Determination of nuclear static moments using post-accelerated exotic beams:

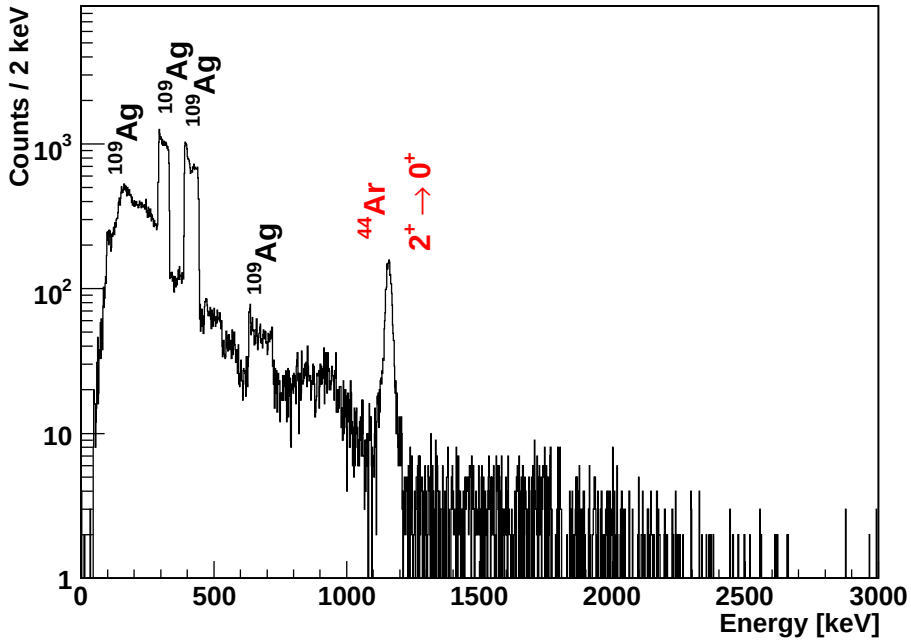
Coulomb excitation of neutron-rich ^{44}Ar at SPIRAL

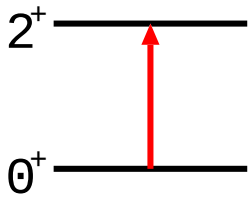
Magda Zielińska[1,2], Andreas Görgen[1], Alexander Bürger[3], Wilton Catford[4], Emmanuel Clément[1,5,6], Cédric Dossat[1], Jędrek Iwanicki[2], Wolfram Korten[1], Joa Ljungvall[1], Paweł J. Napiorkowski[2], Daniel Piętak[7], Geirr Sletten[8], Christophe Theisen[1], Kasia Wrzosek[2]

1) IRFU/SPhN, CEA Saclay, France; 2) HIL, Warsaw University, Poland; 3) University of Bonn, Germany; 4) University of Surrey, Guildford, UK; 5) CERN, Geneva, Switzerland; 6) GANIL, Caen, France; 7) Warsaw University of Technology, Poland; 8) NBI Copenhagen, Denmark;

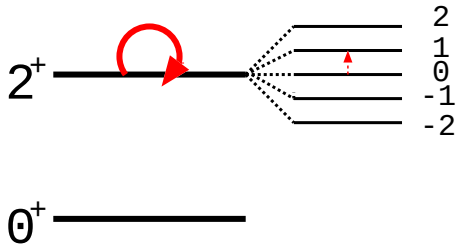
B(E2)'s in radioactive nuclei measured with Coulex

- usually only $2^+ \rightarrow 0^+$ transition visible
- normalisation to target excitation needed





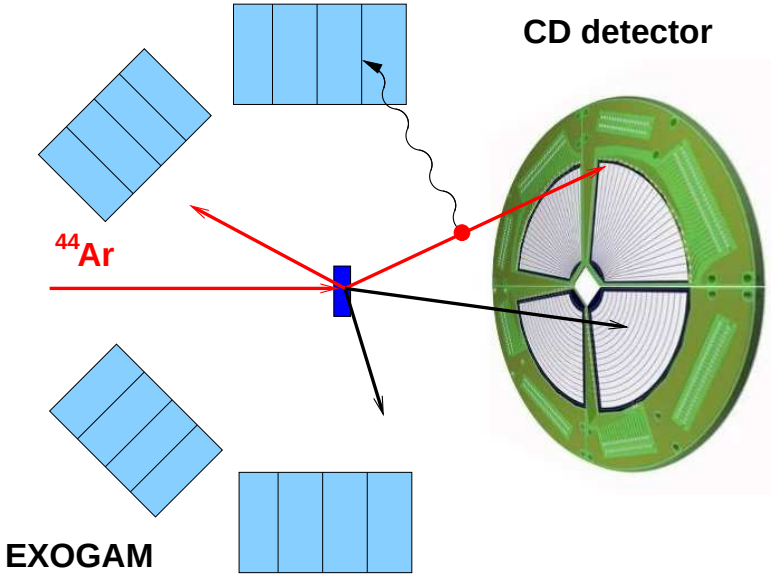
$\langle 2^+ || E2 || 0^+ \rangle^2$
$\sim B(E2; 2^+ \rightarrow 0^+)$

