

Search for long-lived isomeric activities "below" ^{132}Sn

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EURICA Workshop,
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Motivation

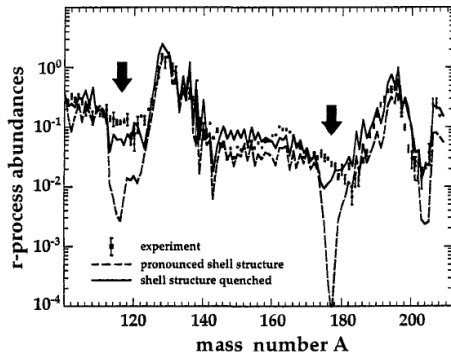
Odd-A silver isotopes

Odd-A palladium nuclei

Odd-A ruthenium nuclei

Conclusions

r -process overabundance in $A \approx 120$ region



K.-L.Kratz, *et al.*, *Hyp.Int.***129** (2000) 185

Nuclear physics input:

- ▶ nuclear masses: Q_β, S_n
- ▶ β -decay half lives: $T_{1/2}$
- ▶ neutron emission probabilities: P_n
- ▶ neutron capture cross-sections: $\sigma_{n,\gamma}$
- ▶ ground state J^π

Observed overabundance in the $A \approx 120$ region.

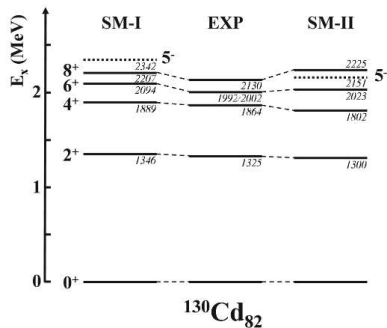
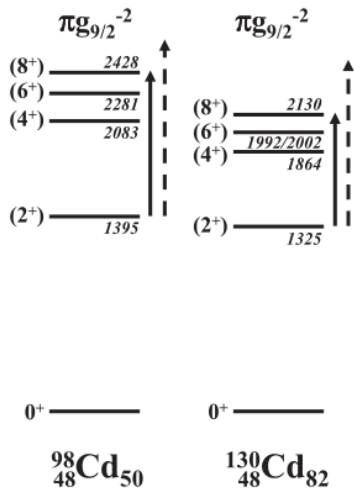
Structural evolution towards N -rich nuclei

- ▶ Shell-quenching
- ▶ Shape co-existence
- ▶ Long β -decaying half-lives

Cegré chart

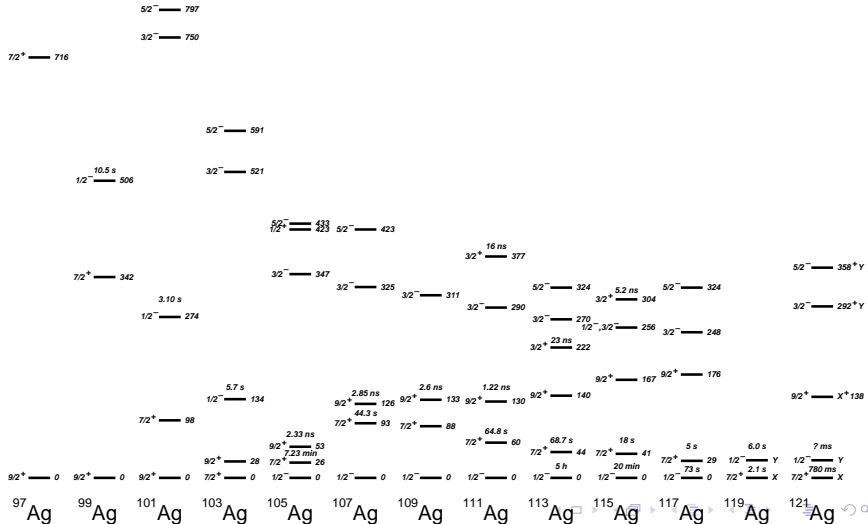
Z	124Sn STABLE 5.79%	125Sn 9.64 D β^- : 100.00%	126Sn 2.30E+5 Y β^- : 100.00%	127Sn 2.10 H β^- : 100.00%	128Sn 59.07 M β^- : 100.00%	129Sn 2.23 M β^- : 100.00%	130Sn 3.72 M β^- : 100.00%	131Sn 56.0 S β^- : 100.00%	132Sn 39.7 S β^- : 100.00%
49	123In 6.17 S β^- : 100.00%	124In 3.12 S β^- : 100.00%	125In 2.36 S β^- : 100.00%	126In 1.53 S β^- : 100.00%	127In 1.09 S β^- : 100.00% β^- -h: 0.03%	128In 0.84 S β^- : 100.00% β^- -h: < 0.05%	129In 0.61 S β^- : 100.00% β^- -h: 0.25%	130In 0.29 S β^- : 100.00% β^- -h: 0.93%	131In 0.28 S β^- : 100.00% β^- -h: 2.00%
48	122Cd 5.24 S β^- : 100.00%	123Cd 2.10 S β^- : 100.00%	124Cd 1.25 S β^- : 100.00%	125Cd 0.65 S β^- : 100.00%	126Cd 0.515 S β^- : 100.00%	127Cd 0.37 S β^- : 100.00%	128Cd 0.28 S β^- : 100.00%	129Cd 0.27 S β^-	130Cd 162 MS β^- : 100.00% β^- -h: 3.50%
47	121Ag 0.79 S β^- : 100.00% β^- -h: 0.08%	122Ag 0.529 S β^- : 99.80% β^- -h: 0.19%	123Ag 0.300 S β^- : 100.00% β^- -h: 0.55%	124Ag 0.172 S β^- : 100.00% β^- -h: 1.30%	125Ag 166 MS β^- : 100.00% β^- -h	126Ag 107 MS β^- : 100.00% β^- -h	127Ag 79 MS β^- : 100.00%	128Ag 58 MS β^- : 100.00% β^- -h	129Ag 46 MS β^- : 100.00% β^- -h
46	120Pd 0.5 S β^- : 100.00%	121Pd >150 NS β^-	122Pd 175 MS β^- : \geq 97.50% β^- -h: \leq 2.50%	123Pd >150 NS β^-	124Pd 38 MS β^- : 100.00%				
	74	75	76	77	78	79	80	81	N

