Contribution ID: **294** Type: **Poster**

Using Cool-Bottom Processing in RGB and AGB stars to explain Isotopic Ratios in Presolar Grains

Tuesday 17 September 2024 10:42 (1 minute)

Current stellar nucleosynthesis models fail to reproduce the measured isotopic abundances in group 2 oxygen-rich presolar grains, which are characterized by large ^{18}O depletions. It was proposed that cool bottom processing in low-mass AGB stars is responsible for the observed isotopic abundances. We modeled cool-bottom processing during the RGB and the AGB of $1.2M_{\odot}$ stars to predict surface ^{18}O/^{16}O, ^{17}O/^{16}O, and ^{26}Al/^{27}Al ratios. Effective secular mixing must work against the steep mean molecular weight (μ) gradient at the bottom of the radiative zone below the convective envelope to overcome a net increase in μ on the order of 0.01% to recreate observed isotopic ratios. Sensitivity tests in which $^{18}\mathrm{O}(p,\alpha)^{15}$N and $^{16}\mathrm{O}(p,\gamma)^{17}$F were varied using reaction rate of factors of 10/0.1 and 1.4/0.71 respectively suggest that nuclear physics input is an important factor in model-grain comparison. This work shows that a secular cool-bottom mixing model that preserves stratification is a viable origin mechanism of the isotopic ratios observed in grains. We will also present an analysis of the surface ^{26}Mg/^{24}Mg, and ^{25}Mg/^{24}Mg ratios, $2M_{\odot}$ and $3M_{\odot}$ stars, and Monte Carlo impact studies on a range of reactions using current experimental uncertainties.

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Session Classification: Poster Flashes