Ojala, J., *et al.*, *Phys. Lett. B*, 867 (2025).

JURogam II experiment: ^{184}Pb



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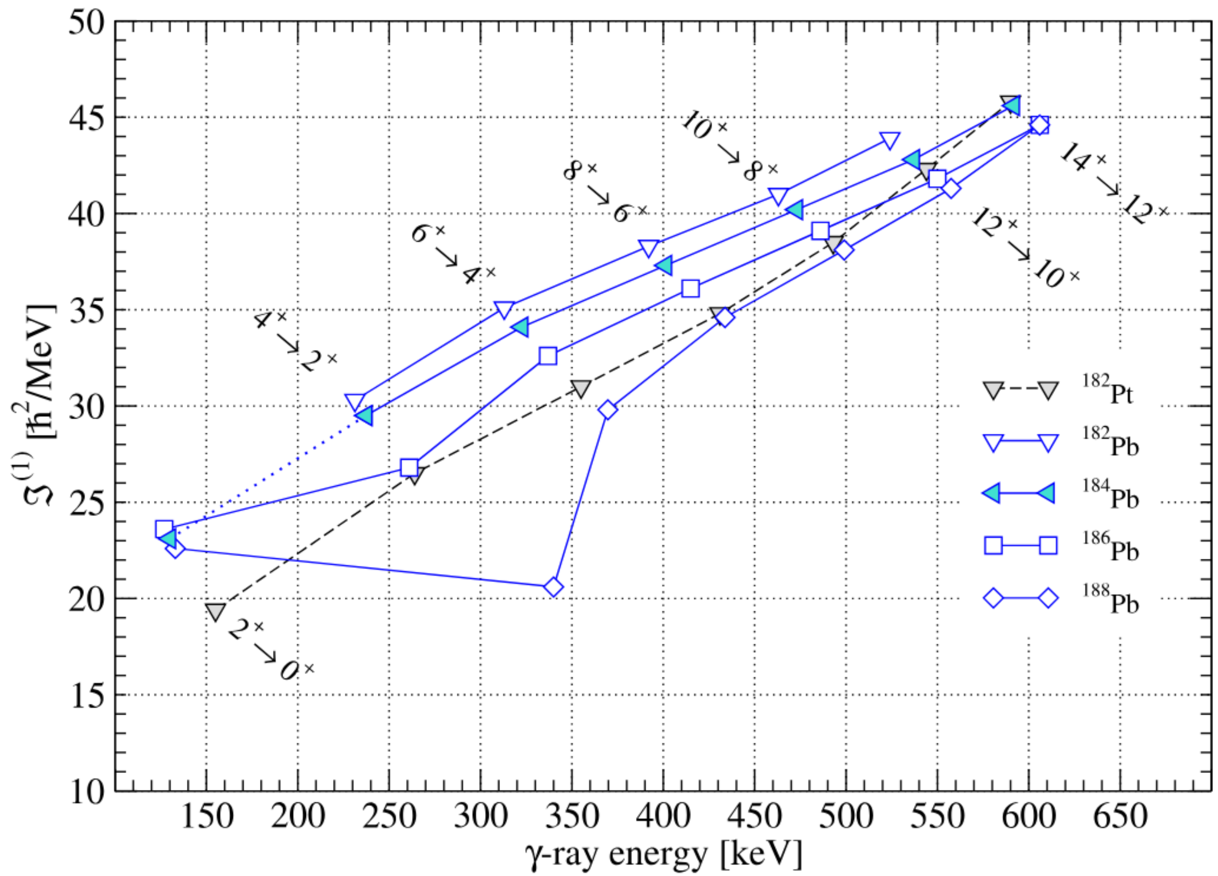
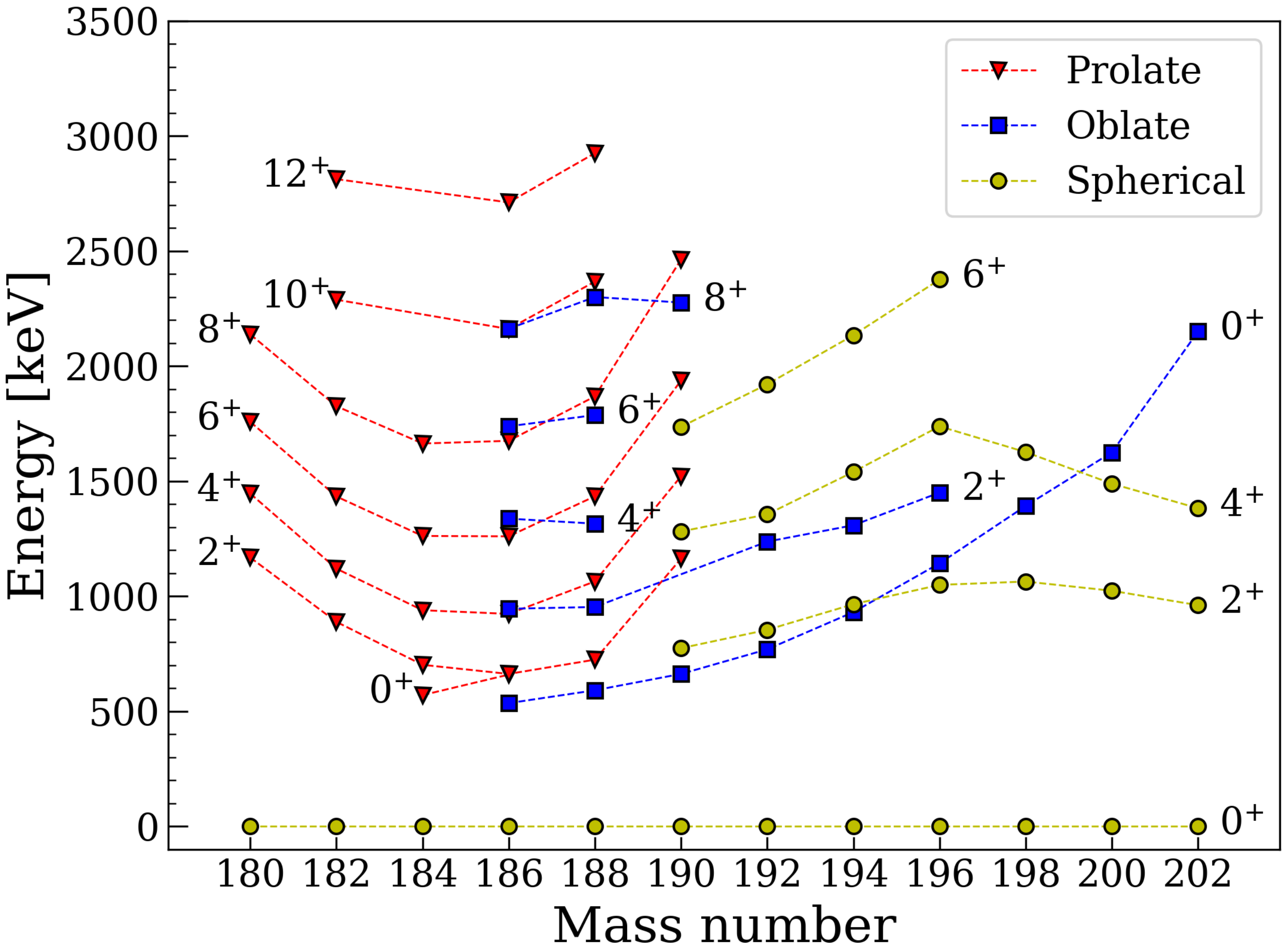
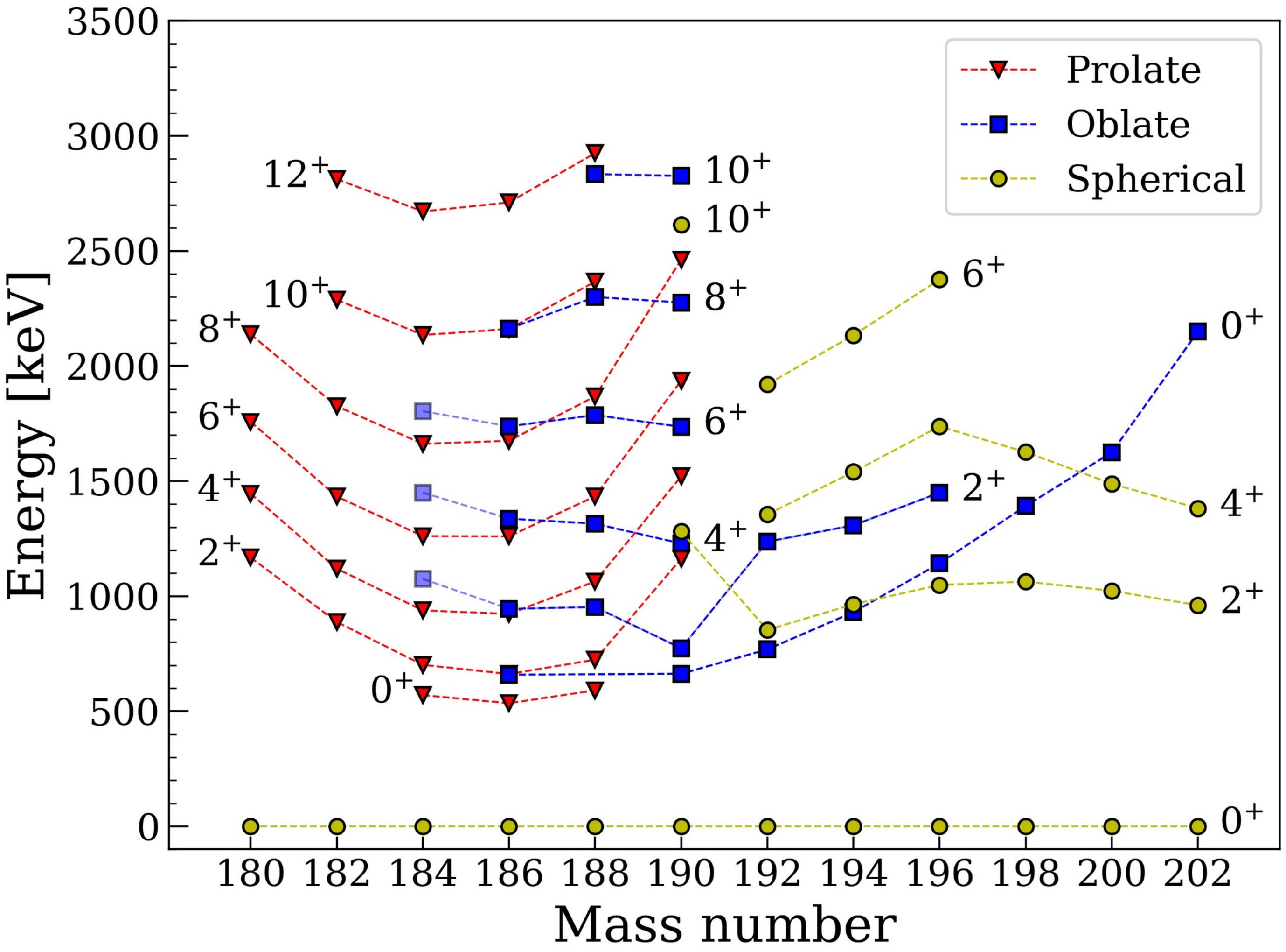


