

A new technique for charting the
reordering of quantum states in
exotic nuclei

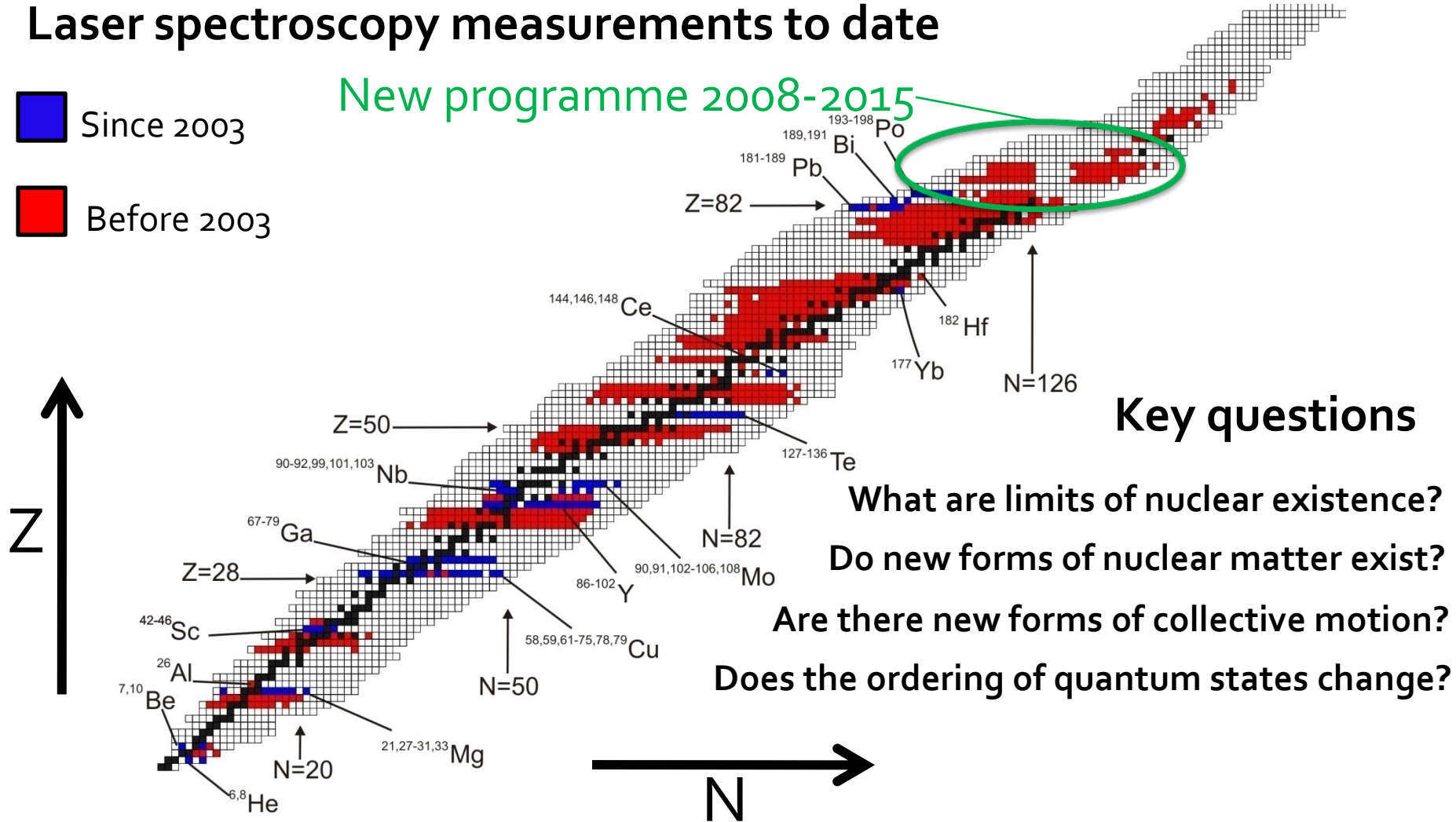
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HIE-ISOLDE: A unique facility for laser spectroscopy

Laser spectroscopy measurements to date

-  Since 2003
-  Before 2003

New programme 2008-2015



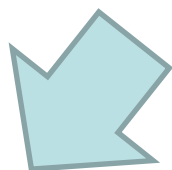
Key questions

- What are limits of nuclear existence?
- Do new forms of nuclear matter exist?
- Are there new forms of collective motion?
- Does the ordering of quantum states change?

