COLLAPS 2012 – Status and Outlook

The Year @ COLLAPS

IS 529 Spins, Moments and Charge Radii Beyond ^{48}Ca

IS 484 Ground-state properties of K-isotopes from laser and β-NMR spectroscopy

IS 497 Laser Spectroscopy of Cadmium Isotopes: Probing the Nuclear Structure Between the Neutron 50 and 82 Shell Closures

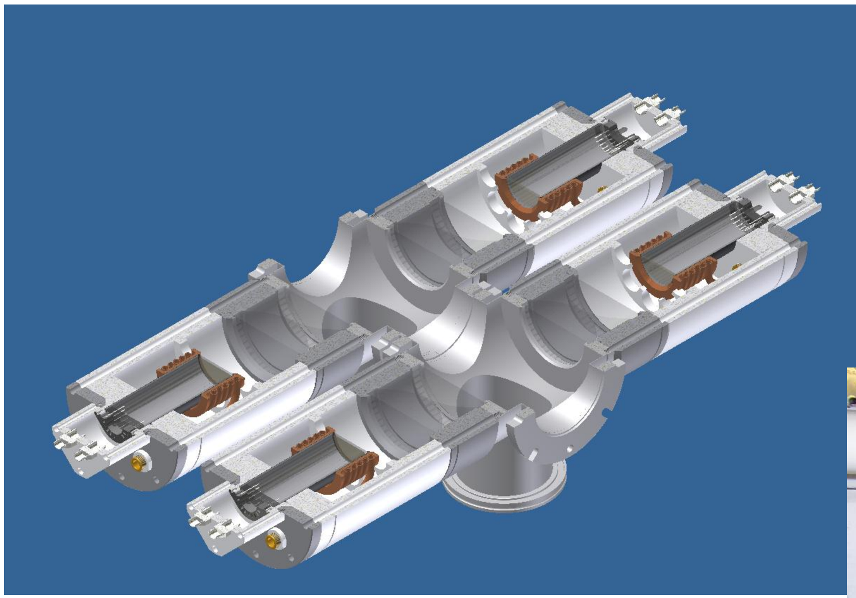
I 88 β-NMR as a novel technique for biological applications

IS 508 Collinear laser spectroscopy of manganese isotopes using optical pumping in ISCOOL

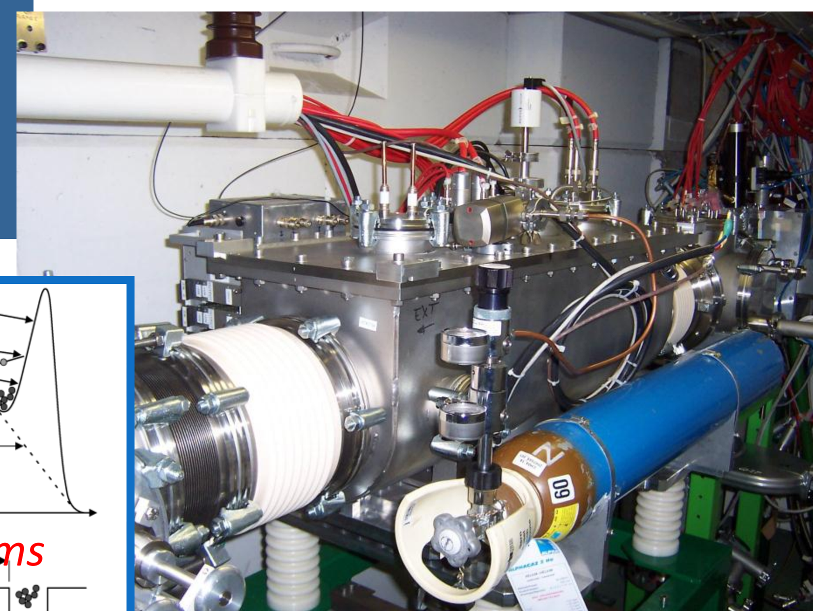
ISOLDE

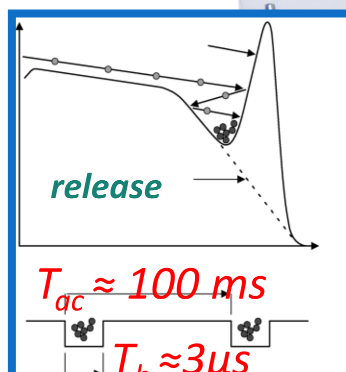
IS 529: Spins, Moments and Charge Radii Beyond ^{48}Ca