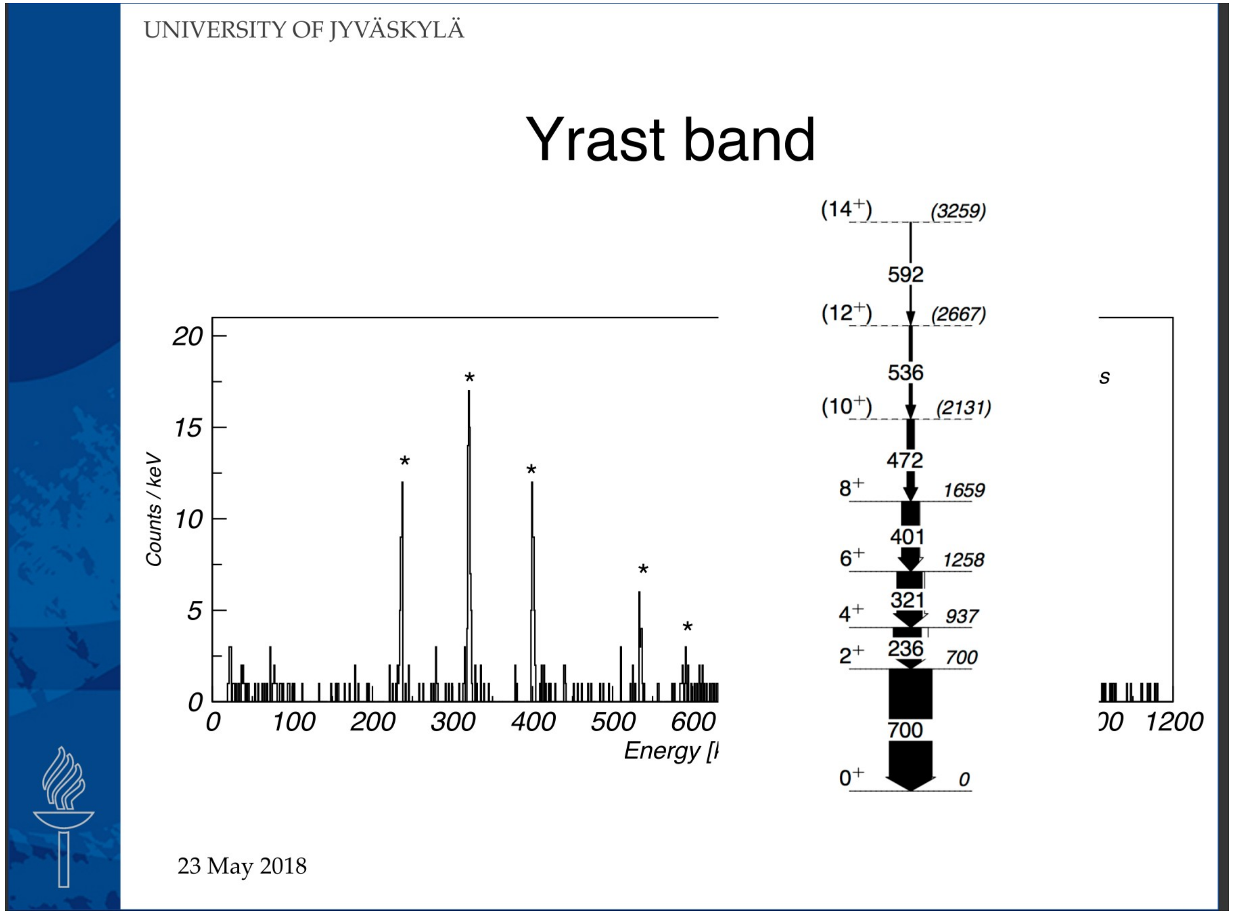
The interpretation of level energy systematics of Pb isotopes before 2021

