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Shell structure of 43S studied by one-neutron knockout reaction

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South of 48Ca in the nuclear chart, the erosion of the neutron magic number 28 and the onset of collective behavior have been observed.
Especially the ground-state deformation, the shape coexistence, and the high-K isomerism in 44S have been discussed both experimentally and theoretically.
In this region these phenomena related to the deformation of the nucleus are thought to originate from the interplay of quenching the N = 28 shell gap and quadrupole excitations across Z = 14, 16 sub-shell and N = 28 shell gaps.
The proton configuration of the 44S ground state was investigated previously but the neutron occupation remains unknown prior to this study.
To clarify the reduction of the N = 28 shell gap and the role of the neutron configuration to the deformation in 44S, an in-beam gamma-ray spectroscopic study focused on the one-neutron knockout reaction from 44S was performed.
One-neutron knockout reaction can selectively produce neutron-hole states and is sensitive to the neutron occupation of the ground state of the projectile nucleus.
Also the parallel momentum distribution of the reaction residue is related to the orbital angular momentum of the knocked out neutron, which is helpful to assign the spin-parity to each final state of reaction residue.

The experiment was performed at the NSCL.
A 100-MeV/u secondary beam of 44S was produced by fragmentation of a 48Ca primary beam on a Be production target.
The secondary beam impinged on a secondary beryllium target inducing the one-neutron knockout-reaction.
Prompt gamma-rays from excited states in 43S emitted at the target were detected by the GRETINA tracking array.
The one-neutron knockout residues were identified in the S800 spectrograph which also measures the momenta and angles of ejectiles.
In order to deduce the level scheme above the isomeric state at 320 keV in 43S and population to this state for the deduction of the neutron configuration in the fp shell, the IsoTagger which consists of 32 CsI scintillators was placed downstream at the end of the beam line.

The level scheme of 43S deduced via the in-beam gamma-ray spectroscopy of this experiment will be presented combining the analysis on momentum distributions produced by the one-neutron knockout reaction. There also will be the comparison with shell model calculations.

Summary

Primary author(s) : MOMIYAMA, Satoru (Department of Physics, University of Tokyo)

Co-author(s) : Dr GADE, Alexandra (NSCL); Mr ELMAN, Brandon (NSCL); Dr BAZIN, Daniel (Michigan State University); Dr WEISSHAAR, Dirk W (NSCL/MSU); Dr LUNDERBERG, Eric (NSCL); Dr BELARGE, Joe (NSCL); Dr WIMMER, Kathrin (The University of Tokyo); Dr KEMPER, Kirby W (Florida State Universy); Dr NIIKURA, Megumi (Department of Physics, the University of Tokyo); Mr KITAMURA, Noritaka (Center for Nuclear Study, University of Tokyo); Dr BENDER, Peter (NSCL); Dr SCHROCK, Philipp (CNS, University of Tokyo); Dr OTA, Shinsuke (Center for Nuclear Study, University of Tokyo)

Presenter(s) : MOMIYAMA, Satoru (Department of Physics, University of Tokyo)

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