

Recent Developments in Collinear Laser Spectroscopy at COLLAPS

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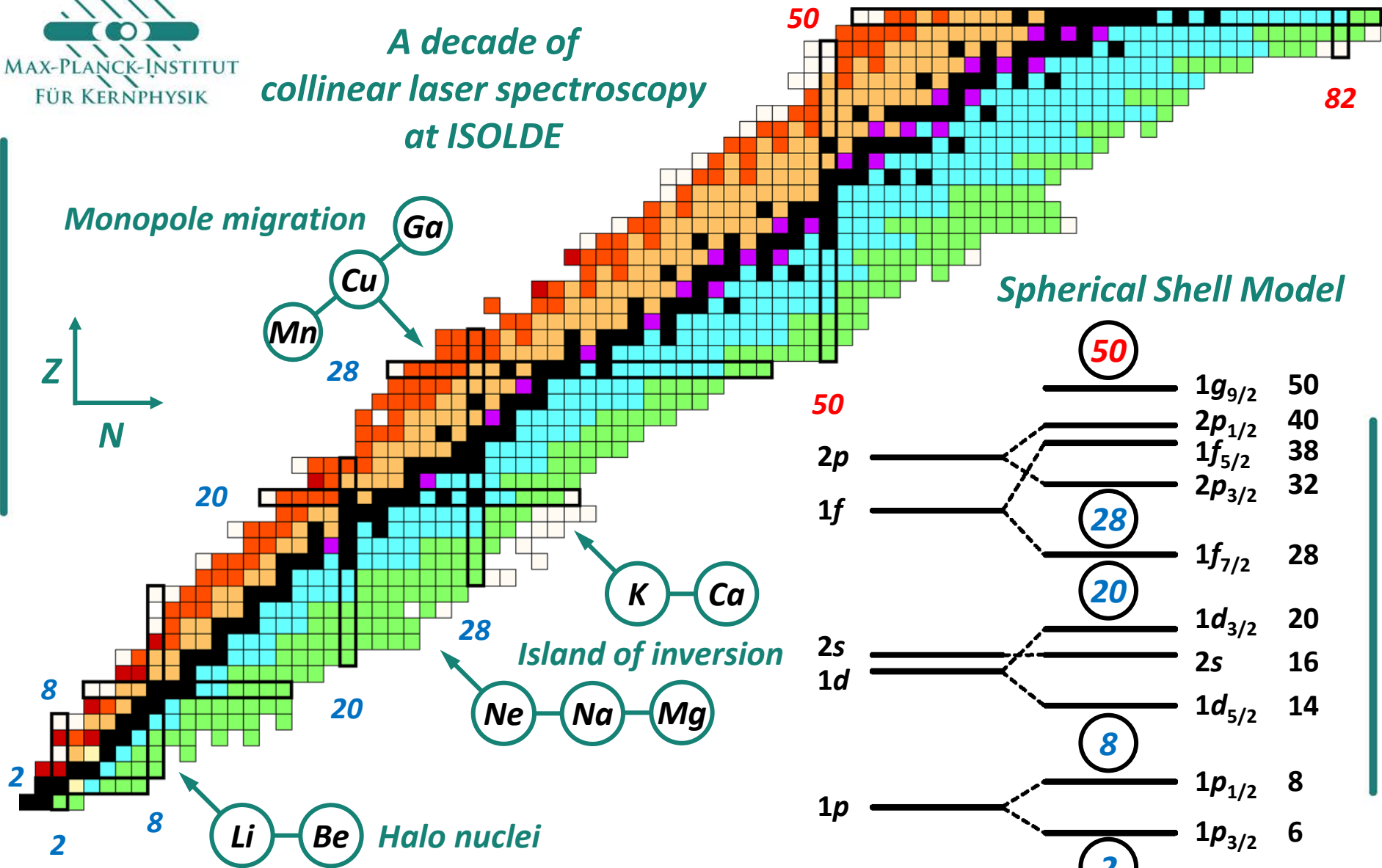
⁷Organisation Européenne pour la Recherche Nucléaire, CH-1211 Geneva 23, Switzerland

⁸GSI Helmholtzzentrum für Schwerionenforschung GmbH, D-64291 Darmstadt, Germany

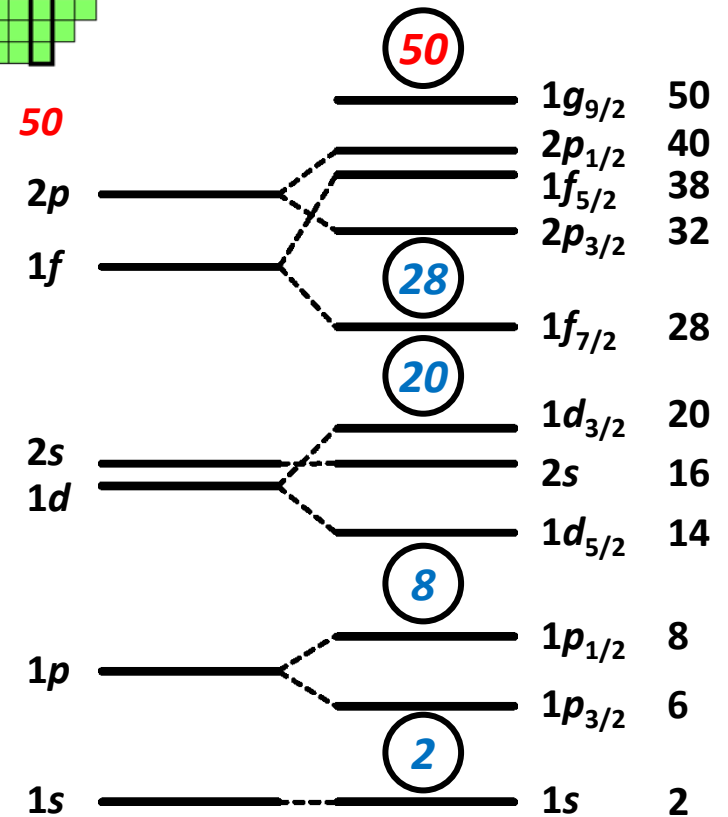
⁹Helmholtz Institute Mainz, D-55099 Mainz, Germany

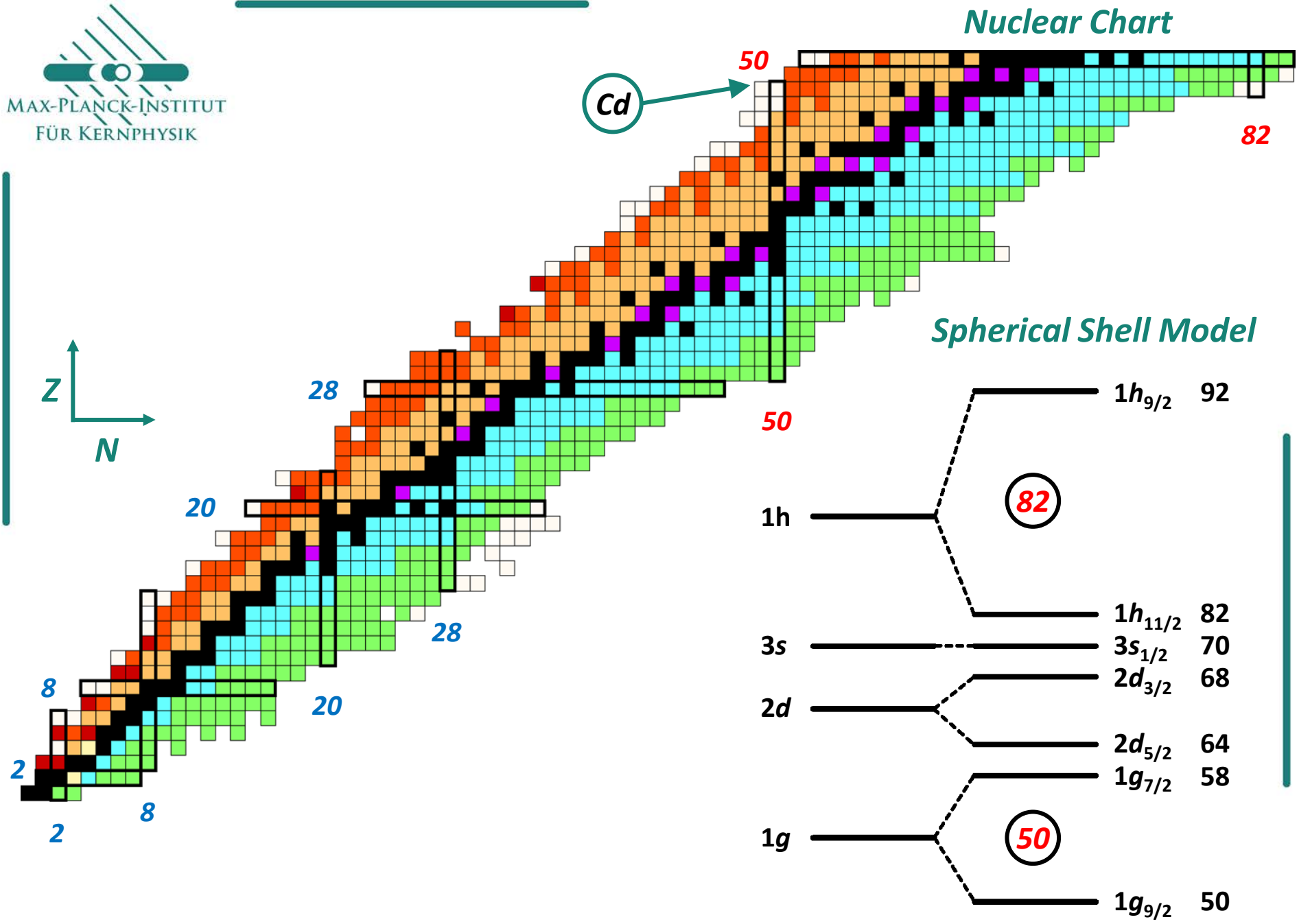
A decade of
collinear laser spectroscopy
at ISOLDE

