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19Ne Sheds Light on Novae Detection

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Classical novae are the most common astrophysical thermonuclear explosion [1] and are thought to contribute noticeably to the galactic chemical evolution [2,3]. As one of the few environments that can be modeled primarily from experimental nuclear data, observations would provide a direct test for current hydrodynamic codes. 18F produced in the runaway is the strongest γ-ray source [4] immediately after the outburst but reaction rates must be constrained further to predict its intensity.

The 18F(p,α)15O reaction remains the largest uncertainty in constraining these rates as key nuclear states in the compound nucleus, 19Ne, are still not known despite previous experimental efforts. To resolve this, the most important levels close to the proton threshold were populated using the charge exchange reaction 19F(3He,t)19Ne at IPN, Orsay. A Split-pole spectrometer measured the tritons and identified the states of interest while a highly segmented silicon array detected alpha and proton decays from 19Ne over a large angular range and at a high angular resolution.

The branching ratios and spin-parities of these important states were extracted from the experimental results and directly contradict previous measurements of the nucleus [5]. In addition to other recent studies [6-8], the results provided input parameters for a comprehensive set of theoretical R-matrix calculations that have realistically modeled the remaining uncertainty in the reaction rate. The newly proposed rate will be discussed, along with implications for future studies of 19Ne necessary to provide an answer to the detectability of classical novae.

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