Neutron monopole drift towards ^{78}Ni investigated by γ-spectroscopy following ^{81}Cu β-decay

INSTITUT DE PHYSIQUE NUCLÉAIRE
ORSAY

12 Sep 2011

EURICA workshop @ GSI

IPN Orsay
M. Niikura, D. Verney, K. Kolos, F. Azaiez, F. Ibrahim,
S. Franchoo, F. Hammache, F. Le Blanc, I. Matea,
N. de Séréville, I. Stefan, D. Testov
CSNSM Orsay
A. Korichi
GANIL Caen
L. Cáceres, E. Clément, G. De France, O. Sorlin, J.-C.Thomas
CENBG Bordeaux
S. Grévy
IPHC Strasbourg
F. Didierjean, G. Duchêne, K. Sieja, F. Nowacki
LNL-INFN
G. De Angelis, E. Sahin, J.J. Valiente Dobon
Osaka University
A. Odahara, T. Shimoda
Tokyo University of Science
T. Sumikama
RIKEN Nishina Center
S. Nishimura

on behalf of EURICA collaboration

Unité mixte de recherche
CNRS-IN2P3
Université Paris-Sud 11

91406 Orsay cedex
Tél : +33 1 69 15 73 40
Fax : +33 1 69 15 64 70
http://ipnweb.in2p3.fr

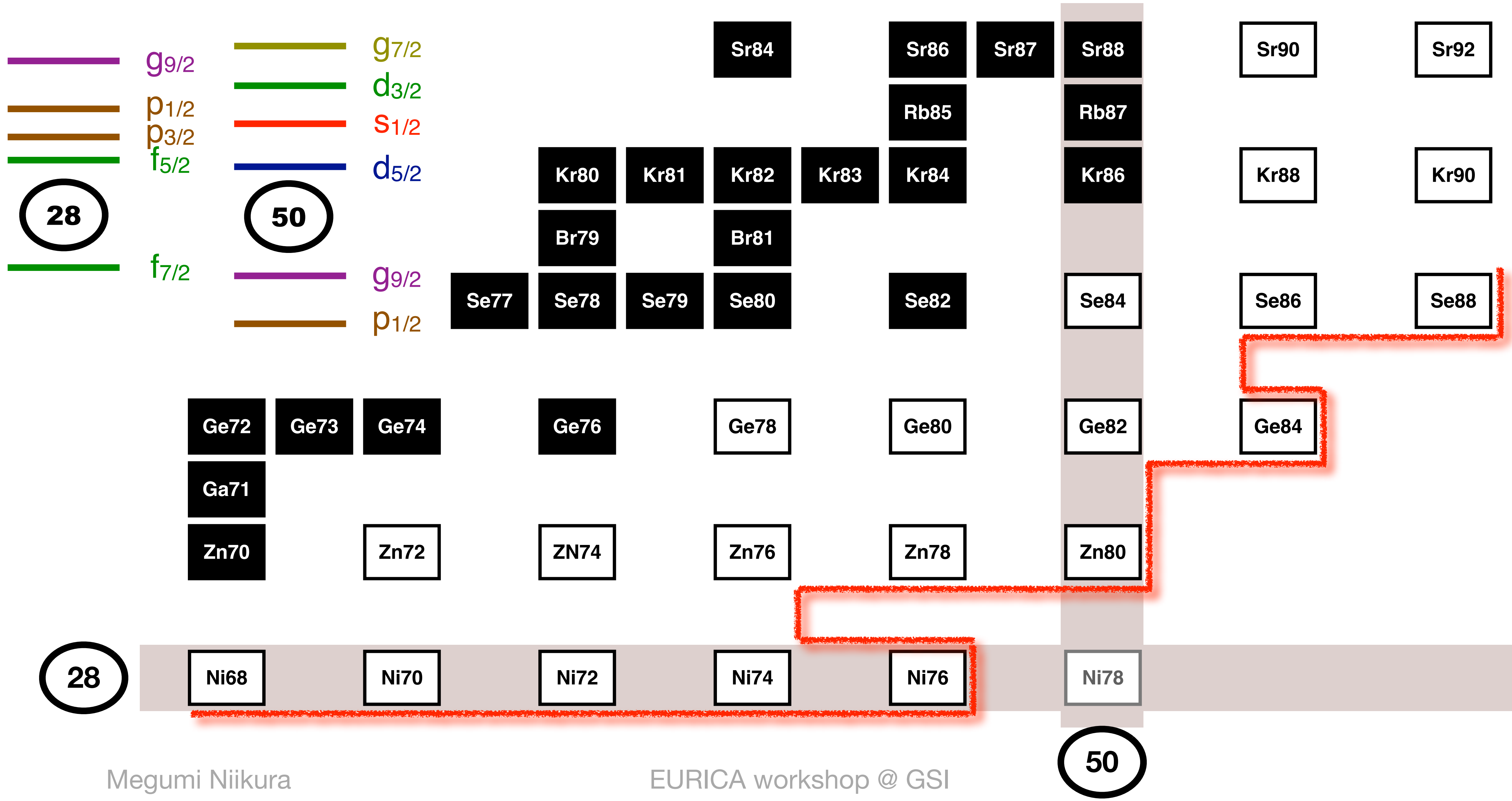
Shell evolution toward to ^{78}Ni

- ^{78}Ni is doubly-magic nucleus?

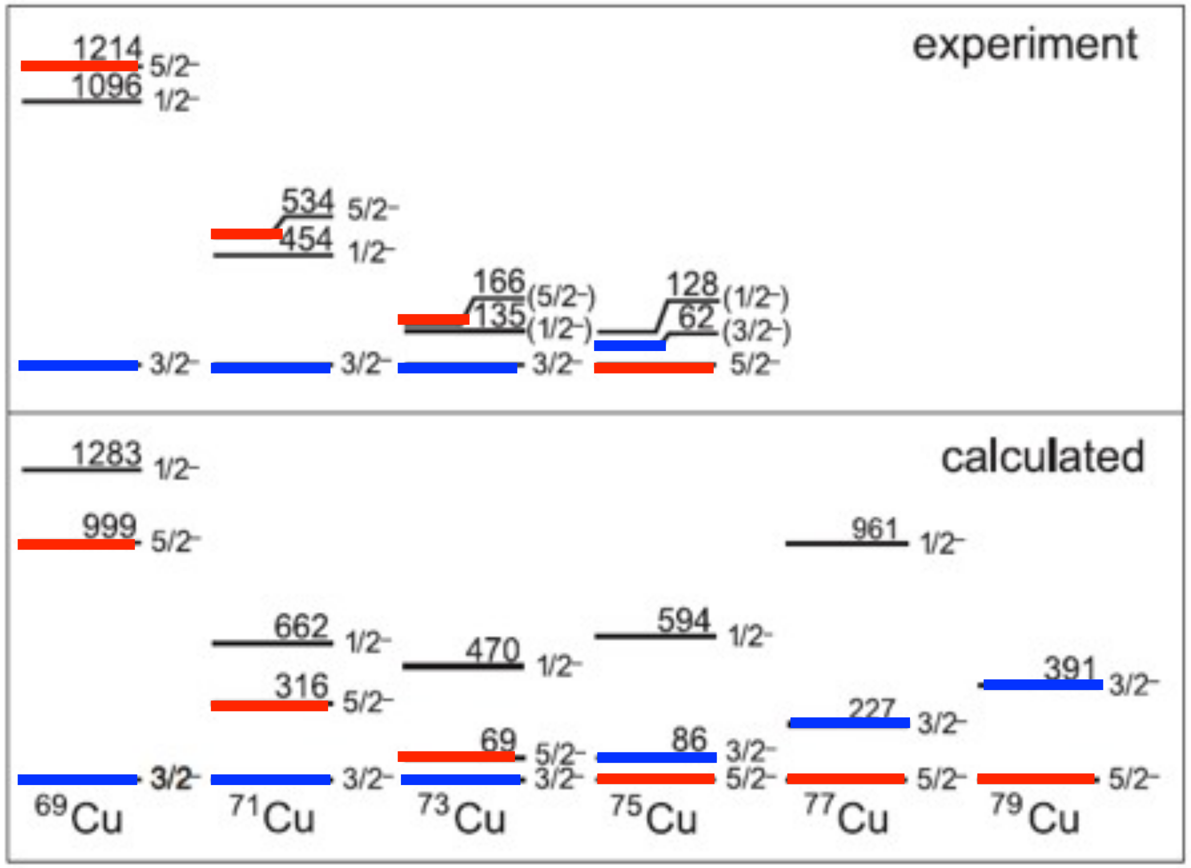
  S_{2n}, $E(2^+)$, $B(E2)$, $E(4^+)/E(2^+)$ etc.. → maybe yes