Nuclear Chart



Spherical Shell Model

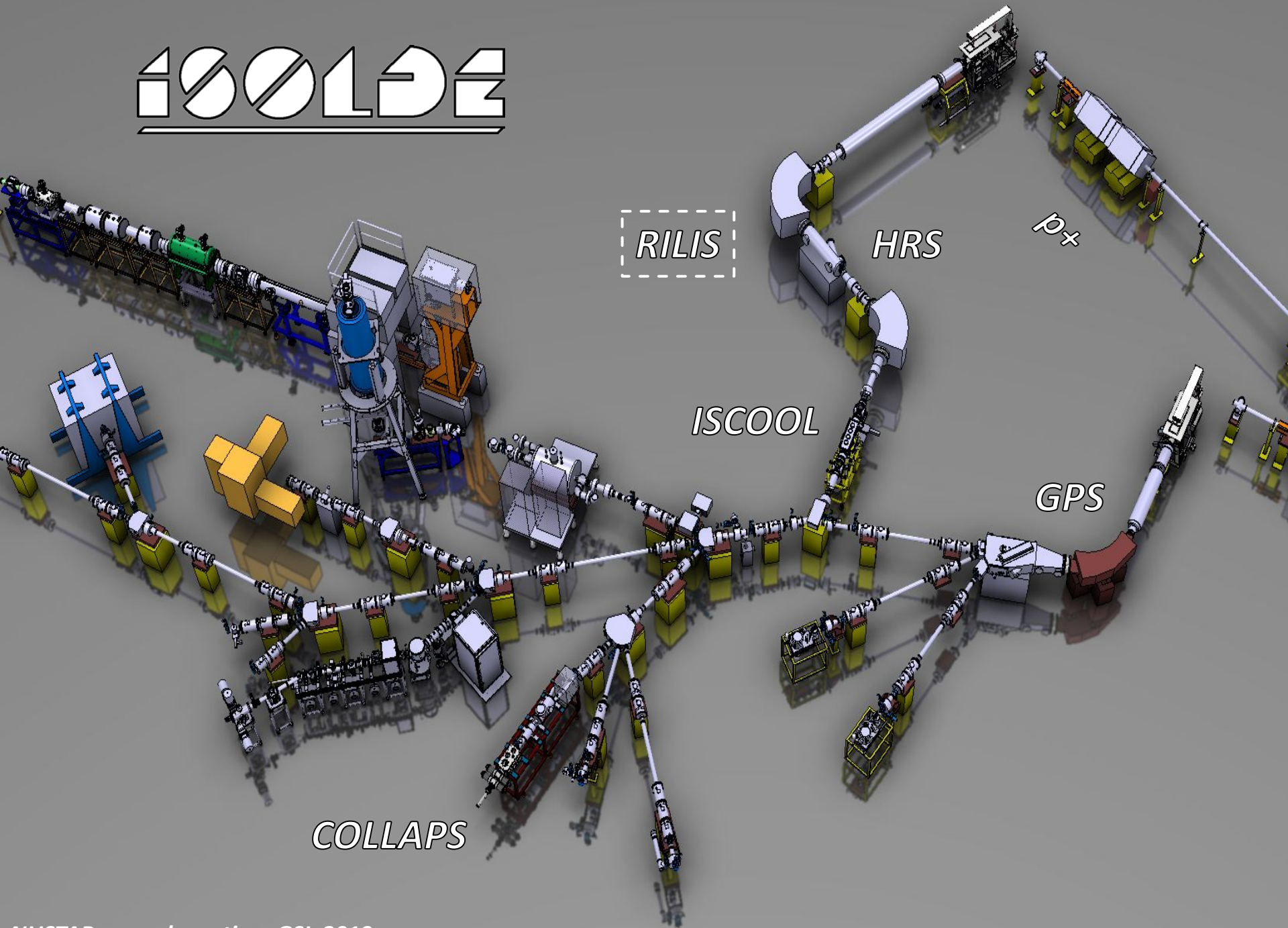




Outline

- **Mg: Island of inversion**
Charge radii by beta detection
- **Be: Halo nuclei and $N = 8$ breakdown**
Abs. frequency measurements
- **K: Spin measurements**
Opt. detection for bunched beams
- **Mg: Bio physics**
NMR in liquids
- **Cd: Shell structure from Q moments**
Frequency quadrupling

ISO-LDE



RILIS

HRS

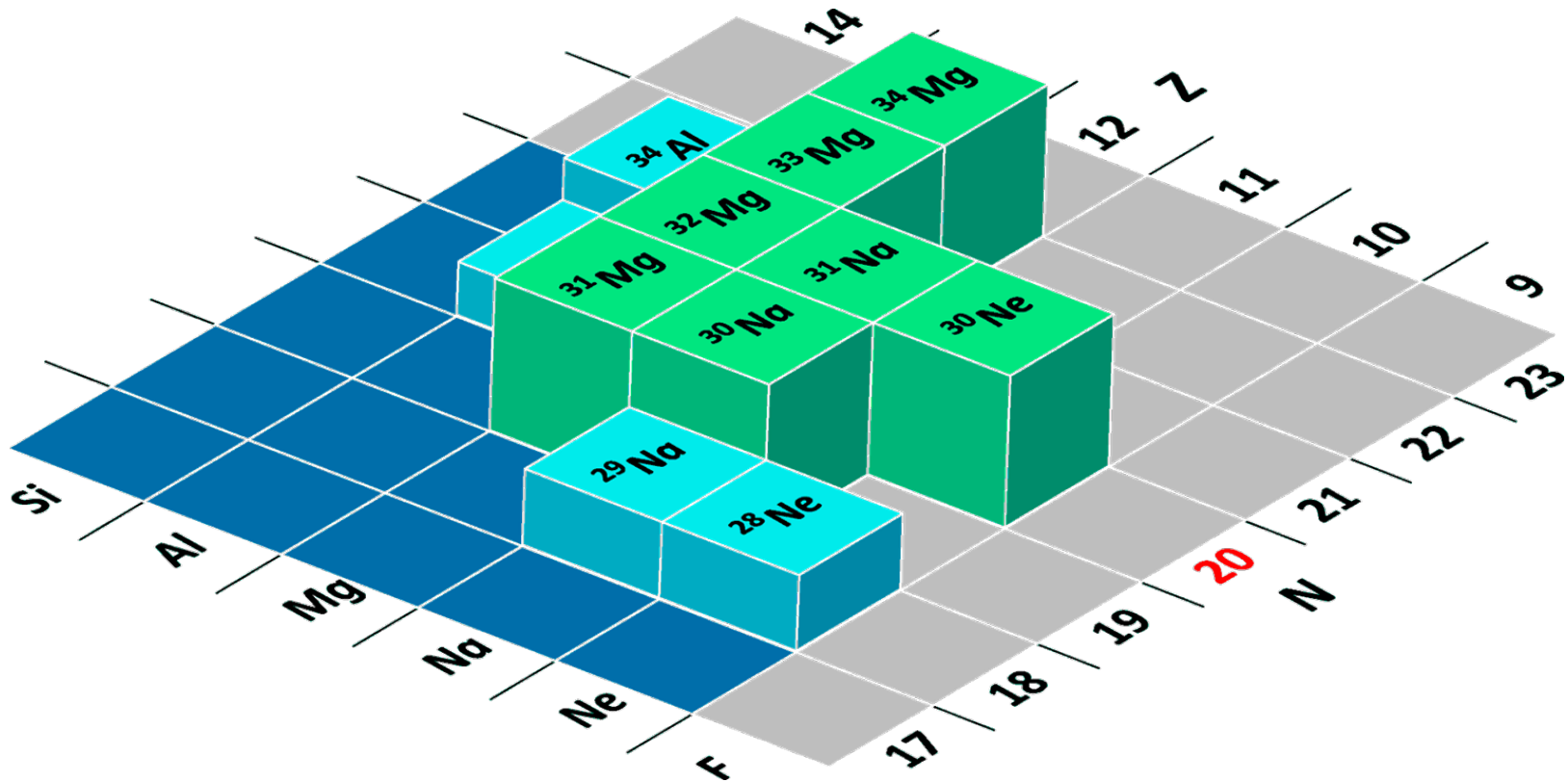
IPx

ISCOOL

GPS

COLLAPS

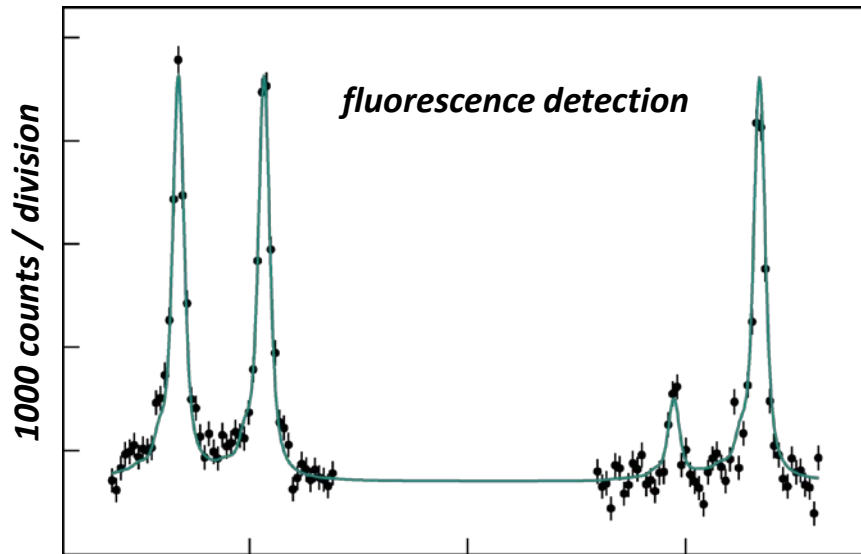
ISLAND OF INVERSION = ISLAND OF DEFORMATION ?



