PROBING RESONANCES IN ^{12}C ABOVE THE TRIPLE-ALPHA THRESHOLD

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Carbon production in stellar environments is dominated by reactions proceeding through resonance states above the triple-alpha threshold. The lowest energy resonance is the well-known 0^+ Hoyle state at 7.65 MeV. The low-lying resonance structure, however, is relatively poorly known. Experimentally probing the region above the Hoyle state is complicated by J=0 and J=3 resonances, which mask much of the detailed structure. The 2^+ rotational excitation of the Hoyle state at ~10 MeV, whose properties are crucial to understanding ^{12}C production at elevated temperatures [1], is an excellent example. More than 50 years have passed between its proposed existence and recent discovery [2-5]. We describe a novel approach to selectively probing the structure above the Hoyle state via electromagnetic transitions from higher-lying resonances. Data has been collected at Aarhus University using the p+^{11}B reaction to populate the 16.11 MeV (2^+) and 17.78 MeV (0^+) resonances in ^{12}C. A large solid angle, high granularity silicon array was used to detect the resulting triple-alpha breakup. A complete kinematical reconstruction of the decay is then used to identify missing energy, corresponding to transitions to the region of interest. We will present the most recent results obtained using this technique.

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[3] W. R. Zimmerman et al., Phys. Rev. C 84, 027304 (2011)
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