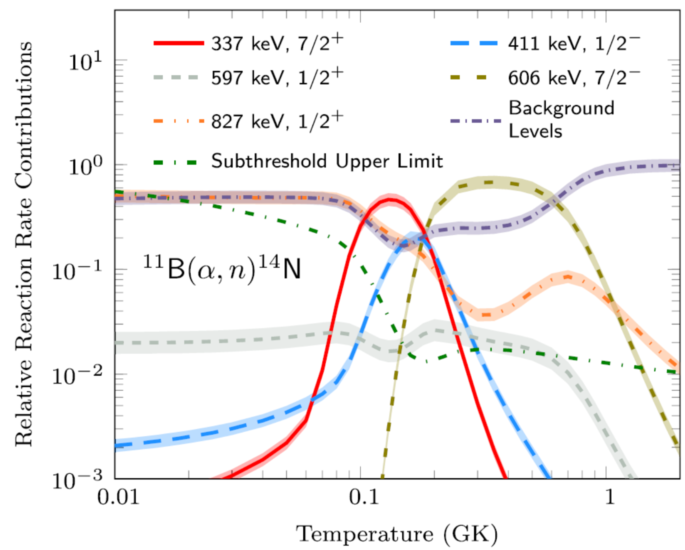
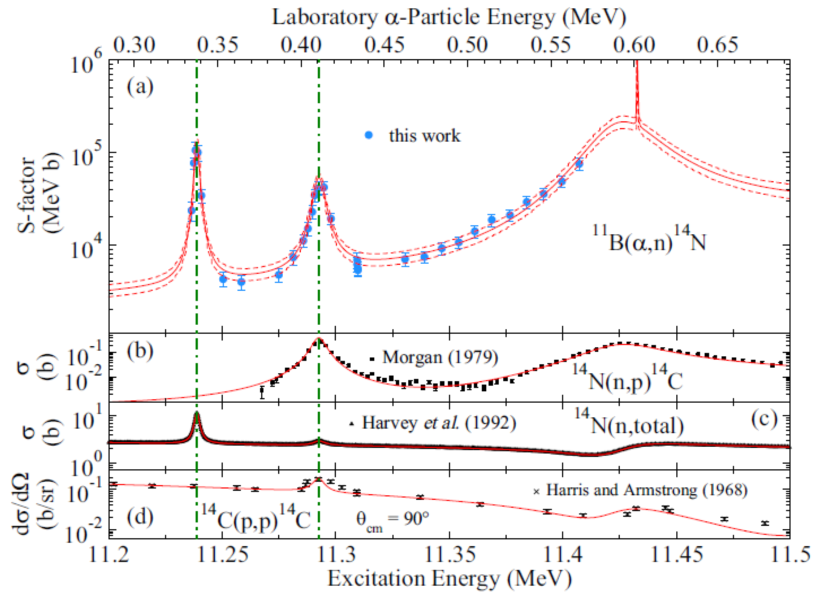
Deep underground measurement of $^{11}B(\alpha,n)^{14}N$

The elemental abundance of the first stars leads to questions about their modes of energy production and nucleosynthesis. The formation of ^{12}C occurs primarily through the 3α process, but other reaction chains may contribute significantly, such as $^{7}Li(\alpha,\gamma)^{11}B(\alpha,n)^{14}N$. This sequence cannot only bypass the mass A=8 stability gap, but could be a source of neutrons in this environment. However, the efficiency of the chain depends on the possible enhancement of its low energy cross section by α-cluster resonances near the reaction threshold.





A new study of the reaction $^{11}B(\alpha,n)^{14}N$ has been undertaken at the CASPAR underground facility from 300–700 keV. A 4π neutron detector in combination with pulse shape discrimination at low background conditions was used. Strengths were determined both for the resonance at 411 keV and for a new resonance at 337 keV that has been measured for the first time. The 337 keV resonance, found to be significantly weaker than previous estimates, reduces the reaction rate in first star environments.

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