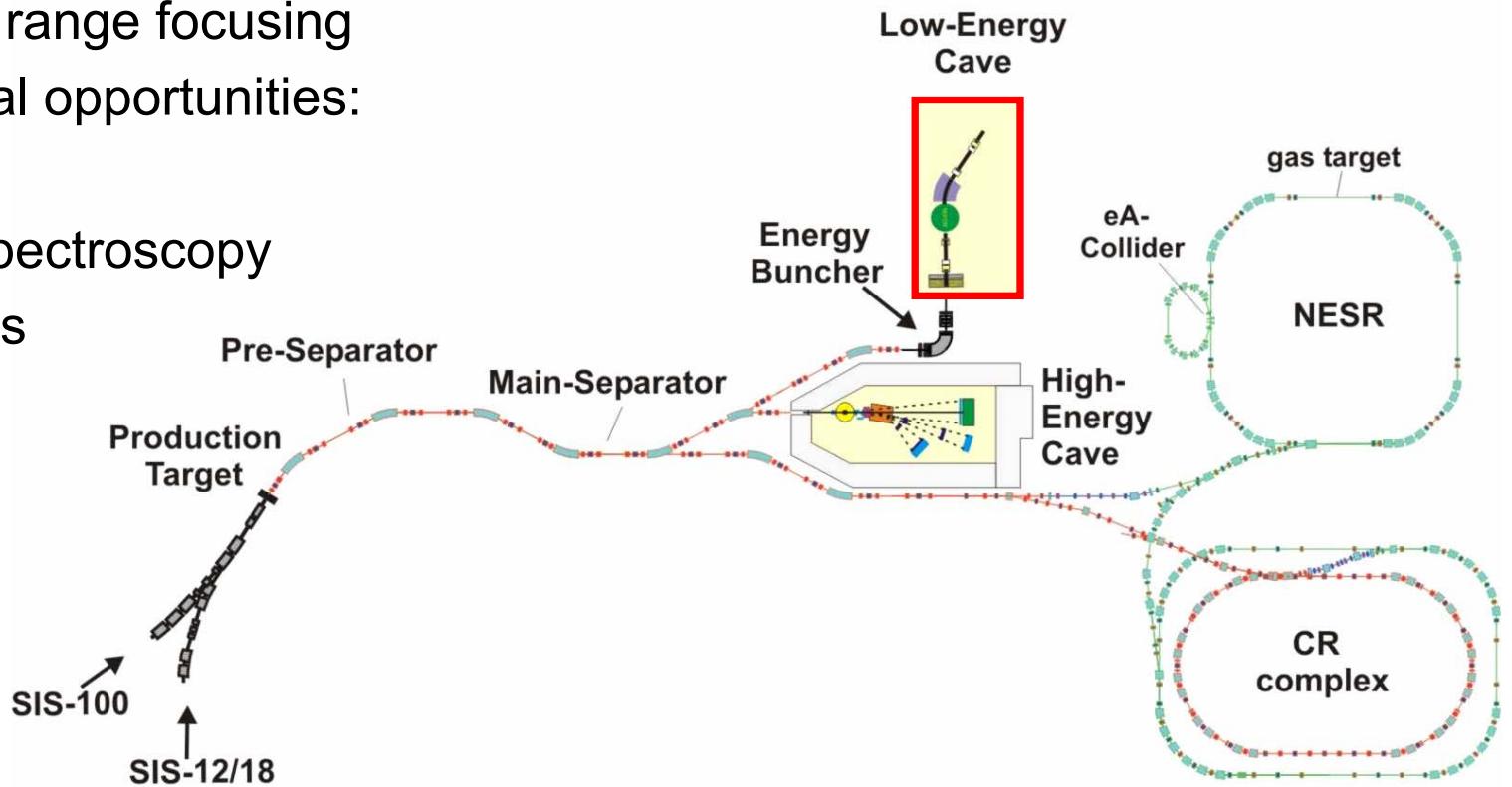


Precision Experiments and Photon Spectroscopy at the Super FRS

Magdalena Górska

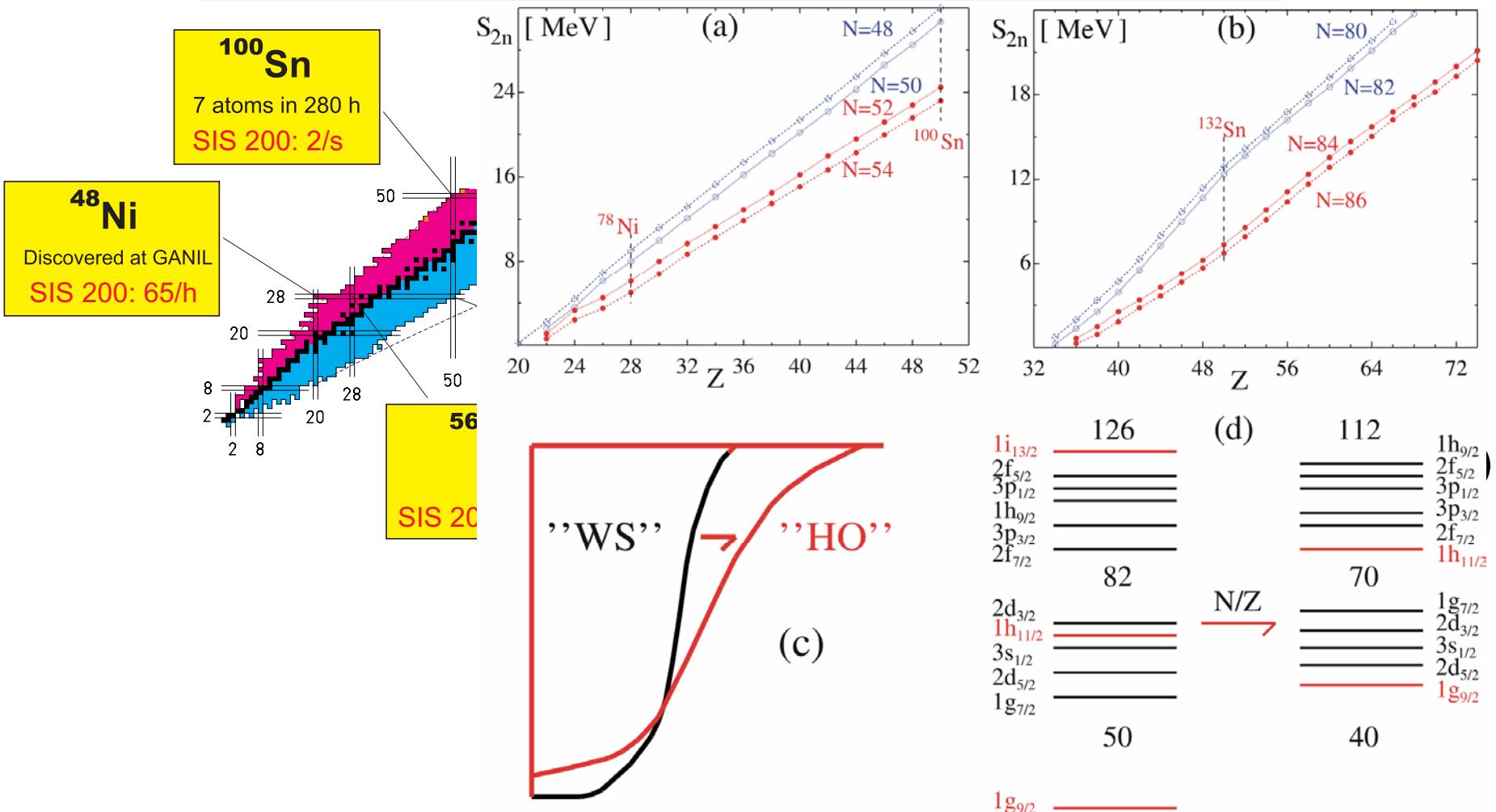
Polish-German Meeting, Warsaw, November 24, 2003

- Motivation for the LEB
- Energy and range focusing
- Experimental opportunities:
 - Agata
 - Laser Spectroscopy
 - Ion Traps



Motivation for the LEB

(Low energy high-quality beams, complementary to ISOL)



