Investigating shape coexistence in the lead region with in-source laser spectroscopy at ISOLDE-RILIS

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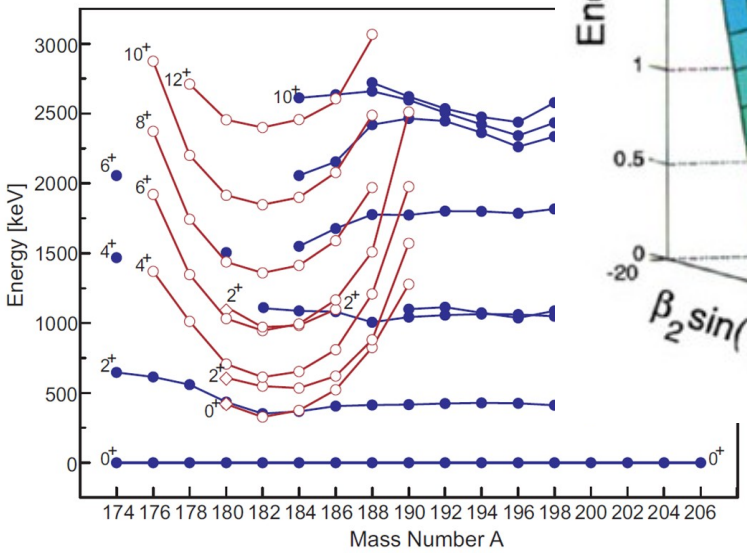
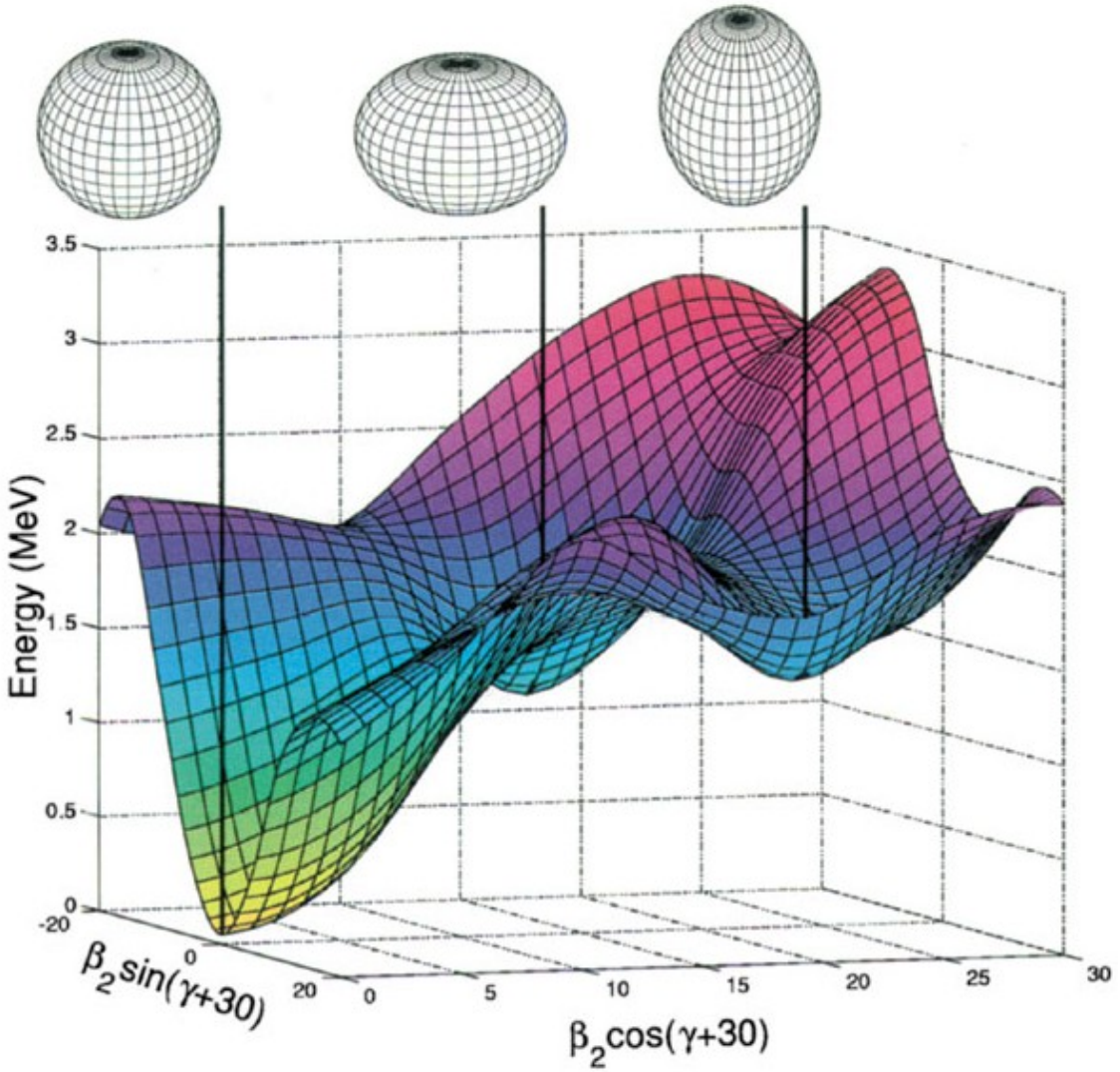
Shape coexistence in the Z=82 region

