

In-beam spectroscopy in the region of ^{254}No at JYFL

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EGAN 2011 Workshop
Padova, 26.-30.06.2011

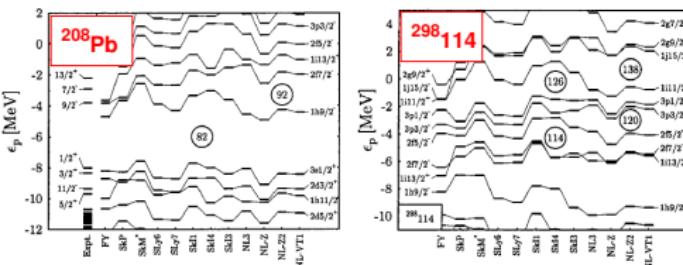


Outline

- 1 Motivation
- 2 Even-Even Fermium Isotopes
- 3 Spectroscopy of ^{255}Lr
- 4 Conclusions And Outlook

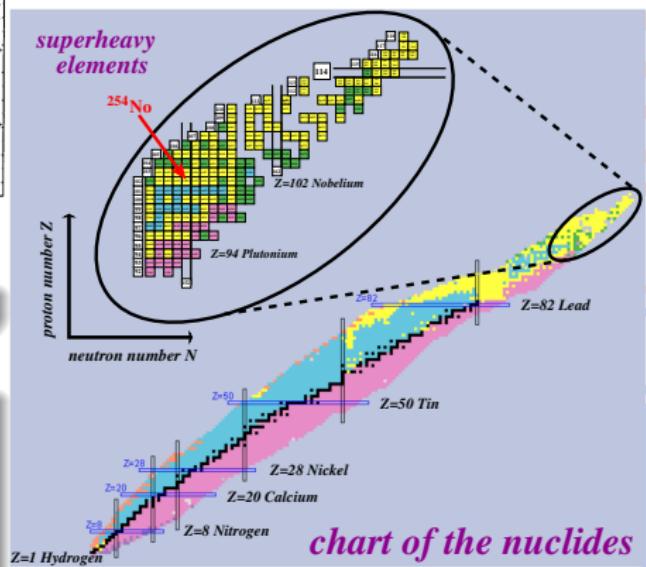


Motivation: Investigation of SHE

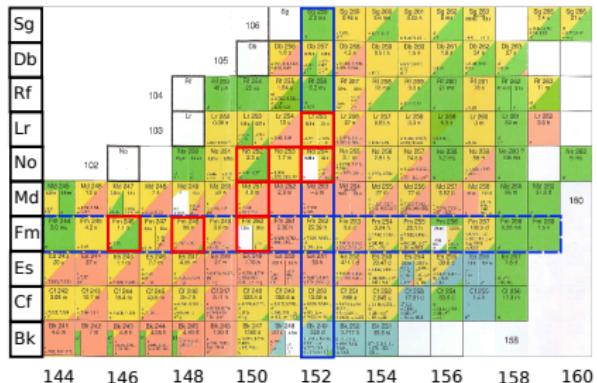


M. Bender *et al.*, PRC **60**, 034304 (1999)

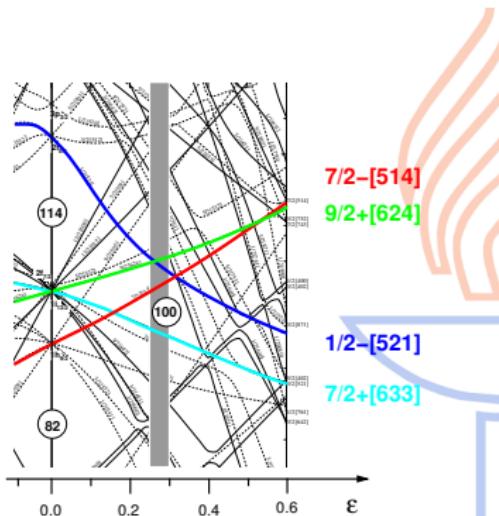
- Prediction of closed shells
 - High density of states
 - High- and low- j levels
 - Experimental data to constrain models
 - ^{254}No - cross section of $\approx \mu\text{b}$



