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Study of ion-ion fusion mechanisms at sub-barrier energies for nuclear astrophysics

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For the last 5 years, the Nuclear Astrophysics Group (NAG) at IFIN-HH has been carrying out a campaign to study fusion reactions important in stellar nucleosynthesis, at sub-Coulomb barrier energies. More recently, we have been focusing on reactions between 12C and 16O nuclei, as they define stellar scenarios in various important evolution phases of massive stars.

In the past, this has been done by irradiating targets of interest at the 3 MV Tandetron facility and measuring their deactivation in the ultra-low background laboratory sitting inside the Slanic salt mine. This allowed us to reach cross-sections of the order of hundred pb for the reaction 13C+12C. As a neighboring reaction to the very important 12C+12C, these measurements provided significant insight into the behavior of the cross-section at very low energies and the fusion mechanisms that are theorized to take place.[1]

In this presentation, I will show preliminary results from the measurement of 13C+16O, the next reaction of interest for our study. It was chosen because it is a neighboring system to 12C+16O with an extra neutron that produces decaying channels which can be measured through deactivation. Related to that, I will also touch upon the BeGa detection station that was recently developed to measure unstable nuclei which are too short-lived to be taken to the Slanic mine.

[1] N. Zhang, D. Tudor et al, Phys. Lett. B 801, 135170 (2020).

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