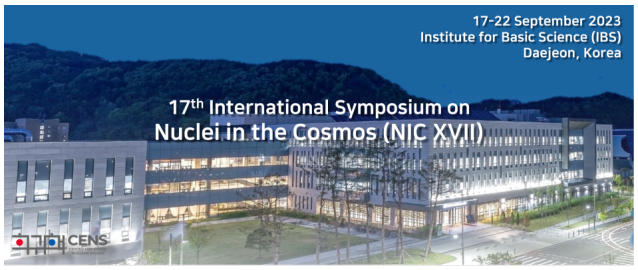

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A new Multi-Channel and Monte Carlo R-Matrix analysis for the estimate of ^{17}O destruction rate in stars

Tuesday, 19 September 2023 17:10 (5 minutes)

When stars approach the red giant branch, a deep convective envelope develops and the products of the CNO cycle appear at the stellar surface. In particular, the ^{17}O is enhanced in RGB and AGB stars. Spectroscopic analyses of O isotopic ratios of these stars provide a powerful tool to investigate the efficiency of deep mixing processes, such as those powered by convective overshoot, rotation, thermohaline instability, gravity wave and magnetic field. However, this method requires a precise knowledge of the reaction rates that determine the ^{17}O abundance in a H-burning shell, among which the $^{17}\mathrm{O}(\mathrm{p},\gamma)^{18}\mathrm{F}$ and the $^{17}\mathrm{O}(\mathrm{p},\alpha)^{14}\mathrm{N}$ reactions are the more relevant. Since the last release of rates compilations (see the JINA reaclib database, https://reaclib.jinaweb.org/) a number of experiments have updated reaction rates, incorporating new low-energy cross section measurements. In order to provide up-to-date input to the astrophysics community we performed simultaneous multi-channel and Monte Carlo R-Matrix analyses of the two reactions including all newly available data, resulting in realistic uncertainty ranges for the rates.

We will give an overview of the input data, the methodology, present the updated reaction rates and give an outlook on planned evaluations of other CNO-cycle reactions using the same approach.

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