Motivation: In-Beam Spectroscopy around ^{254}No

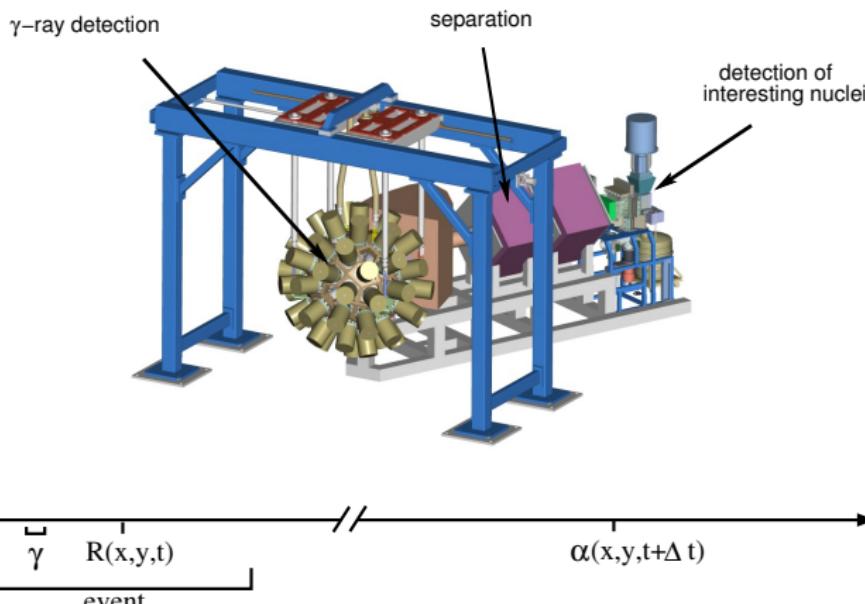


144 146 148 150 152 154 156 158 160



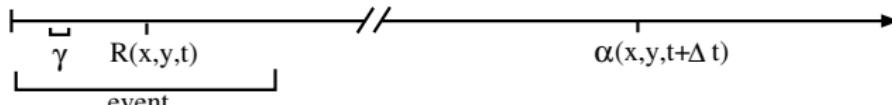
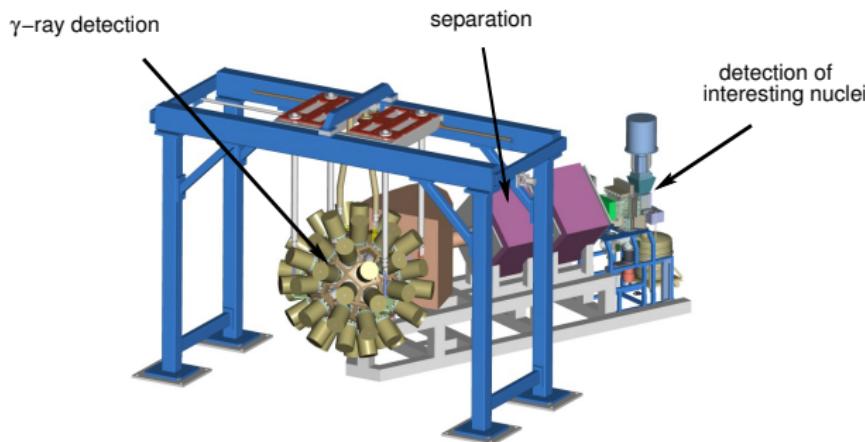
- Heaviest region for in-beam spectroscopy
- Direct links to SHE region