- Maximum at N=104: triple shape coexistence in ^{186}Pb

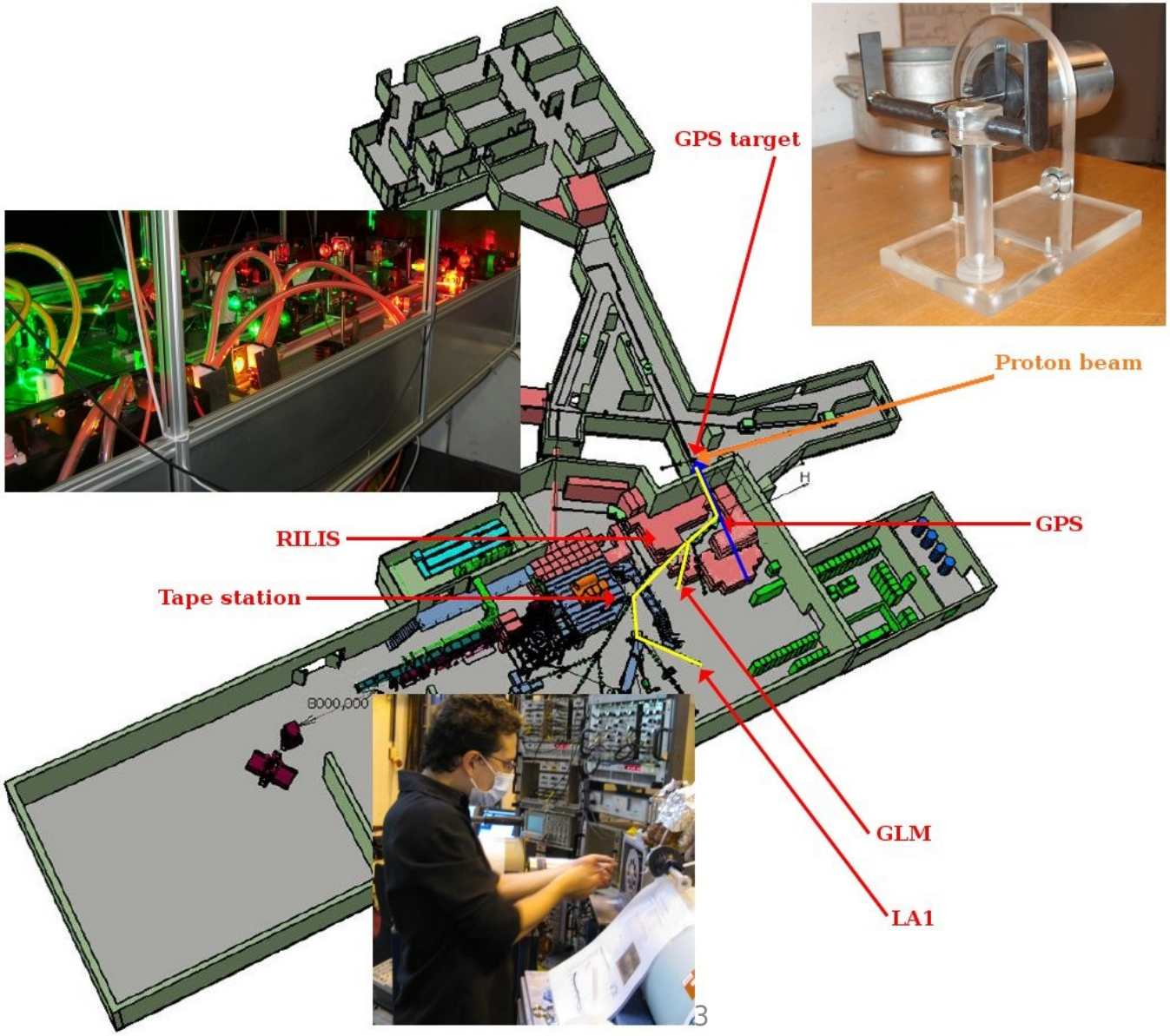
- Parabolic intrusion of deformed band in Hg with maximum at N=104



