

Search for key nuclear structure states below ^{132}Sn

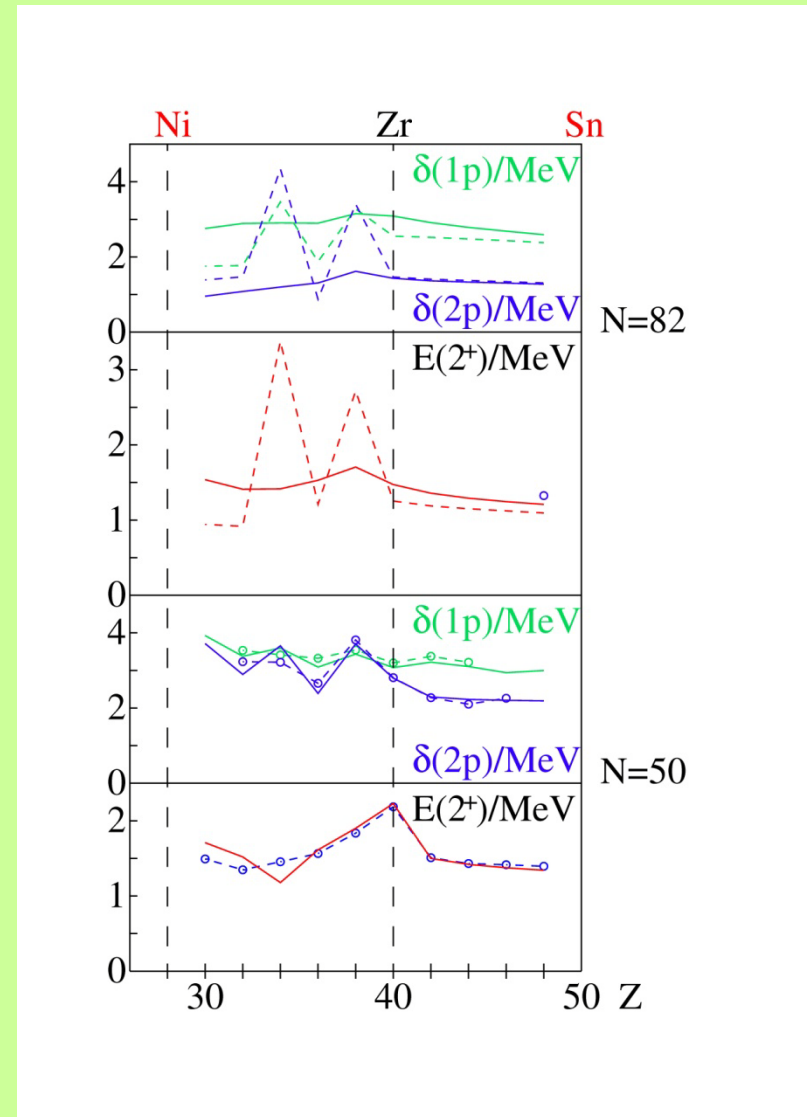
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et al.

Motivation

1. Competition between:
 - **Shell evolution in neutron rich N=82 isotones**: according to presented predictions in contrast to N=50 no Z=38,40 subshells
 - **Shell quenching in extreme neutron rich nuclei towards ^{122}Zr** : a missing Z=38,40 subshell due to coupling to low-lying 2+ proton valence state creates a minimum neutron gap near mid-proton shell at Z=38,40
2. Astrophysics

Evidence for shell evolution

- $1/2^-$ in ^{131}In about 300 keV lower than extrapolated for ^{99}In
- low-lying $3/2^-$ and $5/2^-$ states in ^{131}In
- Figure shows $\delta(1p,2p)$ and $2+$ energy for single hole energy sequence as estimated for ^{131}In and as extrapolated for ^{99}In (dashed)



N = 82 odd mass chain

SM33: ν h11/2 d3/2 s1/2 g7/2d5/2 π g9/2 p1/2

SMJ2: ν h11/2 d3/2 s1/2 g7/2d5/2 π g9/2 p1/2 p3/2 f5/2

3727 ——— 21/2⁻

Proton SPEs

(2750) ——— (5/2⁻)