Experimental Techniques - RDT

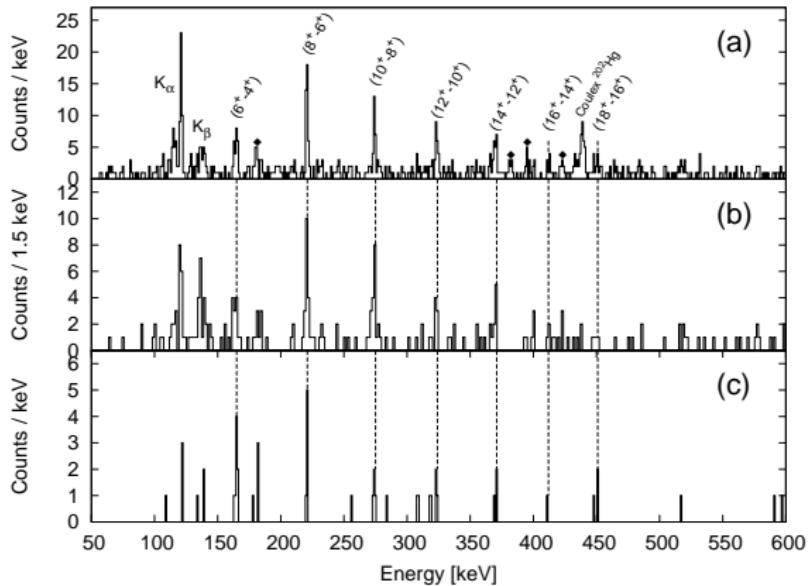


Experimental Techniques - RDT

$^{209}\text{Bi}(^{48}\text{Ca}, 2\text{n})^{255}\text{Lr}$: $\sigma = 200\text{nb} \leftrightarrow \text{Ge rate} \simeq 400\,000\text{Hz}$, 5 alphas/hour
 \Rightarrow selectivity of $\approx 1/10^9$!

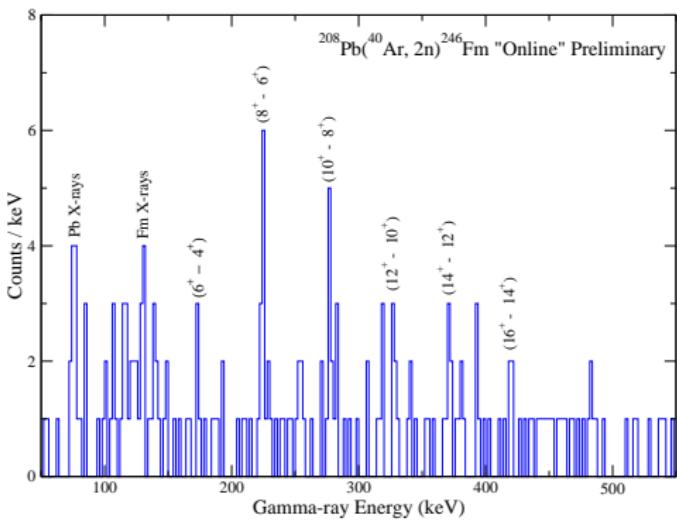


Ground-State Bands in $^{246,248,250}\text{Fm}$



$^{202}\text{Hg}(^{48}\text{Ca},2n)^{248}\text{Fm}$, S. Ketelhut, P.T. Greenlees *et al.*, to be published

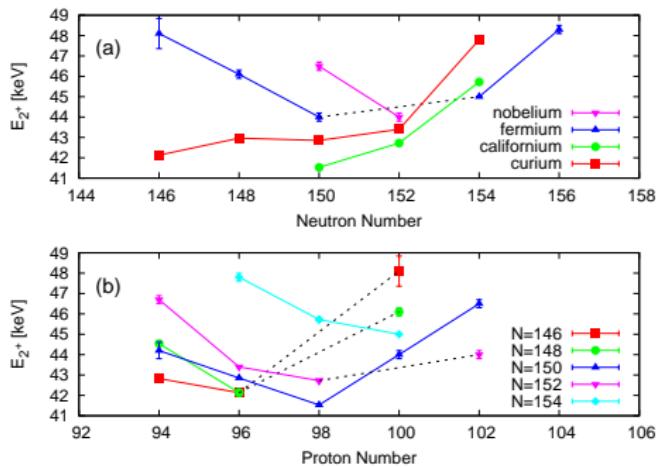
Ground-State Bands in $^{246,248,250}\text{Fm}$



- Established gsb in $^{246,248}\text{Fm}$
- Extended gsb in ^{250}Fm up to $22\hbar$
- JUROGAMII, digital electronics
- New cross section and beam intensity limits ($\simeq 15\text{nb}$, 70 pnA)
- Proof of principle - ^{256}Rf
- 2^+ energies derived by Harris Fits