- What is the nature of valence space which opens up just above?

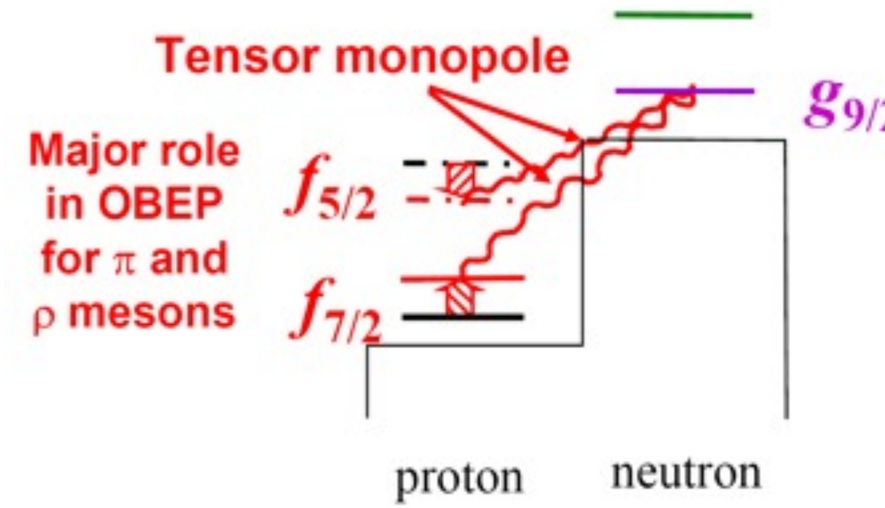
  single particle sequence, shell-evolution

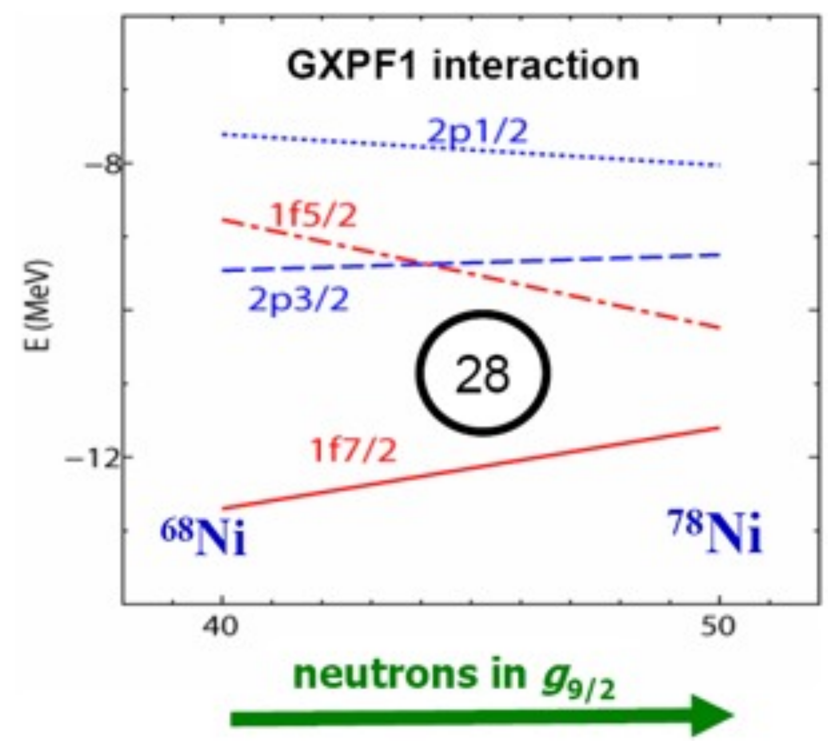


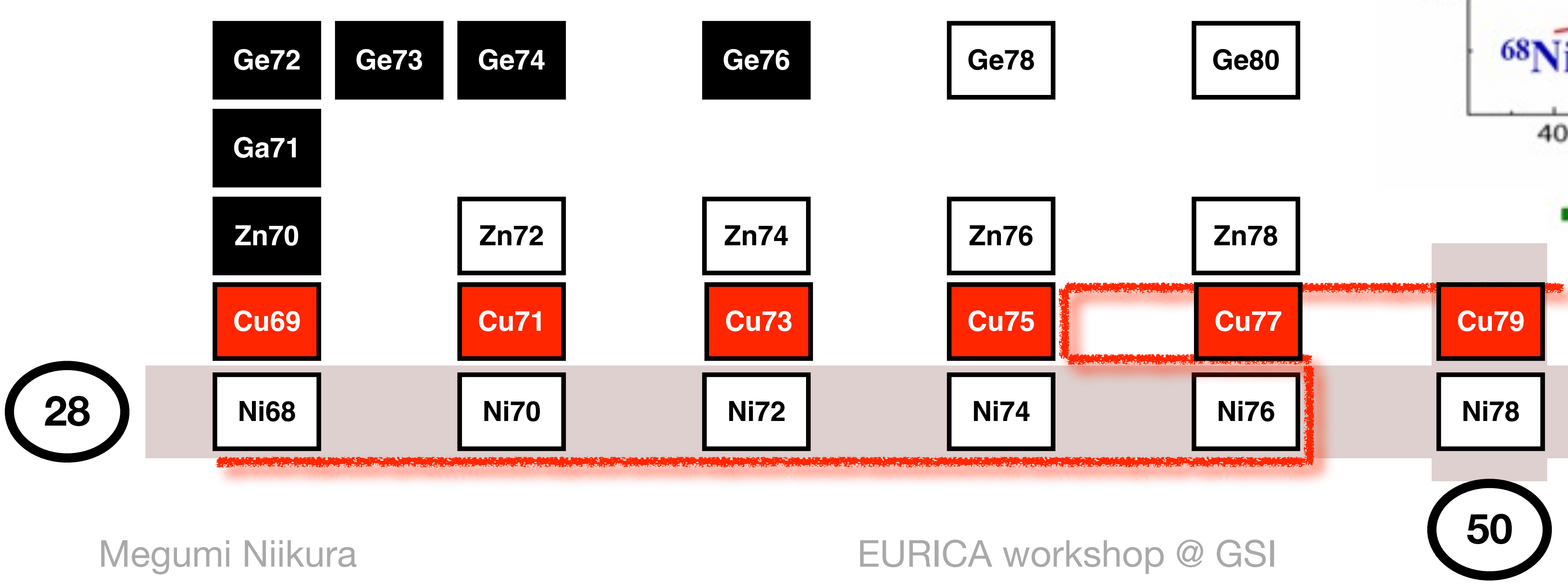
Shell evolution for proton in Z=29 isotope