Search for shell-quenching effects



A. Jungclaus *et al.*, Phys.Rev.Lett.**99** (2007)
 132501

Systematics of the odd-A Ag nuclei



Low-lying isomeric states at the N -rich odd-A Ag nuclei

 $1/2^- \text{---} X$
 $1/2^- \text{---} X$
 $1/2^- \text{---} X$
 ~160 ms

$^{123,125}\text{Ag}$: S.Lalkovski *et al.*,
 Rutherford Centennial
 Conference,
 Manchester, August 2011
 J.Phys.CS(2011)

 $7/2^+ \text{---} 0$
 300 ms
 ^{123}Ag
 $9/2^+ \text{---} 0$
 166 ms
 ^{125}Ag
 $9/2^+ \text{---} 0$
 109 ms
 ^{127}Ag
 $9/2^+ \text{---} 0$
 46 ms
 ^{129}Ag

^{129}Ag : K.-L.Kratz *et al.*,
 Hyp.Int. **129** (2000) 185
 Stellar $T_{1/2} \approx 80\text{ms}$

Unknown:

- ▶ $E(X)$
- ▶ $T_{1/2}(X)$
- ▶ J^π

Shell model calculat

EShM

 $21/2^+ \text{ --- } 3521$

EShM

 $21/2^+ \text{ --- } 3349$

NuSHELL

 $15/2^- \text{ --- } 3284$
 $11/2^- \text{ --- } 2954$
 $15/2^+ \text{ --- } 2529$

NuSHELL

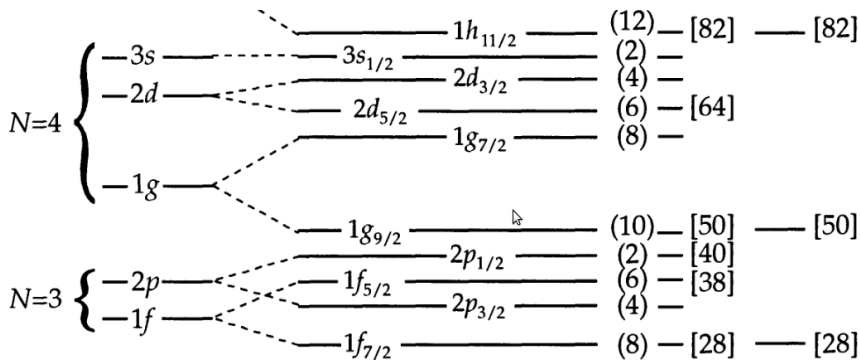
NuSHELL

 $17/2^+ \text{ --- } 2534$
 $15/2^+ \text{ --- } 2512$
 $7/2^- \text{ --- } 2577$
 $17/2^- \text{ --- } 2329$
 $13/2^- \text{ --- } 2323$
 $9/2^- \text{ --- } 2206$
 $17/2^+ \text{ --- } 1903$
 $11/2^+ \text{ --- } 1995$
 $15/2^+ \text{ --- } 1887$
 $17/2^- \text{ --- } 2001$
 $13/2^- \text{ --- } 1690$
 $15/2^+ \text{ --- } 2319$
 $15/2^+ \text{ --- } 2124$
 $15/2^- \text{ --- } 2148$
 $11/2^- \text{ --- } 1977$