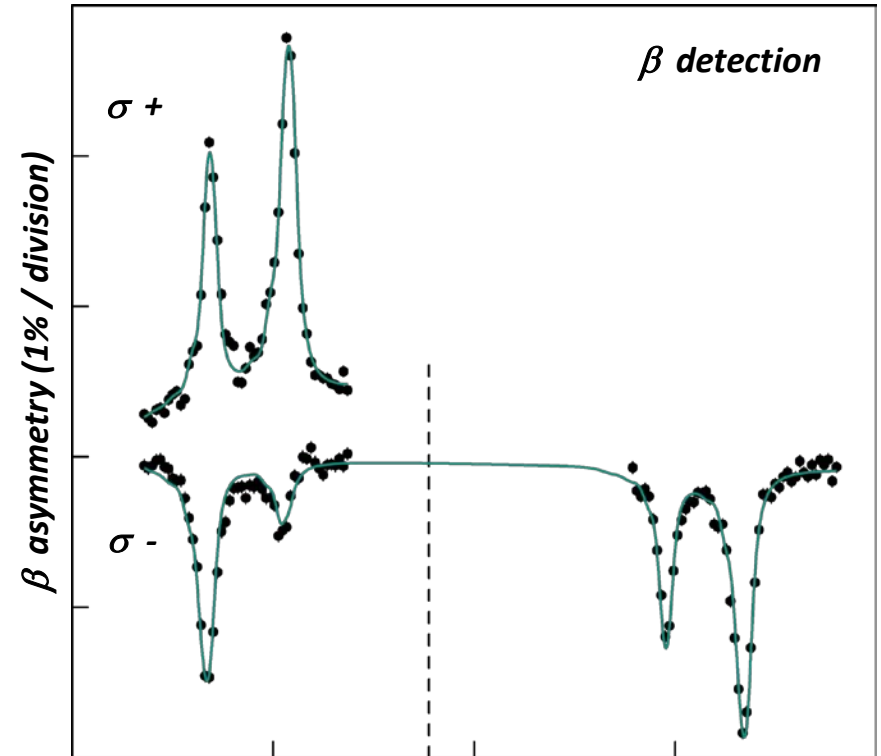
The "island of inversion" in terms of the SPHERICAL shell model

Proof of principle: fluorescence vs. β detection on ^{29}Mg

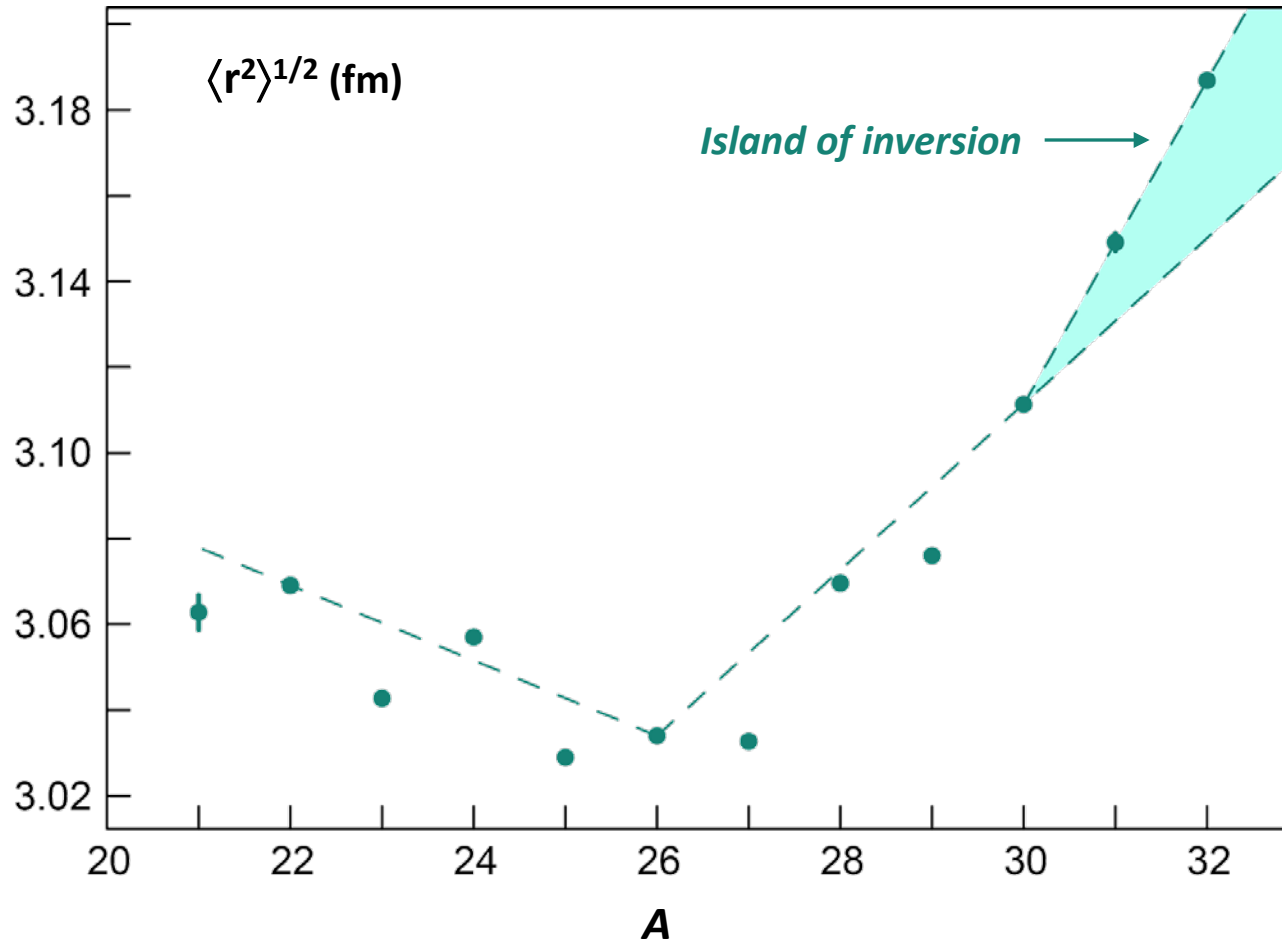
$$\delta\nu(\beta\text{-optical}) \approx 2 \times \sigma$$



$\delta\nu(3s\ ^2S_{1/2} - 3p\ ^2P_{1/2})^{29,26}$ (1GHz / division)