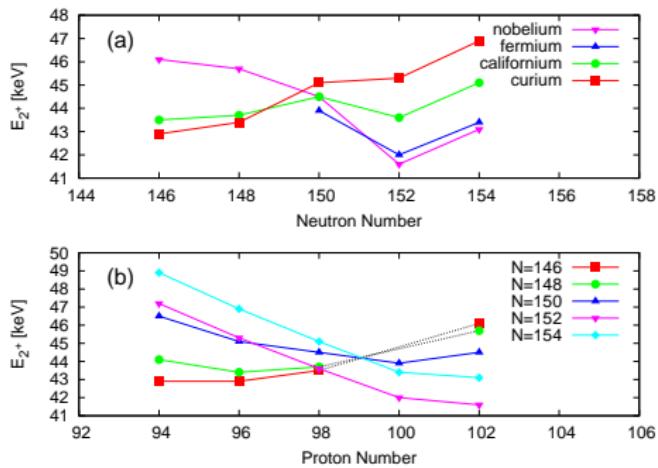
$^{208}\text{Pb}(^{40}\text{Ar}, 2\text{n})^{246}\text{Fm}$, J. Piot et al., to be published

2_1^+ energies - experimental



- Dependent on deformation (moment of inertia)
- Dependent on shell structure (reduced pairing at deformed shells)

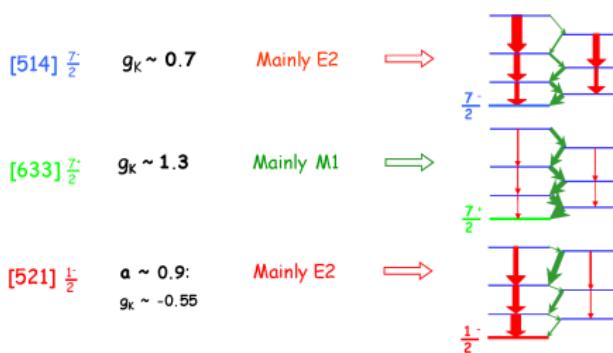
2_1^+ energies - theory



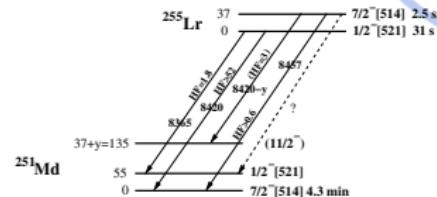
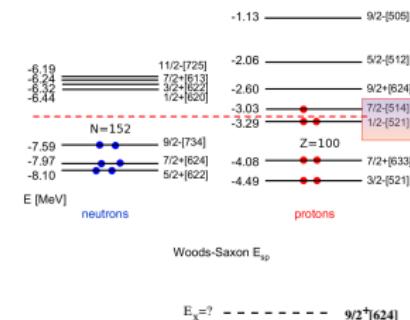
- Dependent on deformation (moment of inertia)
- Dependent on shell structure (reduced pairing at deformed shells)

A.Sobiczewski, I.Muntian, and Z.Patyk, PRC **63**,034306 (2001)

^{255}Lr - Single-Particle Levels and Band Assignment

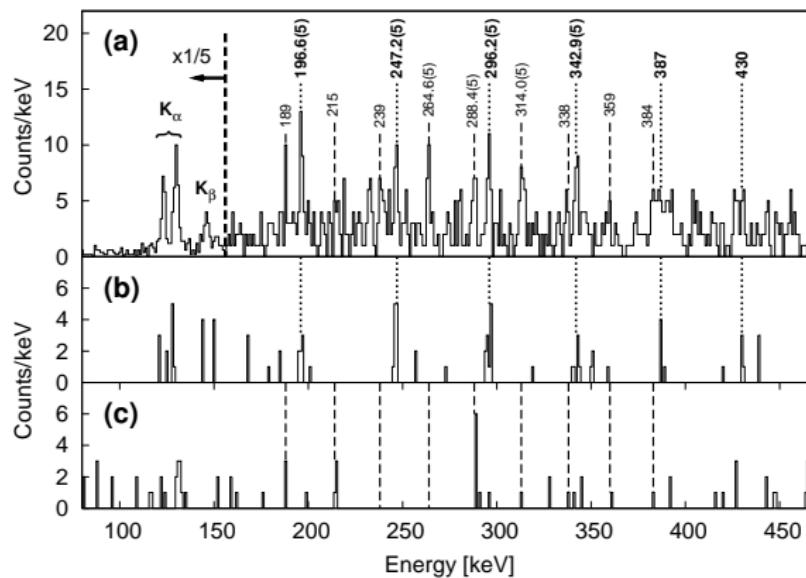


- Expected Nilsson states:
 $1/2^- [521]$, $7/2^- [514]$, $7/2^+ [633]$, $9/2^+ [624]$
- Decoupling expected in $K^\pi = 1/2^-$ band
- $7/2^- [514]$ strongly coupled, decays via E2 cascade
- $7/2^+ [633]$, $9/2^+ [624]$ decay via M1 cascade