Proposal Objectives: $^{49..52}$Ca ✓

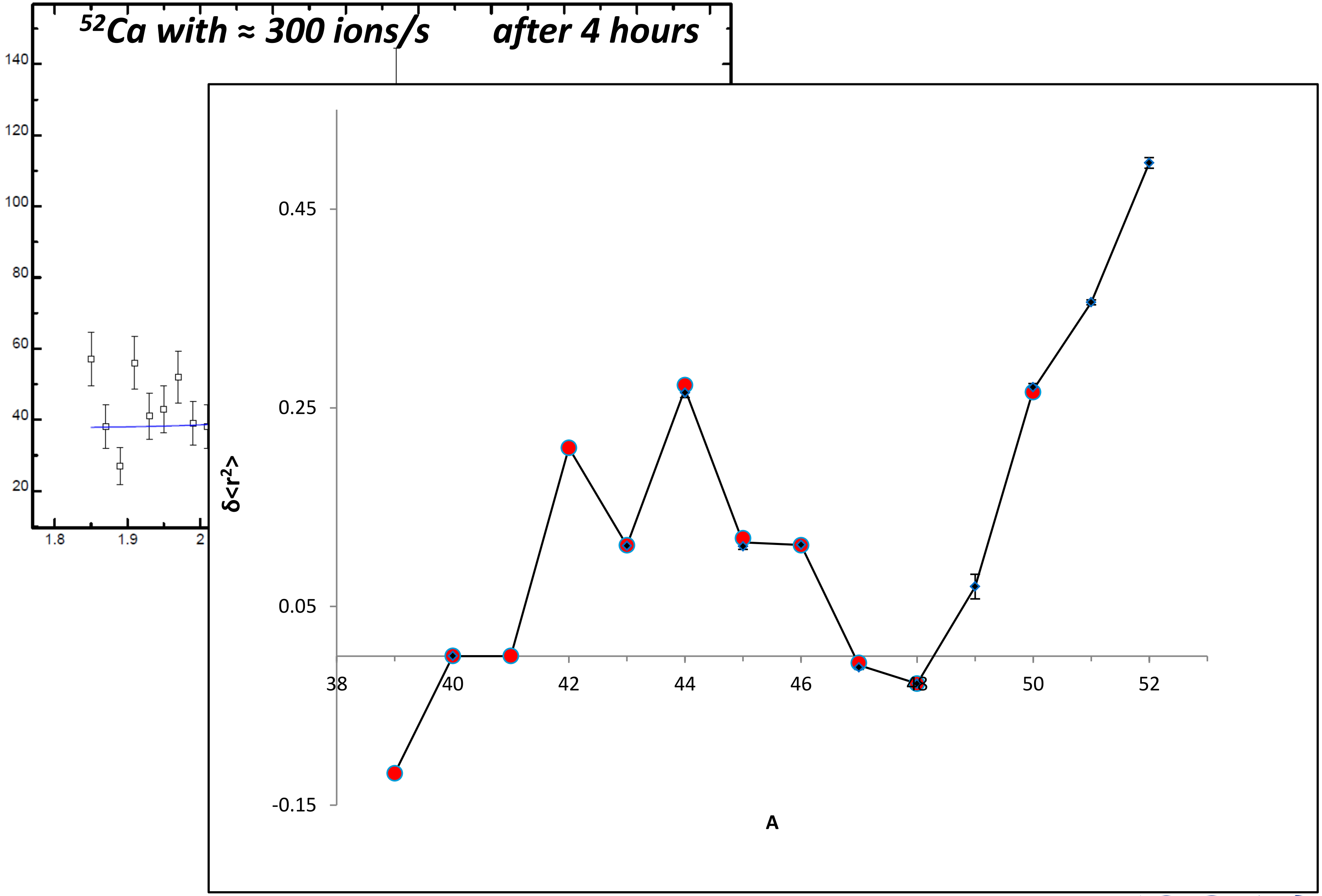


First use of the new optical detection station with ions.





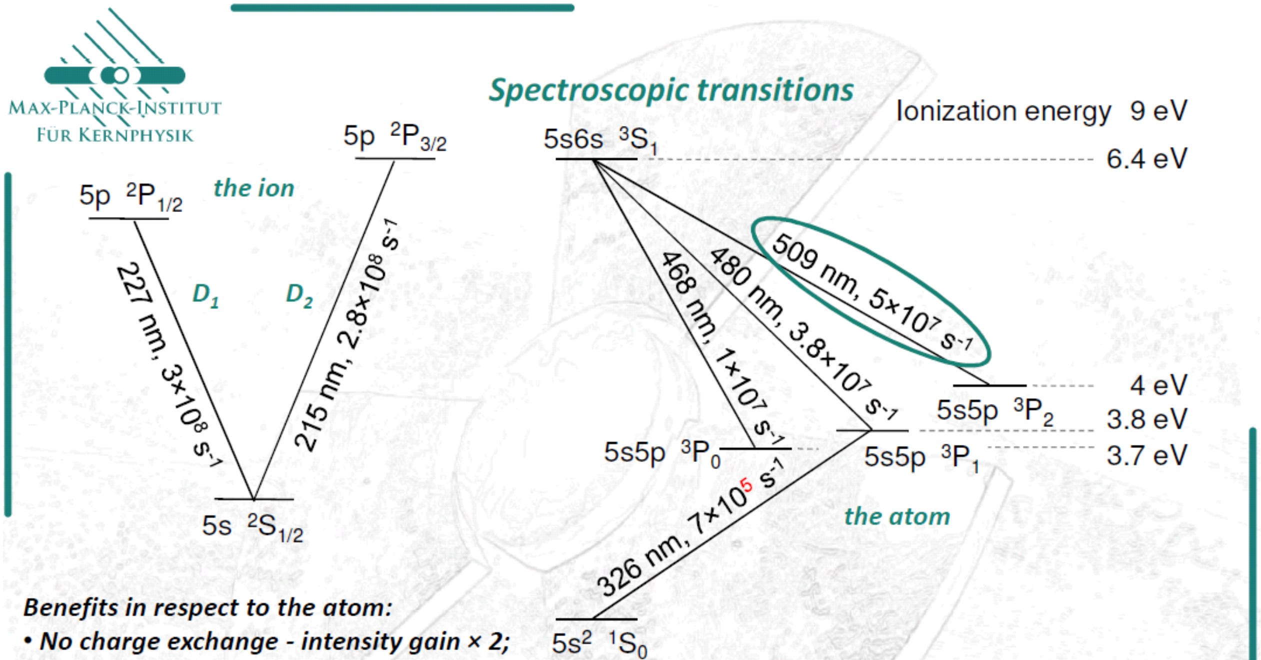
IS 529: Spins, Moments and Charge Radii Beyond ^{48}Ca



IS 497: Laser Spectroscopy of Cadmium Isotopes: Probing the Nuclear Structure Between the Neutron 50 and 82 Shell Closures

Proposal Objectives: $^{100..130}$Cd ✓

In the process of reaching this a new wavelength range was opened up.



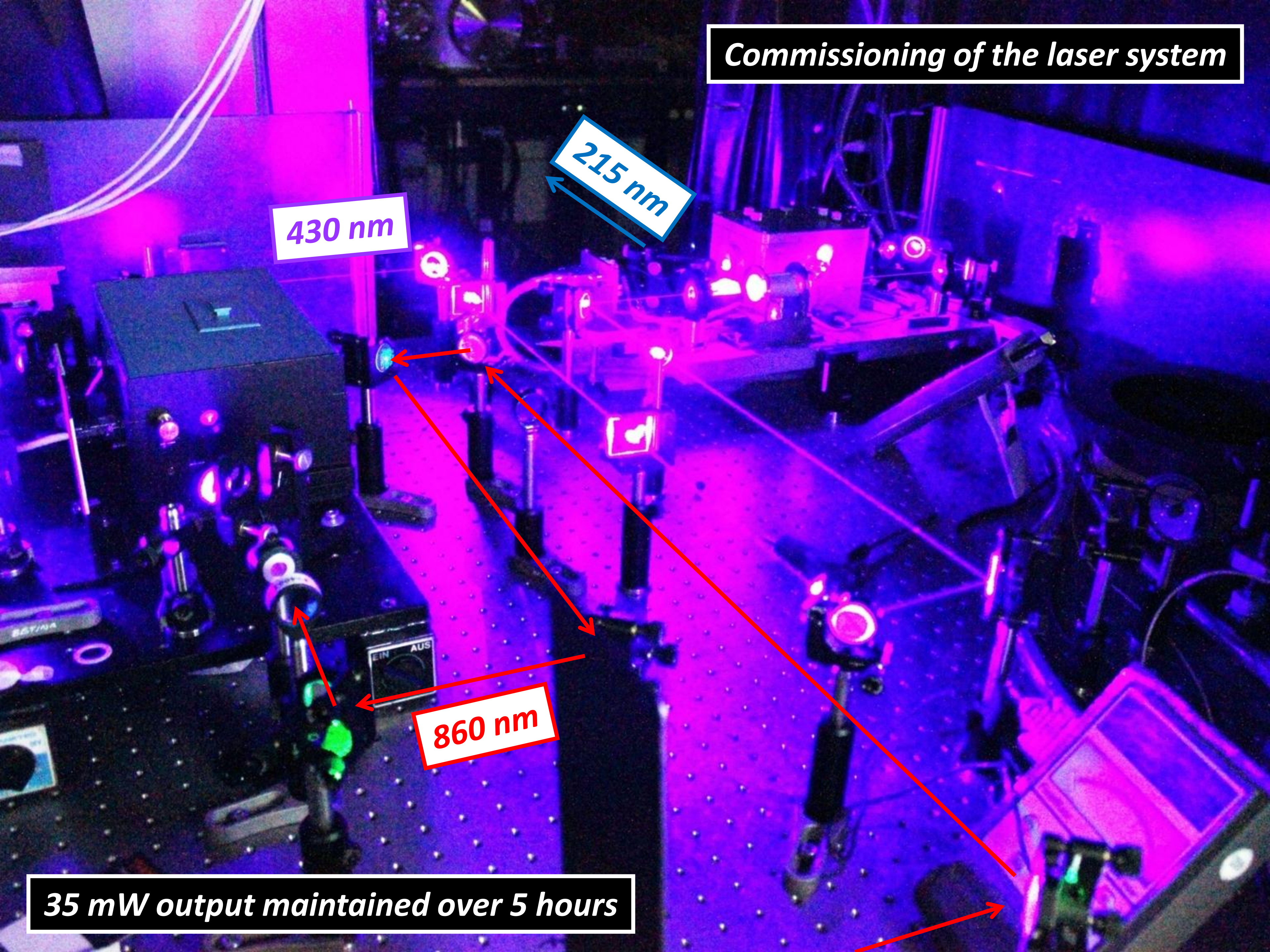
Benefits in respect to the atom:
- *No charge exchange - intensity gain × 2;*
- *No meta stable states - intensity gain × 4;*
- *No pumping out into dark states;*
- *× 5 stronger transitions;*
- *30% quantum efficiency (14% in the atom);*

