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Shell evolution towards 100Sn

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The Sn isotopes between N=50 and N=82 are the longest chain of semi-magic nuclei accessible to nuclear structure studies. They provide an ideal testing ground to study the evolution of shell structure with isospin. Among them 100Sn, the heaviest proton-bound self-conjugate nucleus, is a unique case for studying single-particle energies and residual interactions far from the line of stability. In addition, neutron-proton correlations are expected to play a significant role in 100Sn. The collectivity is expected to have a parabolic evolution with the maximum at the middle of the d5/2g7/2s1/2d3/2h11/2 shell. Recent Coulomb excitation experiments do not display such a drop of collectivity approaching the proton drip line. Limitations in the valence space, and namely the neglect of excitations across the N=50 gap, are pointed out as possible reasons for this failure.
We performed an experiment at the RIKEN RIBF facility to tackle these questions using complementary experimental probes: Coulomb excitation, inelastic scattering, two-neutrons knockout. The DALI2 gamma spectrometer was used to study the spectroscopy of 102,104Sn produced after reaction on a Pb, C and CH2 target, while the heavy residues where identified in the ZeroDegree Spectrometer. A reference measurement with 112Sn was also performed. The results of the Coulomb excitation measurement confirm the persistence of collectivity approaching 100Sn [1]. Inelastic scattering data shed new light on the role of neutron excitations in the collectivity of light Sn isotopes [2], that has been interpreted with help of new QRPA calculations with the Gogny D1S force [3]. Inclusive cross sections for C and H induced knockout come out to be very similar (2.1 and 2.6 mb, respectively) [3], while a stronger population of excited states is observed with an H probe [2]. New transitions have been observed in 102,104Sn.
Based on these results, the spectroscopy of 100Sn via H-induced two-neutrons knockout appears to be feasible at RIBF in the near future.

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