WNPPC 2019

NUCLEAR STRUCTURE OF ^{98}Ru USING β DECAY

SALLY VALBUENA BURBANO

DEPARTMENT OF PHYSICS
GUELPH, ONTARIO
CANADA
2019

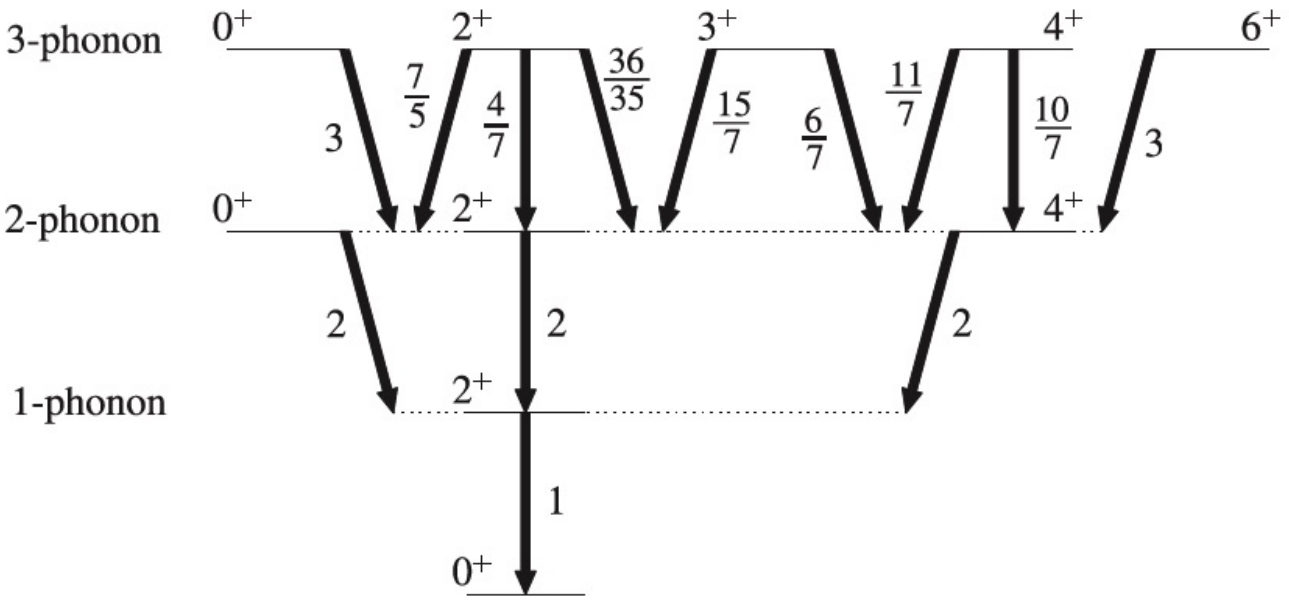
1. Spherical vibrational collectivity
   - Harmonic quadrupole vibrator
   - Candidates for spherical vibrational motion
   - Low-lying levels in ^{98}Ru
2. Experimental Techniques and Equipment
   - $\beta-$ decaying states of ^{98}Rh
   - Experiment
3. Results
   - $\gamma-$ray coincidence spectra observed ^{98}Rh
   - Partial level scheme of ^{98}Ru
   - Partial level schemes of the Ru isotopes
4. Conclusions

Bohr–Mottelson model of vibrations-Harmonic quadrupole vibrator

- $B(E2)$ values for transition obey the property:

$$\Sigma_{I_f^{N-1}} B(E2; I_i^N \rightarrow I_f^{N-1}) = NB(E2; 2_1^+ \rightarrow 0_1^+) \quad (1)$$

