Contribution ID: **90** Type: **Oral presentation**

Single-particle states in fp-shell nuclei through 50Ca(d, p)51Ca transfer reaction.

Wednesday, 26 June 2024 11:00 (20 minutes)

Neutron-rich Ca isotopes towards neutron number N = 34 are pivotal for exploring the evolution of the fp-shell orbitals [1]. Beyond the N = 28 shell gap at 48Ca, new magic numbers at N = 32 and 34 were established through spectroscopy of low-lying states [2] and mass measurements [3]. Most recently, the spatial extension of the 1f7/2 and 2p3/2 neutron orbitals was determined via a one-neutron knockout reaction from 52Ca [4], while the single-particle 2p1/2 , 1f5/2 and 1g9/2 orbitals defining the shell gaps at N = 32, 34 remain to be established experimentally. The 50Ca(d, p)51Ca transfer reaction presents itself as well suited-method to access spectroscopic factors in the fp-shell, where the angular distribution of the reaction products allow for deduction of the angular momentum transfer.

In Decemeber of 2022 the SHARAQ12 experiment was performed at the RIKEN Nishina Center, aiming to study the single-particle structure of 51Ca via the (d, p) reaction using a 50Ca secondary beam. The secondary beam was produced at the BigRIPS separator and then degraded to approximately 15 MeV/nucleon at the OEDO [5] beamline. Beam-tracking has been performed with the recently developed Strip-Readout PPAC detectors [6], recoiling protons coming from the interaction of the beam with the secondary target of CD2 (260 µg/cm2) have been identified with the detector setup TINA2 [7], while the heavy recoils have been identified at the QQD SHARAQ spectrometer. In this contribution, I will present the experiment, current status of the analysis, and the implications on the structure of neutron-rich Ca isotopes.

Collaboration

SHARAQ12

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Session Classification: Wednesday morning 2