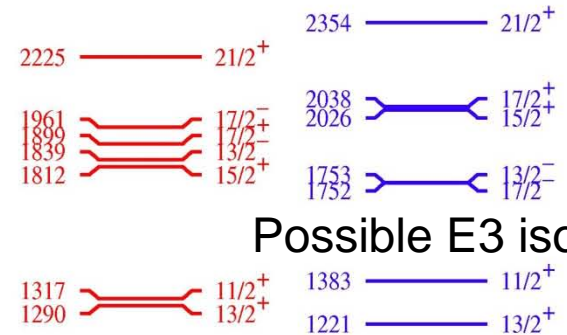
2751 ——— 5/2⁻

(1650) ——— (3/2⁻)

1650 ——— 3/2⁻

- 17/2⁻ in ¹²⁹Ag is M2 isomer to 13/2⁺ or E2 to 13/2⁻ (if sequence reversed)

- isomer would be clear evidence for disappearing Z=38,40 subshell



Possible E3 isomer

Beta decaying isomer

302 ——— (1/2⁻)

307 ——— 1/2⁻

301 ——— 1/2⁻

367 ——— 1/2⁻

227 ——— 1/2⁻

0 ——— (9/2⁺)

0 ——— 9/2⁺

0 ——— 9/2⁺

0 ——— 9/2⁺

0 ——— 9/2⁺

0 ——— 9/2⁺

EX

SM33

SMJ2

EX

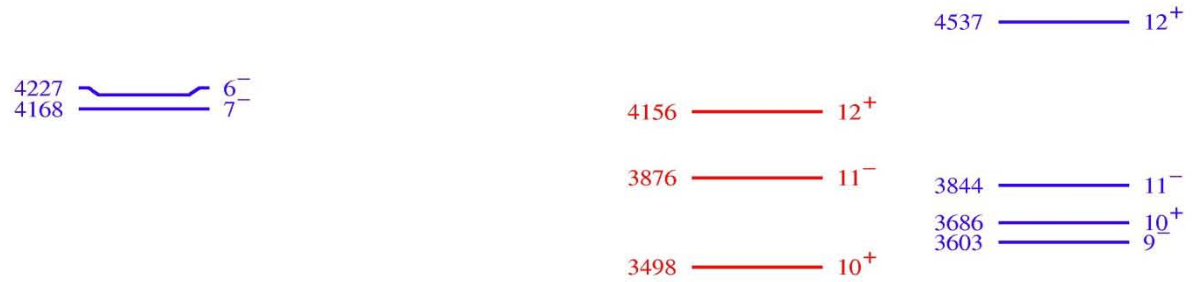
SM33

SMJ2

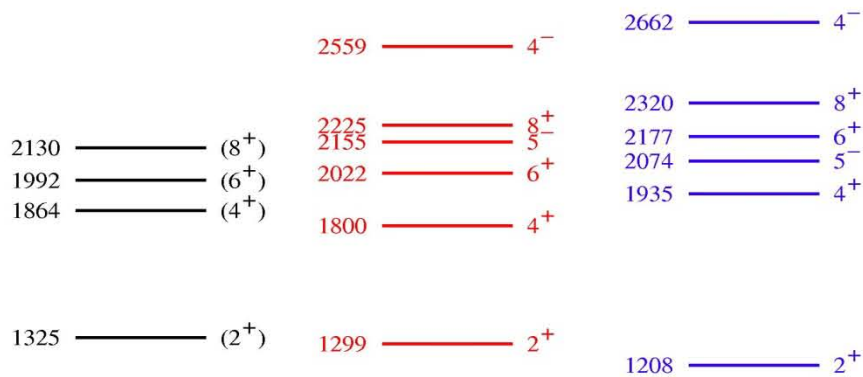
¹³¹In₈₂

¹²⁹Ag₈₂

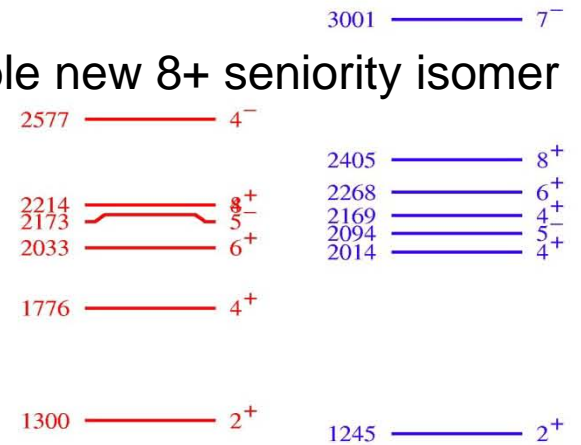
N = 82 even mass chain



Known 8+ seniority isomer



possible new 8+ seniority isomer



0 0^+
EX

0 0^+
SM33
 $^{130}_{48}\text{Cd}_{82}$

0 0^+
SMJ2

0 0^+
EX

0 0^+
SM33
 $^{128}_{46}\text{Pd}_{82}$

0 0^+
SMJ2

N = 81 odd mass chain