K. Flanagan et al., PRL 103, 142501 (2009)





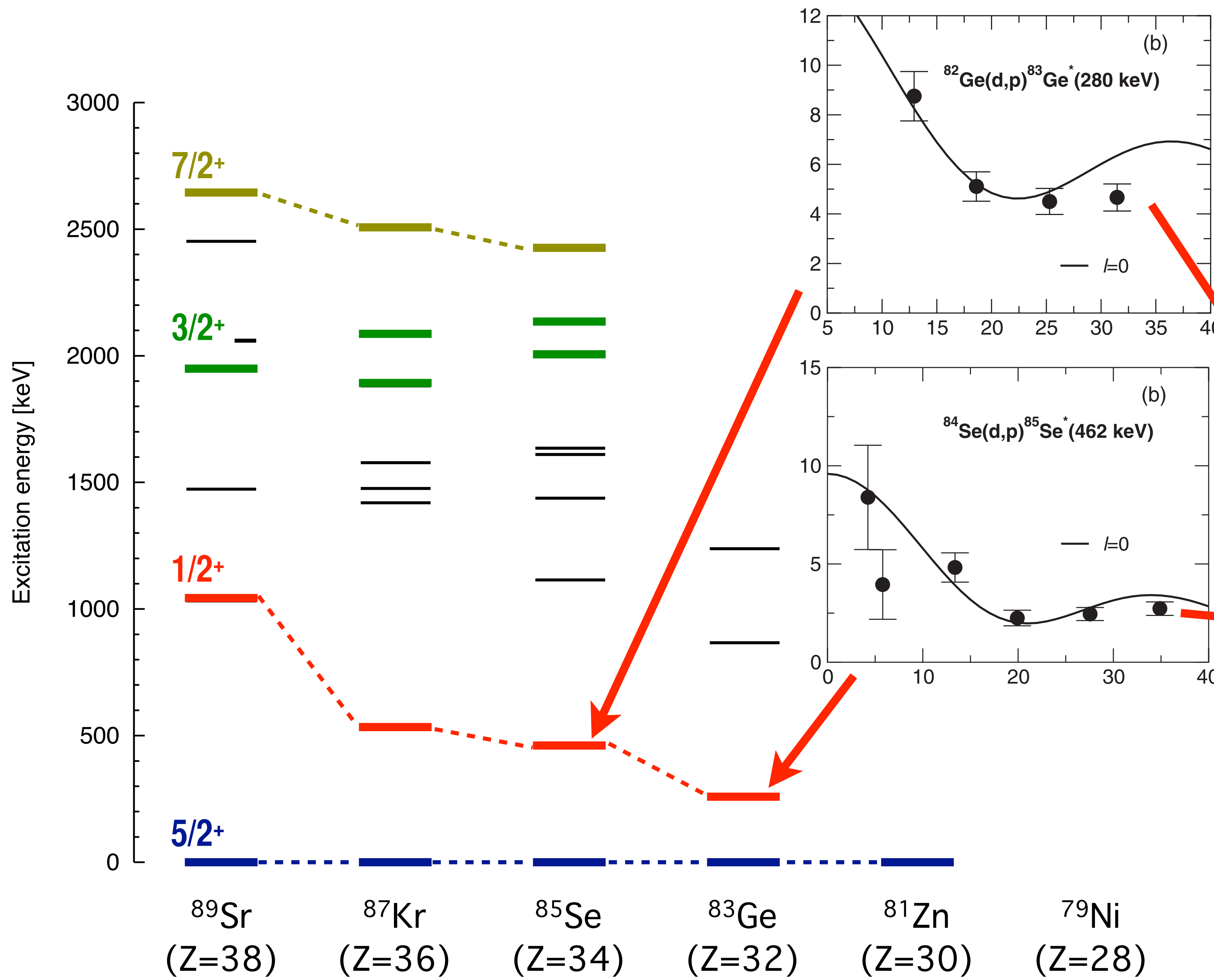


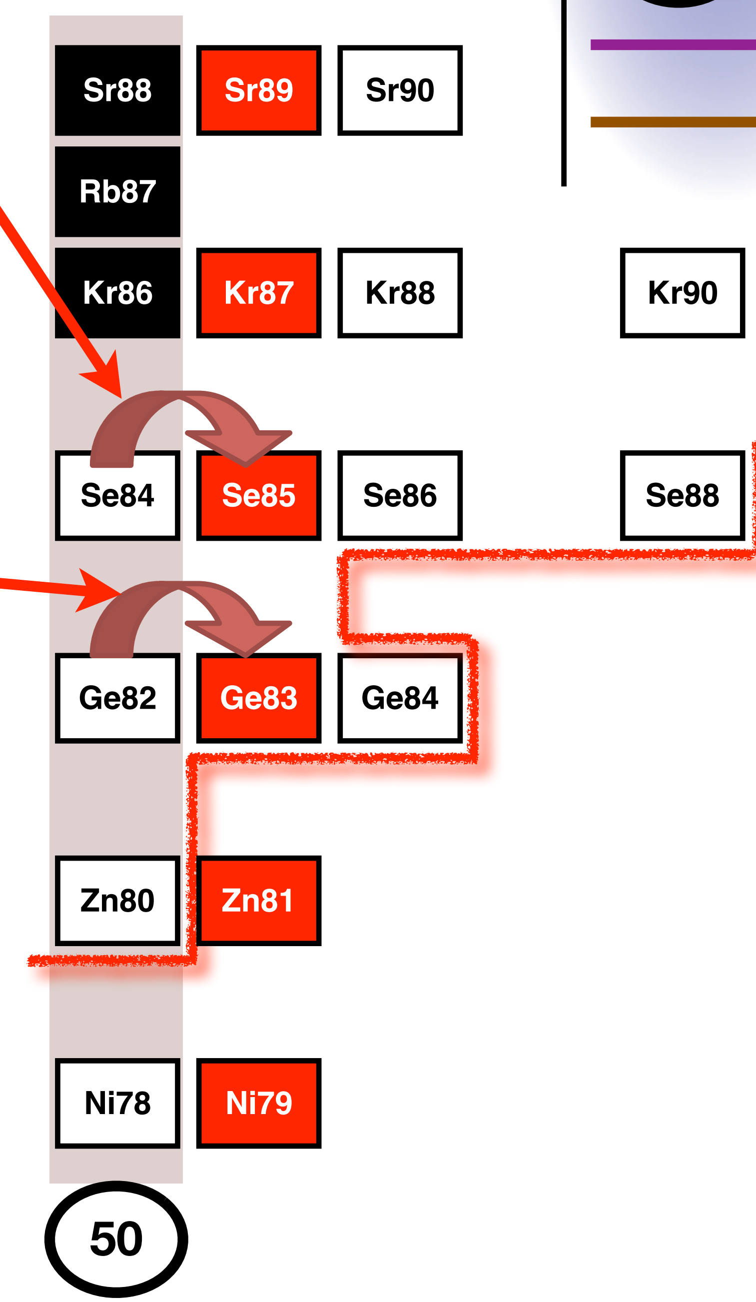
T. Otuka et al, PRL 95, 232502 (2005)