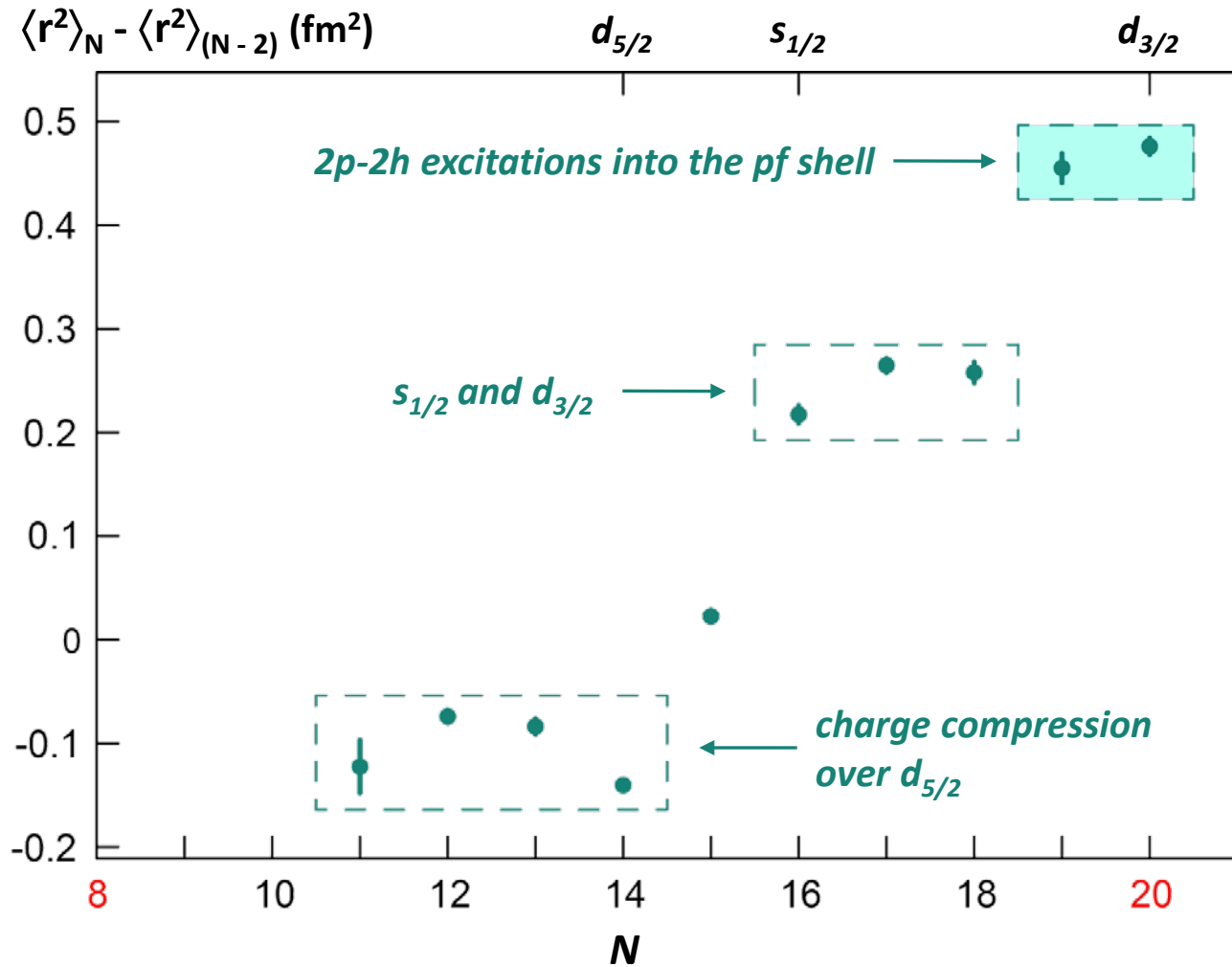


Rms charge radii in the sd shell



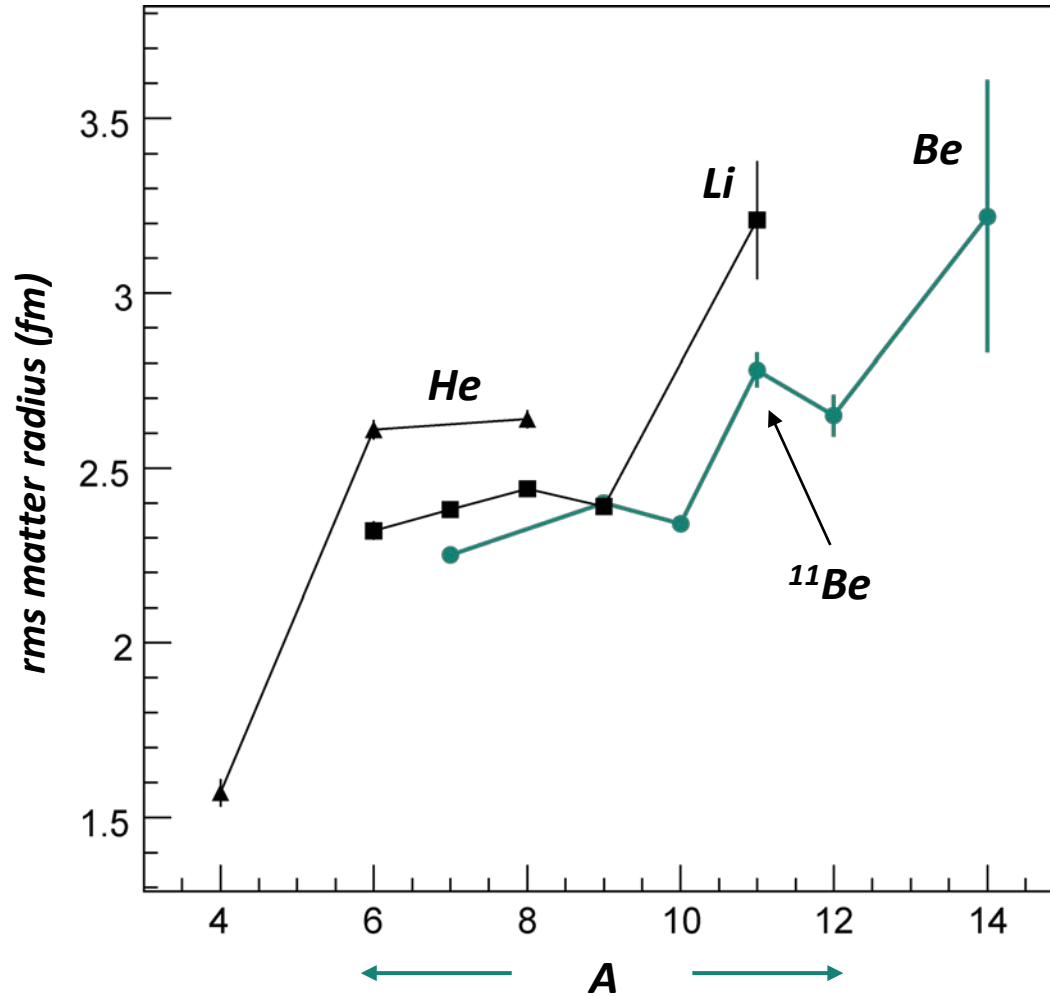
Phys. Rev. Lett. 108, 042504 (2012)

Differential ms radii in the sd shell



Phys. Rev. Lett. 108, 042504 (2012)

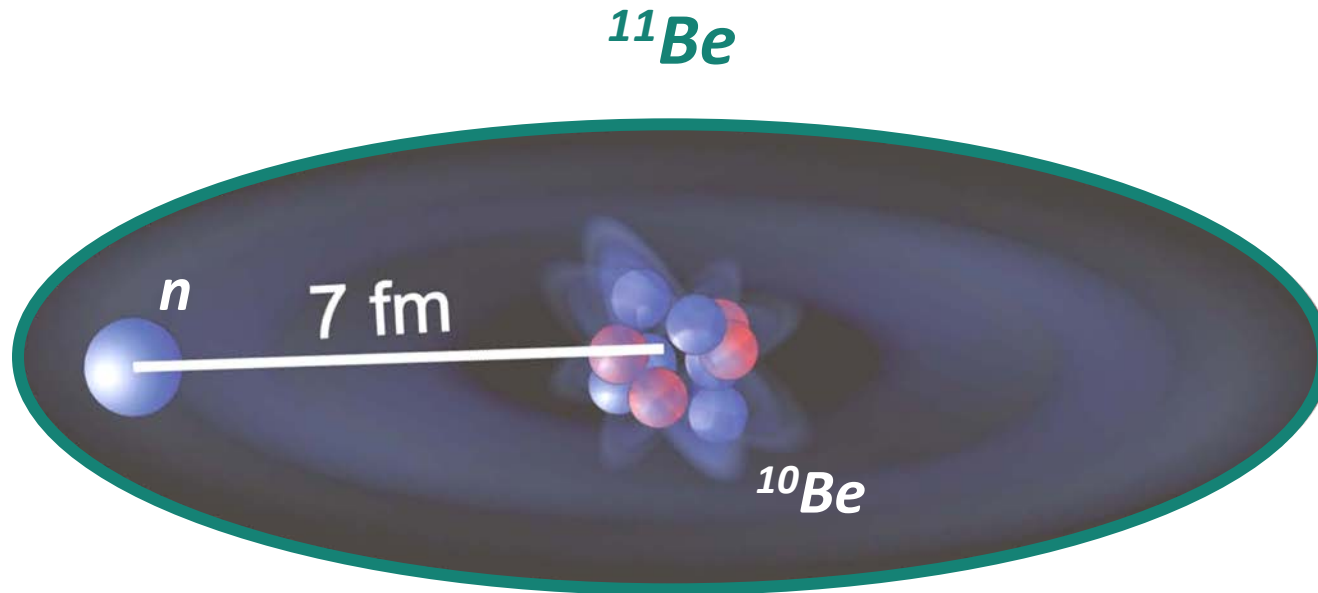
Halo nuclei



Matter radii from interaction cross sections

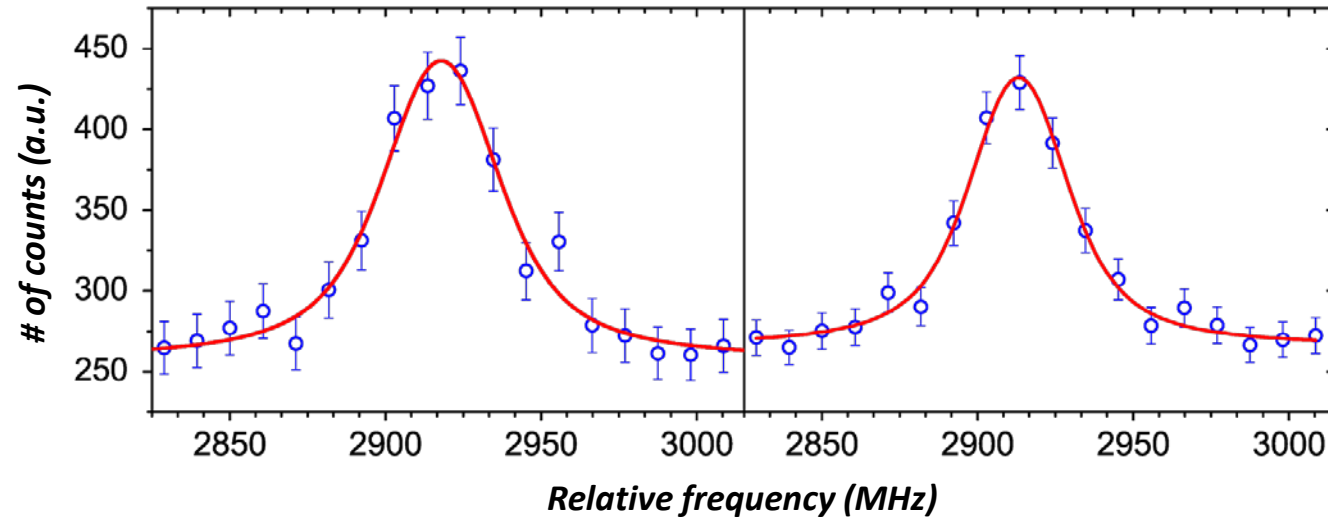
I. Tanihata *et al.*, Phys. Lett. B 206, 592 (1988)