T.R. Werner, J. Dobaczewski, W. Nazarewicz,
Z. Phys. A358 (1997) 169

Opportunities at the LEB

Energy Buncher:

$$B\beta_{\text{Max}} = 10 \text{ Tm}$$

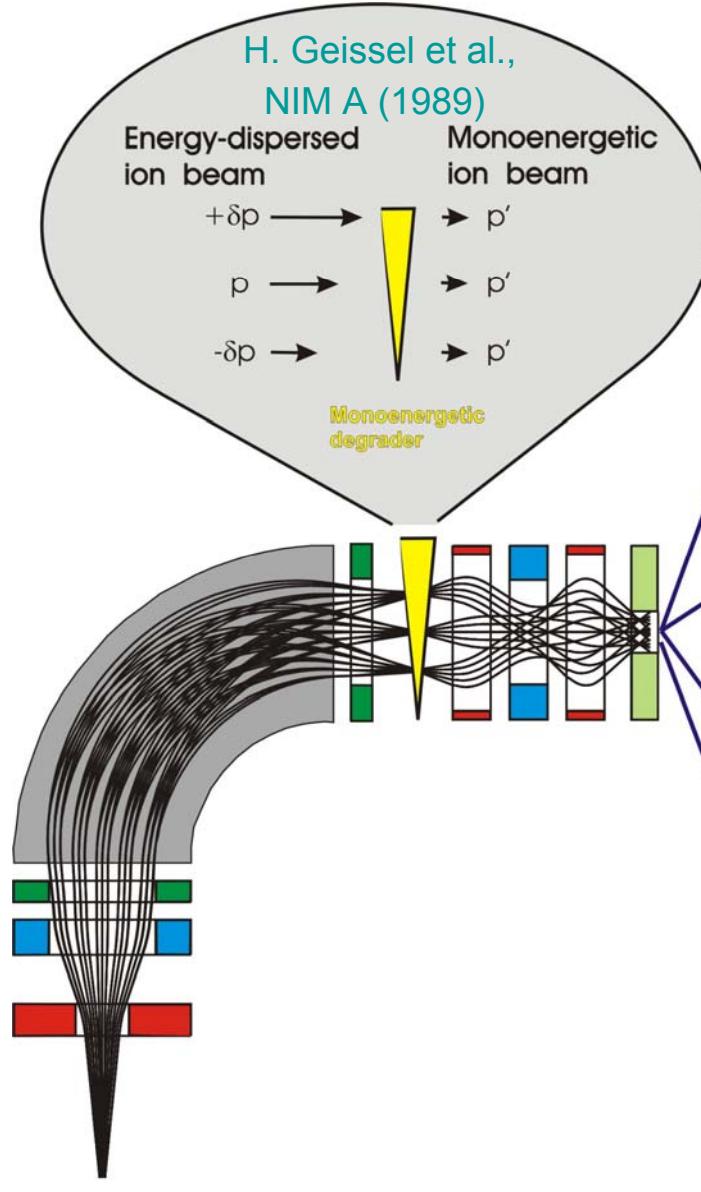
$$\varepsilon_x = \pm 300 \pi \text{ mm mrad}$$

$$\varepsilon_y = \pm 200 \pi \text{ mm mrad}$$

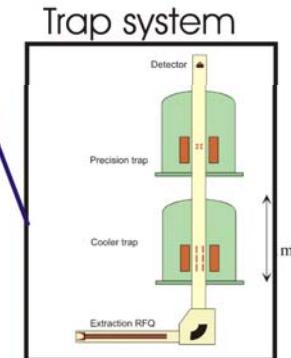
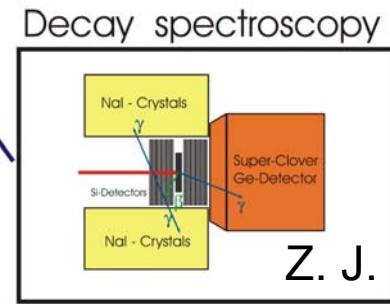
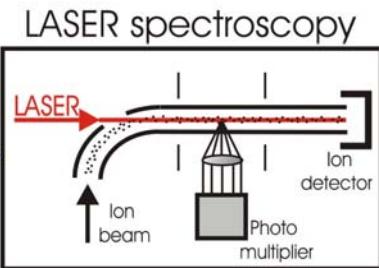
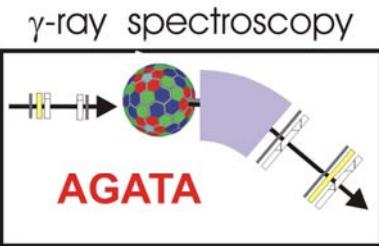
$$\Delta p/p_{\text{acc}} = \pm 2.5\%$$