3990 — (7/2⁺)

4063 — 35/2⁻

Neutron SPEs

2892 — 7/2⁺

2434 — (7/2⁺)

1655 — (5/2⁺)

1655 — 5/2⁺

Possible new:

21/2⁺: E3, β

27/2⁻: E3, β

Low spin β dec. isomer

2553 — 25/2⁻

2161 — 21/2⁻

2076 — 23/2⁻

1945 — 19/2⁻

1866 — 19/2⁺

1864 — 17/2⁻

1746 — 27/2⁻

1745 — 21/2⁺

1572 — 15/2⁻

1378 — 7/2⁺

1238 — 13/2⁻

1157 — 5/2⁺

Possible new:

19/2⁺ : M2

23/2⁻: M2, β to 19/2⁺

or E2 to 19/2⁻ (if sequence rev.)

33/2⁺: E2 to 29/2⁺

and/or E3 to 27/2⁻

Low spin β dec. isomer

3497 — 31/2⁻

3383 — 33/2⁺

3353 — 29/2⁺

2269 — 25/2⁻

2019 — 27/2⁻

1985 — 21/2⁺

1656 — 19/2⁻

1630 — 23/2⁻

1555 — 19/2⁺

1291 — 15/2⁻

1233 — 13/2⁻

1163 — 7/2⁺

1031 — 5/2⁺

332 — (1/2⁺)

317 — 1/2⁺

65 — (11/2⁻)

44 — 11/2⁻

0 — (3/2⁺)

0 — 3/2⁺

EX

SM33

¹³¹Sn₈₁

0 — (3/2⁺)

297 — 1/2⁺

210 — 3/2⁺

0 — 11/2⁻

EX

SM33

¹²⁹Cd₈₁

0 — (11/2⁻)

