Nuclear Astrophysics at LNGS

Current status and future measurements with the brand-new 3.5 MV accelerator

Bellotti Ion Beam Facility

The accelerator

3.5 MV accelerator system developed by High Voltage Engineering to meet the requirements of needed by nuclear astrophysics measurements

ensures very high current for H,He and C ions, excellent energy stability and reproducibility.

Scientific program (2024-2026)

The LUNA collaboration is aiming to shed light on the advanced stages of stellar nucleosynthesis

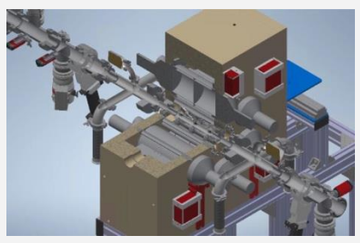
$^{22}Ne(\alpha,n)^{25}Mg$	→	neutron source for the s-process in AGB and massive stars	→ data taking ongoing
$^{12}C+^{12}C$	→	trigger of C burning	→ starting soon **lots of preparatory activities!**
$^{22}Ne(\alpha,\gamma)^{26}Mg$	→	a key reaction for the production of Mg	→ Feasibility study and commissioning

$^{22}Ne(\alpha,n)^{25}Mg$

SHADES project led by A.Best (ERC grant)

hybrid detector array, ^{3}He counters and Liquid scintillators, differential-pumping gas target

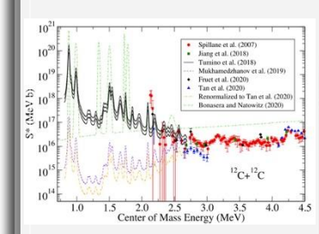
Data taking will start in November 2025

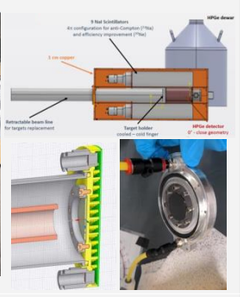


$^{12}C+^{12}C$

first direct measurement below 2.1 MeV

cross section measurement via photon detection, HPGe detector inside a lead shielding, segmented NaI as anti-Compton veto and coincidence detector





No direct data below 2.1 MeV, large uncertainties, different models and interpretations.

$^{22}Ne(\alpha,\gamma)^{26}Mg$

a key reaction for the production of Mg and an important ingredient for understanding the enrichment of globular clusters

detector array, 6 wedge-shaped NaI detectors of dimensions 4"x4"x6" differential-pumping gas target.

Feasibility study and first setup commissioning will start in spring 2025

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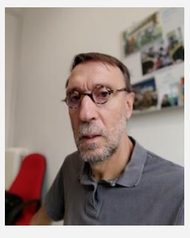

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The LUNA collaboration

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