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Determining the spectroscopic quadrupole moment Q_s of the first 2⁺ state in ⁴⁰Ar

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Abstract content
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The present study aims at determining the spectroscopic quadrupole moment Q_s of the first 2⁺ excited state in ⁴⁰Ar by carrying out second order Coulomb-excitation reorientation-effect measurements at safe energies. Similar measurements were done in the 1970's by Nakai et al [1,2] with no record of the distance separating two nuclear surfaces (S_{min}). The first 2⁺ state at 1461 keV in ⁴⁰Ar was populated through a safe Coulomb excitation experiment carried out at iThemba LABS (Cape Town) using 143.2 MeV ⁴⁰Ar beams on a a 1.39 mg.cm² ²⁰⁸Pb target. The scattered particles were detected using a double sided S3 silicon detector placed 10.05 mm from the target at backward angles in coincidence with the de-excitation of &gamma rays detected using 8 HPGe clover detectors in the AFRODITE array [3]. The semiclassical coupled channel Coulomb excitation code GOSIA [4] calculates theoretical integrated &gamma ray yields and normalised them to the experimental integrated &gamma ray yields (which carries information about the Q_s) is being used to extract the diagonal matrix element of the exited state which are proportional to the Q_s.

References :

1) R. H. Spear, Phys. Rep. 73, 369 (1981).

2) K. Nakai, J. L. Quebert, F. S. Stephens, and R. M. Diamond, Phys. Rev. 24, 16, (1970).

3) M. Lipoglavsek et al., Nucl. Instr. Meth. Phys. Res. A557, 523 (2006).

4) Gosia Manual 2012.

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