Contribution ID: **3** Type: **Accepted**

Measurements of octupole collectivity in 220,222Rn and 222,224Ra using Coulomb excitation

Friday 10 December 2010 11:50 (20 minutes)

There is considerable theoretical and experimental evidence that atomic nuclei can assume reflection asymmetric shapes that arise from the octupole degree of freedom [1]. The associated phenomena that is observed include odd-even staggering of the positive- and negative-parity yrast bands in even-even nuclei, parity doublets in odd mass nuclei [2,3], and enhanced E1 moments due to a division of the centre of charge and centre of mass [4].
From a microscopic point of view, the wave functions of low-lying 3- octupole excitations must contain components which include the intruding unique parity state (l,j). Because of the nature of the octupole-octupole interaction in nuclei, octupole correlations are more pronounced when this intruder state comes close to the Fermi level, giving rise to [l, j; l-3, j-3] particle-hole configurations at relatively low excitation energies. The strongest correlations occur near the proton numbers Z = 34, 56 and 88 and the neutron numbers N = 34, 56, 88 and 134, where it may be possible that octupole deformation occurs in the ground state.
Indeed, at these values of Z and N, the phenomena described have been observed. However, the only observable that provides unambiguous and direct evidence for enhanced octupole correlations in the nuclei is a measure of the E3 matrix element [5,6], which gives, directly, the strength of octupole correlations in the ground state, B(E3; 0+ -> 3-).
The mass region where octupole correlations are expected to be strongest, i.e. at Z = 88 and N = 134, there is an apparent lack of spectroscopic data. Only for 226Ra, with its comparatively long half life of 1600 years, was it possible to measure the B(E3) strength using Coulomb excitation [6]. Coulomb excitation is the only way of probing this information since the 3- state is directly excited from the ground state. When nuclei are produced in excited states, the E1 decay to the 2+ sates dominates over the E3 decay.
This talk will present the current status, and the first results from the recent Coulomb excitation the post-accerated 224Ra beam at REX-ISOLDE using the MINIBALL setup.

[1] P. A. Butler and W. Nazarewicz, (1996) Rev. Mod. Phys. 68, No.2, 349.
[2] J. F. C. Cocks et al., (1997) Phys. Rev. Lett. 78, 2920 ; (1999) Nucl. Phys A 645, 61.
[3] M Dahlinger et al., (1988) Nucl. Phys. A484, 337.
[4] P. A. Butler and W. Nazarewicz, (1991) Nucl. Phys. A533 249.
[5] R.Ibbotson et al., (1993) Phys. Rev. Lett. 71 1990.
[6] H. J. Wollersheim et al., (1993) Nucl. Phys A556, 261.

Author: Mr GAFFNEY, Liam P. (Oliver Lodge Laboratory-University of Liverpool-UK)

Co-authors: Prof. P.A., Butler (Oliver Lodge Laboratory-University of Liverpool-UK); Dr M., Scheck (Oliver Lodge Laboratory-University of Liverpool-UK)

Presenter: Mr GAFFNEY, Liam P. (Oliver Lodge Laboratory-University of Liverpool-UK)

Session Classification: Heavy Mass Nuclei