The simplified Halo picture of ^{11}Be

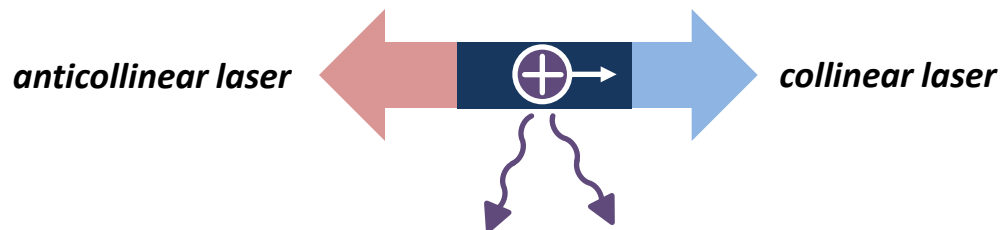


W. Nörtershäuser et al., *Phys. Rev. Lett.* 102, 062503 (2009)

Measurement of the charge radius of ^{12}Be

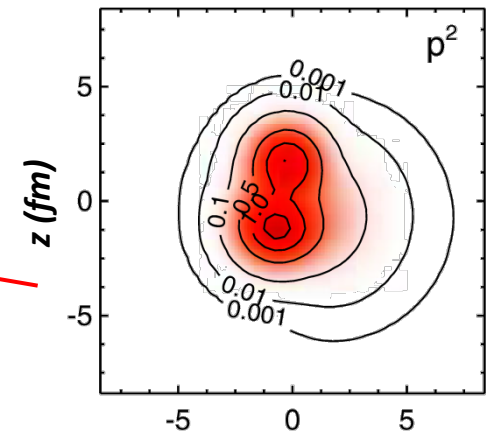
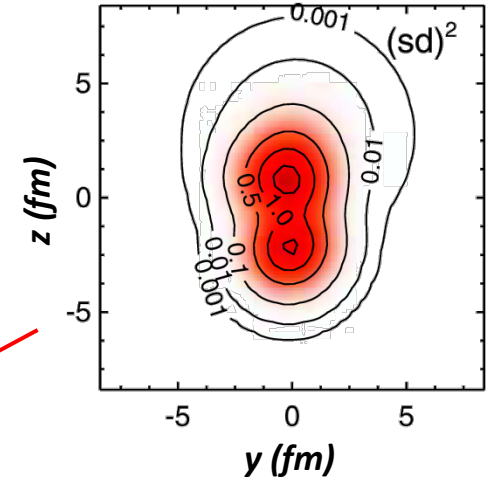
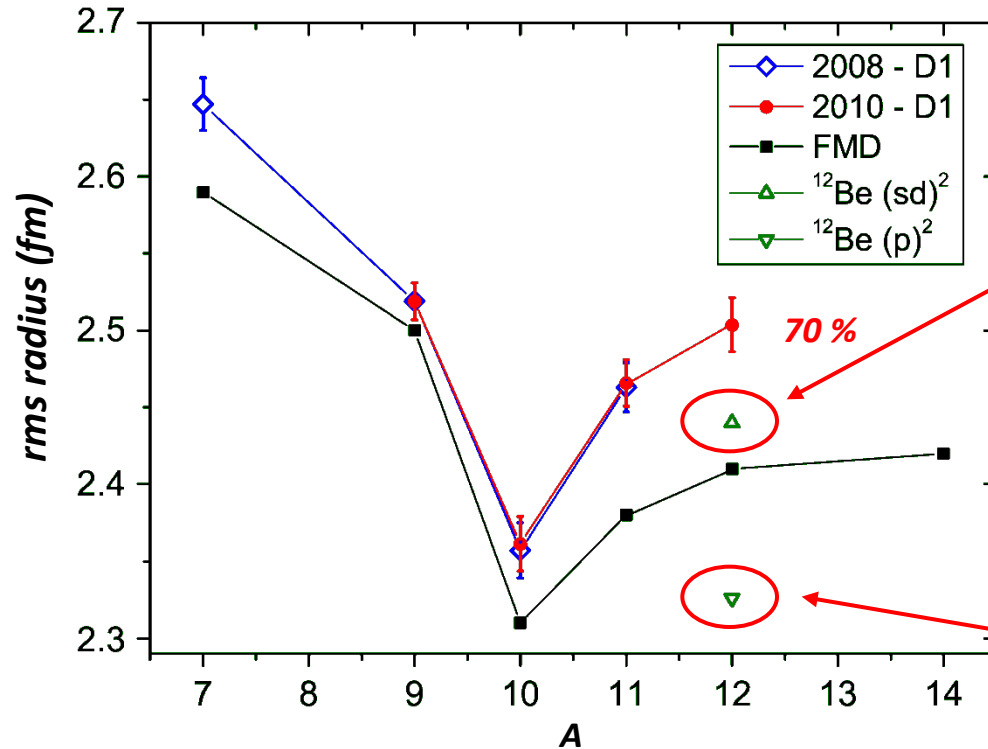


$s_{1/2} \rightarrow p_{1/2}$
313 nm



$$\nu_0^2 = \nu_a \cdot \nu_c$$

Breakdown of $N = 8$



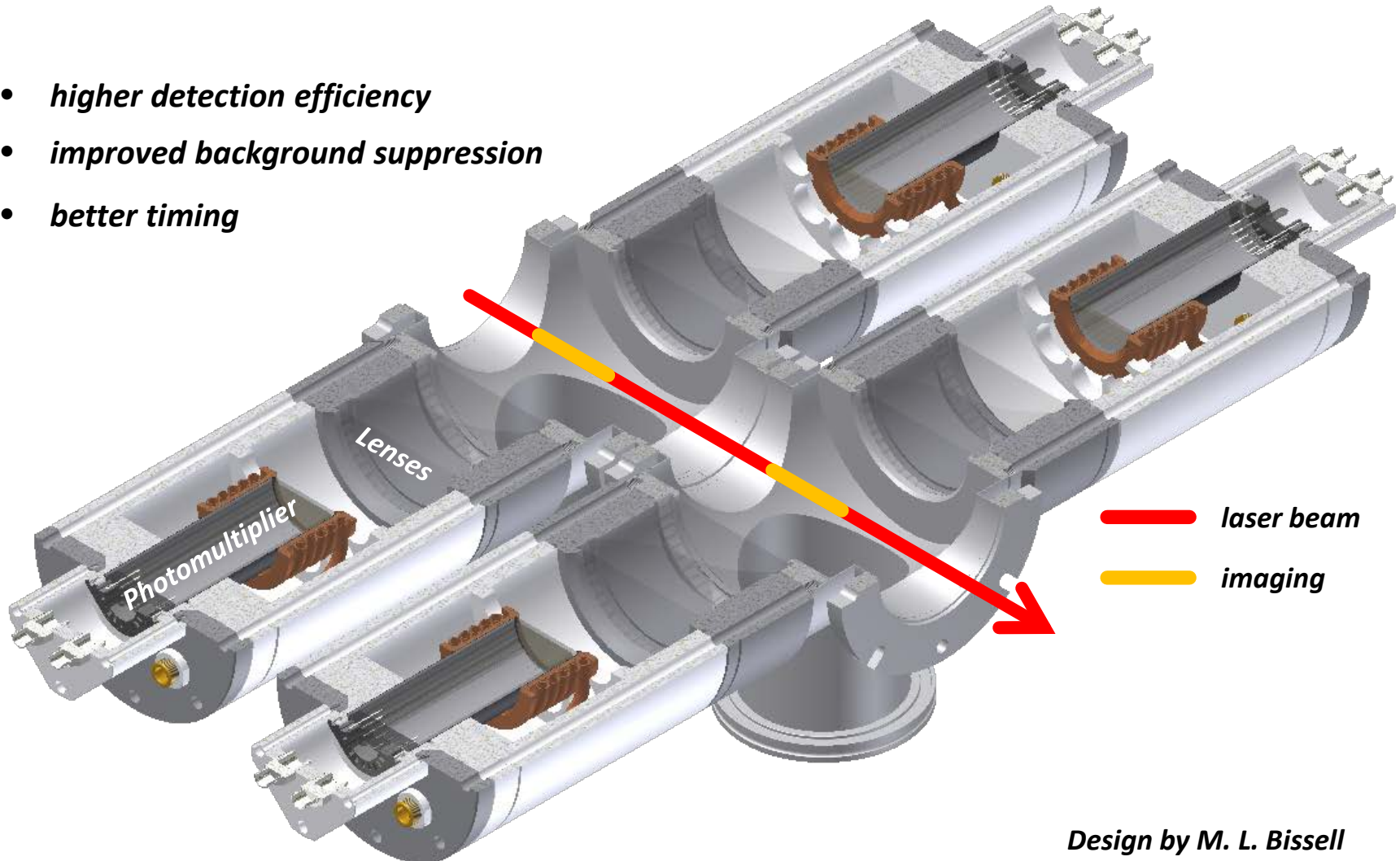
FMD by T. Neff

Matter density in ^{12}Be

A. Krieger et al., Phys. Rev. Lett. 108, 142501 (2012)

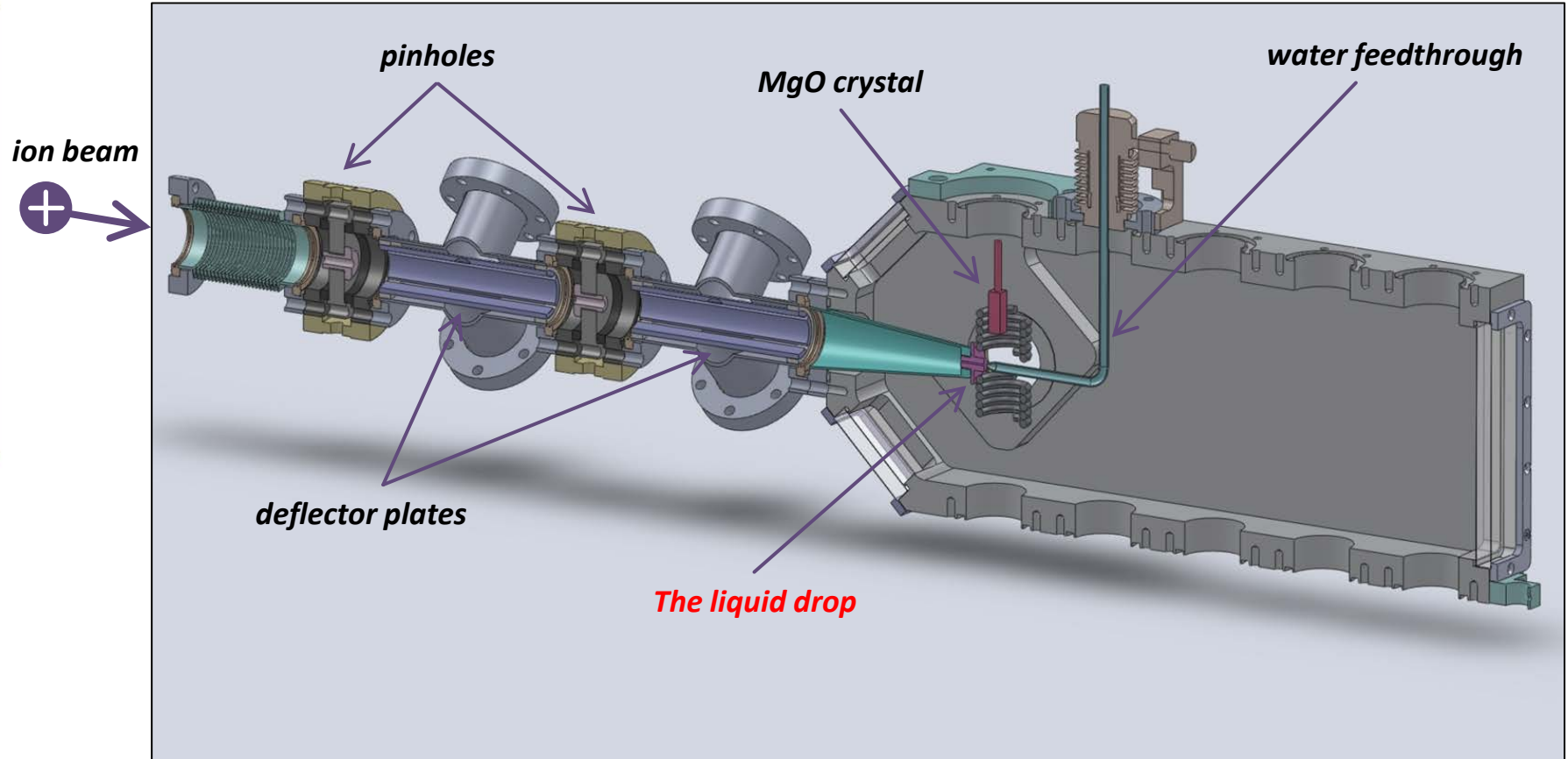
Light collection region designed for K

- *higher detection efficiency*
- *improved background suppression*
- *better timing*



