

Recent Results on Spherical and Deformed Nuclei from NICOLE

Tuesday 18 December 2012 09:00 (20 minutes)

The NICOLE dilution refrigerator is an on-line Low-Temperature Nuclear Orientation facility installed at ISOLDE, principally used to measure the magnetic moments of atomic nuclei.

The ground-state of the nucleus ^{49}Sc has only one $f_{7/2}$ proton outside a doubly magic ^{48}Ca core. This makes this nucleus one of the few available for testing the fundamental theory of nuclear magnetism. The magnetic moment has been measured by online nuclear magnetic resonance (NMR) of nuclei oriented at milli-Kelvin temperatures to be $(+5.616(25) \text{ mN})$ [1]. The result is discussed in terms of a detailed theory of the structure of the magnetic-moment operator, showing excellent agreement with calculated departure from the $f_{7/2}$ Schmidt extreme single-particle limit value. The measurement completes the sequence of magnetic moments of the Sc isotopes with even numbers of $f_{7/2}$ neutrons; the first such isotopic chain between two major shells for which a full set of moment measurements exists. The result further completes the isotonic sequence of ground-state moments of nuclei with an odd number of $f_{7/2}$ protons coupled to a closed sub-shell of $f_{7/2}$ neutrons. A comparison with recent shell-model calculations of the latter sequence is made.

On-line nuclear orientation has been used to measure the gamma-ray angular distributions and magnetic moment of the $37/2^-$ high-K isomer of ^{177}Hf . The magnetic moment of the isomer is found to be $7.33(9) \mu\text{N}$ and high precision E2/M1 multipole mixing ratios are extracted for transitions in bands built on the $23/2^+$, 1.1 s, isomer at 1315.4 keV and on the $9/2^+$, 0.663 ns, isomer at 321.3 keV. These new results and magnetic moment and in-band spectroscopic data on other nearby isotopes are examined to test the degree to which the assumption of additivity can be seen as a reliable predictor of the moments of high-K isomers in this region.

[1] T. Ohtsubo et al. Phys. Rev. Lett. 109, 032504 (2012).

[2] N. Stone et al. in preparation.

Primary author: Dr SIMPSON, Gary (LPSC)

Co-authors: GAULARD, Carole Valerie (Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse (CSNSM)); Mr WAUTERS, Frederik (katholieke universiteit leuven); NIKOLOV, Jovana (University of Novi Sad); VESKOVIC, Miroslav (University of Novi Sad (RS)); STONE, Nicholas (Oxford University); WALKER, Philip Malzard (University of Surrey (GB)); MUTO, Suguru (KEK); OHTSUBO, Takashi (Niigata University); KOESTER, Ulli (Institut Max von Laue-Paul Langevin (FR)); Dr WALTERS, William (University of Maryland (US))

Presenter: Dr SIMPSON, Gary (LPSC)

Session Classification: Heavy nuclei