Contribution ID: **72** Type: **Invited**

Competing particle-hole excitations in ^{30}Na: constraining state-of-the-art effective interactions (Invited)

Monday, 11 July 2016 10:35 (20 minutes)

Light neutron-rich nuclei around N=20 show properties that are not in line with their expected magicity but rather imply a deformed shape. These nuclei lie in the so-called ''Island of Inversion" where the deformation is due to neutron cross-shell excitations dominating their ground and low-lying states. Recently, there has been much interest in studying the transition towards this region to determine the evolution of the sd-pf shell gap around N=20 and to provide a stringent test for nuclear models.

In this work the odd-odd nucleus ^{30}Na is studied via 1p, 1p1n and 1n knockout reactions at the NSCL using ^{31}Mg, ^{32}Mg and ^{31}Na radioactive beams, respectively. Combining high-resolution γ-ray spectroscopy with the selectivity of the various reaction mechanisms we are able to distinguish multiple particle-hole configurations. Negative parity states in ^{30}Na are observed for the first time, providing an important measure of the excitation of the 1p1h configuration and hence the sd-pf shell gap. Extracted band structures and level energies are compared with state-of-the-art shell model calculations.

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