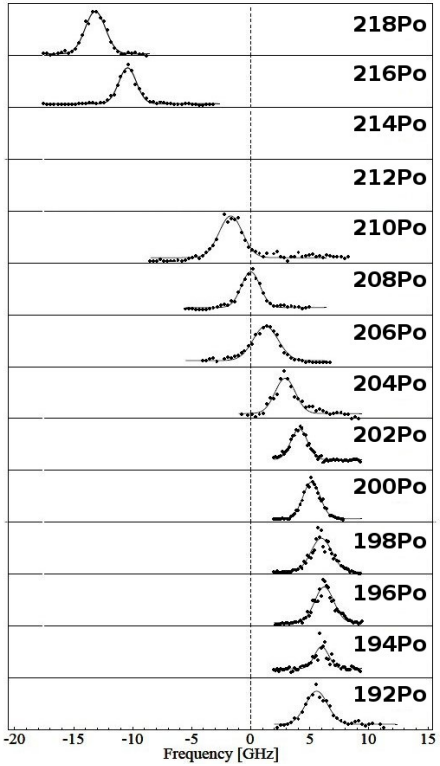


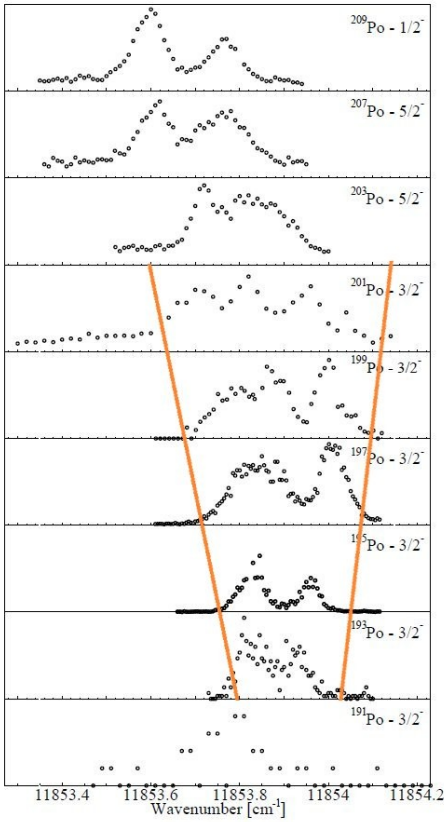
A.N.Andreyev et al., Nature 405(2000)430
J.Elseviers et al., PRC 84(2011)