Wavelengths:
- *Ar$^+$ laser + Stilbene 3 + frequency doubling;*

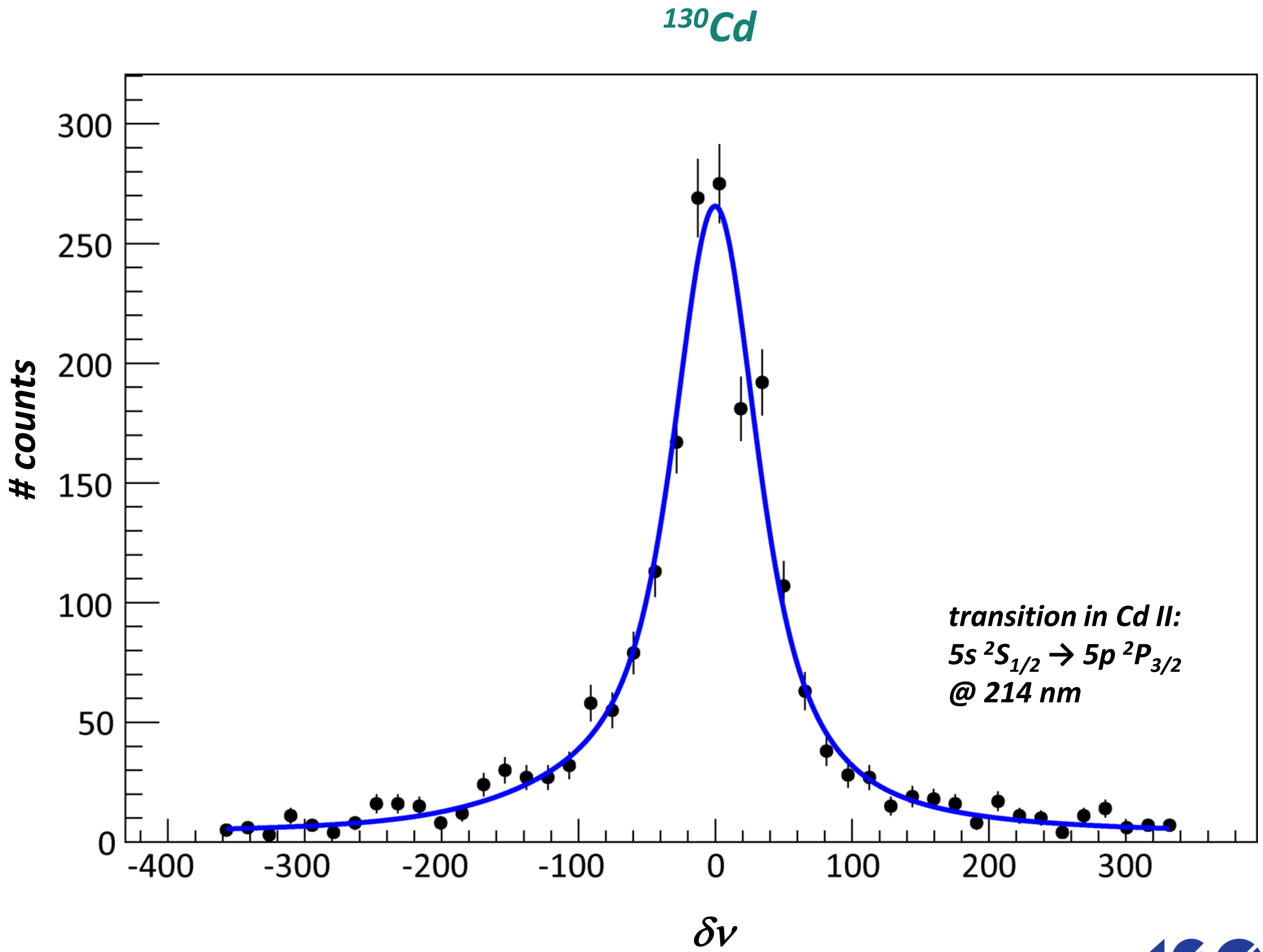
Benefits in respect to the ion:
- *Higher sensitivity to the nuclear spin (Higher J);*

