First time measurement of the ^{19}F(p,α_1)^{16}O reaction at astrophysical energies: evidence of resonances through the application of the Trojan Horse Method

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The ^{19}F(p,α)^{16}O reaction is an important channel of fluorine destruction in H-rich environments as the outer layers of asymptotic giant branch (AGB) stars. Measurements of the ^{19}F(p,α)^{16}O reaction via the Trojan Horse Method (THM) have shown the presence of resonant structures not observed before [1, 2, 3]. As a consequence, the reaction rate at astrophysical temperatures (about $10^7 - 10^8$ K) exceeds up to a factor of 1.7 the one given in [4]. This fact might have important consequences for stellar nucleosynthesis, helping to solve the gap between the F aboundances predicted by theoretical models for AGB stars and the observed values [5]. Here we present the result of an experiment in which THM was used to extract the quasi-free contribution of the ^{2}H(^{19}F,α ^{16}O)n reaction to ^{19}F(p,α_1)^{16}O channel, corresponding to the population of the first excited state of the ^{16}O. Despite the low statistics, three resonances in the E_{cm} energy region below about 500 Kev have been observed. This result confirms the findings of the previuos experiments focused on the ^{19}F(p,α_0)^{16}O channel and hints again to an enhancement of the ^{19}F(p,α)^{16}O destruction rate, with respect to what presently predicted.

Riferimenti bibliografici

[1] Indelicato, I.; La Cognata, M.; Spitaleri, C.; *et al.*, ApJ 845, 1 (2017).

[2] La Cognata, M.; Palmerini, S.; Spitaleri, C.; *et al.*, ApJ 805, 128 (2015).

[3] La Cognata, M.; Mukhamedzhanov, A.; Spitaleri, C.; *et al.*, ApJL 739, 2 (2011).

[4] Angulo, C.; Arnould, M.; Rayet, M.; *et al.*, Nu.Ph.A. 656, 3 (1999).

[5] Abia, C.; Cunha, K.; Cristallo, S.; *et al.*, A& A 581, 88 (2015).