Nuclear Reaction Rate Uncertainties and their effects on Nova Nucleosynthesis Modeling

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The observable consequences of a nova outburst depend sensitively on the details of the thermonuclear runaway which initiates the outburst. One of the more important sources of uncertainty is the nuclear reaction data used as input for the evolutionary calculations. It has been demonstrated that changes in the reaction rates used in a nova simulation can alter the production of individual isotopes (by an order of magnitude) and change global observables such as the peak luminosity and the amount of mass ejected by 10-30% [1].

We present the first systematic analysis of the full impact of reaction rate uncertainties on nova nucleosynthesis. The use of Monte Carlo techniques allows the translation of reaction rate uncertainties into uncertainties in nova model nucleosynthesis (see Fig. 1) and thereby quantifies the extent of disagreement between theory and observations.

By examining the relative importance of changes in individual reaction rates, our analysis can provide guidance in the selection of reactions for further experimental study. We will demonstrate the usefulness of this technique by determining the relative importance of the many individual reactions involved in the production of ^{22}Na. Our analysis not only confirms the important reactions identified in [2], but also finds several additional reactions of similar importance.

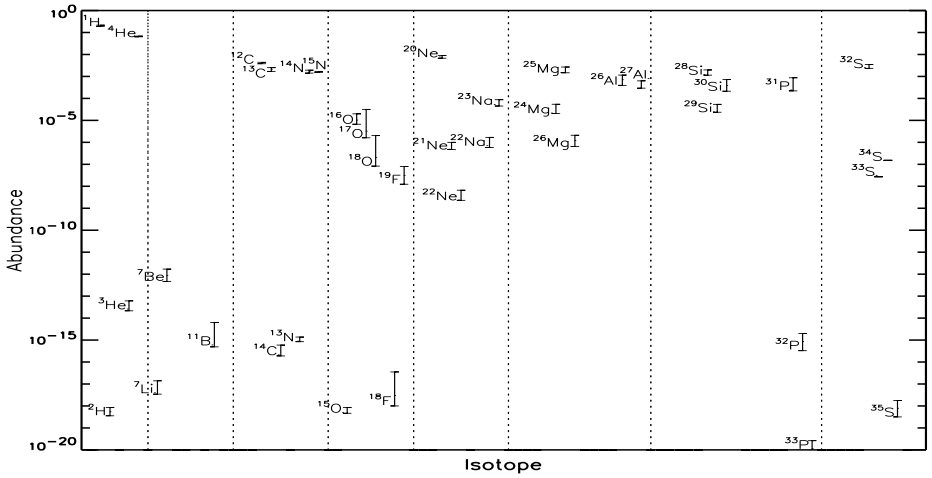

FIG. 1. Final Abundances (elapsed time = 4.7×10^5 sec after peak) for the innermost ejecta of a model for a nova outburst on a 1.25 $M_\odot$ ONeMg white dwarf. The error bars are derived from our Monte Carlo analysis.

[1] S. Starrfield, *et al.*, **MNRAS**, 296, 502 (1998).
[2] J. José, A. Coc, & M. Hernanz, **ApJ**, 520, 347 (1999).

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