The resonant behaviour of the 12C+12C fusion cross section at astrophysical energies

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The ^{12}C+^{12}C fusion channel at low energy plays a critical role in astrophysics to understand stellar burning scenarios in carbon-rich environments [**?**, **?**, **?**]. The temperature for carbon burning to occur ranges from 0.8 to 1.2 GK, corresponding to center-of-mass energies from 1 to 2 MeV. The dominant evaporation channels below 2 MeV are alpha and proton, leading respectively to ^{20}Ne, ^{23}Na. In spite of the considerable efforts devoted to measure the ^{12}C(^{12}C,α)^{20}Ne and ^{12}C(^{12}C,p)^{23}Na cross sections at astrophysical energies, they have been measured only down to 2.14 MeV, still at the beginning of the astrophysical region [**?**]. As known, direct measurements at lower energies are extremely difficult. Moreover, in the present case the extrapolation procedure from current data to the ultra-low energies is complicated by the presence of possible resonant structures even in the low-energy part of the excitation function. For these reasons the Trojan Horse Method [**?**, **?**] can represent a unique way for an accurate investigation at the relevant energies. This has been done recently by measuring the ^{12}C(^{14}N,α^{20}Ne)^{2}H and ^{12}C(^{14}N,p^{23}Na)^{2}H three-body processes at 30 MeV of beam energy in the quasi-free (QF) kinematics regime, where ^{2}H from the ^{14}N Trojan Horse nucleus is spectator to the ^{12}C+^{12}C two-body processes. The cross section experiences a strong resonant behaviour with resonances associated to ^{24}Mg levels. As a consequence, the reaction rate is strongly enhanced at the relevant temperatures. Results, which have been recently accepted for publication in Nature, will be presented and discussed.

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