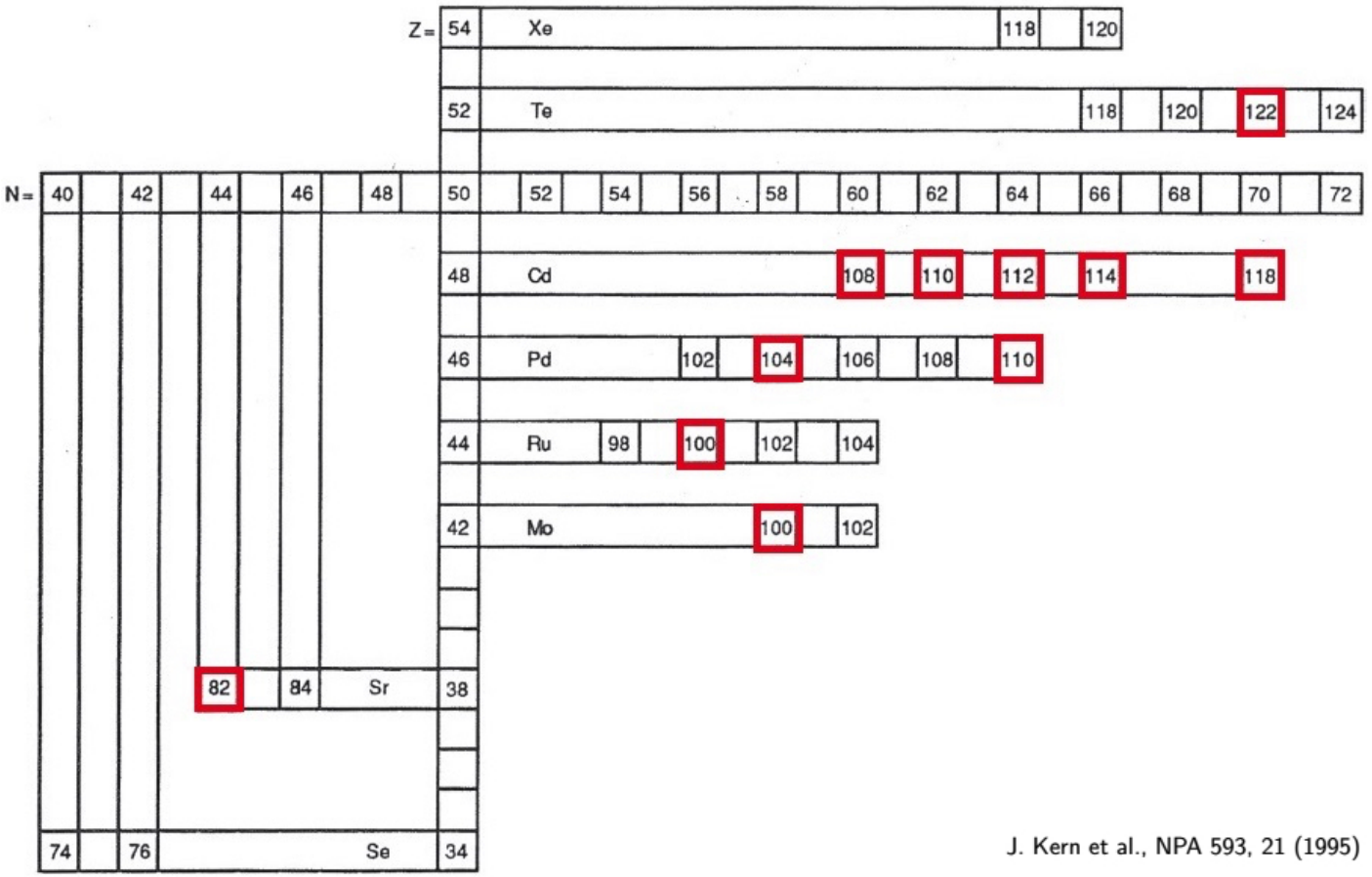
- Allowed $\Delta N = -1$ transitions



P. Garrett et al, PG: NPP 37, 064028

Candidates for spherical vibrational motion ($U(5)$ symmetry) near Z=50

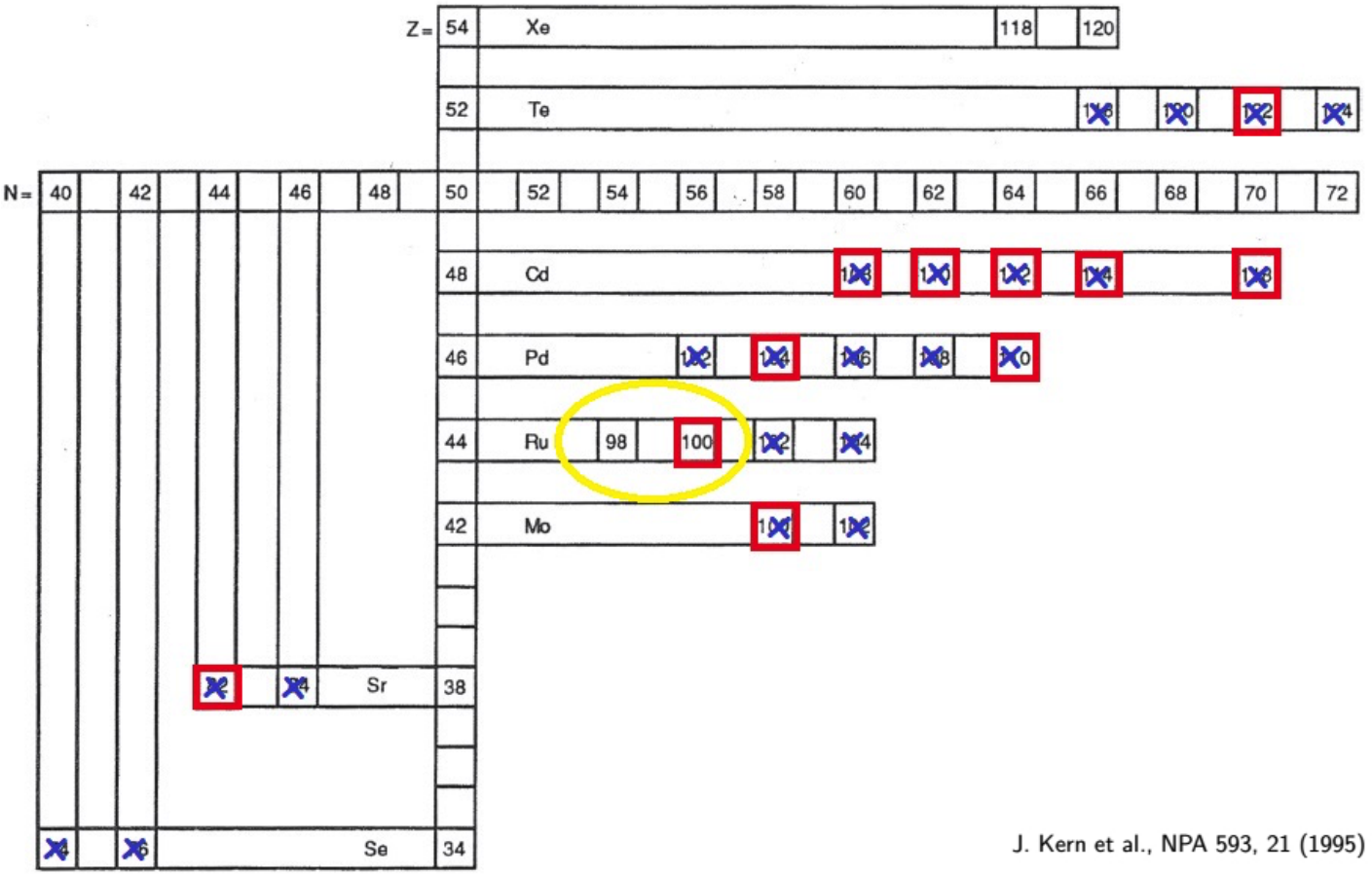
- Survey from 1995



J. Kern et al., NPA 593, 21 (1995)

