IN-BEAM STUDIES OF THE ASTROPHYSICALLY IMPORTANT T_z = -1 NUCLEI*

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The light T_z = -1 nuclei adjacent to the proton dripline play an important in explosive stellar environments. Properties of the states situated just above the proton threshold, which can be resonantly populated in (p,γ) reactions, are of special interest. The ^{20}Na nucleus is part of the sequence ^{15}O(α,γ)^{19}Ne(p,γ)^{20}Na which is thought to dominate the breakout from the hot CNO cycles into the rp-process in X-ray bursters. The properties of ^{22}Mg determine the production of the interstellar γ emitter ^{22}Na as part of the NeNa cycle. The ^{26}Si nucleus lies along the production path of another γ emitter ^{26}Al.

Heavy-ion fusion-evaporation reactions were used in an attempt to learn more about the resonant states and the structure of the ^{20}Na, ^{22}Mg and ^{26}Si nuclei. Prompt γ rays were detected using the GAMMASPHERE array of Compton suppressed Ge detectors. The residues were mass dispersed in the Argonne Fragment Mass Analyzer and selected according to their atomic numbers based on the E-ΔE measurement in an ionization chamber. As a result, all subthreshold states were observed in ^{20}Na and compared with its mirror ^{20}F produced in the same experiment. In ^{22}Mg, the important 2^+ 206 keV resonance [1] was observed and its γ-decay properties were measured. The analysis of the ^{26}Si data is in progress.

The results obtained so far indicate that large high-resolution γ-ray arrays coupled with auxiliary detectors for reaction channel selection is a very promising tool to study astrophysically important states, which is to a large extent complementary to the particle transfer approach.

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