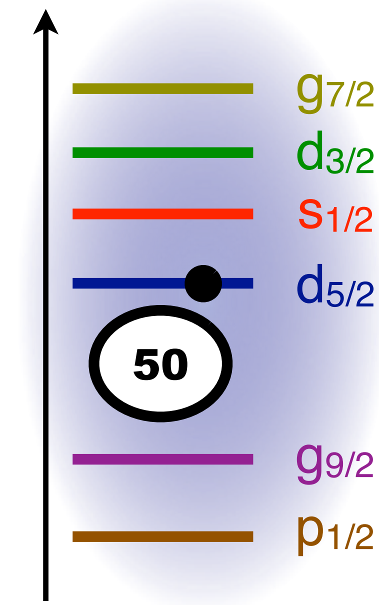
Shell evolution for neutron in N=51 isotone

(d,p) measurement at ORNL

P.J. Thomas et al., PRC 76, 044302 (2007)







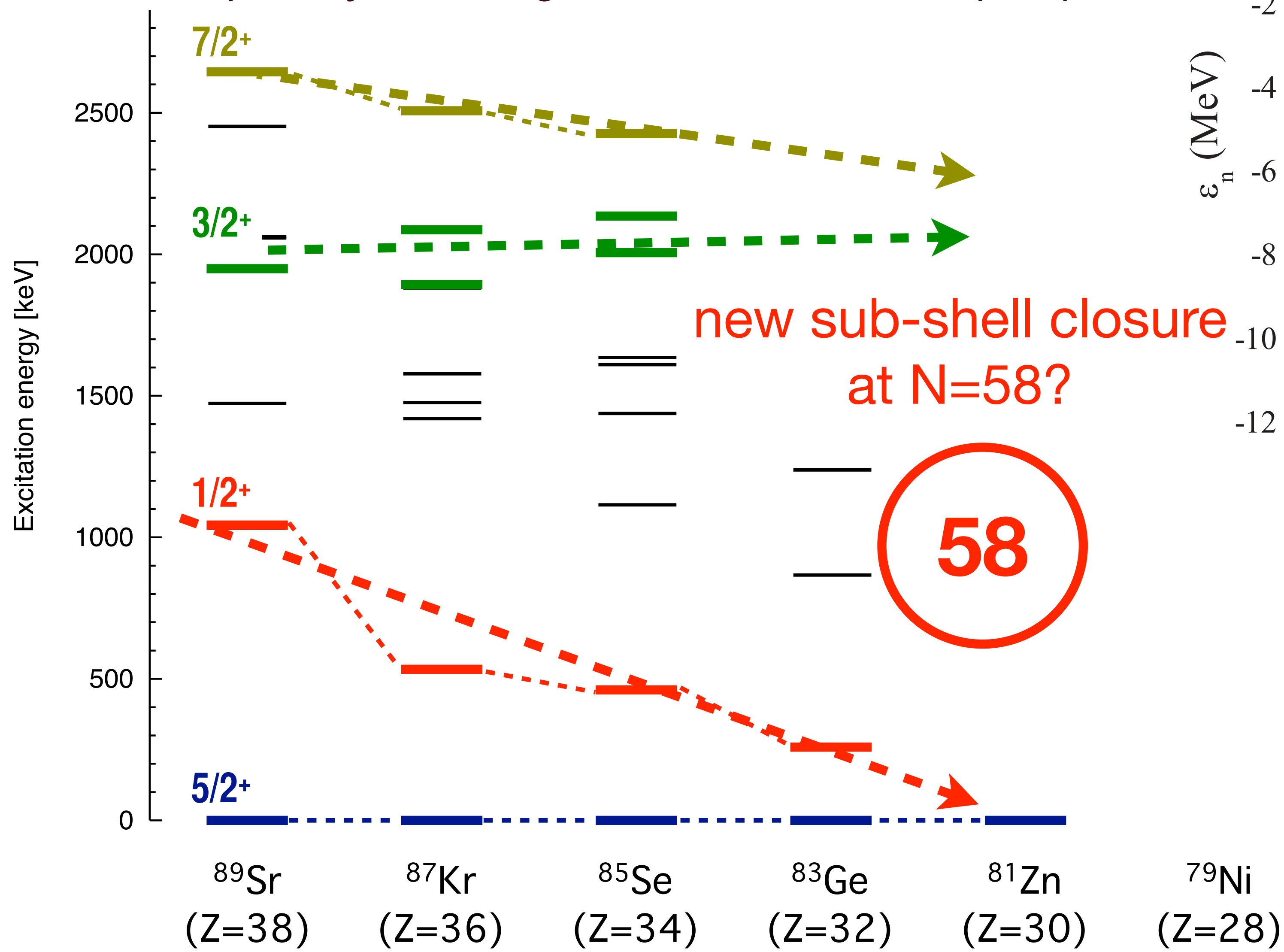
Shell evolution for neutron in N=51 isotone

inversion of $s_{1/2}$ and $d_{5/2}$ at ^{81}Zn?

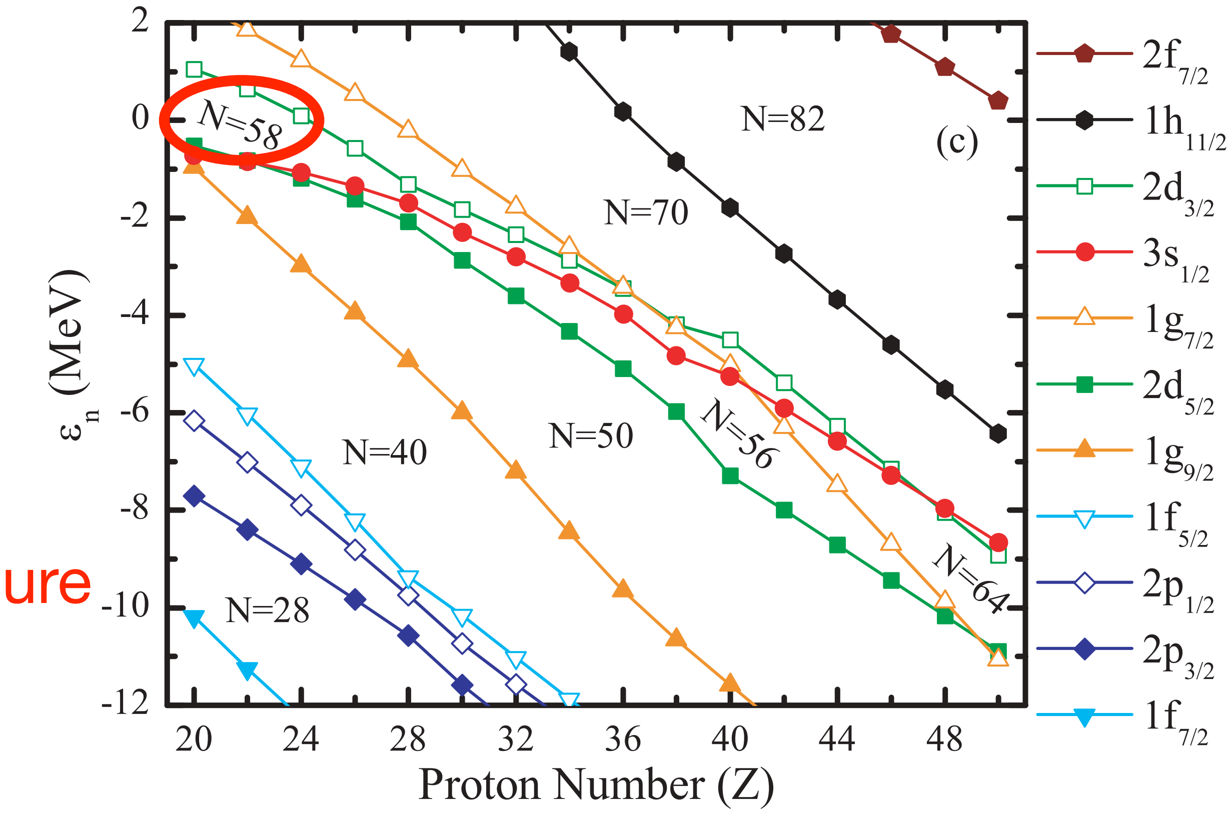
81Zn β-decay: D. Verney et al., PRC 76, 054312 (2007)

