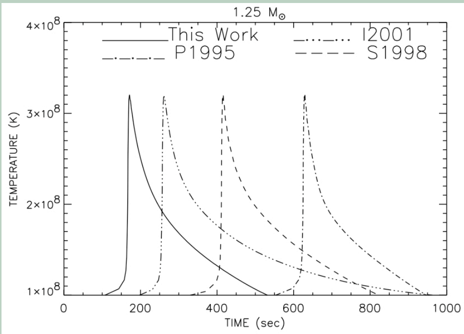
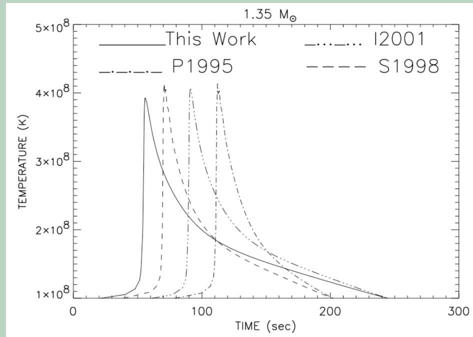
# Effects of the *pep* Reaction and Rate Libraries on Simulations of the Classical Nova Outburst




*Variation of temperature with time of the temperature at the location where a thermonuclear runaway occurs in our classical novae models The plot on the left is for a 1.25 Msun white dwarf and the plot on the right is for a 1.35 Msun white dwarf. Each curve is for a different nuclear reaction rate library; S1998 refers to Starrfield et al. (1998), P1995 refers to Politano et al. (1995), I2001 refers to Iliadis et al. (2001), and "This Work "refers to the calculations done with the latest Iliadis reaction rate library.*

Nova explosions occur on the white dwarf component of a Cataclysmic Variable binary stellar system which is accreting matter lost by a companion. When sufficient material has been accreted by the white dwarf, a thermonuclear runaway occurs and ejects material in what is observed as a Classical Nova explosion.

This project has focused on conditions which produce both mass ejection and a rapid increase in the emitted light by examining the effects of changes in the nuclear reaction rates on the gross features and the nucleosynthesis during the outburst. Upon incorporating a modern nuclear reaction network into our one-dimensional, fully implicit, hydrodynamic computer code we discovered that the pep reaction ($p + e^- + p \rightarrow d + \nu$) was not included in either our previous studies of classical novae explosions or those of the other theoretical investigations. Although the energy production from this reaction is not important in the Sun, the densities in white dwarf envelopes can exceed $10^4$ gm cm$^{-3}$ and the presence of this reaction increases the energy generation rate. The effect of this increase is to reduce the evolution time to the peak of the TNR and, thereby, the accreted mass so that the peak conditions in the outburst decrease irrespective of other changes in the nuclear reaction rates. We have also investigated the effects of updates in the nuclear reaction rate libraries on the evolution and find that the gross features of the outburst are robust with respect to these changes.

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