A new 12C+12C reaction rate from the STELLA collaboration: how to determine astrophysical parameters with nuclear experiments?

E. Monpribat

Among the nuclear reactions driving stellar evolution, 12C+12C fusion gives the key ingredients during carbon burning. This system is known to show many resonances, but also regions with suppressed fusion cross-sections [1,2]. The reaction was recently measured by the STELLA collaboration making use of the gamma-particle coincidence technique for measurement of cross-sections with unprecedented accuracy reaching energies of astrophysical interest, down to the Gamow window of massive stars. Reaction rates were extracted from the experimental data by approximating a hindrance trend, and by adding on top a resonance at the lowest measured energy. The impact of these new rates on the evolution of massive stars was explored by using the stellar evolution code GENEC, and a more detailed study of the nucleosynthesis with a large isotopes network was performed. The sensitivity of the STELLA experiment on the temperature range for C-burning has been thoroughly investigated, showing that the reaction rates determined with this collaboration are relevant for astrophysical studies and simulations [3,4].

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