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Searching for Alpha-cluster Condensed State in ^{20}Ne

The search for Alpha-Cluster Condensate State (ACS) in always more heavy nuclei is one of the most intriguing puzzles of nuclear structure. In particular, in 2021, Adachi et al. observed three states in ^{20}Ne at 21.2, 21.8, and 23.6 MeV [1]. Such states have been suggested to be realistic candidates, being their decay well correlated with the underlying ACSs in lighter nuclei [2]. In this contribution, we attempt to shed light on this topic, populating the excitation energy window of interest via alpha-transfer $^{16}\text{O}(^6\text{Li}, d)^{20}\text{Ne}^*$ at 13.5 MeV/nucleon in inverse kinematics.

This exclusive measurement has been performed in summer 2024 and it consists in the detection of the target recoil deuteron with two OSCAR modules [3] placed backward in the laboratory frame, while the ^{20}Ne decay products were collected thanks to the GARFIELD+RCO apparatus [4]. The large coverage of our apparatus and its identification capability permits to disentangle the different reaction channels involving the weakly bound Li-ions [5]. To confirm the ACS candidate states of ^{20}Ne , we will report on events selected by the presence of the transfer deuteron in coincidence with four (out of five) alpha particles from the excited ^{20}Ne detected, to fully reconstruct the kinematics of its decays for different excitation energy gates.

Preliminary results of this experimental search will be presented.

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- [2] B. Zhou et al, Nat Commun 14, 8206 (2023)
- [3] D. Dell'Aquila et al., Nucl. Instr. and Methods A 877, 227 (2018)
- [4] M. Bruno et al., Eur. Phys. J. A 49, 128 (2013)
- [5] M.L. Wang et al, Nucl. Phys. A 1049 (2024) 122914

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