Wavelength:
- *Ar$^+$ laser + Coumarin 521 (Coumarin 334);*

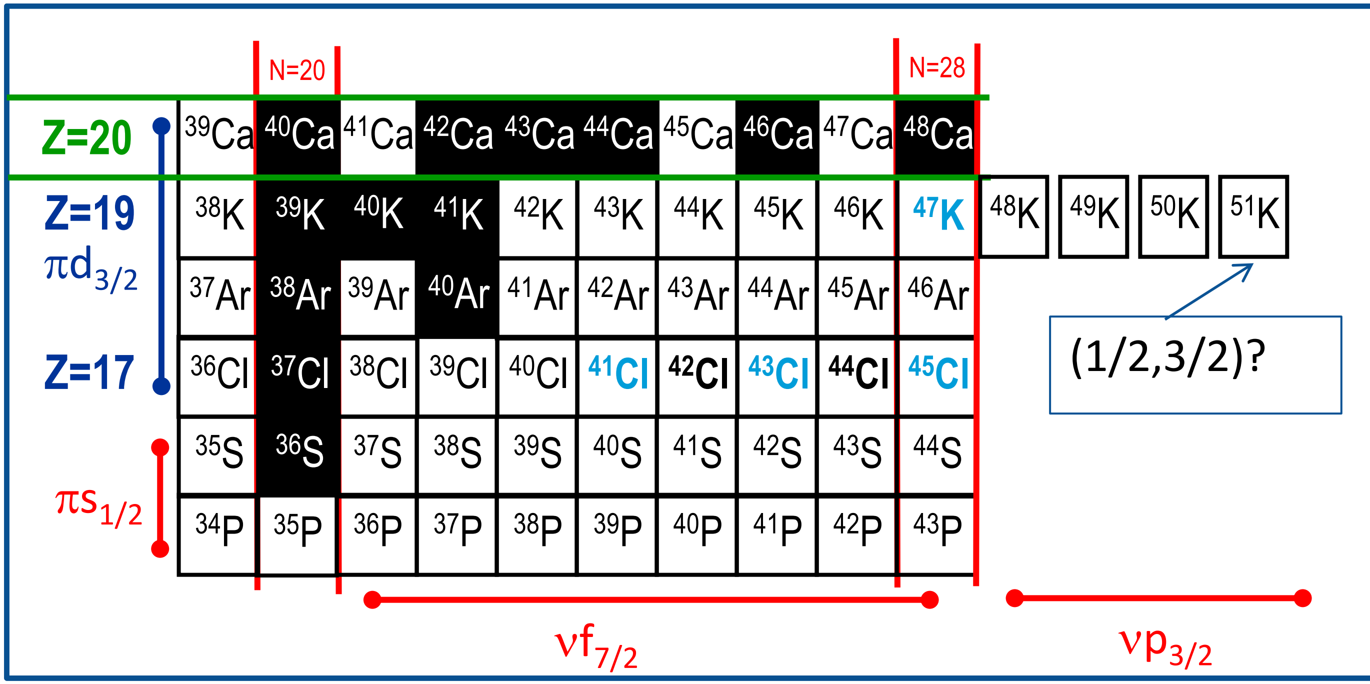
P 271, INTC, Nov 2009

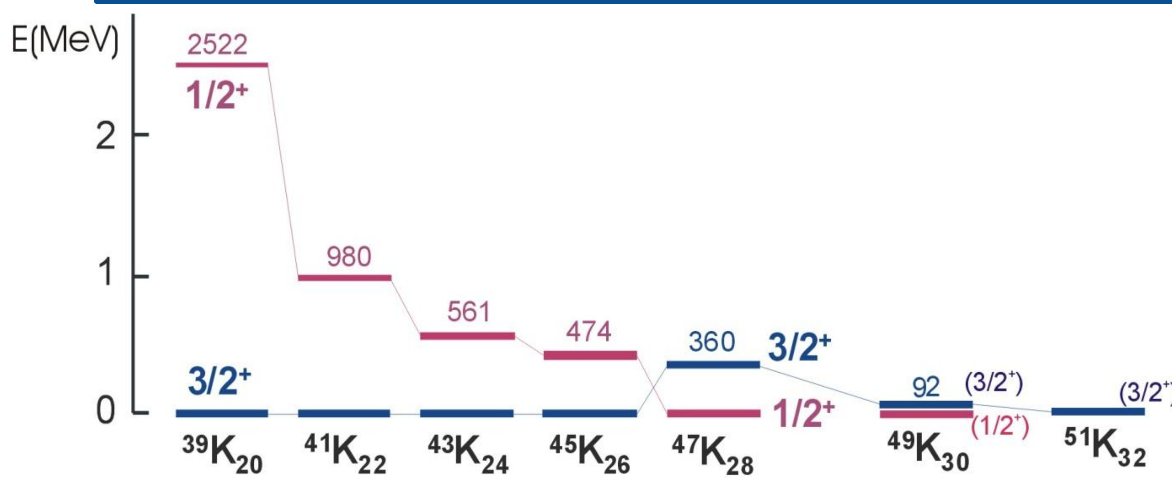

Commissioning of the laser system
215 nm
430 nm
860 nm
EIN
AUS
35 mW output maintained over 5 hours

IS 497: Laser Spectroscopy of Cadmium Isotopes: Probing the Nuclear Structure Between the Neutron 50 and 82 Shell Closures