Candidates for spherical vibrational motion near Z=50

- Updated survey 2018

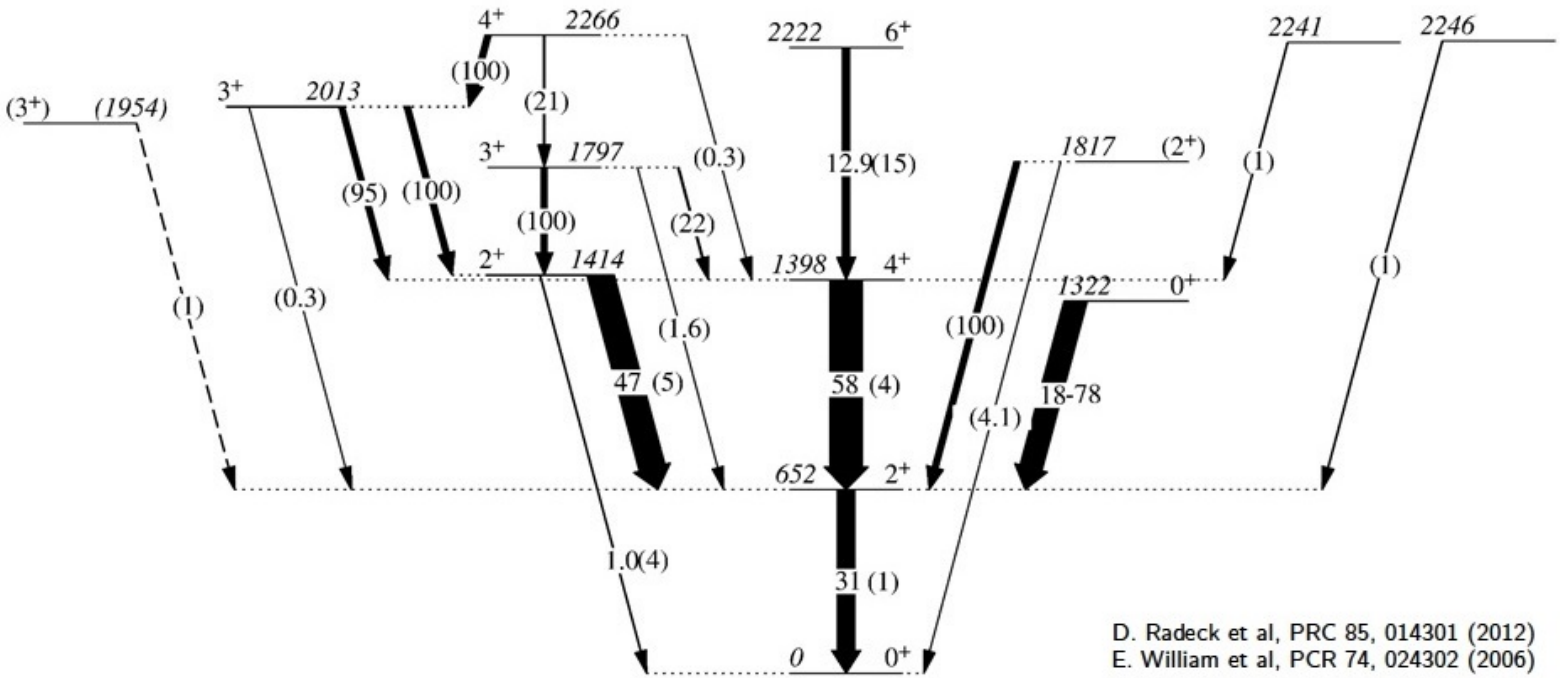


Garrett, Wood, and Yates, Phys. Scr. 93, 063001 (2018)

Low−lying levels in ^{98}Ru

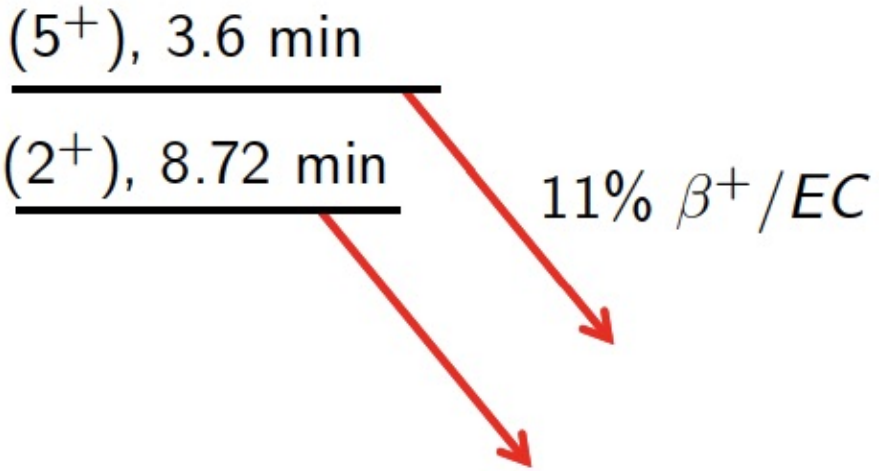
PROBLEM: Decays of the low-spin levels in the candidates are poorly characterized.

