

# SAIP2014



Contribution ID : 179

## Octupole correlations and Collective Couplings in the rare earth nucleus $^{154}\text{Dy}$

Tuesday 08 Jul 2014 at 11:30 (00h20')

### Abstract :

There is currently less information available on the structure of  $^{154}\text{Dy}$  at low spins. The question still remains whether at low spins the structure exhibits permanent octupole deformation [1] or aligned tidal wave octupole phonons [2]. Intermediate spins of the nucleus  $^{154}\text{Dy}$  were populated via the  $^{155}\text{Gd}(3\text{He}, 4n)^{154}\text{Dy}$  reaction at 45 MeV at iThemba LABS using AFRODITE array spectrometer. The even-even nucleus  $^{154}\text{Dy}$  with 6 neutrons and 2 protons outside the closed shell is nearly spherical. The  $N = 88$  isotones have remarkable features; They are at a peak in the  $|M(E3)|^2$  transition strength of  $0^+ \rightarrow 3^-$  transitions for even-even nuclei as a function of neutron number usually called octupole vibration [34]. This was first stated by Chasman theoretically [1] whereby the first excited states in some nuclei have an octupole deformed first excited state with a quadruple deformation in the ground state and shown experimentally for  $^{154}\text{Gd}$  [4]. The strong E3 properties have been described and explained as due to the nearness of  $\Delta J^\pi = 3^-$  shell model orbits to the Fermi surface. They also have very strong E0 transitions from the band built on the  $0^+$  states to the ground state bands [3, 5]. The measurements we have made on  $^{154}\text{Dy}$  are motivated by the findings from our studies of the isotones  $^{152}\text{Gd}$  and  $^{150}\text{Sm}$  from [6] where we observed octupole correlations between the  $0^+$  states and the lowest-lying negative parity band, commonly known as the octupole band. References [1] R. R. Chasman, Phys. Rev. Lett. 42, 630 (1979). [2] S. Frauendorf, Phys. Rev. C77, 021304(R) (2008). [3] S. P. Bvumbi et al., Phys. Rev. C 87, 044333 (2013). [4] S P Bvumbi, "Spin and Parity Assignment in  $^{152}\text{Gd}$  Investigating Octupole Structures"; MSc thesis, University of Western Cape (2008). [5] S. Frauendorf, Y. Gu, J. Sun, Tidal waves as yrast states in transitional nuclei (2007). [6] S. P. Bvumbi, "Investigation of octupole correlations and collective couplings in the rare earth nucleus  $^{150}\text{Sm}$ " PhD thesis, University of Johannesburg, (2013).

### Award :

yes

### Level :

MSc

### Supervisor :

SUZAN PHUMUDZO BVUMBI University of Johannesburg [suzan@tlabs.ac.za](mailto:suzan@tlabs.ac.za)

### Paper :

Yes

**Primary authors :** Mr. ZIMBA, George (University of Johannesburg)

**Co-authors :** Ms. BVUMBI, Suzan Phumudzo (University of Johannesburg) ; Dr. JONES, Pete (iThemba LABS) ; Dr. MASITENG, Paulus (University of Johannesburg) ; Mr. MAJOLA, Siyabonga (UCT/ iThemba Labs) ; Mr. DINOKO, Tshepo (iThemba Labs) ; Prof. SHARPEY-SCHAFFER, John F (UWC) ; Dr. LAWRIE, Elena (iThemba LABS) ; Dr. LAWRIE, Kobus (iThemba LABS)

**Presenter :** Mr. ZIMBA, George (University of Johannesburg)

**Session classification :** NPRP

**Track classification :** Track B - Nuclear, Particle and Radiation Physics

**Type :** Oral Presentation