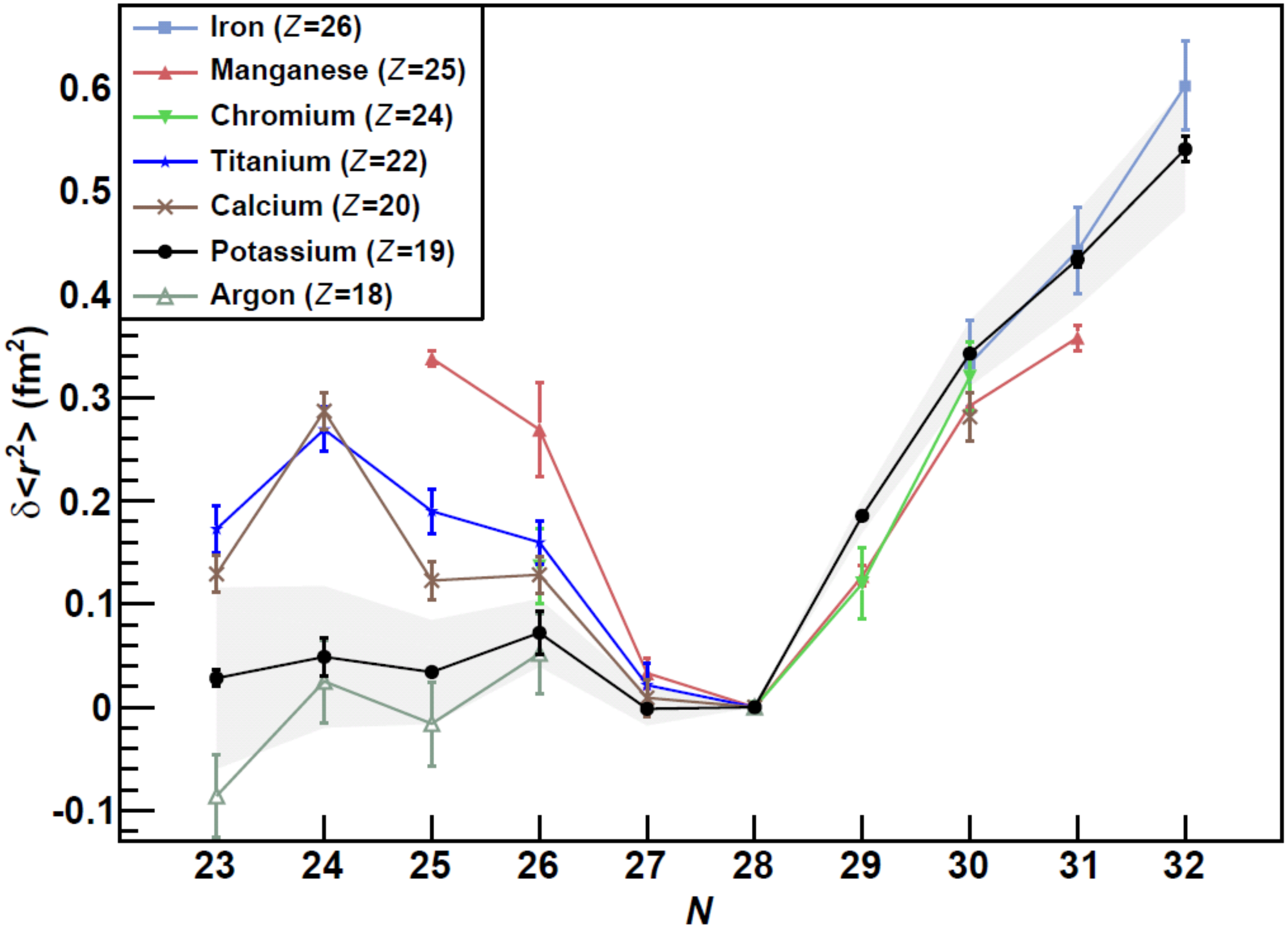


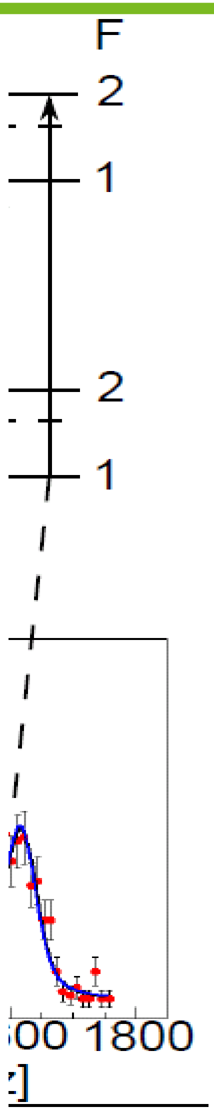
IS 484: Ground-state properties of K-isotopes from laser and β-NMR spectroscopy