Ion optical R = 600

C. Scheidenberger



Exotic nuclei from
Super-FRS with
different momenta
 $+ \delta p, p, - \delta p$



γ -spectroscopy experiments with slow exotic nuclear beams

Experiments with * relativistic beams ($\sim 200\text{MeV/u}$)

* slowed beams (5...20MeV/u)

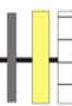
* stopped beams

Investigation of * Coulomb excitation

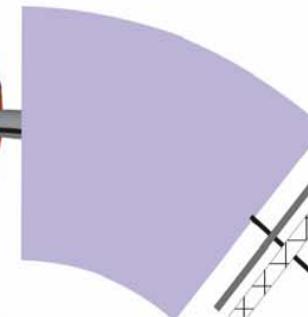
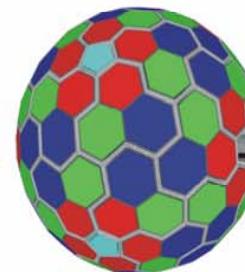
* transfer reactions

* fusion reactions

Exotic beams
from SUPER-FRS



Identification



Identification

AGATA

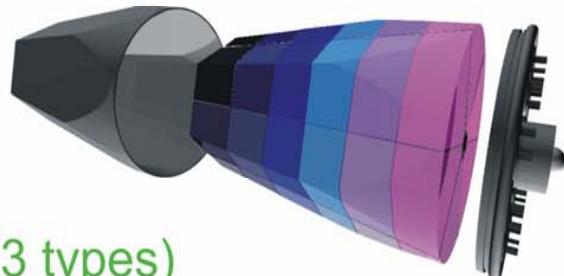
Collaboration: 42 countries including PL

4 π segmented Ge detector shell

17 cm inner radius

80% Ge solid angle

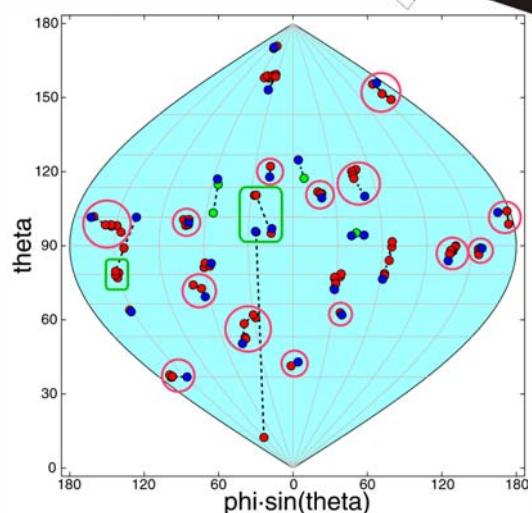
12 regular pentagons



180 irregular hexagons (3 types)

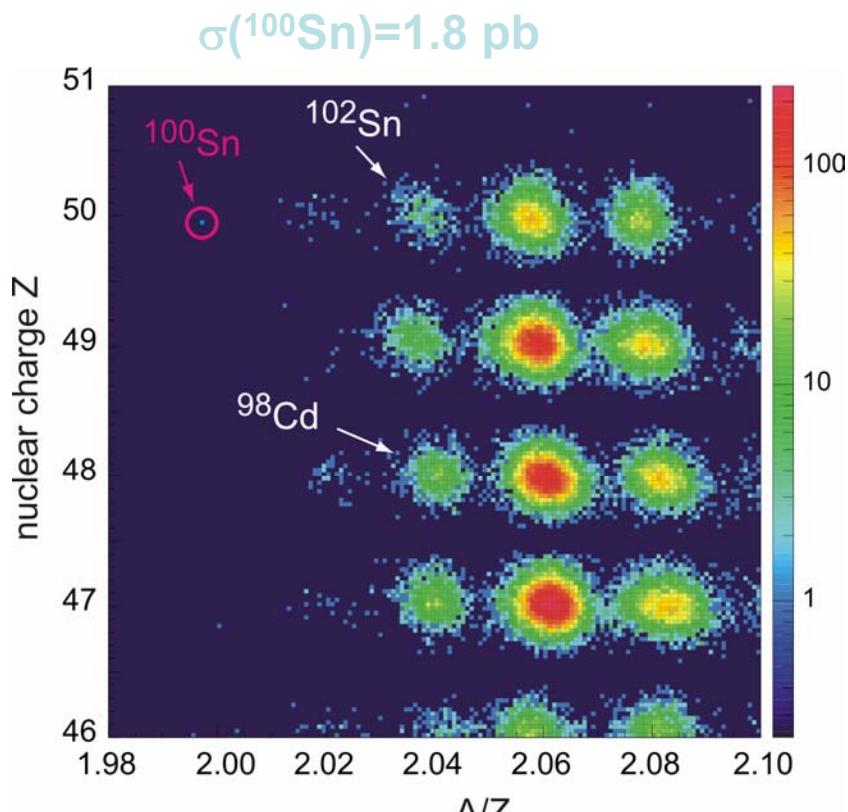
$$\epsilon(M_\gamma=1, E_\gamma=1\text{MeV}) = 0.5$$