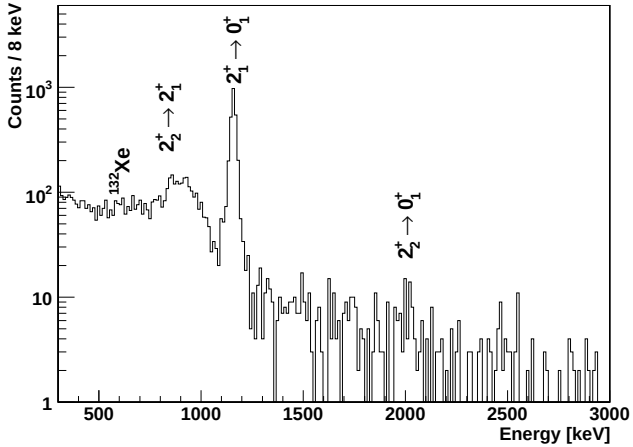


$\langle 2^+ || E2 || 2^+ \rangle \sim Q_0$

- Coulex cross-section depends both on the $B(E2; 2_1^+ \rightarrow 0^+)$ and the quadrupole moment!

Coulomb excitation of ^{44}Ar at GANIL

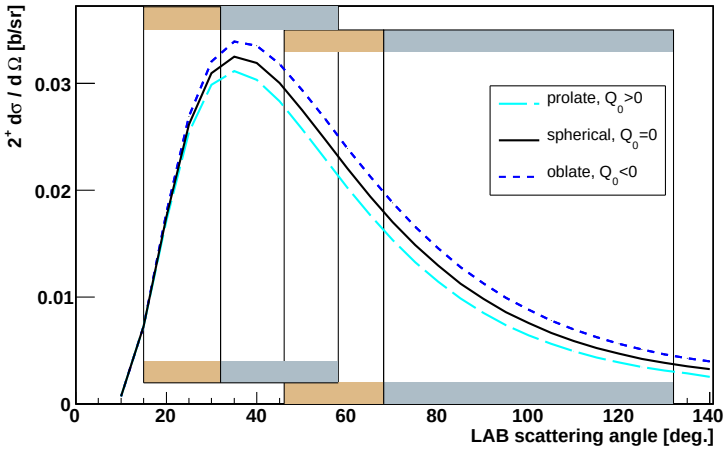




Primary beam: ^{48}Ca, 60 MeV/A, 3.5 μA
Secondary beam: ^{44}Ar

Beam energy	Beam intensity	Target	Target thickness	Duration
3.7 MeV/A	$2.4 \cdot 10^5$ pps	^{208}Pb	1 mg/cm^2	13 UT
2.7 MeV/A	$2.0 \cdot 10^5$ pps	^{109}Ag	0.9 mg/cm^2	8 UT

Extraction of E2 matrix elements

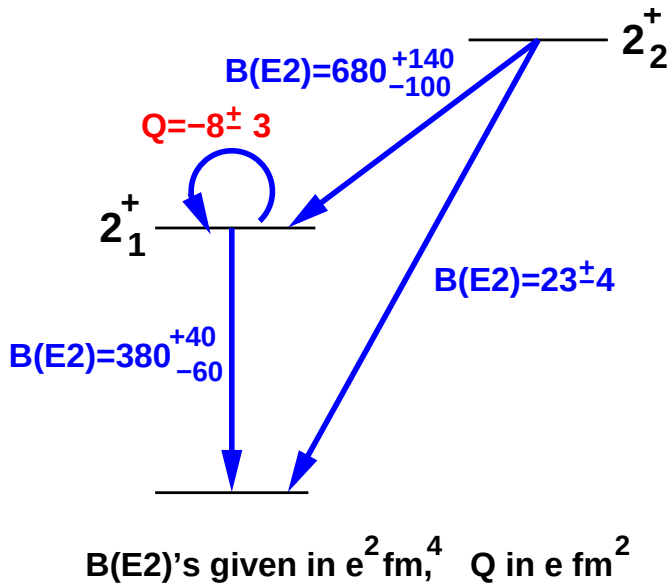


- statistics sufficient to subdivide the data into several angular ranges:
  - $\sim$4300 counts in the $2_1^+ \rightarrow 0^+$ line
  - more than 50 000 counts in normalising transitions in ^{109}Ag

- lowest angular range – influence of quadrupole moment negligible $\rightarrow$ determination of B(E2; $2_1^+ \rightarrow 0^+$)
- information from other bins + data collected on Pb target $\rightarrow$ determination of quadrupole moment of the 2_1^+ state and other B(E2)'s using the standard GOSIA code
- relative normalisation of the bins based on target excitation
- angular ranges chosen to obtain maximum sensitivity to the quadrupole moment

Results

- B(E2; $2_1^+ \rightarrow 0^+$) in agreement with the result from intermediate energy Coulex (345 (41) e^2fm^4)
- quadrupole moment of the 2_1^+ state measured with precision of 35%
- B(E2)'s for transitions deexciting 2_2^+ state measured for the first time



- β deformation: nearly 0.3
- diagonal matrix element – 50% of the rotational value $\rightarrow$ triaxiality ?