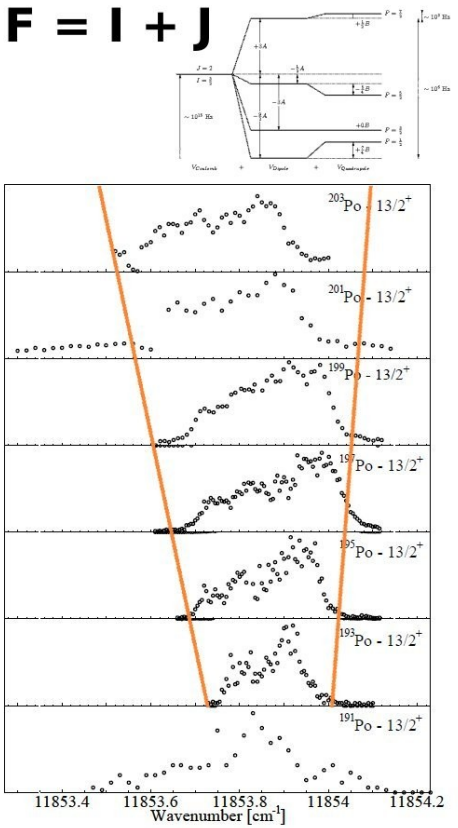
In-source laser spectroscopy at RILIS



Isotope shifts and hyperfine spectra

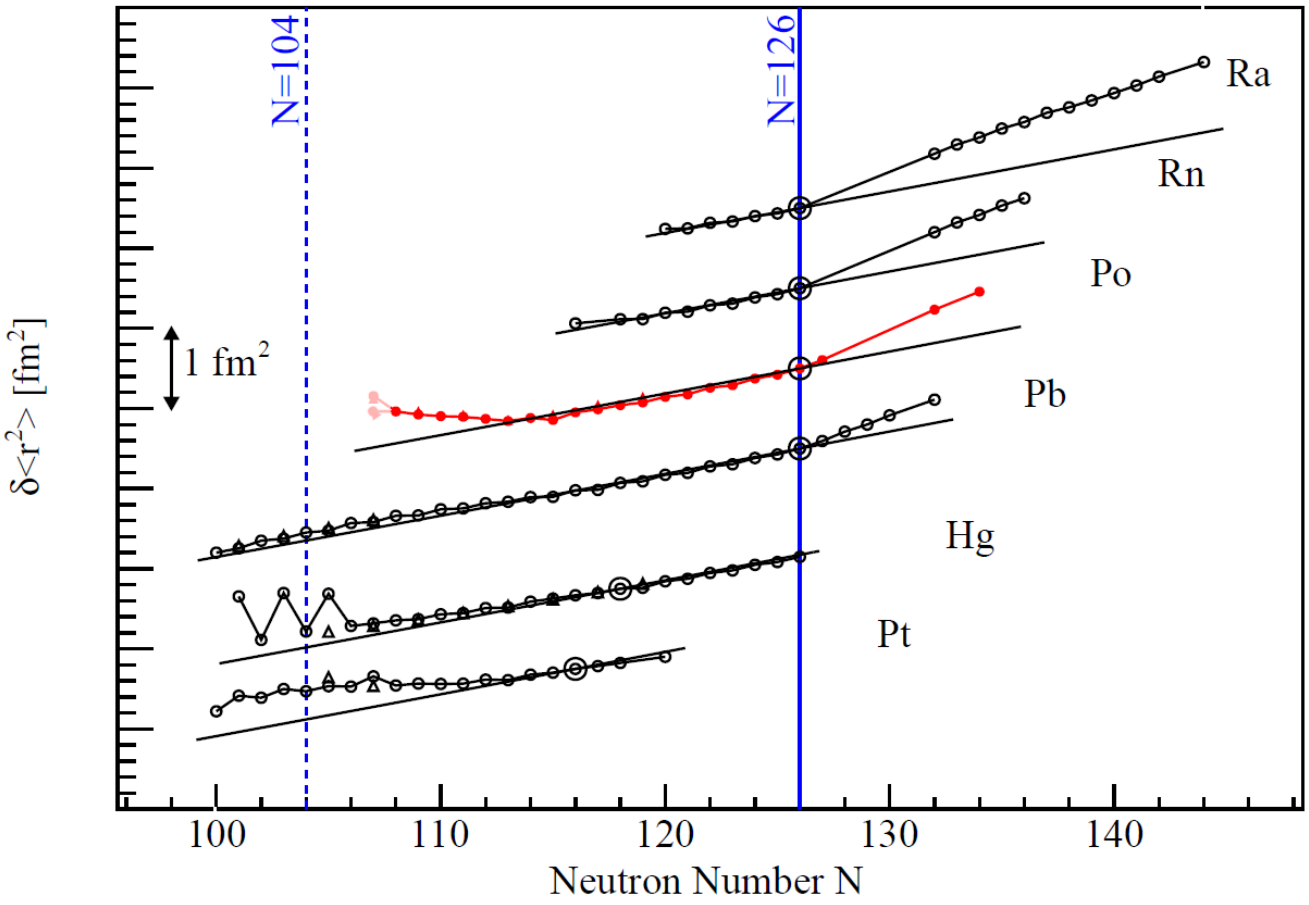




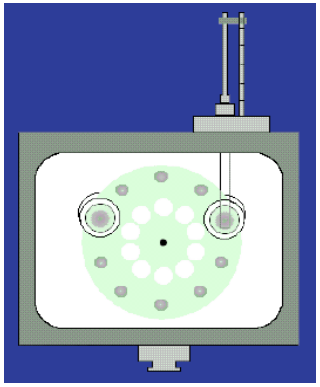


- Measurement down to ^{191}Po ($T_{1/2}$=22ms)
- Detecion using Faraday cup (current), ISOLDE Tape Station ($\beta\gamma$ decay), Leuven Windmill (α decay)

