ID contributo: **39** Tipo: **Poster**

# Normalization of indirect THM data: the 13C(a,n)16O case


## Summary

The s-process is responsible for the production of about 50% of nuclei heavier than iron in low-mass asymptotic giant branch (AGB) stars. In this astrophysical environment, the 13C(a,n)16O reaction is considered to be the main neutron source providing a n-density of 10^6-10^7 cm^-3 at typical energies of 8 keV in radiative conditions.

Since no direct data exist in the Gamow window (140-230 keV), the contribution from a broad resonance (corresponding to the 1/2+ excited state of 17O) close to the reaction threshold still remains a debated problem.

The ASFIN collaboration performed an experiment via the indirect technique of Trojan Horse Method (THM), measuring the 13C(6Li,n16O)d reaction in quasi-free kinematical conditions in order to extract the cross section for the two-body reaction of astrophysical interest. In this way, the deuteron inside the 6Li beam does not interact with the 13C target and is considered to be a spectator of the three-body, in the exit channel, reaction. The asymptotic normalization coefficient (ANC) of the resonance mentioned above was extracted for the first time from a THM experiment and we were able to derive the S(E) factor of the 13C(a,n)16O reaction free from both Coulomb suppression and electron screening effect.

Recently, the 1/2+ state of 17O, for so long time assumed to lay a few keV below the 13C-a threshold, was shown to be at positive Ec.m. values (at about 4.7 keV). We therefore re-analysed the THM data looking for variations of the ANC value in order to compare it with other determinations in literature obtained through different experimental techniques (mostly transfer reactions). In particular, we adopted the parameters obtained from modified HOES R-matrix calculations on THM data in order to best reproduce the astrophysical factor at higher energies for the 13C(a,n)16O reaction. This procedure could represent a new approach to use our indirect data to distinguish among several sets of direct measurements for an absolute normalization. A preliminary study, however, showed that any increase of the rate thus induced is limited to a factor of two at most for the resonance near the reaction threshold. Moreover, at higher temperatures, variations for the 13C(a,n)16O reaction rate are also expected for a wide range of T because of the ambiguous normalization in this region.

Because of the very low neutron density and the long duration of 13C burning during radiative phases in AGB low-mass stars, such a change would not introduce significant variations in the neutron release, so that previous astrophysical predictions for s-process nuclei should be still valid.


**Autore principale:** TRIPPELLA, Oscar (PG)

**Coautore:** LA COGNATA, MARCO SALVATORE (LNS)

**Relatore:** TRIPPELLA, Oscar (PG)