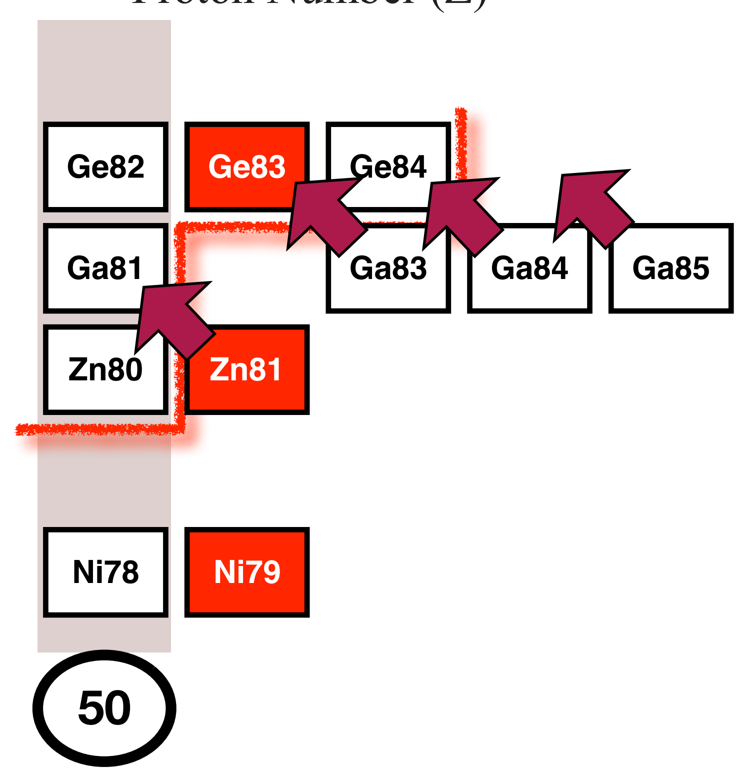
new sub-shell closure at N=58?

83-85Ga β-decay: J.A. Winger et al, PRC 81, 044303 (2010)



