SAIP2013

Contribution ID : 255

A survey of the fine structure phenomenon of the Isovector Giant Dipole Resonance in nuclei across the periodic table at a forward scattering angle

Wednesday 10 Jul 2013 at 13:50 (00h20')

Abstract :

A survey of the fine structure phenomenon of the Isovector Giant Dipole Resonance (IVGDR) was carried out, using proton inelastic scattering at an incident energy of 200 MeV for a wide target-mass range of closed and near-closed nuclei: ^{27}Al, ^{40}Ca, ^{56}Fe, ^{58}Ni and ^{208}Pb. The data obtained will provide an unique insight into the role of different damping mechanisms contributing to the decay of the IVGDR. In this work, a model-independent background subtraction procedure which eliminates the contributions due to the Isoscalar Giant Quadrupole Resonance (ISGQR) and the phenomelogical background effects was initially implemented before the cross-section spectra were converted to the equivalent photo-absorption cross-sections. The equivalent photo-absorption cross-sections were then compared with &gamma-capture; reactions as a check for consistency. Characteristic energy scales from the experimental data will be extracted using the wavelet analysis technique. Three mother wavelets namely, the Morlet, Complex Morlet and Complex Lorentzian mother wavelets will be used to extract these energy scales. Recent studies have shown that, the Complex Lorentzian mother wavelet produces clearer, better defined, wavelet coefficient plots i.e. its power spectra have better separations of scales, therefore, this study promises a re-affirmation of this observation. Furthermore, experimental level densities will be extracted using the fluctuation analysis method. The method utilises the autocorrelation function which is a key tool in obtaining a measure of the cross-section fluctuations with respect to a stationary mean value. It also makes use of the Discrete Wavelet Transform (DWT) analysis which critical in removing the remaining physical background from other multipoles excited and any remaining instrumental background. The experimentally extracted level densities will then be compared with different theoretical parameterisations of the Hartree-Fock Bogoliubov (HFB), Hartree-Fock-Bardeen-Cooper-Schrier (HF-BCS) and Back-shifted-Fermi-Gas model (BSFG). Finally, the state-of-the-art microscopic models for excitation of the IVGDR e.g. the Quasi-particle phonon model (QPM) and the Second Random Phase Approximation (SRPA) will be compared to the experimental data.

Award :

No

Level :

PhD

Supervisor :

Prof J. CarterJohn.Carter@wits.ac.zaUniversity of the WitwatersrandJohannesburg

Paper :

No

Primary authors : Mr. JINGO, Maxwell (School of Physics, University of the Witwatersrand, Johannesburg 2050, South Africa)

Co-authors : Mr. KUREBA, C. O. (School of Physics, University of the Witwatersrand, Johannesburg 2050, South Africa) ; Prof. CARTER, J. (School of Physics, University of the Witwatersrand, Johannesburg 2050, South Africa) ; Dr. CONRADIE, J. L. (iThemba Laboratory for Accelerator Based Sciences, Somerset West 7129, South Africa) ; Prof. FEARICK, R. W. (Physics Department, University of Cape Town, Rondebosch 7700, South Africa) ; Dr. FÖRSTCH, S. V. (iThemba Laboratory for Accelerator Based Sciences, Somerset West 7129, South Africa) ; Dr. FOURIE, D. T. (iThemba Laboratory for

Accelerator Based Sciences, Somerset West 7129, South Africa) ; Ms. HEILMAN, A. M. (Institut für Kernphysik, Technische Universität Darmstadt, D-64829, Darmstadt, Germany) ; Mr. MURRAY, S. H. T. (iThemba Laboratory for Accelerator Based Sciences, Somerset West 7129, South Africa) ; Prof. VON NEUMANN-COSEL, P. (Institut für Kernphysik, Technische Universität Darmstadt, D-64829, Darmstadt, Germany) ; Dr. NEVELING, R. (iThemba Laboratory for Accelerator Based Sciences, Somerset West 7129, South Africa) ; Prof. NEWMAN, R. T. (Department of Physics, University of Stellenbosch, Matieland 7602, South Africa) ; Prof. PAPKA, P. (Department of Physics, University of Stellenbosch, Matieland 7602, South Africa) ; Dr. POLTORATSKA, I. (Institut für Kernphysik, Technische Universität Darmstadt, D-64829, Darmstadt, Germany) ; Prof. RITCHER, A. (Institut für Kernphysik, Technische Universität Darmstadt, D-64829, Darmstadt, Germany) ; Prof. SIDERAS-HADDAD, E. (School of Physics, University of the Witwatersrand, Johannesburg 2050, South Africa) ; Dr. SMIT, F. D. (iThemba Laboratory for Accelerator Based Sciences, Somerset West 7129, South Africa) ; Mr. SWARTZ, J. A. (Department of Physics, University of Stellenbosch, Matieland 7602, South Africa, iThemba Laboratory for Accelerator Based Sciences, Somerset West 7129, South Africa) ; Prof. TAMII, A. (Research Center for Nuclear Physics, Osaka University, Ibaraki, Osaka 560-0047, Japan) ; Dr. USMAN, I. (School of Physics, University of the Witwatersrand, Johannesburg 2050, South Africa) ; Mr. MIRA, J. (iThemba Laboratory for Accelerator Based Sciences, Somerset West 7129, South Africa, Department of Physics, University of Stellenbosch, Matieland 7602, South Africa) ; Prof. COOPER, G. R. J. (School of Physics, University of the Witwatersrand, Johannesburg 2050, South Africa) ; Dr. STEYN, D. (iThemba Laboratory for Accelerator Based Sciences, Somerset West 7129, South Africa)

Presenter : Prof. CARTER, J. (School of Physics, University of the Witwatersrand, Johannesburg 2050, South Africa)

Session classification : NPRP

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

Type : Oral Presentation