IS 484: Ground-state properties of K-isotopes from laser and β-NMR spectroscopy

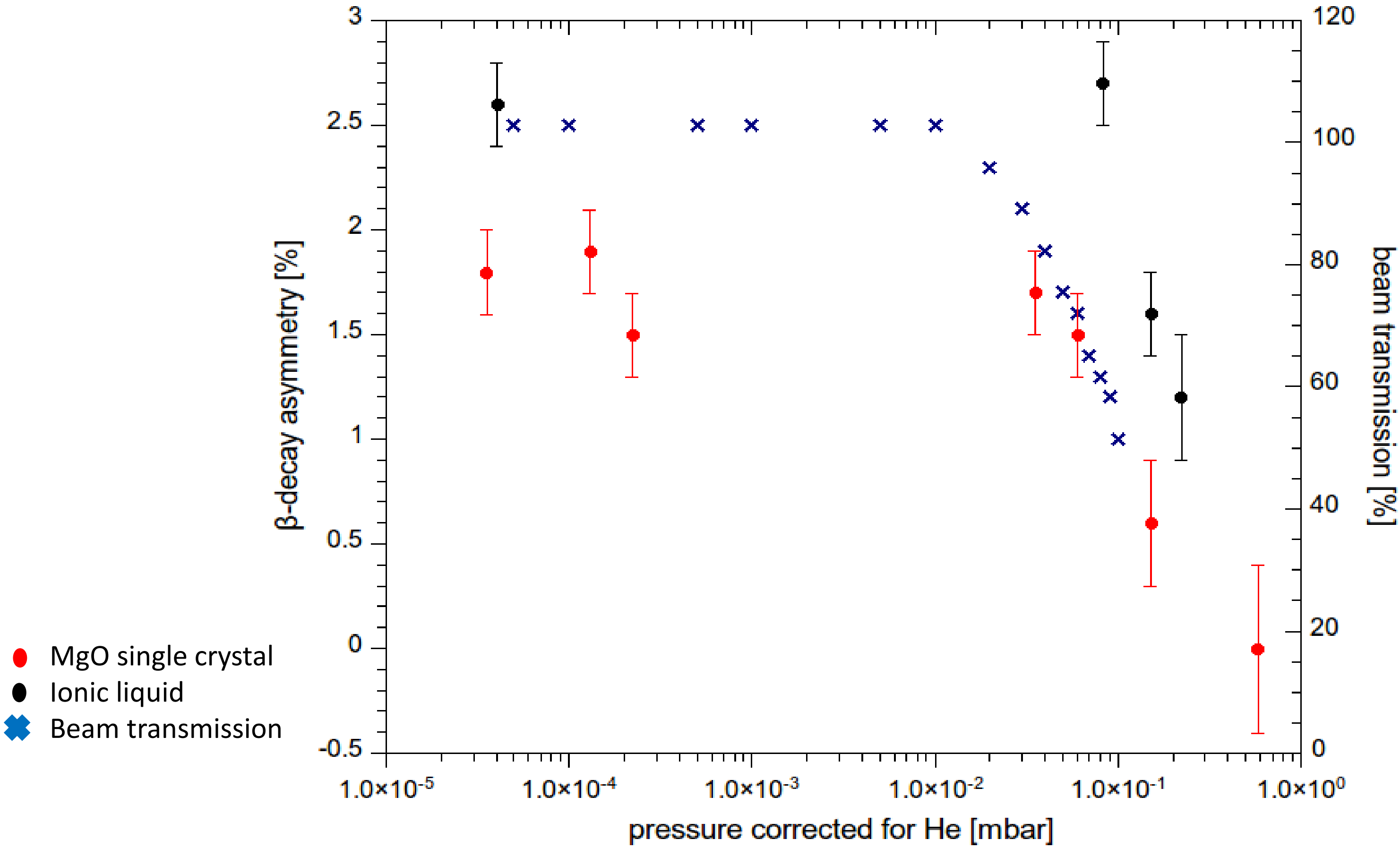




I 88: β-NMR as a novel technique for biological applications

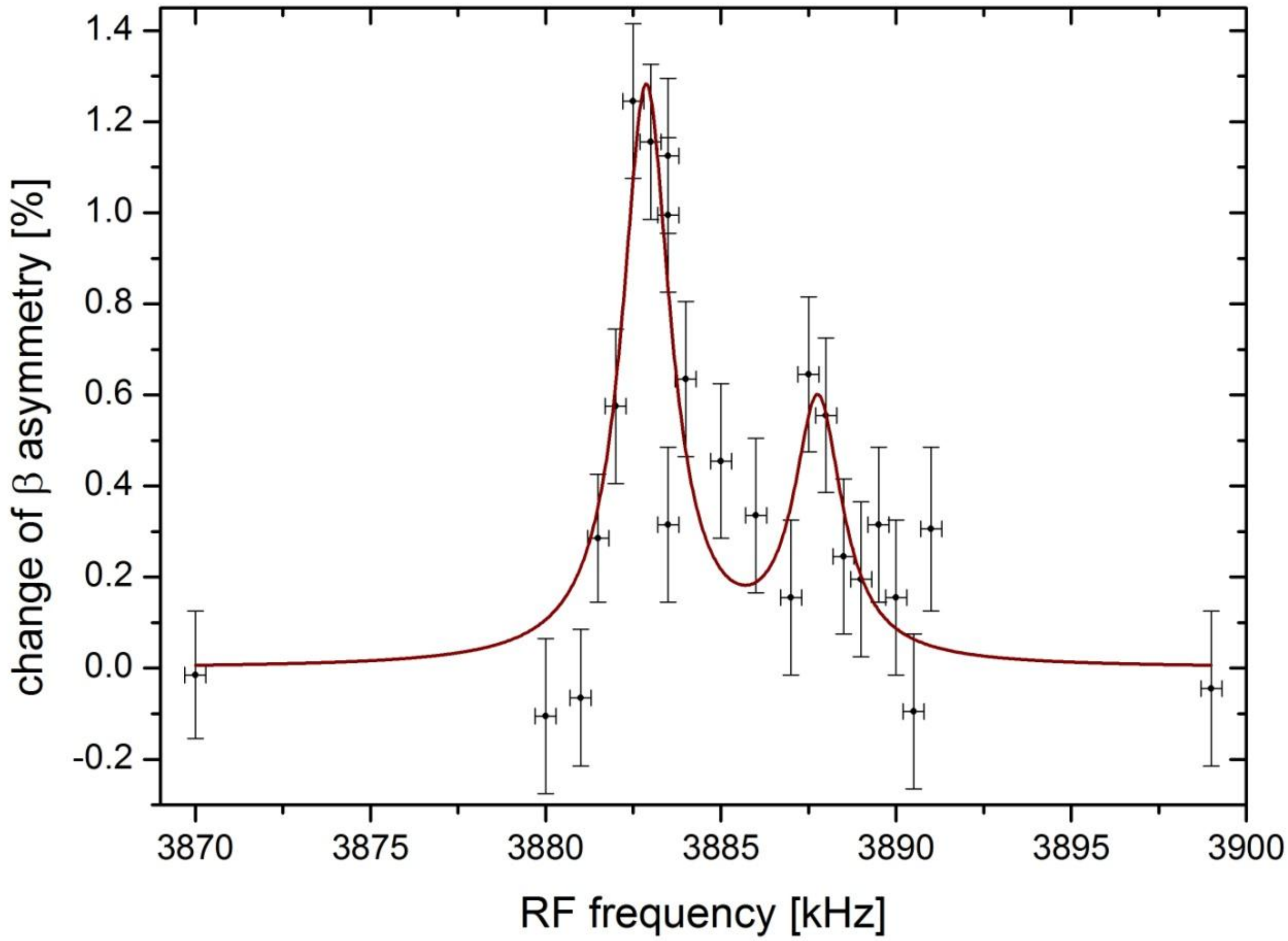
Objective: Demonstrate online β-NMR in liquid samples . ✓

Pressure-dependent β-decay asymmetry

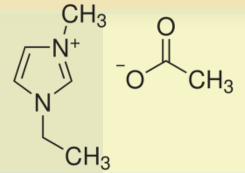


I 88: β-NMR as a novel technique for biological applications

βNMR spectrum for ^{31}Mg in ionic liquid EMIM-Ac

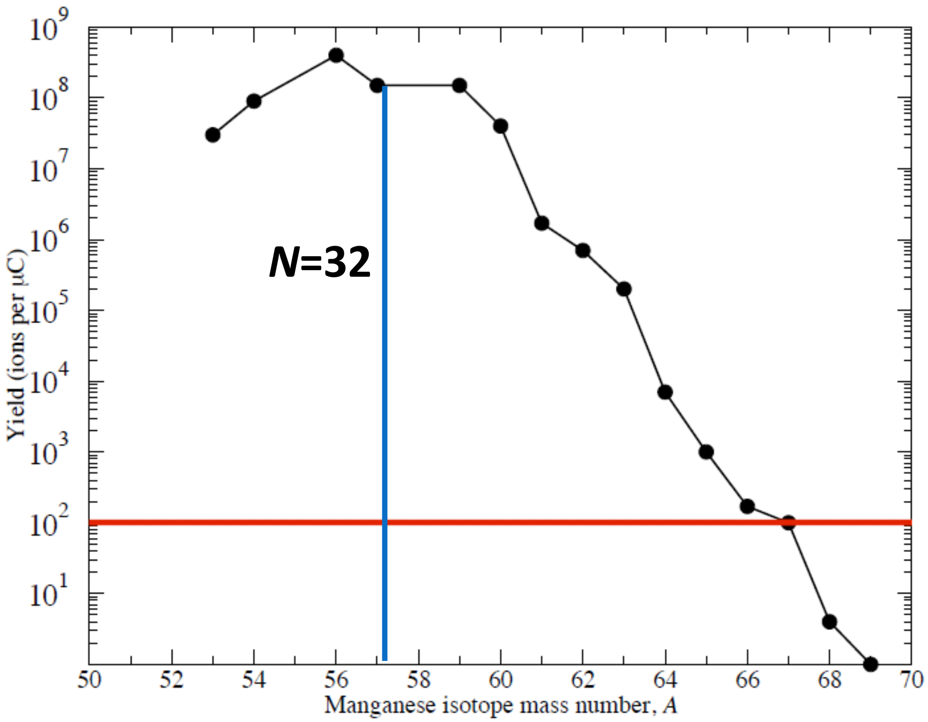


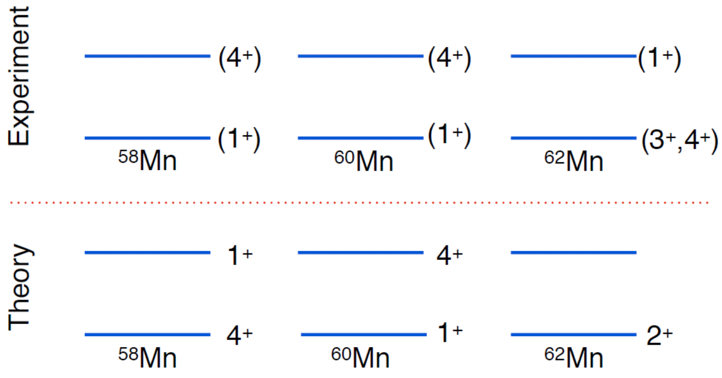
EMIM-Ac



IS 508: Collinear laser spectroscopy of manganese isotopes ~~using optical pumping in ISCOOL~~

