# NUCLEOSYNTHESIS DURING NOVA EXPLOSIONS AND GRAIN FORMATIONS IN EJECTED ENVELOPES

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Recent observations have revealed the existence of infrared brightening in some nova explosions, and its absence in others. These infrared excesses are ascribed to thermal emission from grains which are considered to consist of graphite. Such nova explosions are widely accepted to be triggered by hydrogen shell-flashes on the surface of white dwarfs which accrete matter in close binary systems. As for the hydrogen shell-flash, recently, a general theory applicable even to the case of finite amplitude has been developed. According to this theory, the progress of a shell-flash is determined only by the mass of the white dwarf $M_{WD}$ and the mass of the accreted hydrogen-rich envelope $\Delta M_H$.

We investigate how the relative abundances of CNO elements in the ejected shell depend on $M_{WD}$ and $\Delta M_H$. Two typical groups result concerning the C/O ratio: There exist two critical envelope masses $\Delta M_{cri}^{(N)}$, and $\Delta M_{cri}^{(O)}$, as seen in figure 1, and a critical white dwarf mass $M_{cri} = 1.2M_\odot(N_{CNO}/10^{-3})$, where $N_{CNO}$ denotes the mole number of CNO elements per unit mass. For $\Delta M_H<\Delta M_{cri}^{(N)}$ and $M_{WD}<M_{cri}$, oxygen remains more abundant than carbon throughout the shell-flash. For $\Delta M_H>\Delta M_{cri}^{(O)}$ or $M_{WD}>M_{cri}$, on the contrary, oxygen is destroyed so that carbon becomes abundant relative to oxygen.

Under these predicted chemical compositions, the growth of grains in the ejected shell is investigated. We obtain the lower mass limit of the ejected shell $\xi\Delta M_H$ necessary for grain formation for each case. They are denoted by thick solid curves in the figure. As a result, grains are composed of graphite for $M_{WD}>0.8$ $M_\odot$. In this figure, the loci of the recurrence periods of nova explosions are shown by the dotted curves. We see that nova explosions with recurrence periods shorter than $10^4$ years will not accompany the formation of grains.

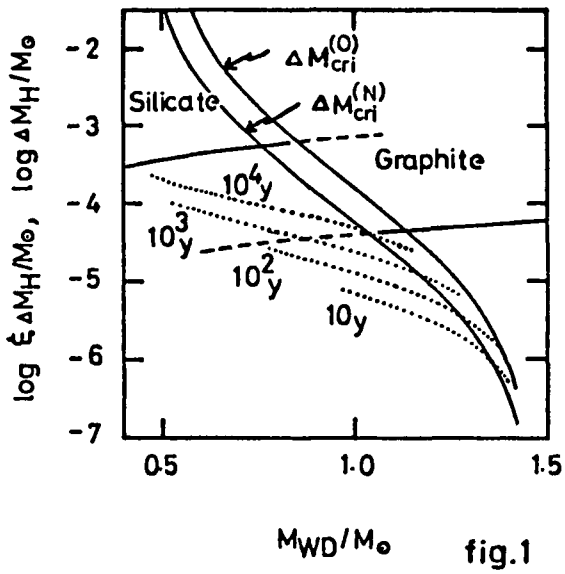


fig.1



https://doi.org/10.1017/S0252921100076764 Published online by Cambridge University Press