He^3 AS THE RECURRENT NOVA TRIGGER MECHANISM

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Observations of recurrent novae (Warner 1976) imply the presence of a red giant (RG) in most, if not all, cases. Giant secondaries in nova systems are otherwise known or suspected only in the peculiar slow novae RR Tel and RT Ser. Bath and Shaviv (1978) showed quantitatively that only a red giant can transfer enough hydrogen-rich mass ($\sim 10^{-5} M_{\odot}$) to a white dwarf (WD) companion rapidly enough (in ~30 years) to yield a recurrent nova.

The temperature T of the WD hydrogen-rich envelope depends critically on the poorly studied and understood cooling process during accretion. Unless $T > 2\times10^7$K can be maintained at the envelope base, the time to thermonuclear runaway will be >> 30 years. If the accretion process does not keep the envelope hot, *I propose that the* He^3 *transferred from the red giant to the WD envelope will.* The He^3 abundance Y_3 in mass transferred from a RG of mass M_* is (Iben and Truran, 1978)

$$Y_3 \sim 2\times10^{-4} (M_{\odot} / M_*)^2 .$$

Numerical simulations of a $5\times10^{-6} M_{\odot}$ envelope with $Y_e = .002$ and $Y_3 = 0$) on a cold 1.25 $M_{\odot}$ WD yield drastically different results. For $Y_3 = 0$, a "dud" occurs -- there is no runaway and the envelope and WD cool together. For $Y_3 = .002$, a rapid increase in the envelope base temperature by $\sim 8\times10^6$K occurs in ~ 15 years as He^3 is convected to, and burned at the envelope base. This rapid heating "switches on" the CNO cycle and a full-scale runaway occurs, leading to a nova outburst.

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https://doi.org/10.1017/S0252921100076697 Published online by Cambridge University Press