Contribution ID: **7** Type: **oral presentation**

Revised reaction rate for the astrophysical reaction 18O(p, α)15N via a global R-matrix analysis

Saturday 23 August 2025 15:40 (12 minutes)

The $^{18}\mathrm{O}(p,\alpha)^{15}\mathrm{N}$ reaction plays a crucial role in influencing the abundances of key isotopes such as $^{19}\mathrm{F}$, $^{18}\mathrm{O}$, and $^{15}\mathrm{N}$ in asymptotic giant branch (AGB) stars. This reaction may offer a potential mechanism to explain the discrepancies between observational data and theoretical model predictions.
A comprehensive R-matrix analysis of the $^{18}\mathrm{O}(p,\alpha)^{15}\mathrm{N}$ reaction has been conducted, incorporating supplementary constraints from other reaction channels, especially, the $^{15}\mathrm{N}+\alpha$ scattering data were involved in the analysis for the first time. All available experimental data have been systematically compiled and used in the R-matrix analysis.
A revised determination of reaction rate has been extracted relying on the present fitting parameters. The uncertainties on the corresponding reaction rates were then obtained by a Monte Carlo analysis. The currently determined reaction rates are systematically lower than those measured by Bruno *et al.* (2019), resulting in reduced depletion efficiency of $^{18}\mathrm{O}$ that consequently enhances its surface abundance in AGB stars. Therefore, this enables scientists to reduce reliance on dilution assumptions when interpreting observational data through theoretical models.
This work has been published in the Astrophysical Journal 973:93 (2024).

Research field of your presentation

Experimental Low-energy nuclear physics

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Session Classification: Young scientist session 1