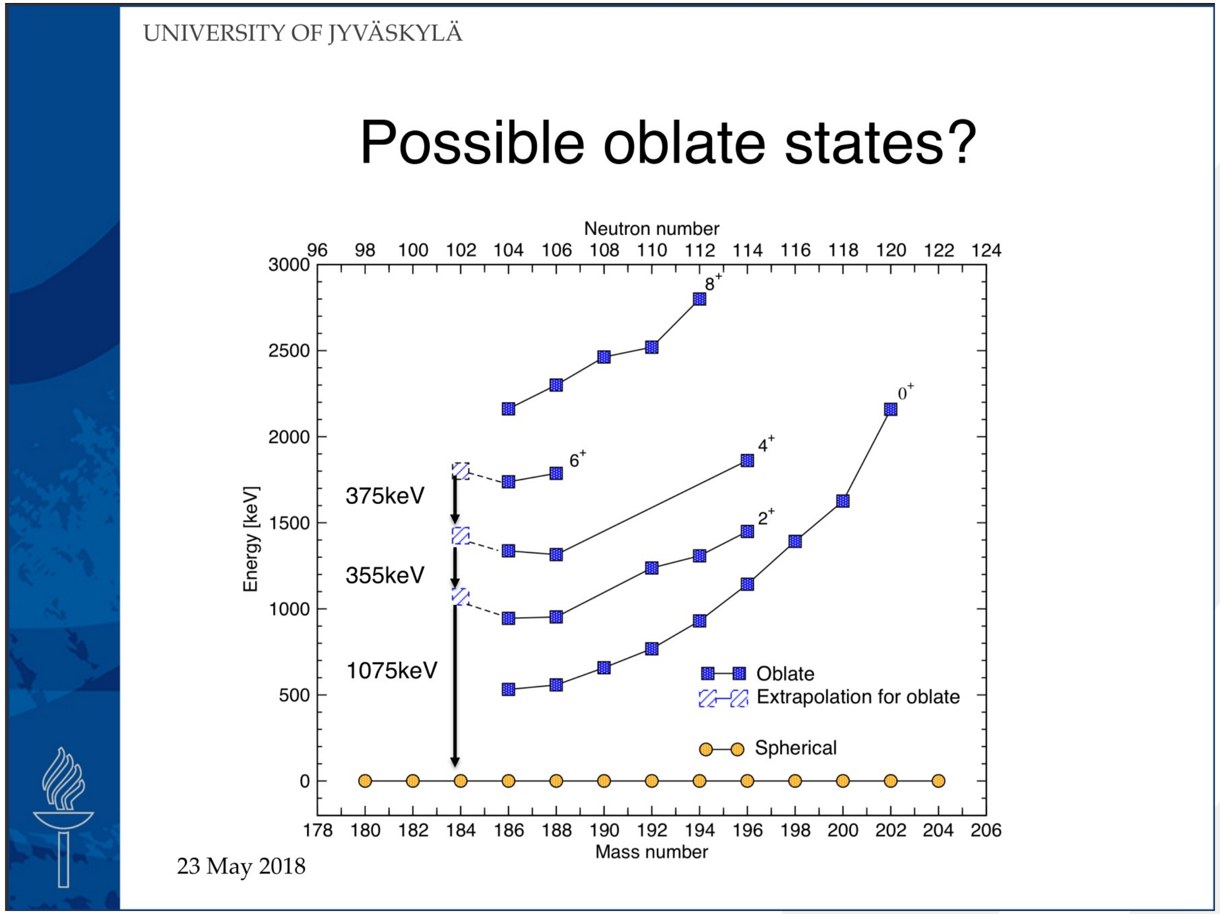


After Pb-184 experiment



14th Nordic meeting





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THANK YOU!