Contribution ID: **230**   Type: **Contributed Talk**

The Impact of Extra Mixing in Low-Mass Stars on Presolar Grain Abundance Predictions

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 compared to solar. It is proposed that cool bottom processing in low-mass AGB stars is responsible for the observed isotopic abundances. In this study, cool-bottom processing is modeled during the RGB and the AGB phases of $1.2M_{\odot}$ stars with solar metallicity to predict surface ^{18}O/^{16}O, ^{17}O/^{16}O, and ^{26}Al/^{27}Al ratios. In a $1.2M_{\odot}$ star, effective secular mixing must work against a steep mean molecular weight (μ) gradient at the bottom of the radiative zone below the convective envelope to recreate observed isotopic ratios. A net increase in μ on the order of 0.01% must be overcome. Simulations with slight variations in the depth and rate of extra mixing reproduce the full range of isotopic abundances observed in grains. Sensitivity tests in which $^{18}\mathrm{O}(p,\alpha)^{15}$N and $^{16}\mathrm{O}(p,\gamma)^{17}$F were varied using the reaction rate factors of 10/0.1 and 1.4/0.71, respectively, suggest that nuclear physics inputs are an important factor in model-grain comparison. This study will present the results of a one-zone Monte Carlo impact analysis identifying the nuclear reactions that most influence the surface abundances of oxygen and aluminum. Full stellar evolution simulations are used to study the effect of varying these reaction rates. This work shows that a secular cool-bottom mixing model that preserves stratification is a viable origin mechanism for the isotopic ratios observed in grains.

Author: COCKSHUTT, Maeve (University of Victoria/TRIUMF)

Co-authors: HERWIG, Falk (University of Victoria); LIU, Nan (Boston University); DENISSENKOV, Pavel (University of Victoria)

Session Classification: Stellar Abundances II –Presolar Grains