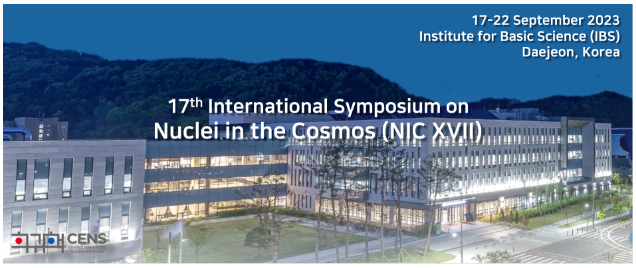

Contribution ID: **69** Type: **Poster**

Measurement of the 27Al(p,alpha)24Mg fusion reaction at astrophysical energies via the Trojan Horse Method.

Tuesday, 19 September 2023 18:15 (5 minutes)

The abundance of 26Al carries a special role in astrophysics, since it probes active nucleosynthesis in the MilkyWay and constrains the Galactic core-collapse supernovae rate. It is estimated through
the detection of the 1809 keV-line and from the superabundance of 26Mg in comparison with the most abundant Mg isotope (A=24) in meteorites. For this reason, high precision is necessary also in the investigation of the stable 27Al and 24Mg [1,2]. Moreover, these nuclei enter the so-called MgAl cycle playing an important role in the production of Al and Mg [3]. Recently, high-resolution stellar surveys have shown that the Mg-Al anti-correlation in red-giant stars in globular clusters
may hide the existence of multiple stellar populations, and that the relative abundances of Mg isotopes may not be correlated with Al.
The common thread running through these astrophysical scenarios is the 27Al(p,alpha)24Mg fusion reaction, which is the main 27Al destruction channel and directly correlates its abundance with the 24Mg one. Since available spectroscopic data and tabulated reaction rates show large uncertainties owing to the vanishingly small cross section at astrophysical energies, we have applied the Trojan Horse Method (THM) to the three-body quasi-free reaction d(27Al,alpha 24Mg)n.This has allowed us to perform high precision spectroscopy on the compound nucleus 28Si, from which we extracted important information on the 27Al(p,alpha)24Mg fusion cross section in the energy region of interest
for astrophysics, not accessible to direct measurements. All details can be found in refs.[4,5]. In particular, the indirect measurement made it possible to assess the contribution of the 84 keV
resonance and to lower upper limits on the strength of nearby resonances.
We have evaluated the effect of the THM recommended rate on
intermediate-mass asymptotic giant branch stars experiencing hot bottom burning. Here, a sizeable increase in surface aluminum abundance is observed at the lowest masses due to the modification on the fusion cross section, while 24Mg is essentially unaffected by the change we determined.

[1] S. Palmerini et al., Monthly Notices of the Royal Astronomical Society 467, 1193 (2017).
[2] C. Iliadis et al., The Astrophysical Journal Supplement 193, 23 (2011).
[3] C. Iliadis et al., Nuclear Physics A 841, 3 (2010).
[4] M. La Cognata et al., The Astrophysical Journal 941, 96 (2022).
[5] M. La Cognata et al., Physics Letters B 826, 136917 (2022).

Primary authors: LA COGNATA, Marco (INFN - LNS); PALMERINI, Sara (University of Perugia and INFN Perugia, Italy)

Co-authors: Dr OLIVA, Alessandro (INFN LNS); Dr DI PIETRO, Alessia (INFN LNS); Prof. TUMINO, Aurora (Kore University, Enna); Dr MAIOLINO, Concetta (INFN LNS); Dr LATTUADA, Dario (Kore University, Enna); HAMMACHE, Faïrouz (IJCLab-Orsay); Dr DELL'AGLI, Flavia (INAF, Observatory of Rome); GUARDO, Giovanni Luca (INFN LNS); RAPISARDA, Giuseppe Gabriele (University of Catania); Prof. LAMIA, Livio (University of Catania); SERGI, Maria Letizia (University of Catania); Prof. GULINO, Marisa (Kore University, Enna); VENTURA, Paolo (INAF, Observatory of Rome); Dr PRAJAPATI, Paresh M. (INFN LNS); Dr ADSLEY, Philip (Texas

A&M University); Dr FIGUERA, Pierpaolo (INFN LNS); SPARTÀ, Roberta (Kore University, Enna); ALBA, Rosa (INFN LNS); Dr PIZZONE, Rosario Gianluca (INFN LNS); Prof. CHERUBINI, Silvio (University of Catania); Prof. ROMANO, Stefano (University of Catania); SANTONOCITO, domenico (INFN - LNS)

Presenter: PALMERINI, Sara (University of Perugia and INFN Perugia, Italy)

Session Classification: Poster session (Nuclear reaction rates and stellar abundances)

Track Classification: Nuclear reaction rates and stellar abundances