ADVANCED
GAMMA
TRACKING
ARRAY



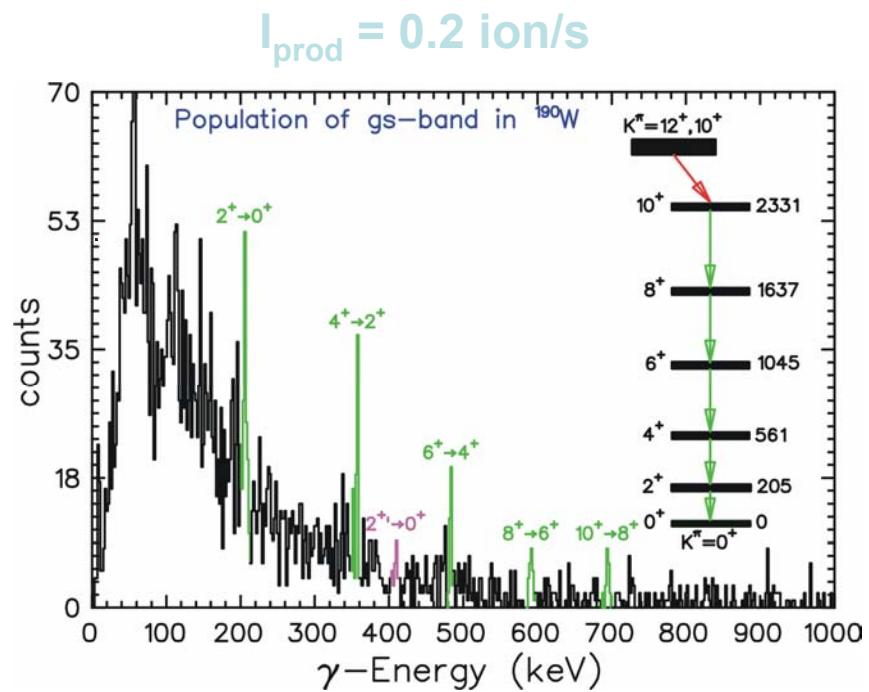
Single-atom spectroscopy

Identification of the