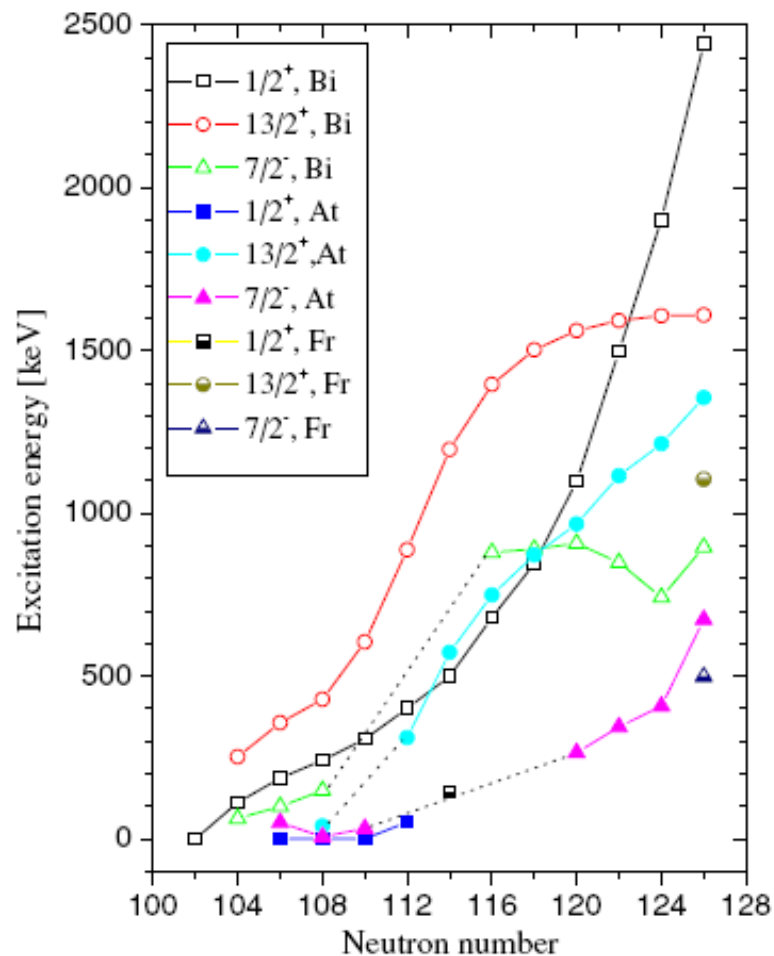
Re-ordering of quantum states in Francium

Systematic reduction in energy of the deformed $\pi(1/2+)$ in isotopes in this region of the chart

$\pi(1/2+)$ proton intruder state becomes the ground state in ^{195}At and ^{185}Bi