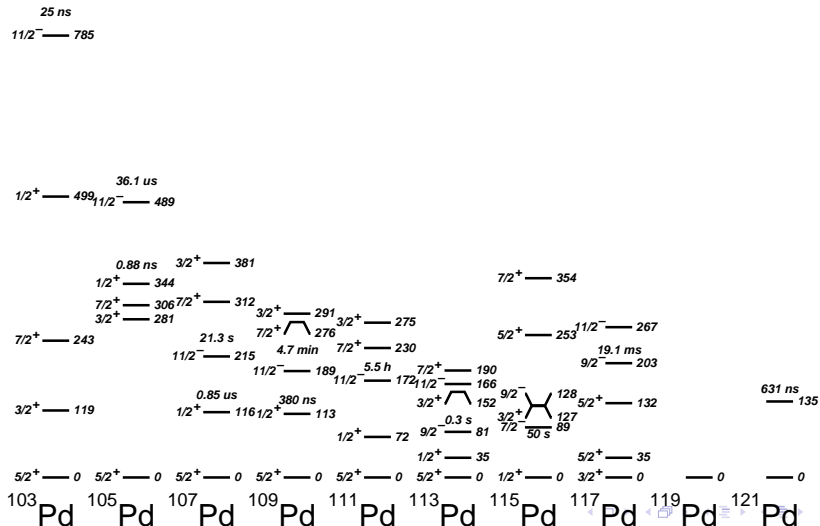
EShM

 $21/2^+ \text{ --- } 2018$
 $11/2^+ \text{ --- } 1907$
 $15/2^+ \text{ --- } 1747$
 $3/2^+ \text{ --- } 1759$
 $5/2^+ \text{ --- } 1678$
 $5/2^+ \text{ --- } 1542$
 $3/2^+ \text{ --- } 1421$
 $11/2^+ \text{ --- } 1337$
 $13/2^+ \text{ --- } 1226$
 $5/2^+ \text{ --- } 1069$
 $7/2^+ \text{ --- } 1116$
 $17/2^+ \text{ --- } 1051$
 $7/2^+ \text{ --- } 734$
 $13/2^+ \text{ --- } 1365$
 $11/2^+ \text{ --- } 1228$
 $9/2^- \text{ --- } 1146$
 $7/2^- \text{ --- } 1123$
 $13/2^+ \text{ --- } 1268$
 $17/2^+ \text{ --- } 1794$
 $17/2^- \text{ --- } 1545$
 $11/2^+ \text{ --- } 1424$
 $7/2^- \text{ --- } 1499$
 $13/2^- \text{ --- } 1381$
 $9/2^- \text{ --- } 1312$
 $11/2^+ \text{ --- } 1035$
 $13/2^+ \text{ --- } 851$
 $5/2^- \text{ --- } 780$
 $3/2^+ \text{ --- } 642$
 $5/2^+ \text{ --- } 594$
 $17/2^+ \text{ --- } 569$
 $5/2^+ \text{ --- } 594$
 $3/2^- \text{ --- } 592$
 $17/2^+ \text{ --- } 561$
 $7/2^+ \text{ --- } 490$
 $5/2^+ \text{ --- } 1051$
 $7/2^+ \text{ --- } 734$
 $9/2^+ \text{ --- } 271$
 $9/2^+ \text{ --- } 243$
 $5/2^- \text{ --- } 494$
 $3/2^- \text{ --- } 420$
 $9/2^+ \text{ --- } 207$
 $7/2^+ \text{ --- } 0$
 $9/2^+ \text{ --- } 0$
 $1/2^- \text{ --- } 17$
 $9/2^+ \text{ --- } 0$
 $9/2^+ \text{ --- } 0$
 $1/2^- \text{ --- } 291$
 125 Ag
 127 Ag
 129 Ag

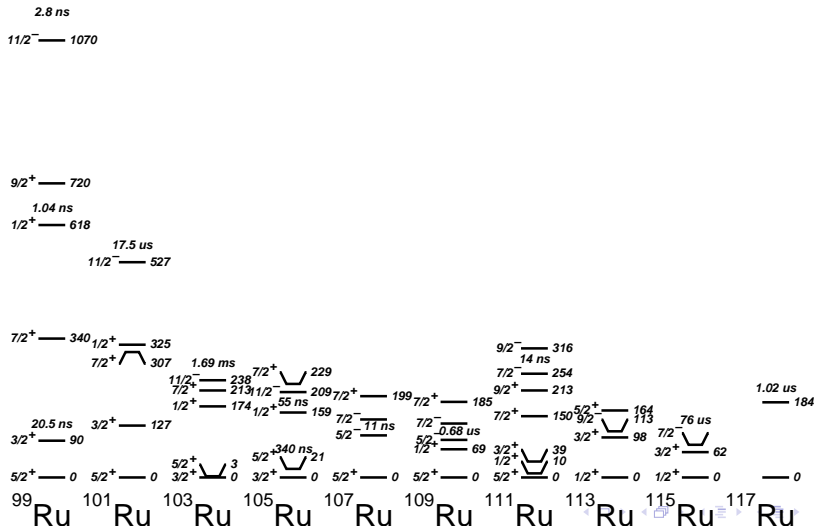
$N = 3$ and $N = 4$ oscillator shells



Neutron-rich odd-A palladium isotopes



Shell model calculations



Conclusion

Aim:

- ▶ To allocate the long lived isomers in the extremely *N*-rich odd-*A* Ag, Pd, Rh and Ru nuclei

Motivation

Odd-A silver isotopes

Odd-A palladium nuclei

Odd-A ruthenium nuclei

Conclusions

Collaboration

Prof. Phil Walker
Dr. Zsolt Podolyak
Dr. Filip Kondev
...