- Low energy
- γ−ray decay branches



$\beta-$ decaying states of ^{98}Rh

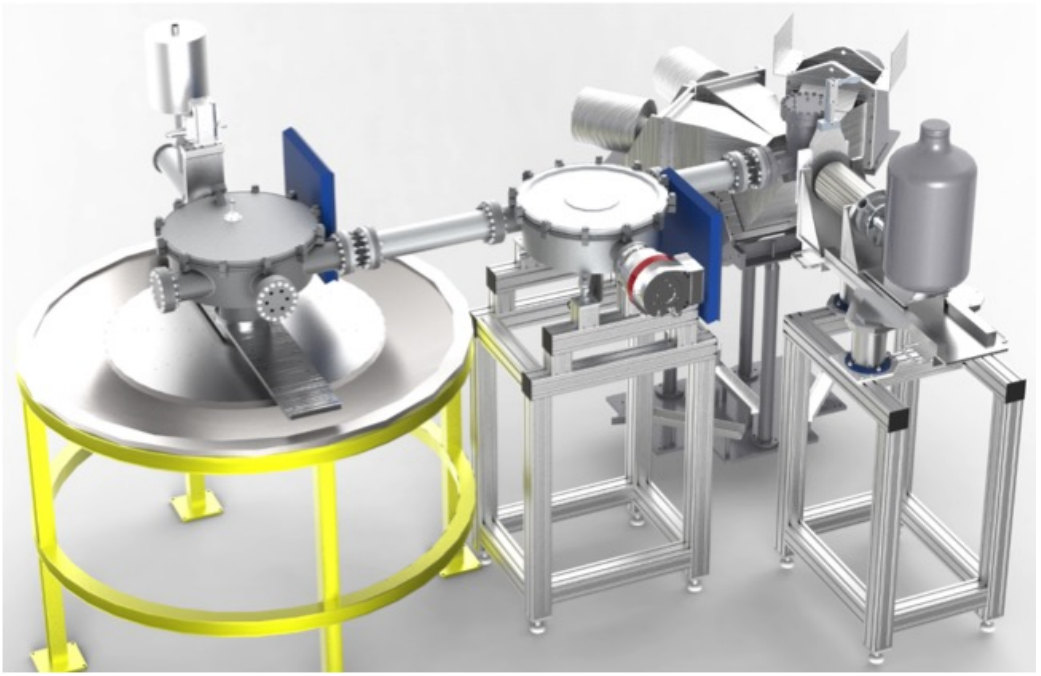
- β-decay ideal way to populate low-spin states at high excitation energy to seek weak decay branches
- Q =5057 (10)keV



- PROBLEM: Rh is a refractory element. ISOL facilities not an option.