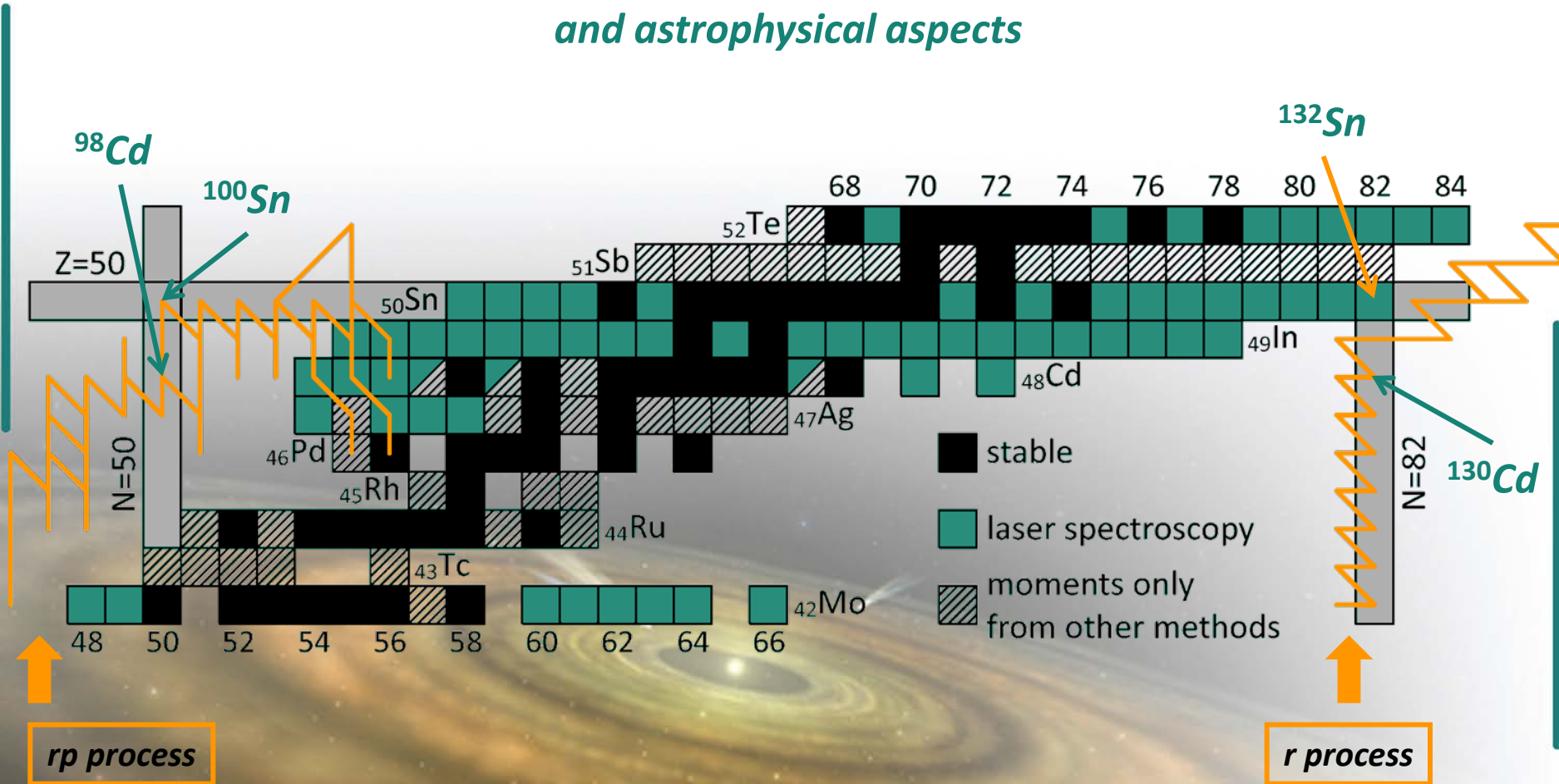
Design by M. L. Bissell

Radioactive Beams for Biophysical Studies

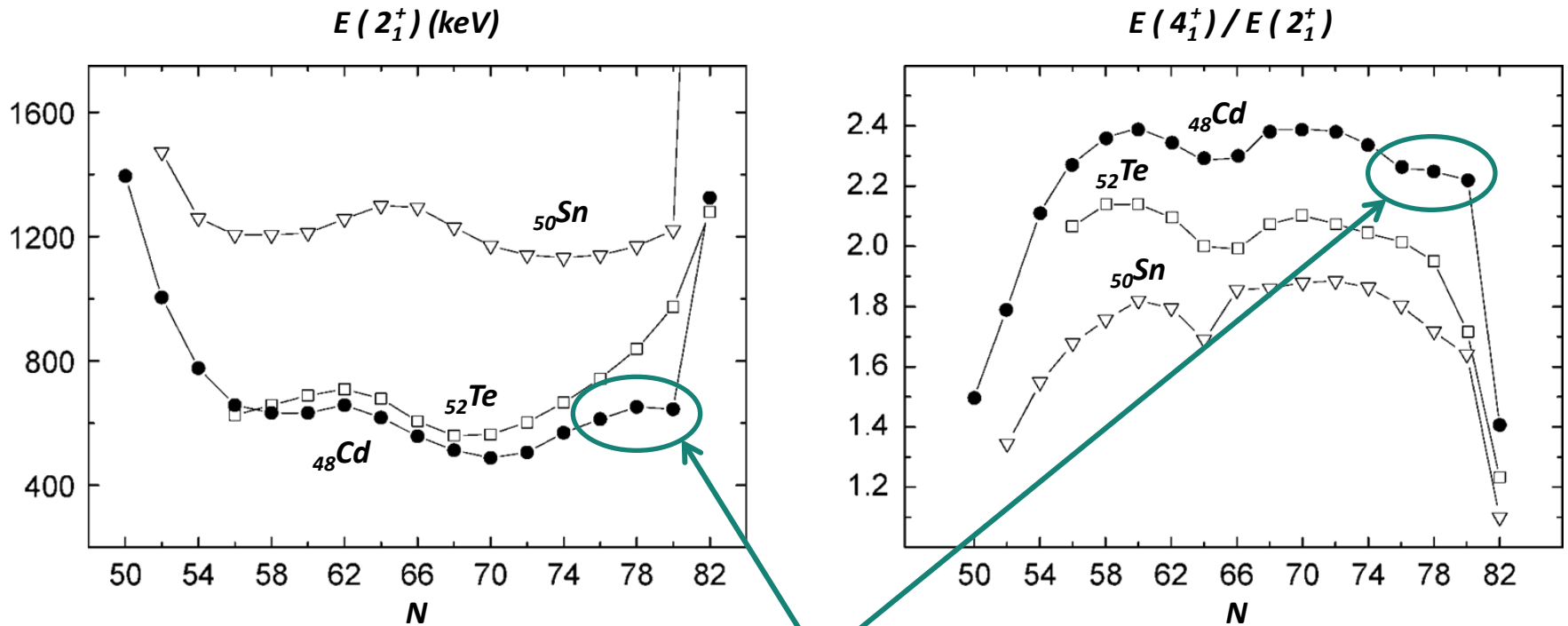


Project by: Monika Stachura*, K. Johnston, L. Hemmingsen*, A. Gottberg
* University of Copenhagen

Survey of nuclear moments in the $Z \approx 50$ region and astrophysical aspects



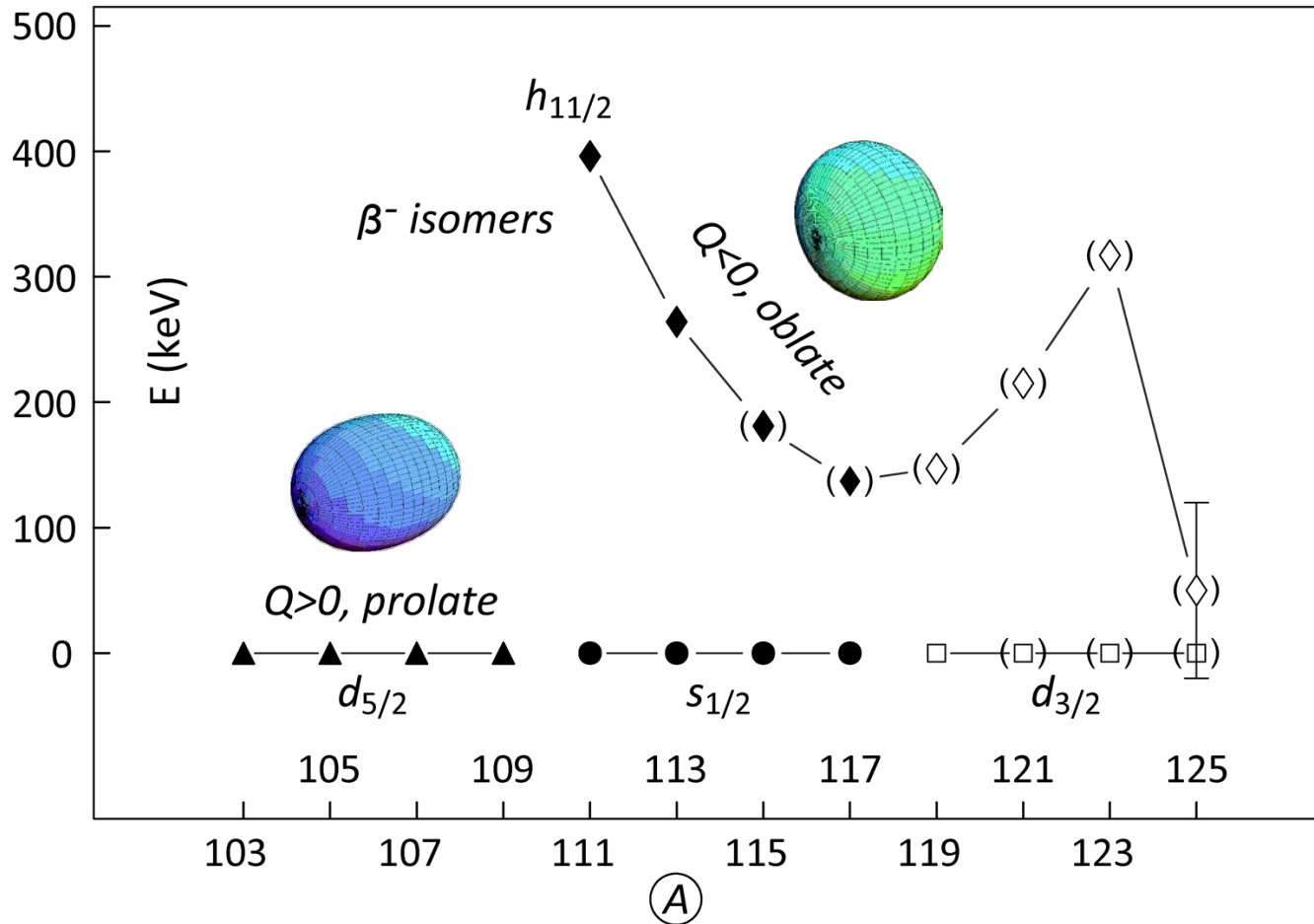
Indication for collectivity in the even - even isotopes



