Contribution ID: **41** Type: **Poster Presentation**

Comparative study of the isoscalar giant monopole resonance in ^{58}Ni and analysis of its fine structure

Background:
Inelastic α-particles scattering at energies of a few hundred MeV and very-forward scattering angles including 0° has been established as a best tool for the study of the isoscalar giant monopole (IS0) strength distributions in nuclei across the periodic table. The present study describes a systematic investigation of the fine structure of the IS0 resonance in ^{58}Ni.

Objective:
This work aims to extract the IS0 strength distributions and analysis of their fine structure in the energy region of the isoscalar giant monopole resonance (ISGMR).

Methods:
The ISGMR was excited in ^{58}Ni using α-particle inelastic scattering measurements acquired with an $E_\alpha = 196$ MeV beam at scattering angles $\theta_{\text{Lab}} = 0^\circ$ and 4°. The K600 magnetic spectrometer at iThemba LABS was used to detect and momentum analyse the inelastically scattered α particles. An experimental energy resolution of $\approx$ 70 keV (FWHM) was obtained, revealing fine structure in the excitation-energy region of the ISGMR. The IS0 strength distributions in the nuclei studied were obtained with the Difference-of-Spectrum (DoS) technique. Further, the extraction of characteristic energy scales from the fine structure observed in the IS0 strength distributions was performed using the technique of Continuous Wavelet Transform (CWT). The theoretical comparison is based on the phonon-phonon coupling (PPC) model where the calculation of the single spectrum and the parameters of the residual interaction are done with the Skyrme forces f^-.

Results:
IS0 strength distributions for ^{58}Ni are extracted and compared to previously published results from experiments performed at 240 MeV incident energy at the Texas A&M University (TAMU) and from experiments performed at 386 MeV incident energy at the Research Center for Nuclear Physics (RCNP). With some exceptions, a reasonable agreement is obtained. Wavelet-analysis techniques are used to extract characteristic energy scales of the fine structure of the ISGMR from the experimental data. Comparisons with the PPC predictions provide insight into the damping mechanisms of the ISGMR.

Conclusions:
Fine structure in the energy region of the ISGMR is observed and may arise from coupling to collective phonons and the non-harmonicity owing to interactions among phonons.

Apply to be considered for a student ; award (Yes / No)?

No

Level for award;(Hons, MSc, PhD, N/A)?

N/A

Primary author: BAHINI, Armand (School of Physics, Wits)

Co-authors: USMAN, Iyabo (University of the Witwatersrand, Johannesburg.); CARTER, John (University of the Witwatersrand); Prof. VON NEUMANN-COSEL, Peter (Institut fur Kernphysik, Technische Universitat Darmstadt, D-64289 Darmstadt, Germany); NEVELING, Retief (iThemba LABS); Dr ARSENYEV, N. N. (Laboratory of Theoretical Physics, Joint Institute for Nuclear Research, Dubna, Moscow Region 141980, Russia); ADSLEY, Philip (University of Stellenbosch/iThemba LABS); BOTHA, Nolan (University of the Witwatersrand); BRUMMER, J (University); DONALDSON, Lindsay (iThemba Laboratory for Accelerator Based Sciences); JONGILE, SANDILE (UNIVERSITY OF ZULULAND); KHUMALO, Charmane (iThemba LABS); LATIF, Mouftahou (School of Physics, University of the Witwatersrand, Johannesburg, 2050); LI, Kevin (Stellenbosch University, iThemba Labs); MABIKA, Phumzile (University of the Western Cape); MOLEMA, Pheladi (Wits); MOODLEY, Chané Simone (University of the Witwatersrand); OLORUNFUNMI, Sunday (University of Witwatersrand, Johannesburg); PAPKA, Paul (Stellenbosch University); PELLEGRI, Luna (University of Witwatersrand and iThemba LABs); REBEIRO, Bernadette (University of the Western Cape); SIDERAS-HADDAD, ELIAS (University of the Witwatersrand); SMIT, Frederick David (iThemba LABS); TRIAMBAK, Smarajit (University of the Western Cape); Dr VAN ZYL, JJ (Department of Physics, Stellenbosch University, 7602 Matieland, Stellenbosch, South Africa)

Presenter: BAHINI, Armand (School of Physics, Wits)

Session Classification: Poster Session

Track Classification: Track B - Nuclear, Particle and Radiation Physics