Type: Contributed Oral/Poster

## Shell evolution toward the island of inversion with $^{29} \rm Mg$

Friday, 15 July 2016 09:40 (15 minutes)

The "Island of Inversion" refers to a group of very neutron rich nuclei centred on  $^{30}$ Ne and  $^{32}$ Mg, in which the gap in energy at N=20 between the 1s0d and 0f1p shells has become sufficiently small to allow the latter configurations to dominate the ground states, effectively favouring particle-hole configurations. One of the keys to understanding the "Island of Inversion" lies in the evolution of the orbital energies as we move from stable nuclei into this region.

The  $^{28}$ Mg(d,p) $^{29}$ Mg reaction offers detailed probing of the neutron orbitals and interactions that determine the properties of the more neutron-rich isotopes where the "Island of Inversion" becomes fully developed. The details that are hidden in the properties of  $^{32,34}$ Mg are exposed and quantified in the structure of  $^{29}$ Mg.

The changes in the relative energies of shell model orbits, depending on the neutron/proton balance in the nucleus, cause level energies to evolve and therefore change the shell gaps and their corresponding magic numbers, effectively replacing N=20 by N=16. This can be studied most effectively by means of single nucleon transfer reactions.

The (d,p) reaction is an ideal tool to probe this behaviour, as it allows the transfer of a neutron into the 0d3/2, 0f7/2, 1p3/2 and higher lying orbitals, and the energies of the observed states relate directly to the spacing between the sd and fp orbitals at N=20.

We will present results obtained recently at TRIUMF in inverse kinematic, using a  $^{28}$ Mg beam produced and reaccelerated by the ISAC-II facility. The  $^{29}$ Mg spectroscopy was studied via the missing mass method and particle-gamma coincidences obtained from the combination of SHARC and TIGRESS arrays.

Recently obtained results on  $^{29}$ Mg spectroscopy studied via (d,p) using the SHARC and TIGRESS arrays will be presented. The  $^{28}$ Mg $(d,p)^{29}$ Mg reaction offers detailed probing of the neutron orbitals and interactions that determine the properties of the more neutron-rich isotopes where the "Island of Inversion" becomes fully developed. The details that are hidden in the properties of  $^{32,34}$ Mg are exposed and quantified in the structure of  $^{29}$ Mg.

**Primary authors:** Dr MATTA, Adrien (University Of Surrey); Dr ORR, Nigel (LPC Caen); Prof. CATFORD, Wilton (University of Surrey)

**Co-authors:** Dr GARNSWORTHY, Adam (TRIUMF); Dr DIGET, Christian (University of York); Dr PEAR-SON, Christopher (TRIUMF); Dr DELAUNAY, Franck (LPC Caen); Dr LOTAY, Gavin (University Of Surrey); Dr HACKMAN, Greg (TRIUMF); Dr HENDERSON, Jack (TRIUMF); Dr SMITH, Jenna (TRIUMF); Mr ANDREW, Knapton (University Of Surrey); Dr MOUKADDAM, Mohamad (TRIUMF); Dr RUOTSALAINEN, Panu (TRIUMF); Mr WILKINSON, Ryan (University Of Surrey); Mr HALLAM, Sam (University of Surrey - TRIUMF); Mr CRUZ, Steffen (UBC & Camp; TRIUMF)

**Presenter:** Dr MATTA, Adrien (University Of Surrey)

**Track Classification:** Shell evolution through direct reactions - Spectroscopy of nuclear levels and nuclear shapes through direct reactions