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Spectroscopic Studies Close to 100Sn Using Neutron Knockout Reactions

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Characterizing the nature of single-particle states outside of double shell closures is essential to a fundamental understanding of nuclear structure. This is especially true for those doubly magic nuclei lying far from stability that are much less studied and where the shell closures influence nucleosynthetic pathways. The region around 100Sn is one of the most important due to the proximity of the N=Z=50 magic numbers, the N=Z line, the proton drip-line, and the end of the rp-process. However, owing to low production rates there is a lack of spectroscopic information and until recently, there were no firm Jπ assignments for odd-mass tin isotopes lighter than 109Sn. There is experimental and theoretical evidence for a reversal of the spins of the ground and excited states in 101Sn compared to 103Sn coming from the near degeneracy of the d5/2 and g7/2 orbitals and the unexpectedly strong pairing for the (g7/2)2 configuration. Recent experiments using the S800 at the NSCL have revealed the nature of the ground and first excited states in 105,107Sn via the momentum distribution of residues from a neutron knockout experiment. We propose one-neutron knockout experiments on beams of 104,102Sn to measure the l-values of the ground and excited states in 101,103Sn, identified via γ rays measured in DALI2 in coincidence with residues detected at the end of the Zero Degree Spectrometer (ZDS). The degree of mixing in the ground states of 102,104Sn between the d5/2 and g7/2 single-particle states will be extracted from the population of the final states compared to reaction calculations.

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