Doubly Magic ^{100}Sn



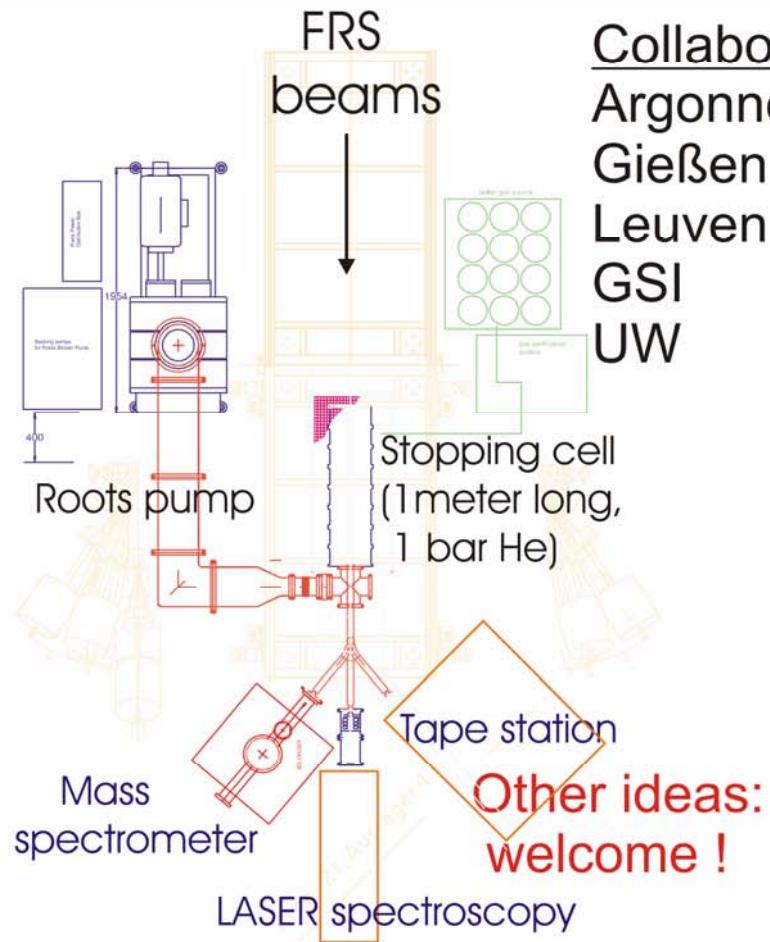
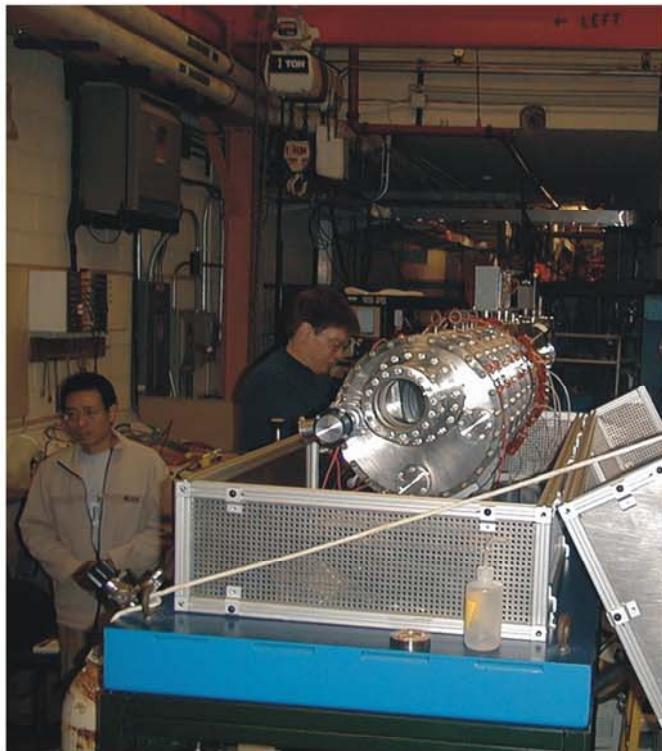
A. Stolz (TUM)

