Contribution ID: **209** Type: **Oral contribution**

Study of the magicity of the 13B nucleus and mixed configurations in 12Be via QFS knockout reactions.

Thursday 30 June 2022 15:20 (20 minutes)

The ^{13}B(p, pn)^{12}B and ^{13}B($p, 2p$)^{12}Be reactions have been used at about 470 MeV/A with CH2 and C targets to study the shell structure of two N = 8 isotones.
The ^{13}B nuclei were produced by the FRS-GSI facility and transmitted to the R3B-LAND beam line where the γ-sphere Crystal Ball and the neutron detector Land were used to determined the cross section of the bound and unbound states in ^{12}B and ^{12}Be nuclei, in which the energy and J values of almost all populated states were previously assigned.

In case of a strong N = 8 shell closure in the ^{13}B nucleus, the $0p_{1/2}$ neutron orbital (the normal configuration) is expected to be fully occupied, with a negligible fraction of occupancy for the valence $1s_{1/2}$ and $0d_{5/2}$ orbitals (the intruder one). In such a case, the neutron removal reaction will not populate states of negative parity constructed with these intruder configurations. From the small content of intruder $1s0d$ states that we found, it is deduced that the magicity at N = 8 is strongly preserved in ^{13}B, similarly to the doubly magic nucleus ^{14}C, before suddenly collapsing in ^{12}Be where the intruder content is by far dominating. Our results are globally in agreement with those extracted from the ^{13}B(p, d)^{12}B transfer reaction [1].

From the ^{13}B($p, 2p$)^{12}Be reaction, we obtained the sum of the 0^+_1 and 0^+_2 isomeric state, the feeding of the 2^+_1 bound state as well as the one of the 2^+_2 resonance state [2]. By using the wave functions of the 0^+_1 and 0^+_2 states proposed by Chen et al. [3], and that of ^{13}B deduced from our study of ^{13}B(p, pn)^{12}B reaction, we find that the one-proton removals reactions to the 0^+_1 and 0^+_2 states in ^{12}Be have similar cross sections. As for the 2^+_2 state, we have observed its decays to the ground and first excited states of ^{11}Be, as well as to the ground state of ^{10}Be by $2n$ emissions. This clarifies the controversy on its decay and nature from the works of Fortune [4] and Smith *et al.*[5]. The cross section to the 2^+_2 state is about 8 times larger than that of the 2^+_1 state. We therefore conclude that the two 0^+ states exhibit more mixing than the 2^+ does, and that the 2^+_2 state is a candidate for the spherical band in ^{12}Be.

[1] W. Liu *et al.*, Phys. Rev. C 104, 064605 (2021)
[2] A. Kamenyero, "Structure of ^{12}Be via the study of multi-neutron decays and two-neutron correlations", PhD thesis, University of Caen (2022)
[3] J. Chen *et al.*, Phys. Lett. B 781, 412 (2018)
[4] H. T. Fortune, Eur. Phys. J A 52, 11 (2016)
[5] J. K. Smith *et al.*, Phys. Rev. C 90, 024309 (2014)

Topic

Experiment

Authors: Mr BARRIERE, Antoine (for the R3B Collaboration); Dr KAMENYERO, Armel; Dr REVEL, Aldric; SORLIN, Olivier (GANIL); AND THE R3B COLLABORATION

Presenter: Mr BARRIERE, Antoine (for the R3B Collaboration)

Session Classification: THU3