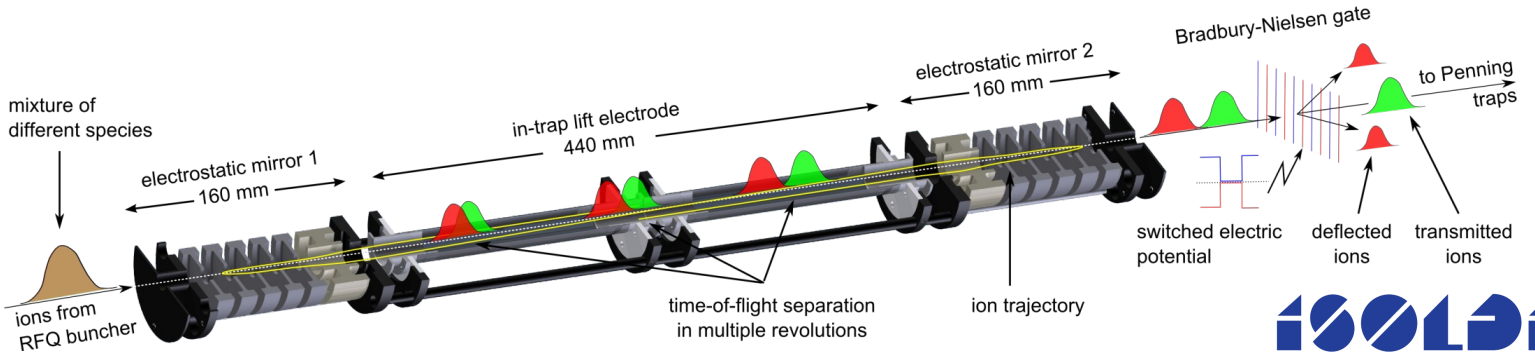
Charge radii: even-Z systematics



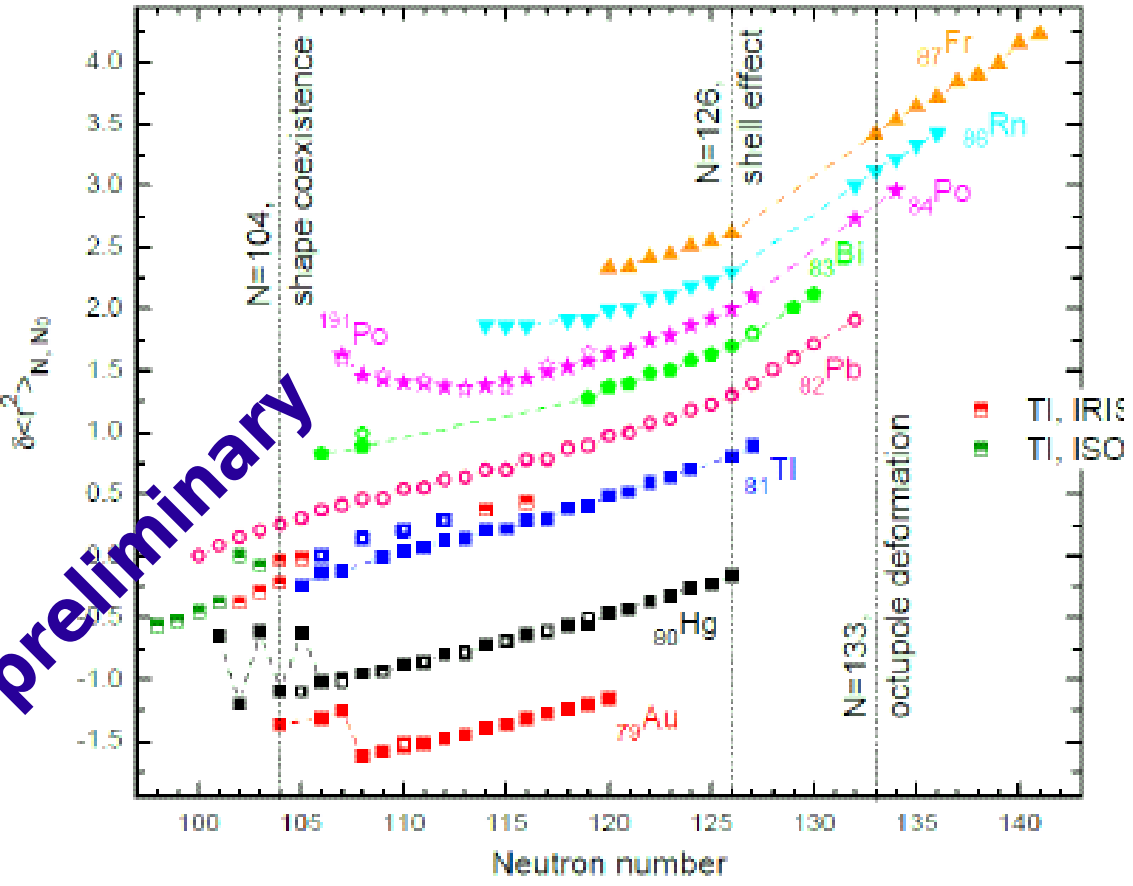
PRIME NEWS!! Au laser spectroscopy



Some neutron-deficient Au isotopes have recently been investigated, in a synergy between the RILIS, Windmill and ISOLTRAP collaborations.



Charge radii: odd-Z systematics



Conclusions

- The ISOLDE RILIS can be used as a sensitive tool for the study of nuclear shapes (and magnetic dipole moments).
- Since 2000, the $\delta\langle r^2\rangle$ of 34 new isotopes of Au, Tl, Pb, Bi & Po have been measured, with half-lives as low as 22ms and production rates down to 0.01 per second.
- In spite of the shape coexistence, the ground state of the Pb isotopes show no shape mixing.
- The Po isotopes depart rapidly and steadily from the spherical droplet, unlike the Hg, showing the importance of the microscopic effects from the proton orbital occupancy.
- The neutron-deficient Au isotopes are under investigation.
- A deeper understanding of the excited states is required (β decay & Coulomb excitation - talks by E.Rapisarda, P.Butler & N.Kesteloot; transfer reactions at HIE-ISOLDE – talk by M.Huyse).
- The importance of the unpaired proton in odd-*Z* nuclei remains under investigation (study of At - talk by S.Rothe).
- Higher precision is required to extract spins and quadrupole moments (CRIS technique – talk by K.T.Flangan).