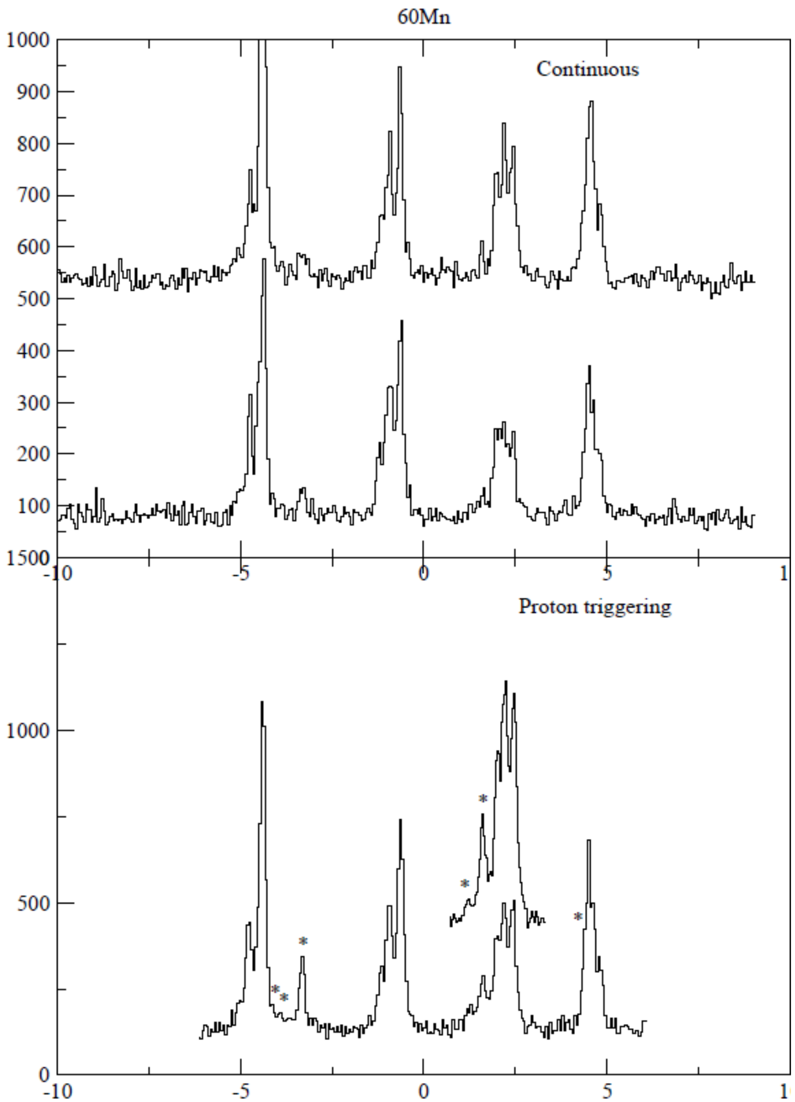
Proposal Objectives: $^{57..66}$Mn 10.5 shifts of 18 taken.
$^{51..64}$Mn measured including ^{58,60,62}Mn isomers . ✓

