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Nucleosynthesis and stellar modeling of AGB stars

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The last brief phase of nuclear burning for low to intermediate mass stars is the Asymptotic Giant Branch (AGB). It is during the AGB that the richest nucleosynthesis occurs, driven by thermal instabilities of the helium-burning shell, the products of which are dredged to the stellar surface by recurrent mixing episodes. Envelope burning occurs in the most massive AGB stars, also altering the surface composition. The AGB phase is terminated when rapid, episodic mass loss expels the envelope into the interstellar medium, making these stars important contributors to the chemical evolution of galaxies and stellar systems. We review current issues and recent developments in the evolution and nucleosynthesis of AGB stars. We begin with a brief introduction to the topic, followed by an outline of the regions and time-scales for the various important nuclear reactions that occur in these stars. Then we focus on the different numerical approaches adopted in modeling this brief evolutionary phase (parametric, detailed models) with a special emphasis on the associated nucleosynthesis. We will discuss recent efforts to understand the effect that convection, mass loss and reaction rate uncertainties have on the nucleosynthesis, and the role that AGB stars plays in the chemical evolution of the Galaxy.