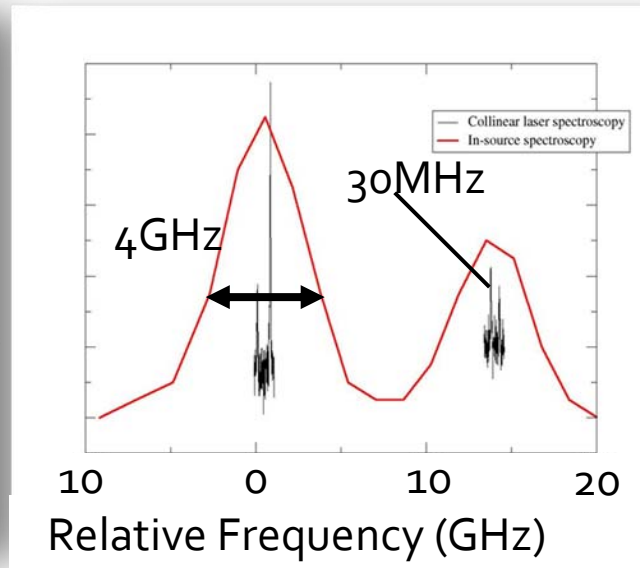
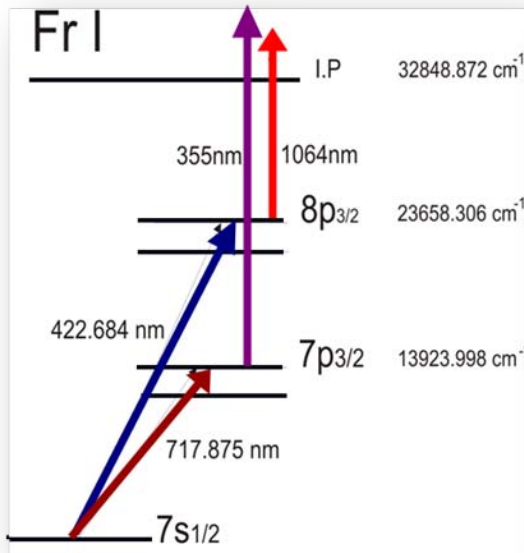
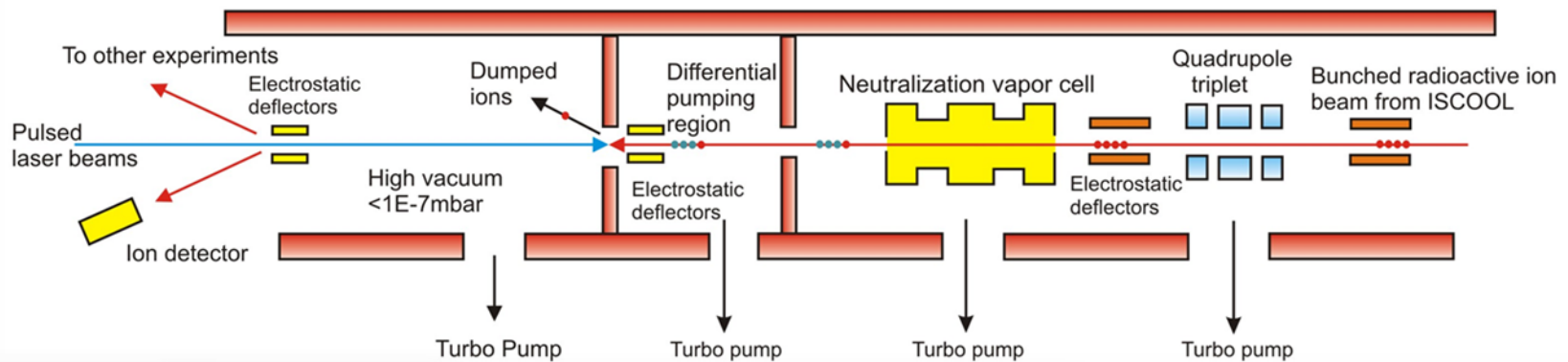
The isomer shifts of $^{201,203}\text{Fr}$ and their magnetic moments will provide important information to better understand the evolution of nuclear structure in this region.



Collinear Resonant Ionization Spectroscopy (CRIS)

$$\Delta E = \text{const} = \delta \left(\frac{1}{2} m v^2 \right) \approx m v \delta v$$

~0.3m for A~200 60kV and 1μs bunches



Combining high resolution nature of collinear beams method with high sensitivity of in-source spectroscopy. Allowing extraction of B factors and quadrupole moments.