Contribution ID: **60** Type: **Invited talk**

Detailed spectroscopy of the non-canonically doubly magic 54Ca

Monday, 31 July 2023 16:15 (25 minutes)

The nuclear magic numbers correspond to large energy gaps between successive nucleon orbits. In stable nuclei, these correspond to 2, 8, 20, 28, 50, 82, and 126, however, in exotic nuclei the 20 and 28 magic numbers are known to disappear, whilst 32 and 34 emerge as "non-canonical" magic numbers. The latter was first inferred through γ-ray spectroscopy of ^{54}Ca at the RIBF, with subsequent mass measurements, and knockout reactions validating this picture.

Owing to the availability of higher beam intensities, and the experimental set-up of the SEASTAR2017 experiment, the spectroscopy of ^{54}Ca could be extended to beyond the S_{2n} level. Direct proton and neutron knockout reactions from ^{55}Sc and ^{55}Ca, respectively, on a liquid hydrogen target, a part of the MINOS device, were used to populate levels in ^{54}Ca. The γ-ray decays of these states were recorded in the DALI2+ array and the neutron decays in the NeuLAND+NEBULA arrays. Comparison of the reaction products' momenta to DWIA calculations assigned the angular momentum of the nucleon that was removed to populate a given state.

During the talk, an overview of the basic conditions required for the emergence of the $N = 34$ shell gap to occur shall be given, followed by the experimental evidence for the closure. Following this, the results of the spectroscopy described above shall be discussed in detail within the context of the shell model, specifically incorporating the GXPF1Br interaction, as well as pairing forces.

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Session Classification: Shell migration at the neutron numbers N=32,34 around Ca