289 — 1/2⁺

72 — 3/2⁺

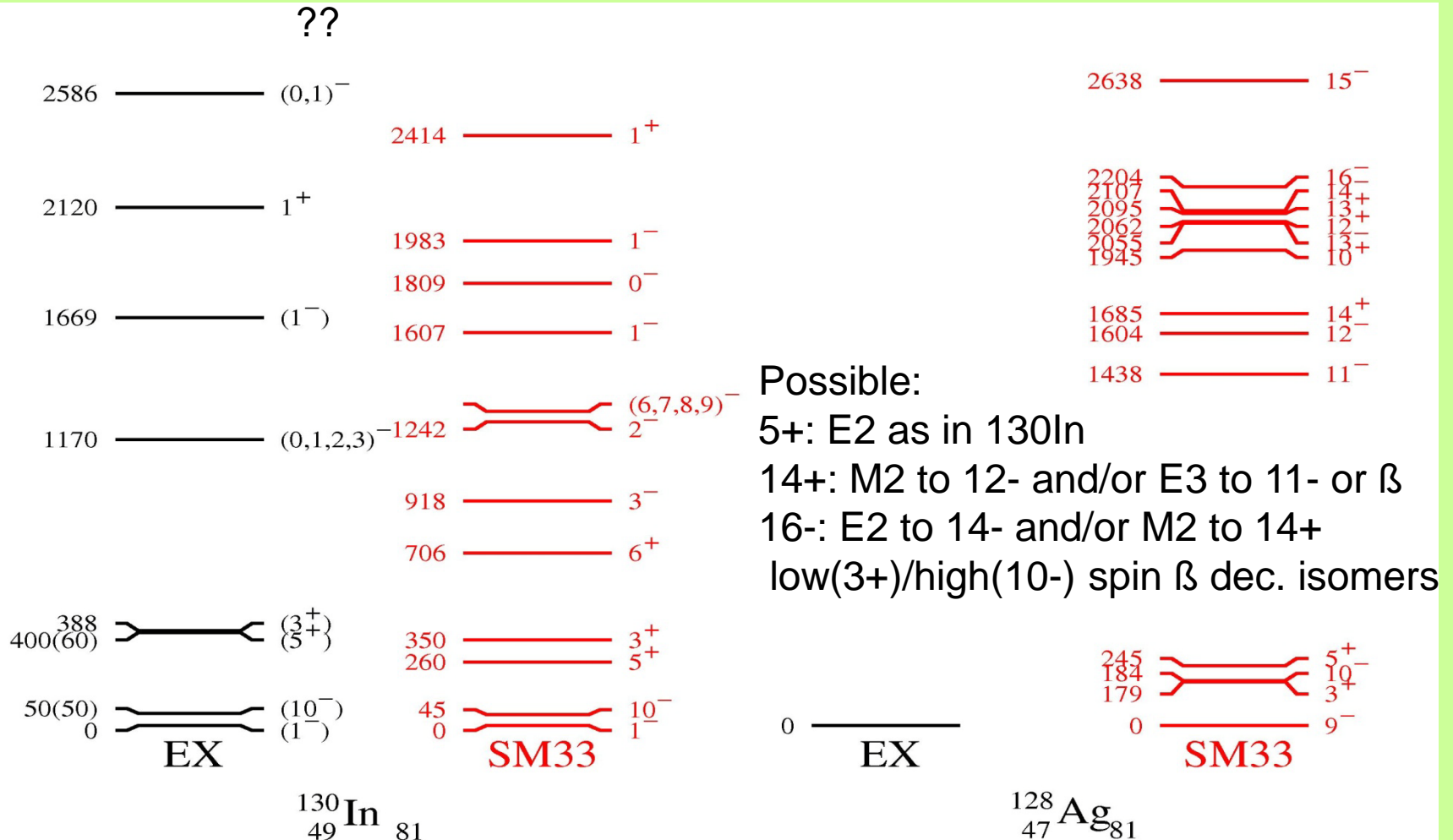
0 — 11/2⁻

EX

SM33

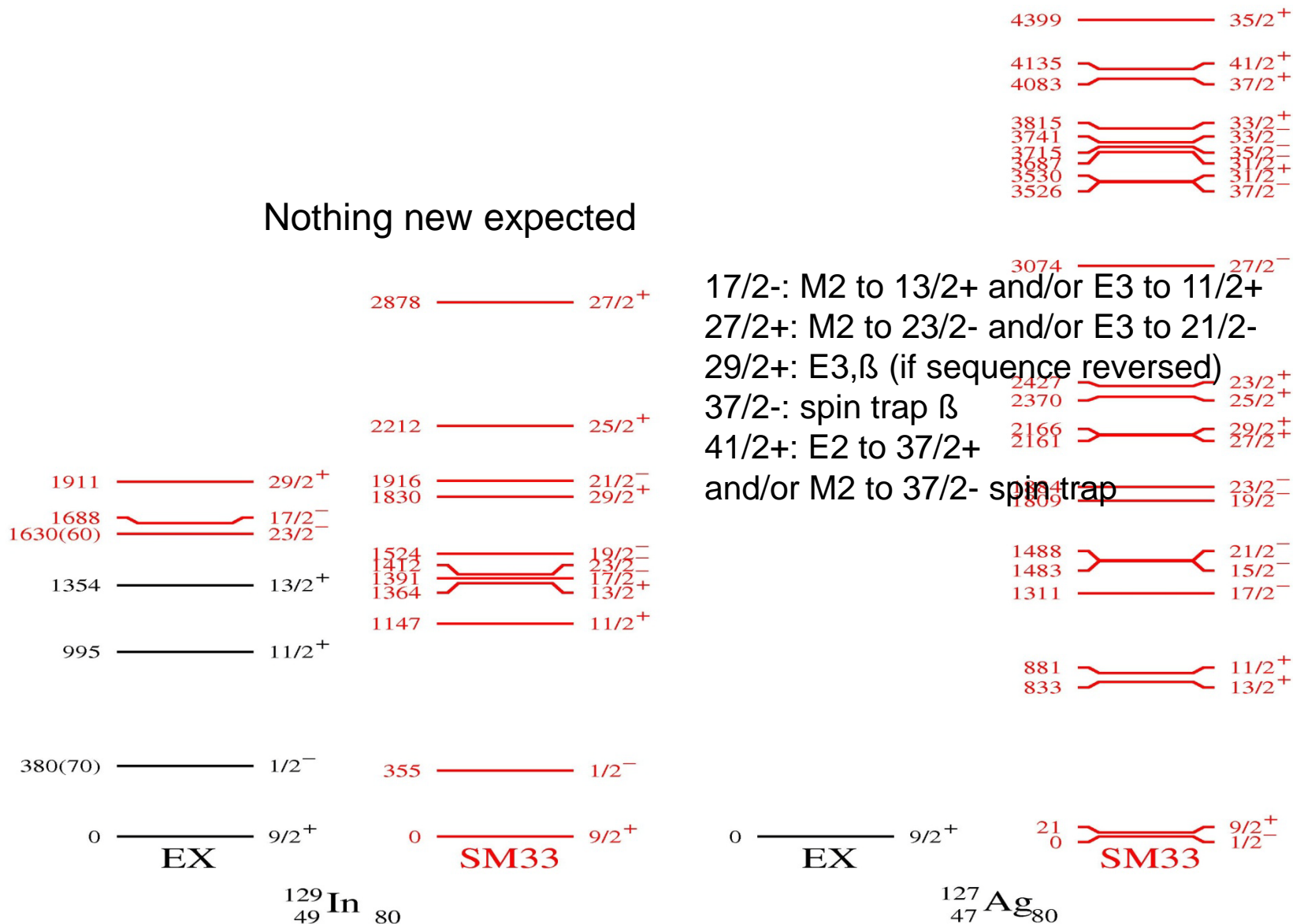
¹²⁷Pd₈₁

N = 81 even mass chain



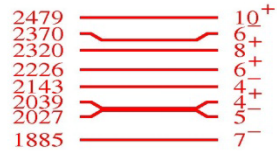
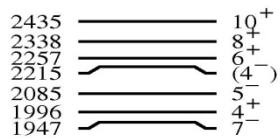
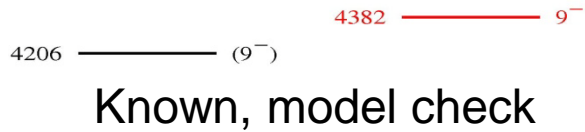
N=80 odd mass chain

Nothing new expected

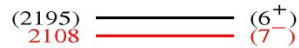


N = 80 even mass chain

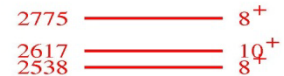
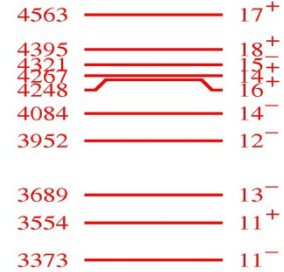
18+ spin trap β



¹³⁰Sn₅₀₈₀



¹²⁸Cd₄₈₈₀



SM33

¹²⁶Pd₄₆₈₀

10+: E2 to 8+ and/or E3 to 7-
 16+: M2 to 14-
 and/or E3 to 13- or β
 18+: E2

Conclusions

- new seniority isomers (not many)
- many spin trap isomers
- many new β decaying isomers
- core excited isomers (see ^{131}In) less safely predictable
- Spectroscopy data on these will serve to understand shell evolution towards ^{122}Zr