Contribution ID: **7** Type: **not specified**

Unbound states in ^{16,18,20}C with the R^{3}B setup: the search for the mixed-symmetry 2^+ state

Wednesday, 19 August 2020 17:10 (15 minutes)

The evolution of the traditional nuclear magic numbers away from the valley of stability is an active field of research. Experimental efforts focus on providing key spectroscopic information that will shed light into the structure of exotic nuclei and understanding the driving mechanism behind the shell evolution.
Recently, $^{\rm A}$N(p,2p)$^{\rm A-1}$C quasi-free scattering reactions were employed at the R3B/LAND setup at GSI to measure the proton component of the 2^+_1 state of ^{16,18,20}C in order to investigate the $\rm Z = 6$ spin-orbit shell gap towards the neutron dripline. The experimental findings support the notion of a moderate reduction of the proton $1p_{1/2} - 1p_{3/2}$ spin-orbit splitting towards the neutron dripline \cite{ina1,ina2}.

We work upon the model of a two-state mixing of pure proton and pure neutron excitations to describe excited 2^+ states in neutron-rich carbon isotopes \cite{petri, aug}. The coupling of the unperturbed proton and neutron 2^+ states should gives rise to a second 2^+ state of mixed symmetry character expected to be strongly populated in these (p,2p) reactions. This mixed-symmetry 2^+ state should lie at an excitation energy of about 7 MeV, above the neutron separation energy, and thus, likely decay by neutron emission. The goal of this work is to identify this mixed-symmetry 2^+ state. Its observation will add weight to our simple picture of describing the neutron-rich C isotopic chain, giving us great insights into the shell evolution towards the neutron dripline at Z=6.

In this contribution, I will present the current status of the experimental investigation of the structure of unbound states of ^{16}C, ^{18}C and ^{20}C induced via quasi-free scattering $\rm (p, 2p)$ reactions from ^{17}N, ^{19}N, and ^{21}N, respectively.

\begin{thebibliography}{}
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Field of your work

Experiental nuclear physics

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Session Classification: Young Scientist Session 3