SOLUTION:

Newly commissioned β decay tape Station at iThemba Labs

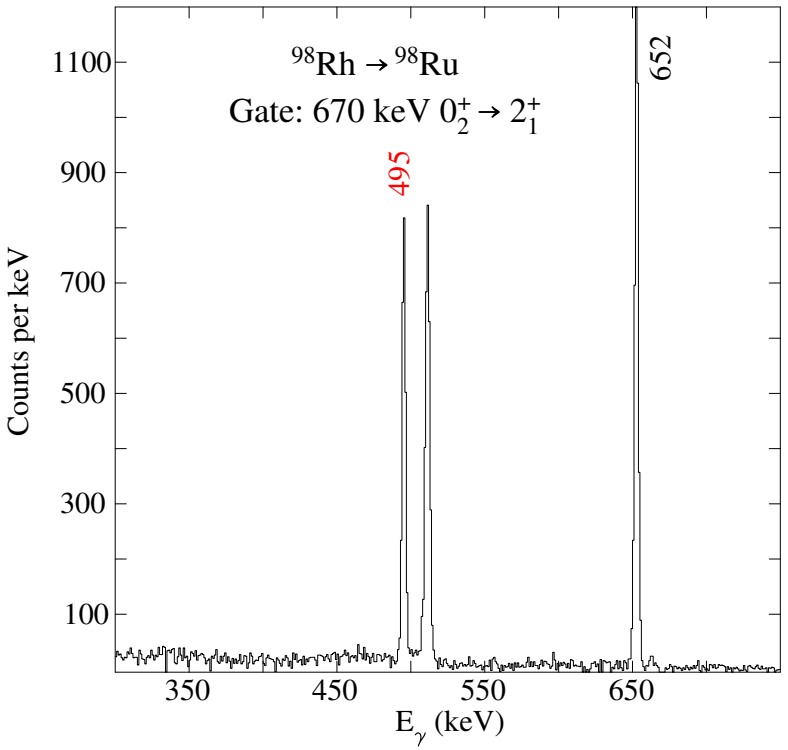


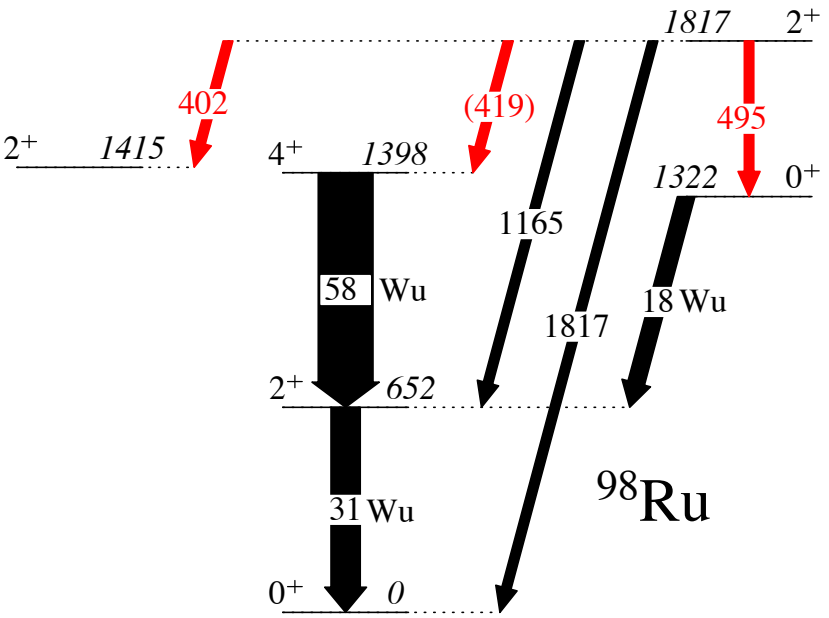
Beam: ^{12}C
Target: ^{98}Y
Product: ^{98}Rh
Beam energy: 45 MeV
Beam current: 10 nA

Detectors:

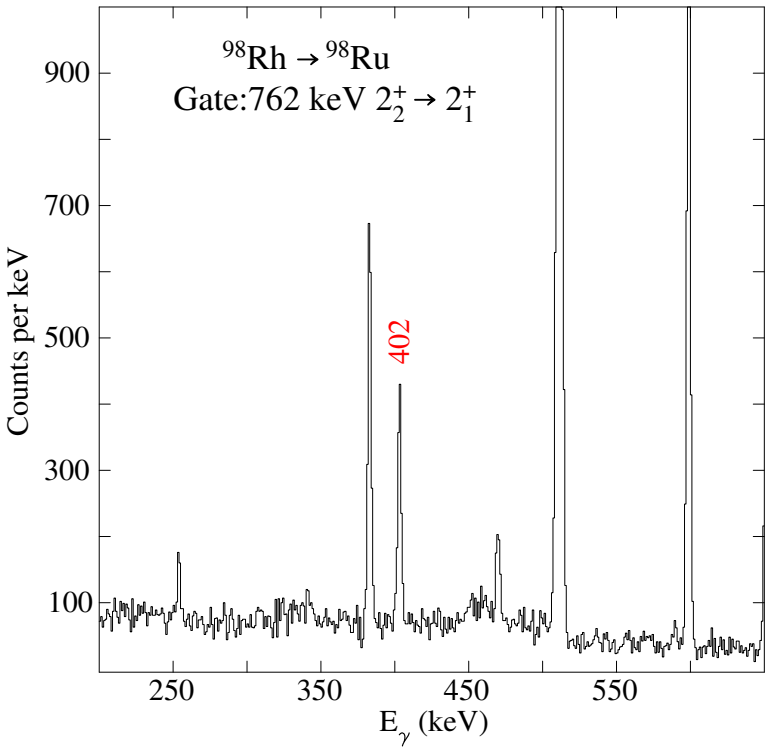
3 Clover + 1 Tigress (germanium): $\gamma-$rays
1 plastic scintillator : β particles
SiLi : Electron conversion

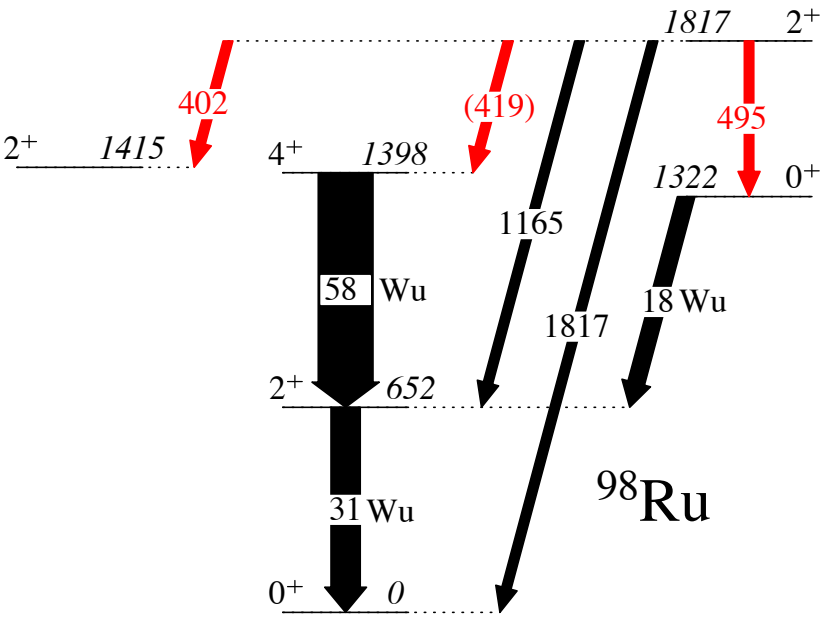
$\gamma-$ray coincidence spectra observed ^{98}Rh