K - isomerism



FRS: Zs. Podolyak et al.,
Phys. Lett. B491 (2000) 225
Warsaw Group

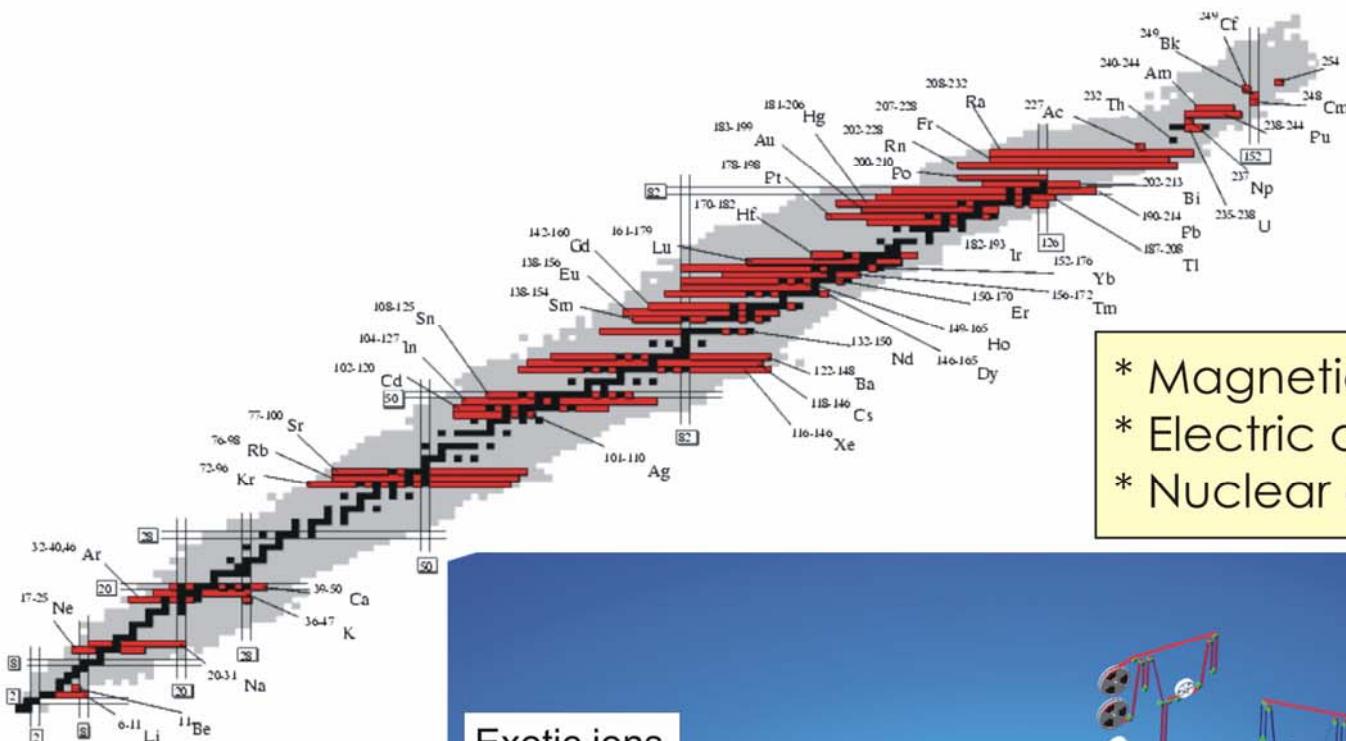
FRS Ion-Catcher Setup*: a study for the LEB of the Super-FRS



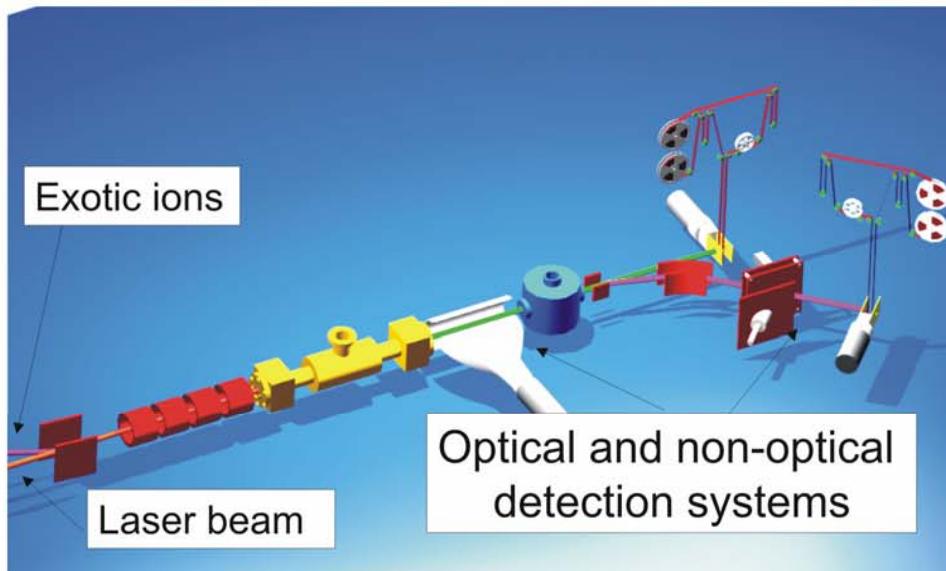
Collaboration:
Argonne ANL
Gießen Univ.
Leuven
GSI
UW

* Part of the European RTD Network "ION CATCHER"

