Investigating the Evolution of the Pygmy Dipole Resonance with deformation in Samarium Isotopes

Speaker: Harshna Jivan





Laboratory for Accelerator Based Sciences



Motivation: The Pygmy Dipole Resonance



Motivation: PDR in deformed nuclei



GDR splitting → Oscillation along and perpendicular to symmetry axis

A. Krugmann, et. al. (2014), (to be published) Courtesy of Peter Von Neumann-Cosel



Possible interpretation PDR splitting → oscillation of p-n core against n-skin along two axes (K-splitting)

Recent experiment at RCNP ¹⁵⁴Sm(p,p') @ 295 MeV Showed presence of a double-hump structure in the PDR.



Motivation: Evolution of PDR with deformation

Investigated in ¹³²⁻¹⁶⁶Sn using RQRPA formalism

D. Peña Arteaga, et. al. PRC 79 034311 (2009)



Deformation quenches the isovector dipole response in the PDR region

Motivation: Evolution of PDR with deformation

Investigation with liquid drop model calculation



M. Faccioli, J.A. Lay, A. Vitturi, M.V. Andrés, E.G. Lanza (to be published) Courtesy of E.G Lanza

Comparison of ratio between the transition probability of K=0 and K=1 for the isovector and iscoscalar component

 \rightarrow Variation in ratio for isoscalar case is stronger

Our study

^{154,144}Sm(α,α'γ) at 120 MeV at the iThemba LABS
Using the K600 magnetic spectrometer in 0° mode and BaGeL (Ball of Germanium and LaBr detectors)





At the K600 focal plane: 1 XU VDC (position and angle) 1 plastic scintillator paddle (PID)

BaGeL: 8-12 HPGe Clovers 2-6 large volume LaBr3:Ce







BaGeL

 Performed using ⁶⁰Co, ¹³⁷Cs, ⁵⁶Co, ¹⁵²Eu and AmBeFe radioactive sources











Calibration

the GEANT package [8]. The upper curve corresponds to the add-back detection mode and the lower one to the direct mode.

¹⁵⁴Sm Preliminary results: Co-incidence Matrix



¹⁵⁴Sm Preliminary results: Ground state decay projections



Summary

- The Evolution of the PDR with deformation is being investigated using the $(\alpha, \alpha' \gamma)$ reaction in ¹⁴⁴Sm and ¹⁵⁴Sm @ iThemba LABS
- Preliminary results for of ¹⁵⁴Sm show population in the region of interest
- ¹⁴⁴Sm experiments set to take place in November 2018

Next steps for ¹⁵⁴Sm analysis

- Geant simulations for efficiency @
 higher energies
- Deduce angular correlation
- Extract cross sections

Collaborators

Supervised by L. Pellegri and E. Sideras-Haddad

Full Name

Institution

Title or Position

J. Carter I. Usman O. S. Olurunfunmi P.T. Molema C.S. Moodley L. Baloyi R. Nevelina F.D. Smit G. F. Stevn L. Donaldson P. von Neuman-Cosel S. Bassauer M. Singer P. Adsley P. Papka J.J. van Zyl M. Wiedeking P. Jones S. Triambak N. Orce Y. Fujita H. Fuiita A. Tamii N. Kobayashi J. Isaak A. Czeszumska A. Inoue S. Nakamura A. Negret C. Mihai K.C.W. Li W. Brummer D. Savran A. Zilges S. Siem A. Görgen

University of the Witwatersrand iThemba LABS iThemba LABS iThemba LABS iThemba LABS TU Darmstadt, Germany TU Darmstadt, Germany TU Darmstadt, Germany **CNRS**, France Stellenbosch University Stellenbosch University iThemba LABS iThemba LABS University of the Western Cape University of the Western Cape RCNP, Osaka University, Japan IFIN-HH, Romania IFIN-HH, Romania Stellenbosch University Stellenbosch Universitv GSI Helmholtzzentrum für Schwerionenforschung, Germany Universität zu Köln, Germany University of Oslo, Norway University of Oslo, Norway

Professor Researcher PhD student MSc student MSc student MSc student Researcher Researcher Researcher Postdoc Professor PhD student PhD student Postdoc Professor Researcher Researcher Researcher Professor Professor Professor Researcher Professor Assistant Professor Assistant Professor Postdoc PhD Student MSc student Researcher Researcher PhD Student PhD Student Researcher Professor

Professor

Professor

Thank you!