

# The subtleties of pairing and collective structures in deformed nuclei

*Thursday, 5 December 2013 14:10 (25 minutes)*

It is well known that simple monopole pairing is a pretty crude approximation. It can account for the observations that the ground states of all even-even nuclei have spin-parity  $0^+$  and that there is a pairing gap above the ground state in deformed nuclei before particle-hole (p-h) configurations can be excited. As an approximation it is best for proton and neutron mid-shell nuclei where the available single particle Nilsson wavefunctions have large overlaps. However at the beginning of regions of deformation, where high-K orbitals can be brought to the Fermi surface from a lower shell, simple monopole pairing is inadequate in describing the physics of the observed data. This is because the overlap of the wavefunctions is small for low-K deformation driving prolate orbitals and high-K oblate orbitals extruded from a lower shell. This was initially pointed out by Griffin, Jackson and Volkov [1] and used to account for the back-bending frequencies of bands based on high-K orbitals by Jerry Garrett [2].

More recently, with a considerable increase in the quantity and quality of experimental data available, configuration dependent pairing has been used to account for the properties of low-lying first excited  $0^+$  states in  $N=88$  and  $90$  nuclei at the onset of deformation in the rare earths [3,4]. The properties of  $0^+$  states in these and other nuclei at the start of regions of deformation and the effects blocking of pairing leading a decrease in the back-bending critical frequencies in odd nuclei will be presented.

[1] R. E. Griffin, A. D. Jackson and A. B. Volkov, Phys. Lett. 36B, 281 (1971).

[2] J D Garrett et al., Phys. Lett. B118, 297 (1982).

[3] J F Sharpey-Schafer et al, Eu. Phys. J. A47, 5 (2011).

[4] J F Sharpey-Schafer et al, Eu. Phys. J. A47, 6 (2011).

**Primary author:** Prof. SHARPEY-SCHAFER, John F (University of Western Cape)

**Presenter:** Prof. SHARPEY-SCHAFER, John F (University of Western Cape)

**Session Classification:** Nuclear Physics