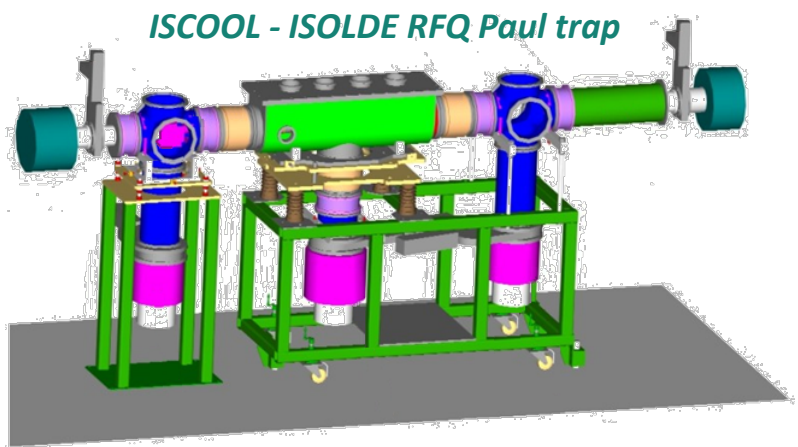
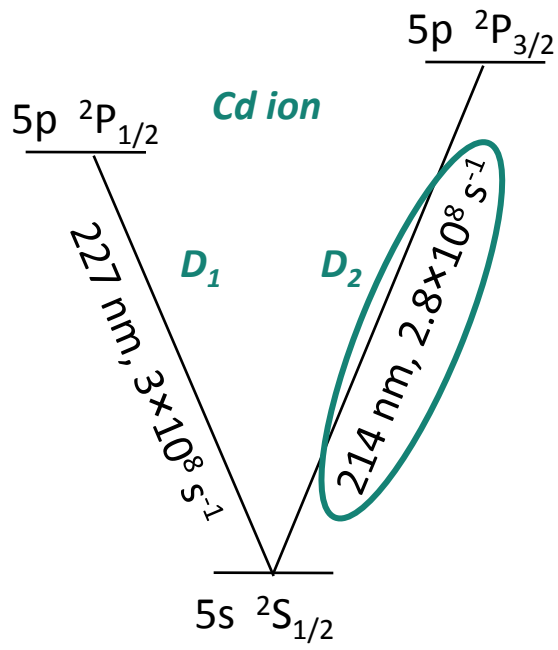
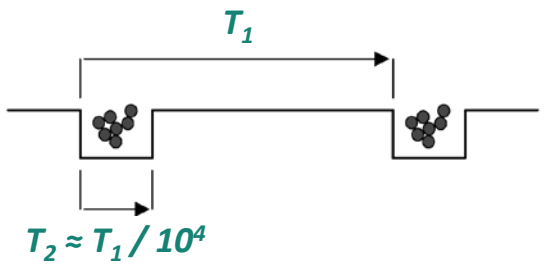
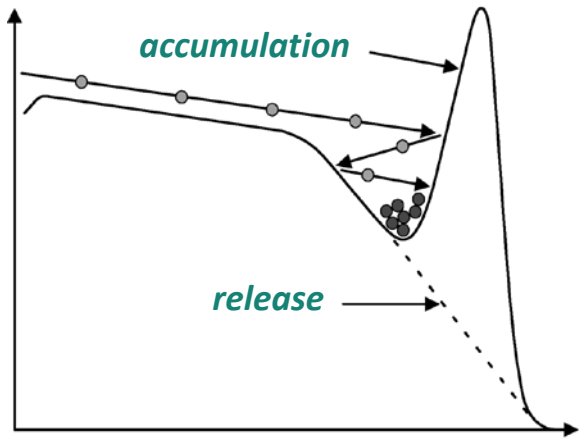
Anomaly in the energy levels of $^{126, 128}\text{Cd}$

- Evidence in the rms charge radii?
- Evidence in the Q moments of the neighboring odd isotopes?