Collinear LASER spectroscopy



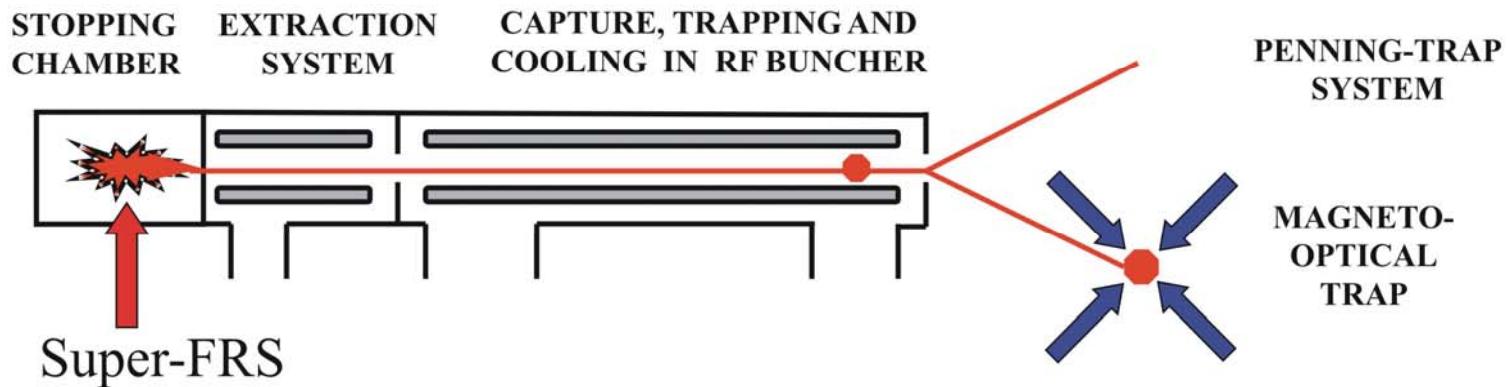
- * Magnetic dipole moments
 - * Electric quadrupole moments
 - * Nuclear charge radii



Experiments in ion and atom traps

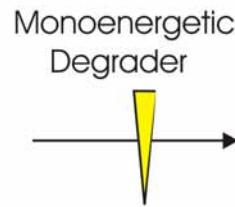
- * Nuclear structure studies
- * Tests of SM
- * Nuclear astrophysics

Nuclear binding energies, Q-values,
superallowed β -decay, unitarity of CKM-Matrix
 β - ν -correlations (search for scalar weak interact.)

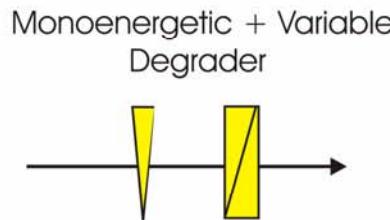


Opportunities at the LEB

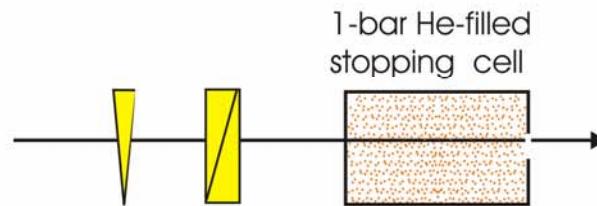
Slow beams
(~100...10 MeV/u)



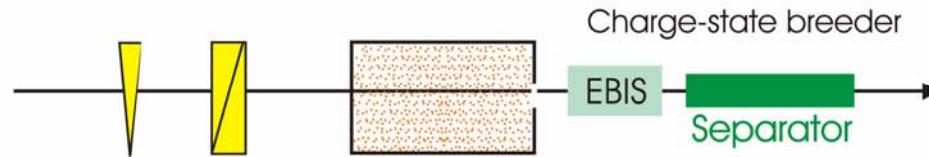
Stopped beams
(~25 meV)



ISOL-type beams
(~10...100 keV)



Highly-charged ions



Re-accelerated beams
(~1...10 MeV/u)



Probing new fields at LEB with:

- swift monoenergetic exotic beams
(gamma-ray spectroscopy)
- ISOL type beams
(laser spectroscopy, precision experiments)
- beam stopped in thin absorbers
(α , β , γ spectroscopy) - see the next talk