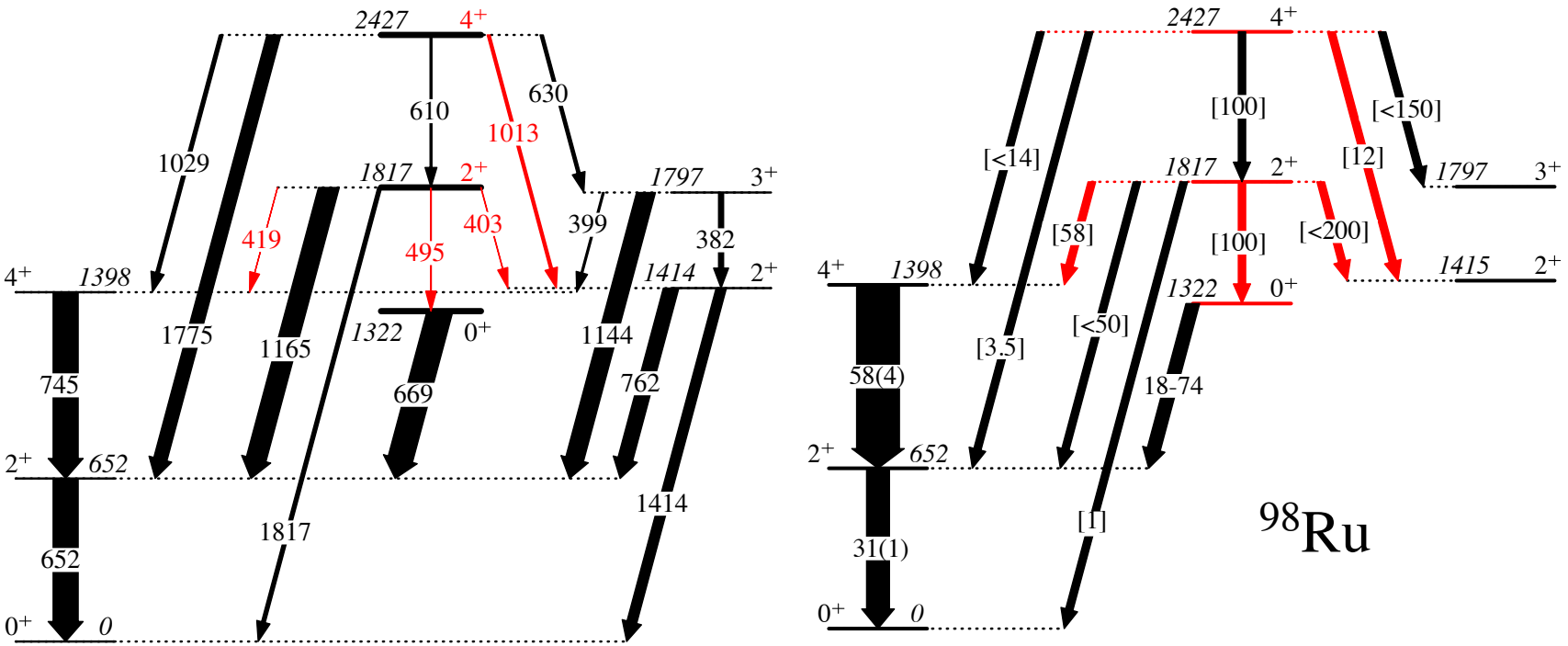


$\gamma-$ray coincidence spectra observed ^{98}Rh

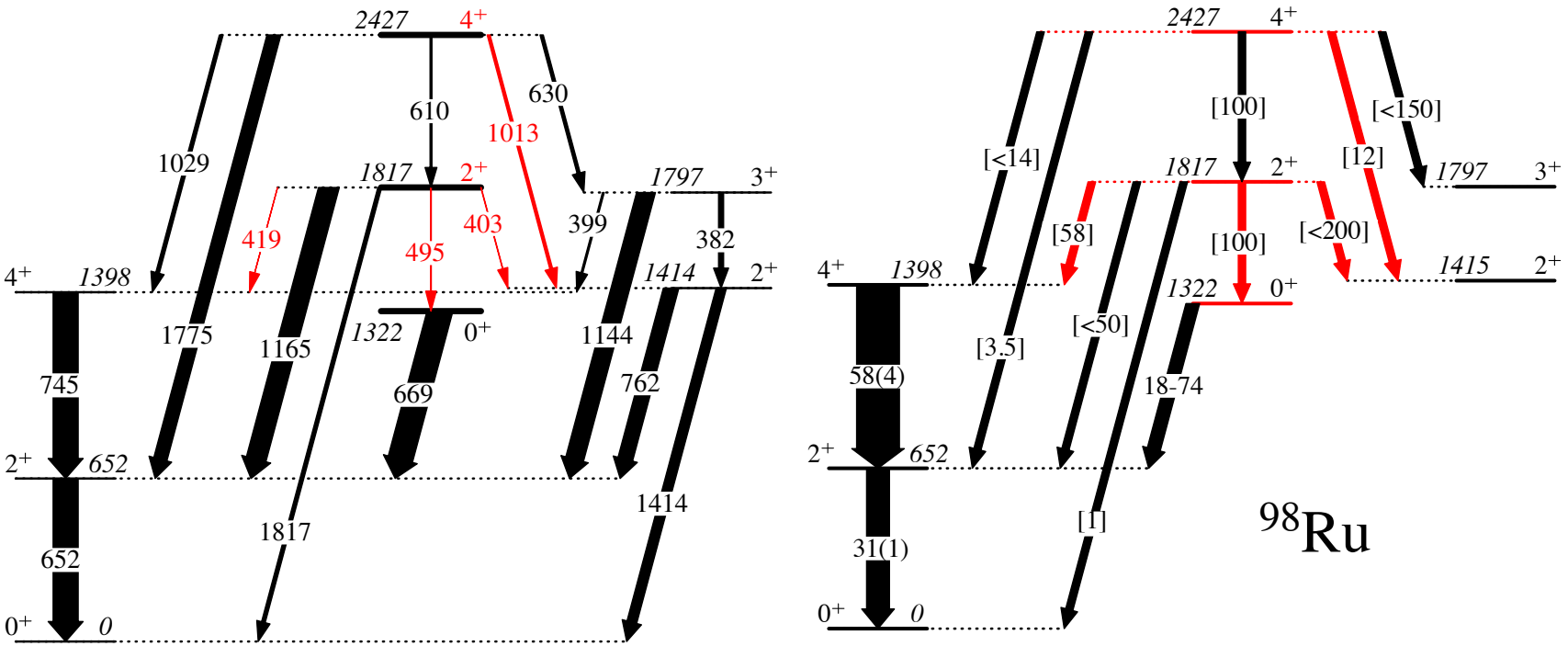




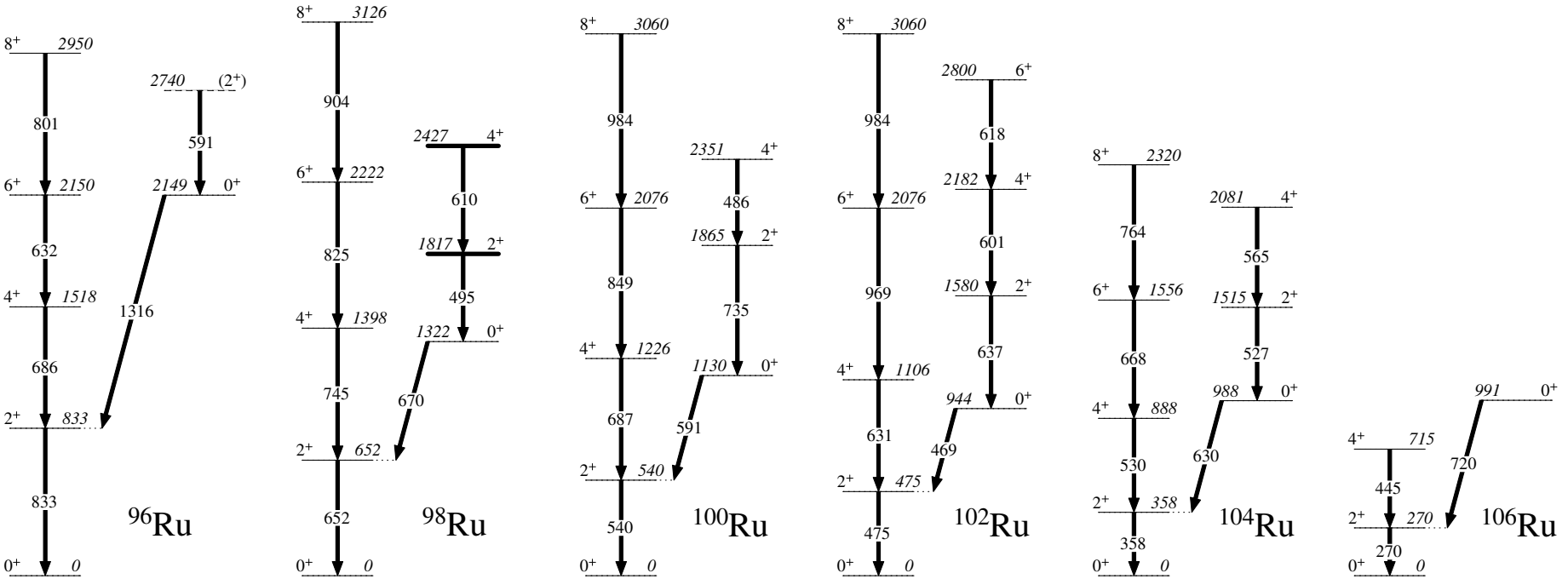
Partial level scheme of ^{98}Ru



Partial level scheme of ^{98}Ru



Partial level schemes of the Ru isotopes



Conclusions

- ^{98}Ru is considered one of the best candidates for vibrational behaviour.
- Very high-statistics data sets were collected for $^{98,100}Ru$, resulting in considerable expansions of their decay schemes.
- Several weak E2 transitions were newly observed
  - 495 keV $(2_3^+ \rightarrow 0_2^+)$
  - 402 keV $(2_3^+ \rightarrow 2_2^+)$
  - 419 keV $(2_3^+ \rightarrow 4_1^+)$

THANK YOU

Collaborators:

University of Guelph:

Paul Garret
Vinzenz Bildstein

University of Zuzuland:

S. Ntshangase

iThemba Labs

Rob Bark
Lucky Makhathini
D. Bucher
E. Lawrie
K. Lawrie
B. Singh
R. Dubey

University of the Western Cape

S. Triambak
B. Rebeiro
Mohammed Kamil
Cebo Malotano
J. Ondze
C. Mehl

References I


J. Kern, P.E. Garret, et al. *Search for nuclei exhibiting the U(5) dynamical symmetry*. 2005 [arXiv:hep-ph/0502010v1]


P. E. Garret, J. L. Wood and S. W. Yates, Critical insights into nuclear collectivity from complementary nuclear spectroscopic methods.[https://doi.org/10.1088/1402-4896/aaba1]


K. Green. *Nuclear Structure of* ^{112}*Cd Through Studies of* β. University of Guelph, 2009.


Data as compiled at www.nndc.bnl.gov