Spins, moments, shapes and isomers in the odd - A isotopes



Bunched-beam fluorescence of ¹⁰⁰⁻¹³⁰Cd

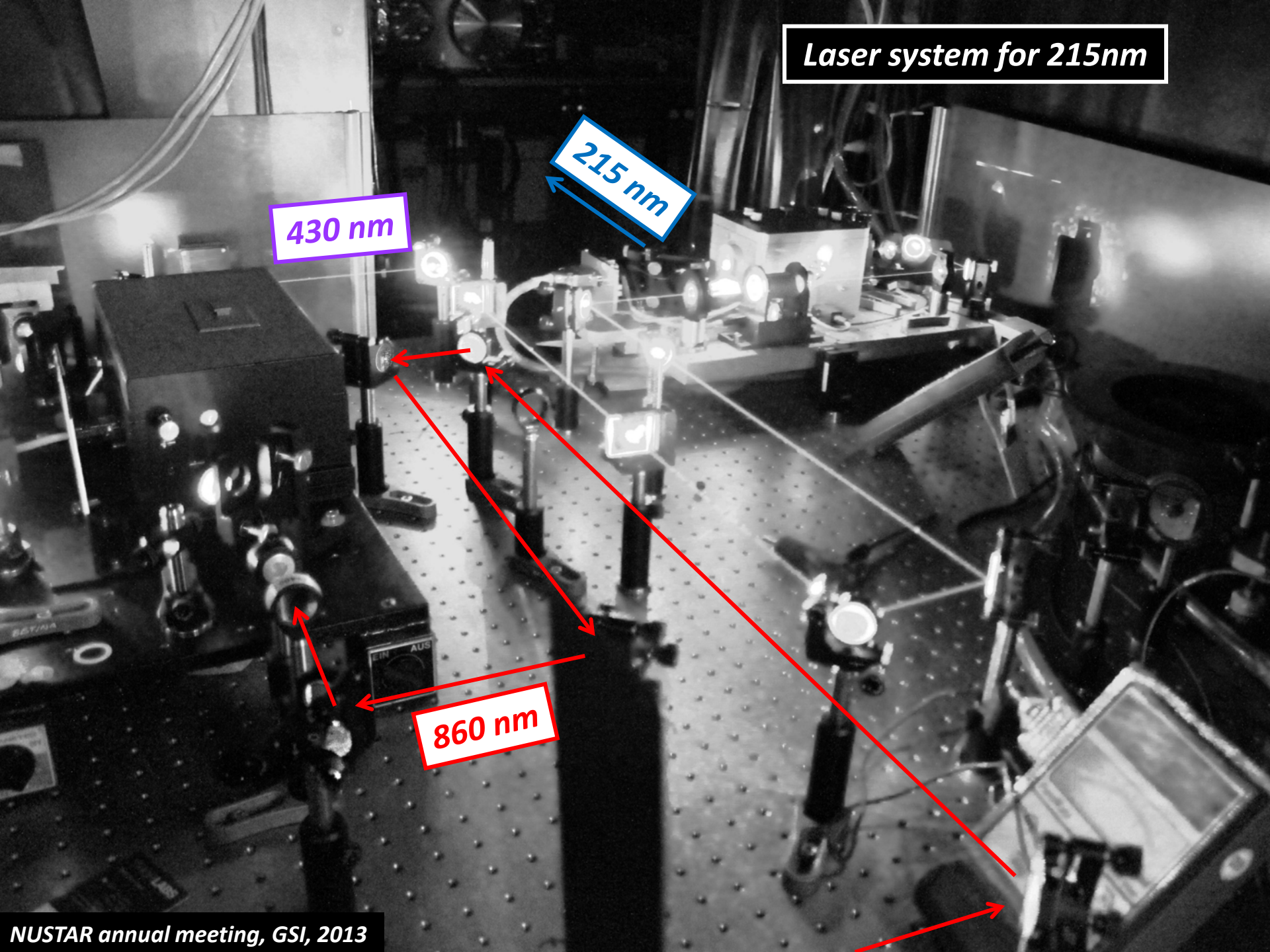


Laser system for 215nm

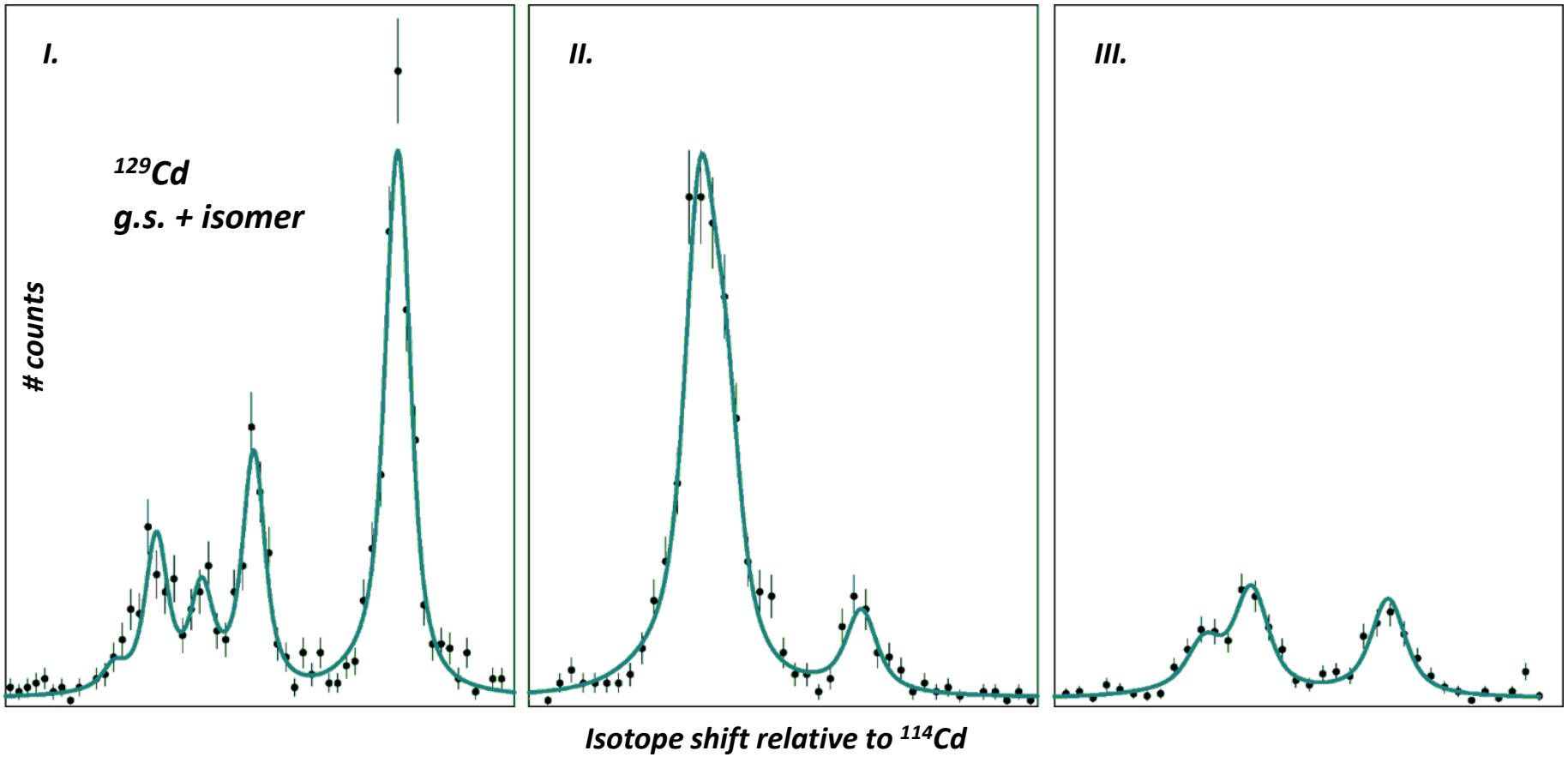
430 nm

215 nm

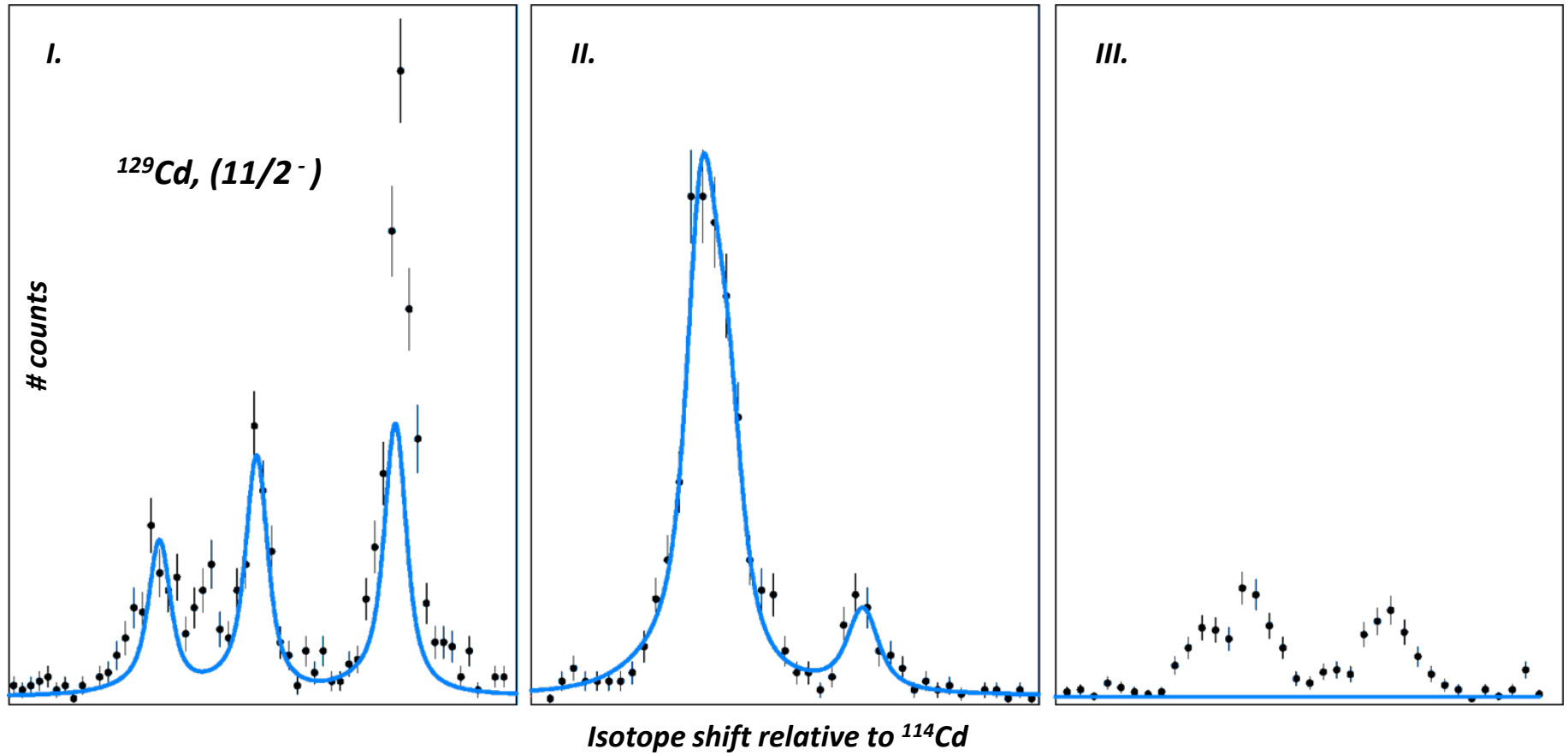
860 nm



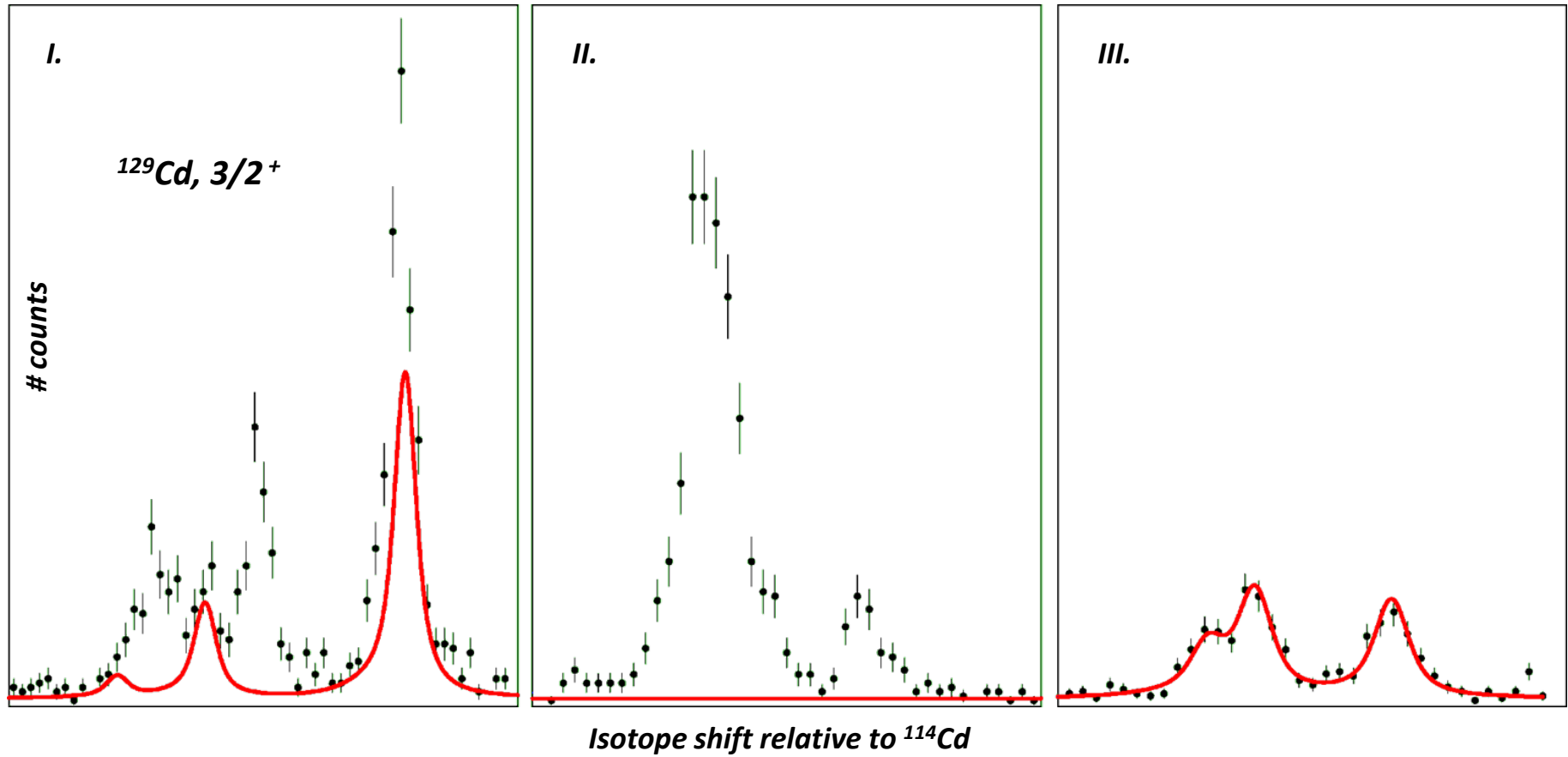
Discovery of a long-lived isomeric state in ^{129}Cd



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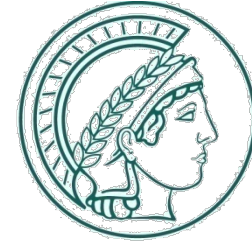


Discovery of a long-lived isomeric state in ^{129}Cd



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