Single particle orbits in N=50 isotone
from spherical HFB calculations

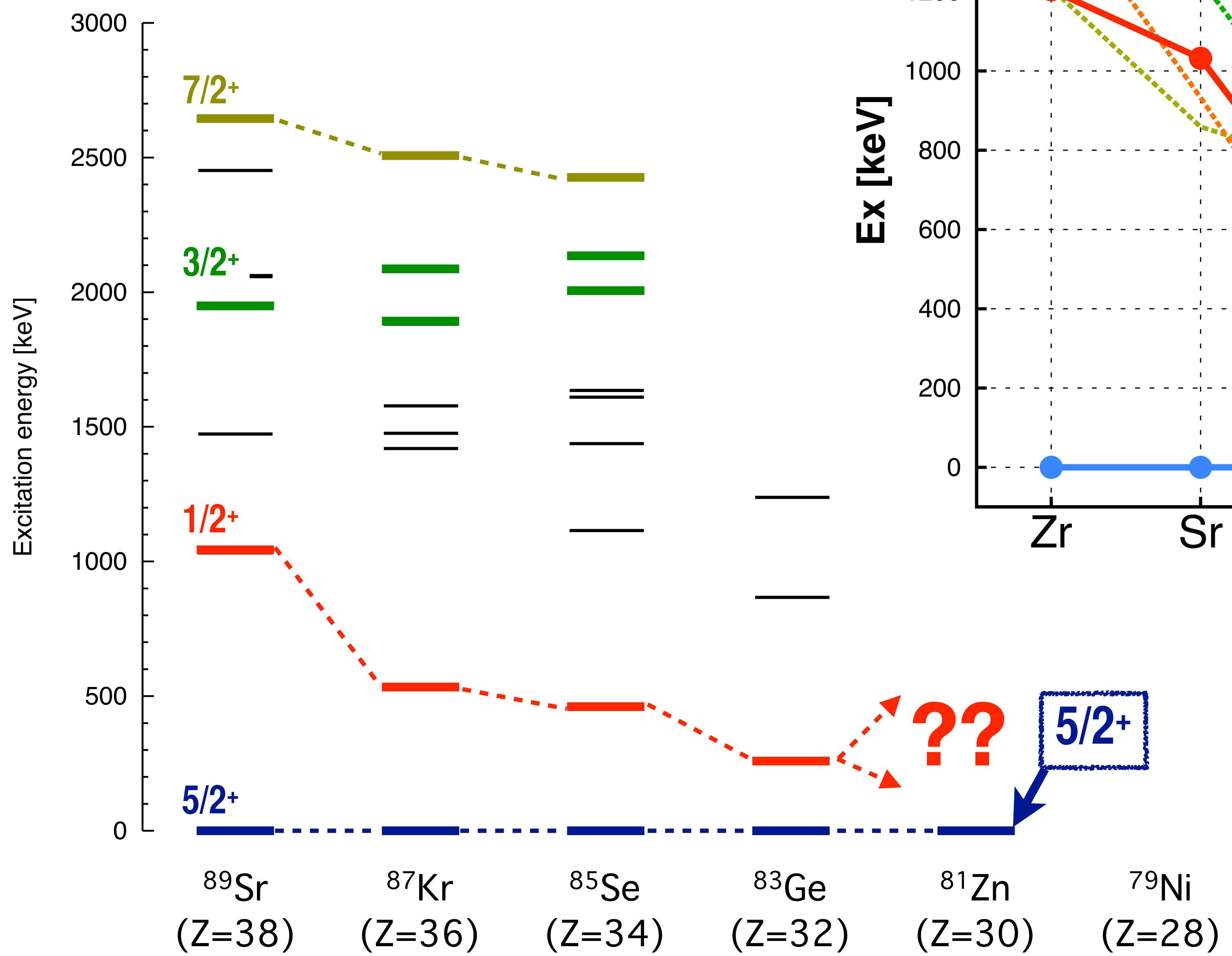


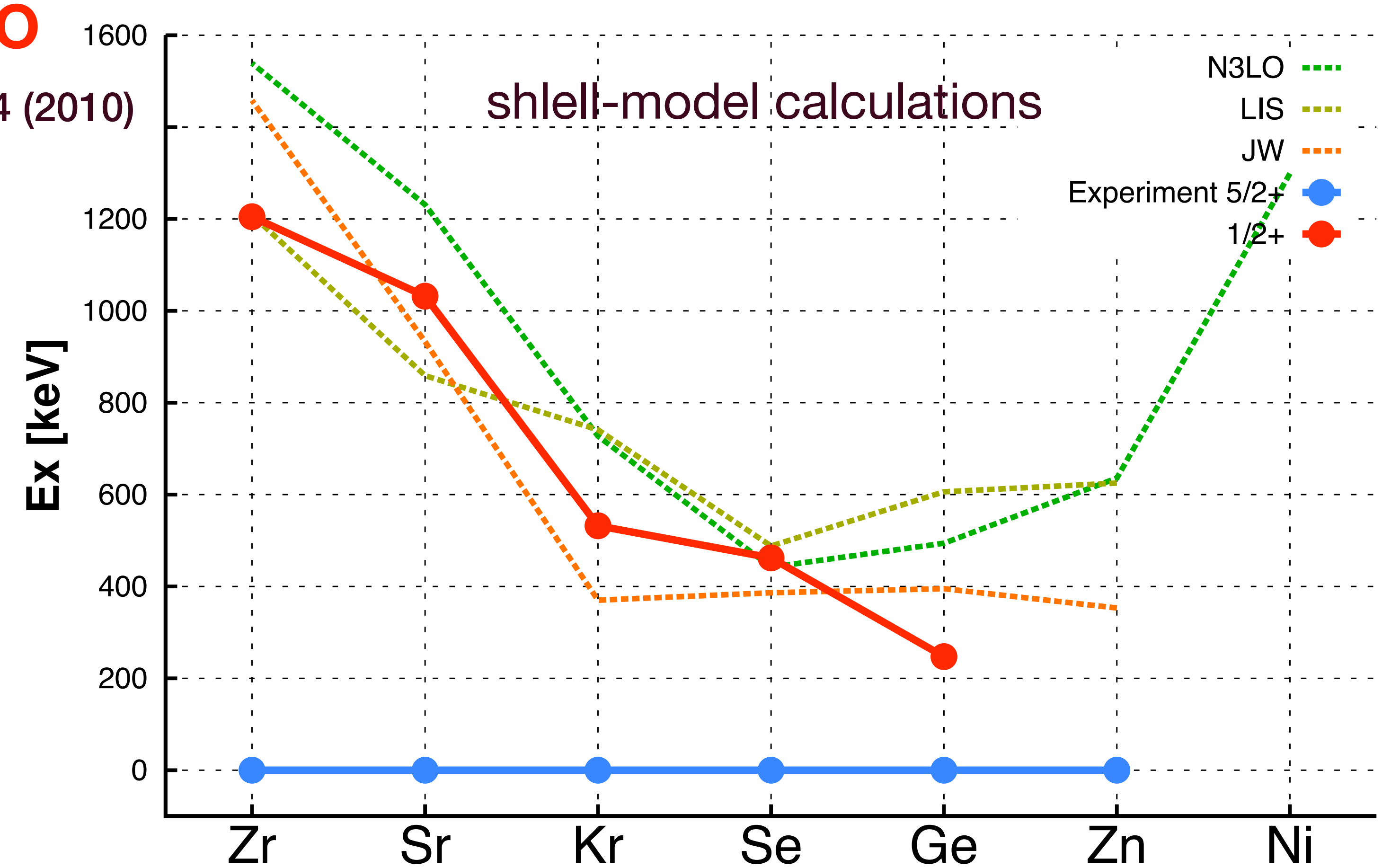


Shell evolution for neutron in N=51 isotone

inversion of $s_{1/2}$ and $d_{5/2}$ at ^{81}Zn? → **NO**

81Zn β-decay: S. Padgett et al., PRC 82, 064314 (2010)





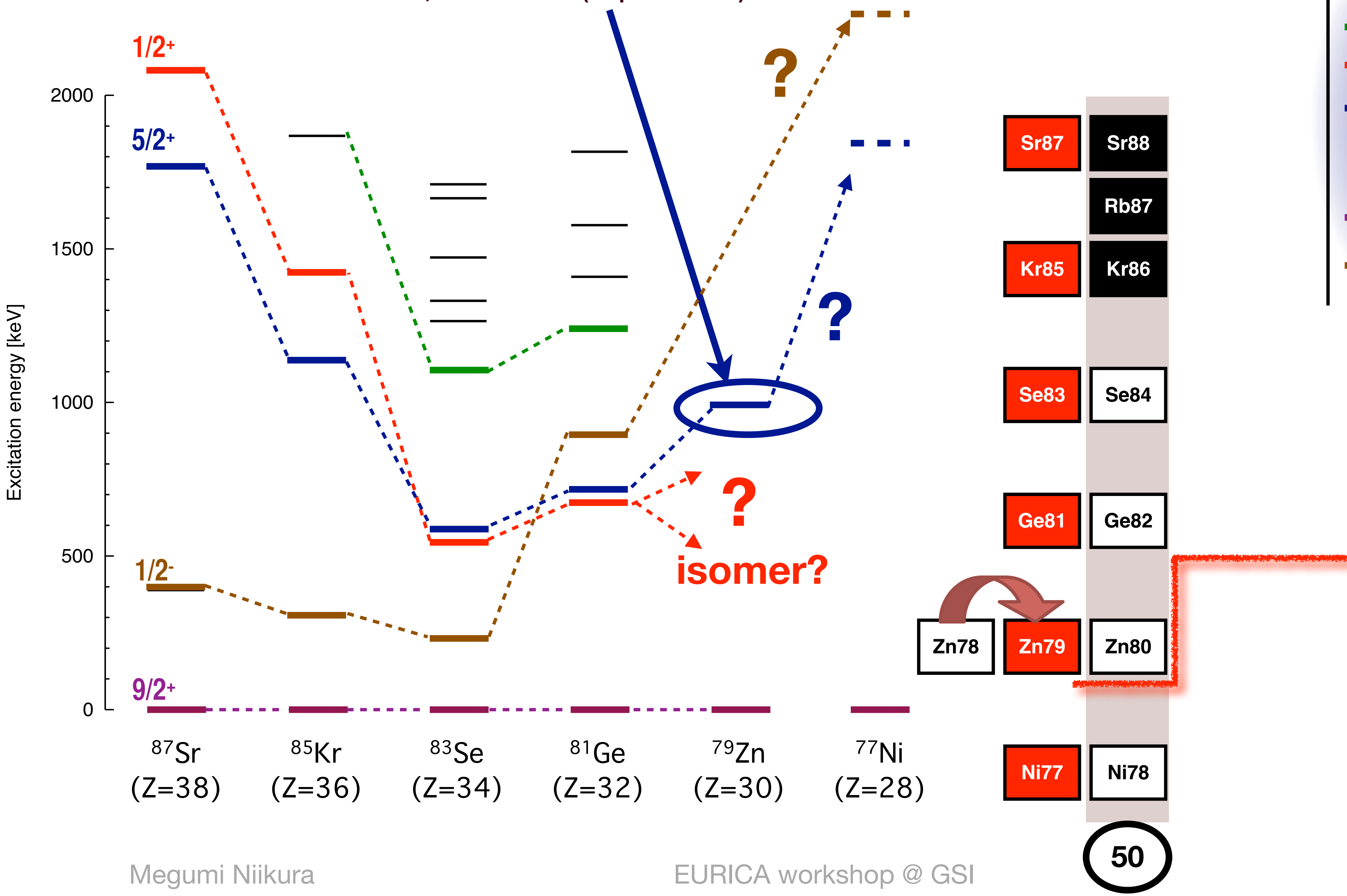
N3LO: S. Padgett et al., PRC 82, 064314 (2010).
LIS : A.F. Lisetskiy et al., PRC 70, 044314 (2004).
modified K. Sieja et al., PRC 79, 064310, (2009).
JW : Ji and Xiangdong, PRC 37, 1256 (1988).