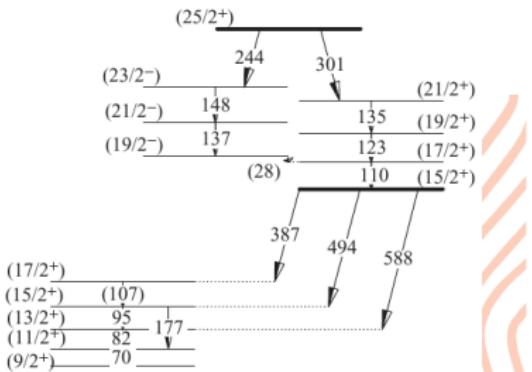
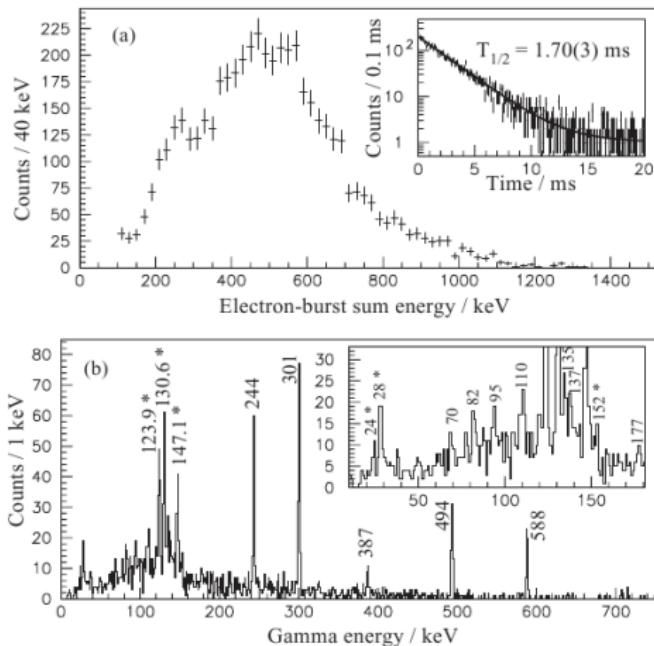
A.Chatillon *et al.* EPJ A **30**, 397 (2006)

^{255}Lr - Rotational Bands



$^{48}\text{Ca} + ^{209}\text{Bi} \Rightarrow ^{255}\text{Lr} + 2n$, S. Ketelhut, P.T. Greenlees *et al.*, PRL **102**, 212501 (2009)

^{255}Lr - Isomeric Decay



- Identify by summed-electron signal
- Gammas not identical to in-beam part
- Position of the $9/2^+[624]$ state?
- Transition $9/2^+[624]$ to $7/2^-[514]$?
- To be studied in upcoming experiment

H.B. Jeppesen *et al.* PRC **80**, 034324 (2009)

Conclusions And Outlook

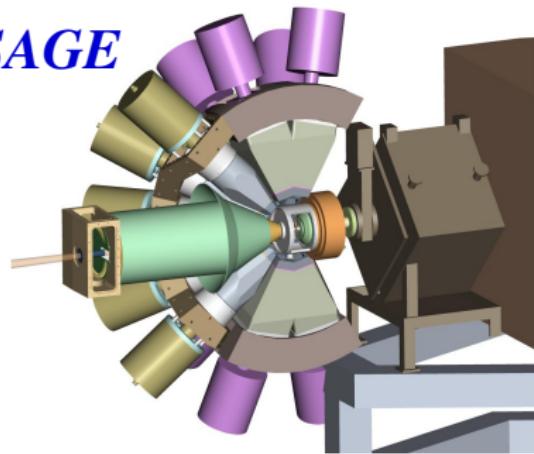
Summary

- Ground-state bands in fermium isotopes
- Extension of 2^+ energy systematics
- ^{255}Lr - two new bands

Approved Proposals

- ^{256}Rf - $\sigma = 12\text{nb}!$
- ^{255}Lr - delayed and prompt (SAGE)
- ^{251}Md , ^{253}No with SAGE
- ^{254}No - B(M1)/B(E2) of isomeric band

SAGE

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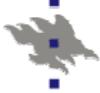
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