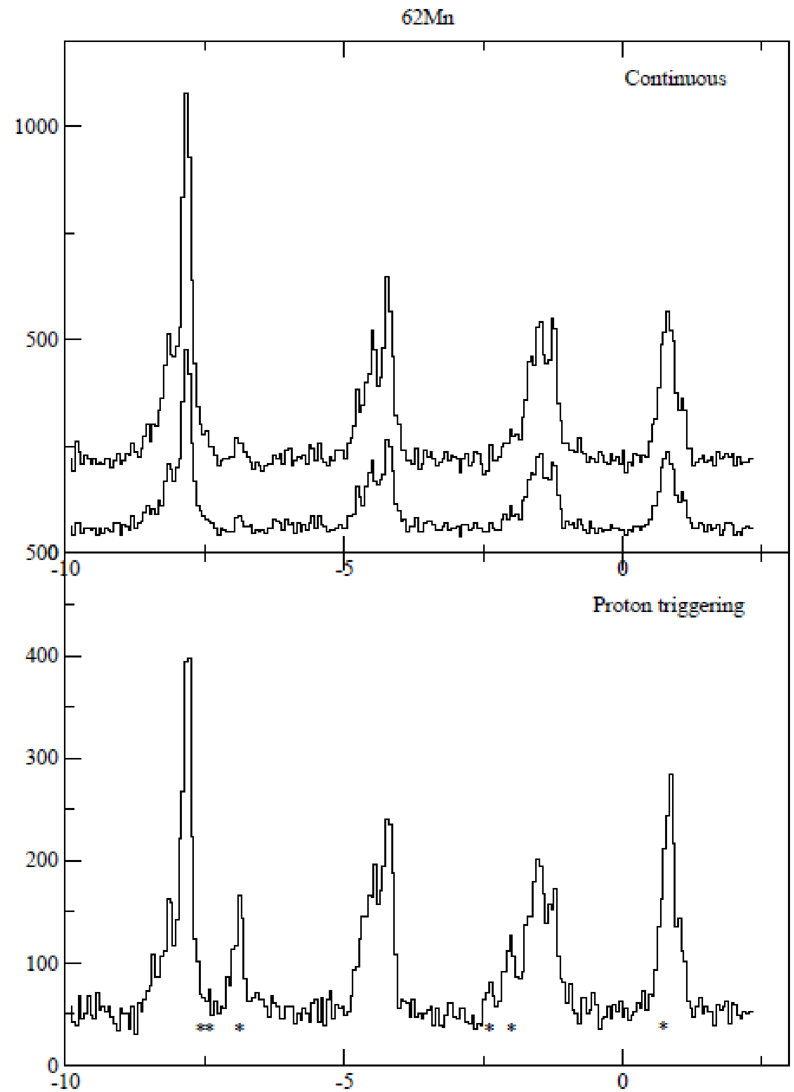




Testing shell model interactions
Wavefunction composition sensitive to moments

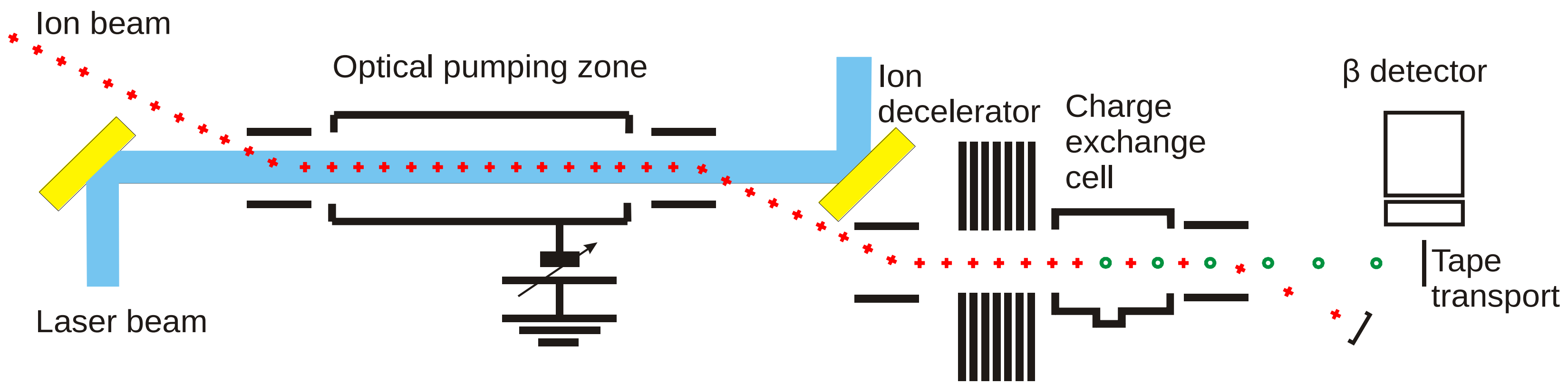
IS 508: Collinear laser spectroscopy of manganese isotopes using optical pumping in ISCOOL

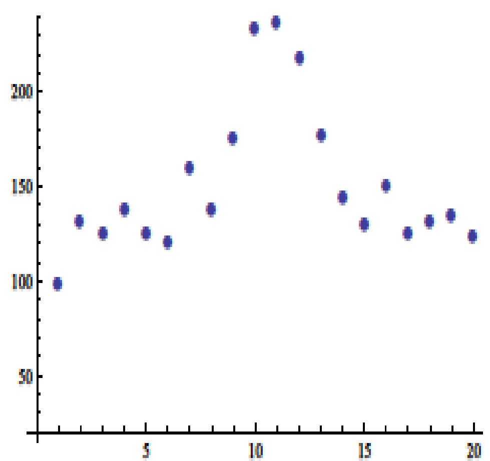


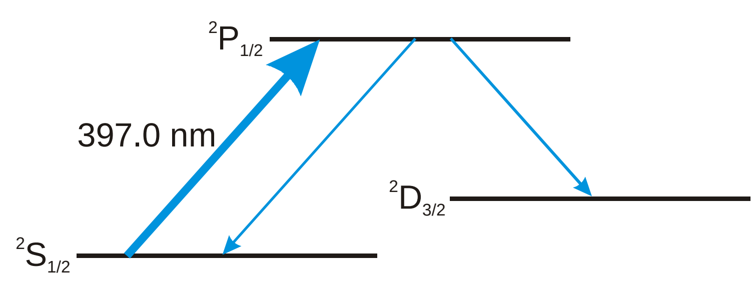


Outlook for Ca

Radioactive detection of Optically pumped ions after state selective Charge exchange (ROC)







The theoretical possibilities: 1 ion/s of an even isotope over 5 shifts.

Outlook for Cd

Yields drop by 2 orders of magnitude per isotope beyond 100 or 130… The limit.

But

Laser system developed opens up many more possibilities in this region *And* beyond.

Publications of spins moments and charge radii in preparation .

-> See poster by D. T. Yordanov for more details.

Outlook for K

Publications: Spins and Moments (J Papuga *et al*.) in preparation.
Charge radii (K. Kreim *et al*.) in preparation.

See Poster by Jasna for details.

Future prospects: With an intensity upgrade ^{52}K comes into reach.
Quadrupole moments may also shed light on the structural evolution in this region .

Outlook for Bio - β-NMR

Publications: Proof of concept results in preparation for publication. See talk by A. Gottberg.

Future prospects: Enormous possibilities for both Biological and Solid State physics .

but

Will require a dedicated beamline and laser systems.

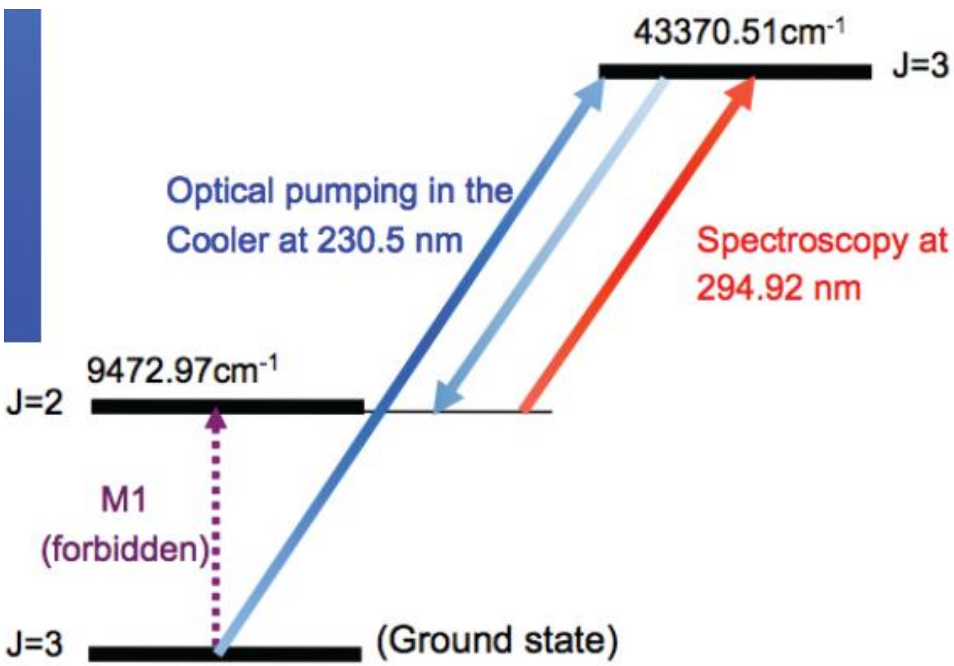
Possibilities to develop polarized beams for an entire range of elements.

Outlook for Mn

Analysis underway by B. Cheal and C. Babcock.

Realignment of ISCOOL during the shutdown will allow optical pumping in the cooler for this case and others.

- $^{65, 66}$Mn are then easily reached.



Thanks To

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