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A possible nuclear solution to the 18F deficiency in novae

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Crucial information on nova nucleosynthesis can be potentially inferred from γ-ray signals powered by 18F decay [1]. Therefore, the reaction network producing and destroying this radioactive isotope has been extensively studied in the last years. Among those reactions, the 18F(p,α)15O cross-section has been measured by means of several experiments, using direct and indirect methods. The presence of interfering resonances in the energy region of astrophysical interest has been reported by many authors including the recent applications of the Trojan Horse Method (THM).
The THM is an indirect method using direct reactions to populate 19Ne states of astrophysical importance, with no suppression by the Coulomb and centrifugal barriers. In this work, we evaluate what changes are introduced by the THM data in the 18F(p,α)15O astrophysical factor recommended in a recent R-matrix analysis [2-4], accounting for existing direct and indirect measurements [5]. We will particularly focus on the role of the THM experiment, since it allowed to cover the 0-1 MeV energy range with experimental data, with no need of extrapolation and with unprecedented accuracy (better than 20%).
Then, the updated reaction rate is calculated and implications of the new results on nova nucleosynthesis are discussed. In particular, while no change on the dynamical properties of the explosion is found, important differences in the chemical composition of the ejected matter is observed, with a net reduction in the mean 18F content by a factor of 2 and a corresponding increase in the detectability distance [4].
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Primary author: LA COGNATA, MARCO SALVATORE (LNS)

Presenter: LA COGNATA, MARCO SALVATORE (LNS)

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