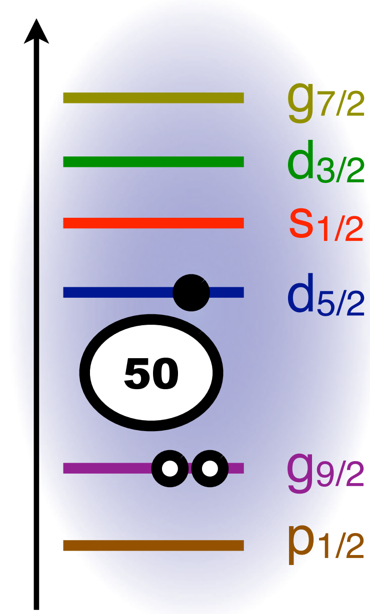
Some hint from N=49 isotone systematics

(d,p) measurement at ISOLDE

R. Orlandi et al., ARIS Conf. (unpublished)

Shell-model calc.
from D. Sohler's presentation





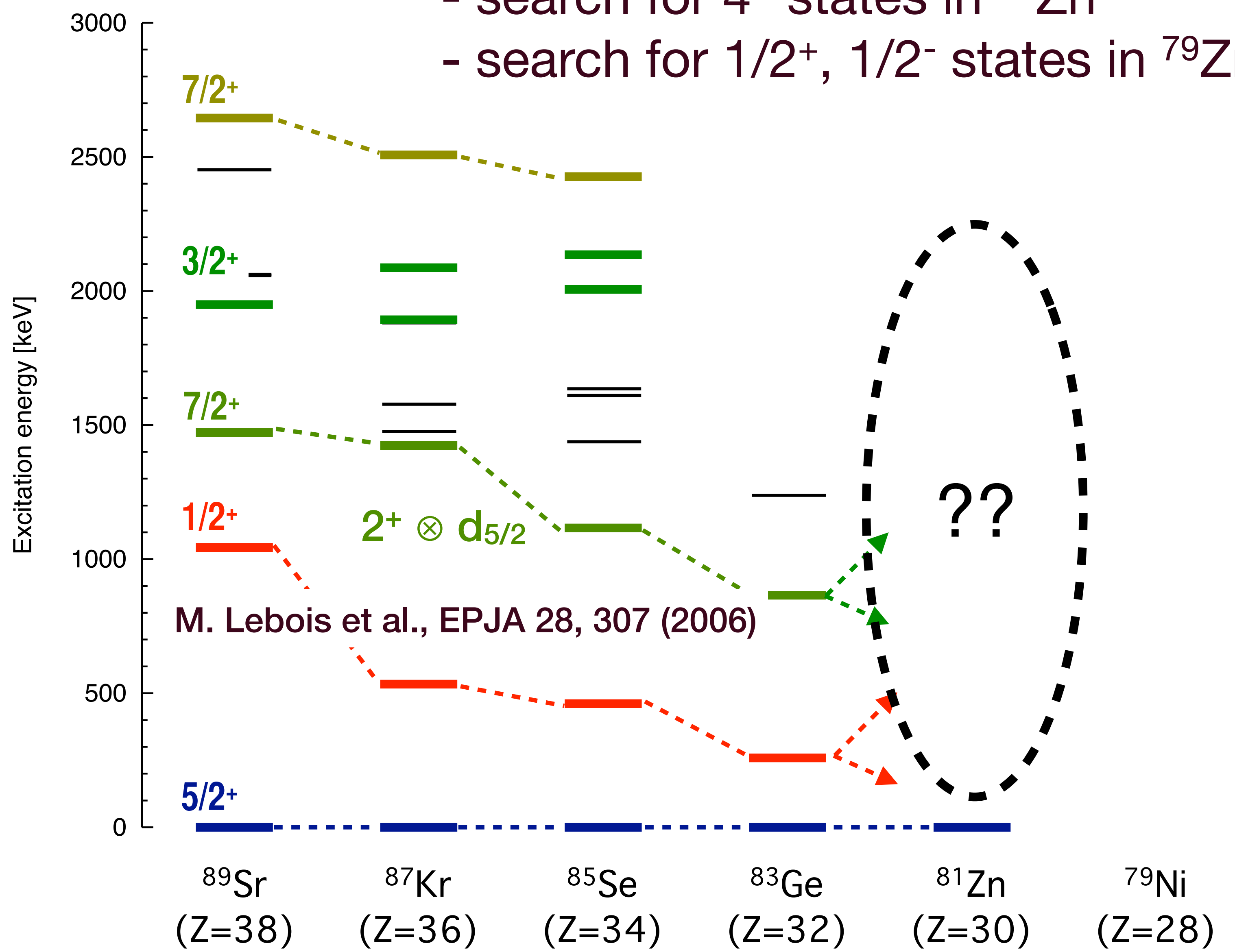
Proposed experiment

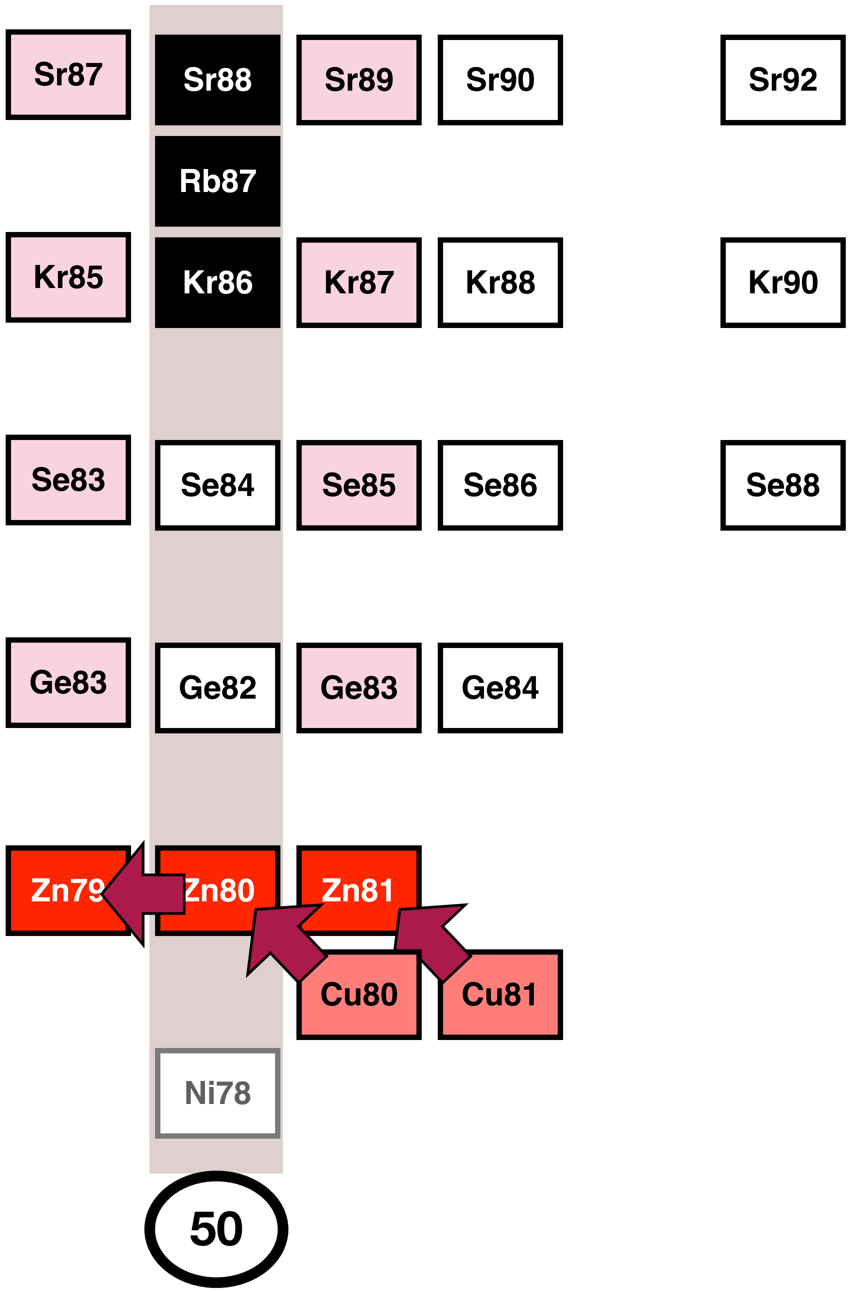
NOTHING IS KNOWN ABOUT EXCITED STATES in ^{81}Zn!

→ β-γ spectroscopy following ^{81}Cu

in addition..

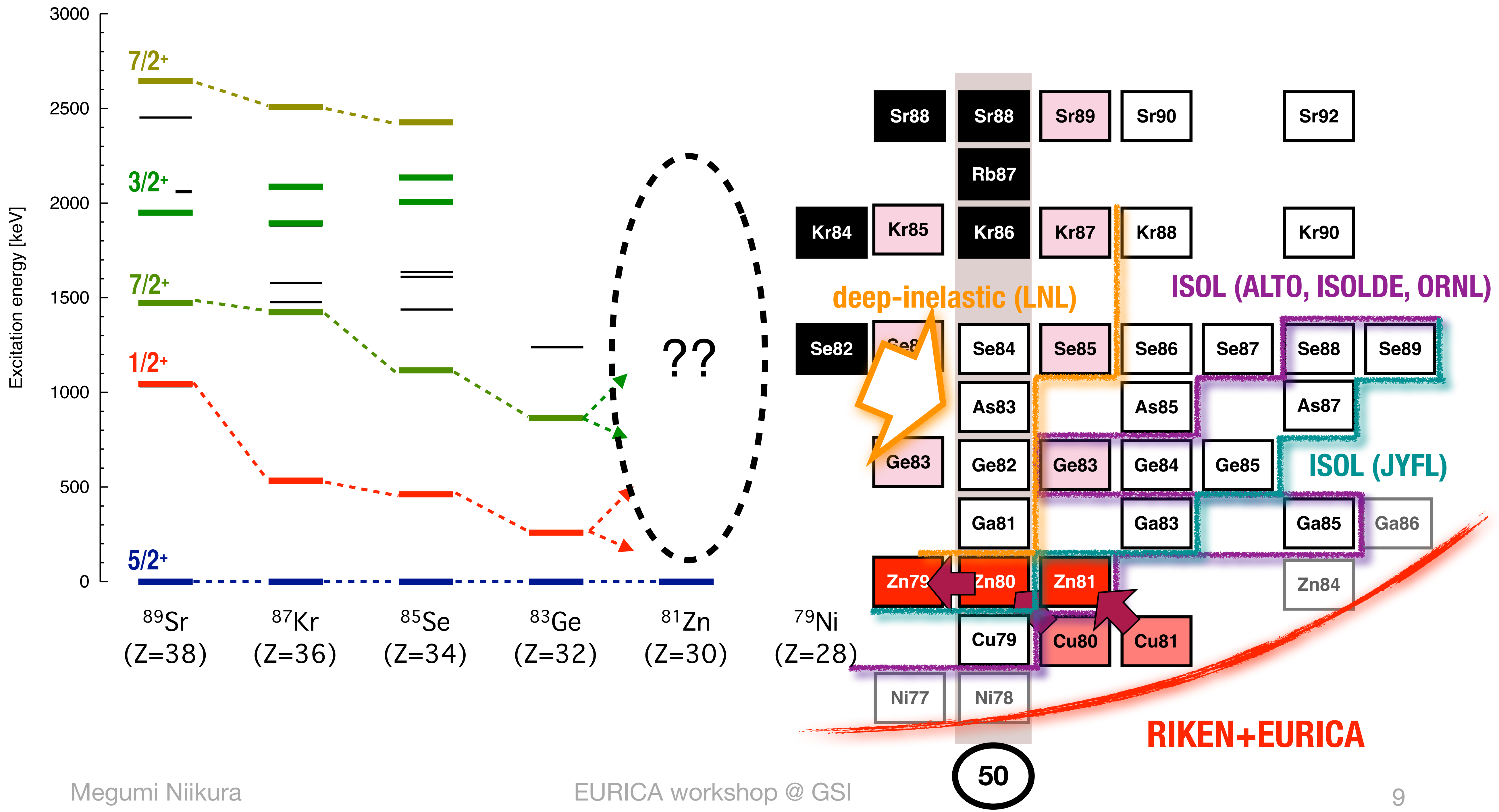
- search for 4^+ states in ^{80}Zn
- search for $1/2^+$, $1/2^-$ states in ^{79}Zn





Advantage of RIBF+EURICA

Deep-inelastic reaction : G. de Angelis NPA 787, 74c (2007)
ISOLDE : http://oraweb.cern.ch/pls/isolde/query_tgt
Mass mesurement : J. Hakala et al., PRL 101, 052502 (2008)



Beam time estimation

- U beam intensity : 5 pnA
- β efficiency: 50%
- γ efficiency: 20%

- cocktail beam of ^{79,80,81}Cu
  (same setting for ^{78}Ni half-life measurement)

- 5×10^3 ^{81}Cu-decays / week
- 5×10^4 ^{80}Cu-decays / week
- 2×10^5 ^{79}Cu-decays / week

- 200 counts of β-γ coin. / week for ^{81}Zn
- 2300 counts of β-γ coin. / week for ^{80}Zn
- 10000 counts of β-γ coin. / week for ^{79}Zn

I.N. Borzov, PRC 71, 065801 (2005)