

Nuclei in the Cosmos (NIC XVII)



Contribution ID: 42

Type: **Oral**

$^{22}\text{Ne}+a$ measurements deep underground

Monday, 18 September 2023 14:45 (15 minutes)

The reactions $^{22}\text{Ne}(a,n)^{25}\text{Mg}$ and $^{22}\text{Ne}(a,g)^{26}\text{Mg}$ are of high importance for the formation of heavy elements in the weak s process, main s process branchings and strongly influence the Mg isotopic ratios that we can directly observe in stellar atmospheres. For an accurate astrophysical modeling, both reaction cross sections need to be known at energies far below the Coulomb barrier, where direct measurements are severely hampered due to the low event rates to be detected. Many indirect studies have probed the relevant compound nucleus energy region (> 10.6 MeV), but large uncertainties remain regarding the contributions of the various excited states to the astrophysical reaction rates.

To tackle this issue, a new campaign of direct measurements of both reactions is currently being prepared at the new 3.5 MV accelerator in the Bellotti Ion Beam facility of the INFN-LNGS deep underground laboratory. The ultra-low gamma and neutron background in combination with novel detection setups and high ion beams will greatly extend the detection sensitivity, allowing to measure much lower cross sections than previously possible. The measurement of the neutron channel using an innovative hybrid detection setup is taking place in the framework of the “SHADES” ERC grant.

We will give an overview of the state of the art and the current status of the experimental projects.

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Session Classification: Underground nuclear astrophysics

Track Classification: Underground nuclear astrophysics