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First Measurement with Trojan Horse Method Using Radioactive Ion Beam

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For the first time, the Trojan Horse Method (THM) was applied to study a reaction induced by a radioactive beam at low energies relevant for astrophysics. In particular, the 18F(p,α)15O process was investigated via the 18F(d,α15O)n quasi-free reaction.
This reaction is interesting for astrophysics, as the γ-ray emission from classical novae is dominated by positron annihilation resulting from the beta decay of radioactive nuclei, and especially of 18F (τ=110 min). A good knowledge of the nuclear reaction rate of production and destruction of 18F is mandatory to calculate the amount of 18F synthesized in novae and the resulting γ-ray radiation intensity.
The 18F(p,α)15O reaction, a 18F destruction channel, was studied by many recent experiments. Despite significant progress, the cross section in the energy range covering novae temperatures is still unknown. Moreover, the extrapolation of the reaction rate down to low energies is complicated by the presence of several resonances of the 19Ne nucleus.
In this context, the THM was applied to the 18F(d,α15O)n quasi-free reaction. The 18F beam produced at the CRIB facility at RIKEN, Japan, was focused onto a CD2 target and the ejected particles were detected using a new deigned experimental set-up covering a large solid angle. The reaction cross section has been for the first time investigated in the energy range from 0 up to 700 keV, and the predicted 30 keV resonance has been studied.
The obtained results will be discussed.

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