THE CHEMICAL COMPOSITION OF THE WHITE DWARFS IN CATACLYSMIC VARIABLE SYSTEMS WHICH PRODUCE NOVAE

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Recently a number of studies have been published on the nuclear abundance of nova ejecta, as summarized by Truran and Livio (1986). H is always underabundant (compared to solar) and He is overabundant except for the cases where the heavier elements are far overabundant. The abundances of C, N, and O range from nearly solar to highly overabundant. A few novae are very rich in Ne and Mg as well as O, which has led to the discovery that these novae occur on O/Ne/Mg white dwarfs (Williams, et al., 1985). We will assume that the abundances are an accurate and consistently determined set of data for our purposes. The nova ejecta is a combination of original white dwarf material, remnant material, remaining on the white dwarf from the previous outburst, and accreted material, all of which has undergone thermonuclear processing during the outburst. The question we address here is "Can we untangle the observational abundances to determine the contributions of each source?" A positive answer would allow us to tell whether the white dwarf's mass is increasing or decreasing and thus have implications on the accreting white dwarf model for a SNI.

We will make the following assumptions: 1) the accreted material is of a solar composition; 2) the original white dwarf material is either He or C/O or O/Ne/Mg; 3) during an outburst the material is well mixed such that the ejected material and the remnant material initially have the same abundance; 4) the H and C of any remnant material are burned to He and N before next accretion period; 5) all of the excess N comes from proton capture unto C and little O is created or destroyed; 6) He depletion is negligible; 7) the ejected material is composed of white dwarf material, remnant material and accreted material (hereafter referred to as the components of the ejecta); and 8) two sequential out-

https://doi.org/10.1017/S0252921100093921 Published online by Cambridge University Press

bursts have similar composition. Assumptions 3, 4, 5 and 6 are based on nova calculations.

Table I gives the component fractions and the white dwarf compositions for various novae. In all cases, a remnant component fraction of zero is possible. Naturally the remnant component is ultimately composed of white dwarf and accreted material and the first values given represent their relative contributions. Table I is divided into C/O and O/Ne/Mg which represents the types of white dwarfs that the outburst has occurred on. The four C/O novae show a surprisingly consistant ~50%C and 50%O for the white dwarf composition, and the white dwarf component of the ejecta ranges from 10-50%. For the two O/Ne/Mg novae, the white dwarf component varies from 40 to 85%. The very high abundance of S and the relative low abundance of Mg and Si for the white dwarf of V1370 Aql are very difficult to understand from a stellar evolution point of view. A nova with nearly solar heavy element abundance like RR Pic, HR Del and USco could have erupted on a He envelope white dwarf that is decreasing in mass or on any white dwarf that is increasing in mass.

Table I

			C/O Novae				O/Ne/Mg Novae	
		T Aur	V1500 Cyg	V1668 Cyg	DQ Her		V693 CrA	V1370 Aql
WD		.12 - .08	.26 - .24	.30 - .25	.53		.39 - .24	.86 - .41
Rem		.0 - .31	.0 - .11	.0 - .15	.0		.0 - .39	.0 - .53
Acc		.88 - .61	.74 - .65	.70 - .60	.47		.61 - .37	.14 - .06
WD	C	.57	.51	.56	.45	O	.55	.24
	O	.43	.49	.44	.55	Ne	.43	.53
						Mg	.02	.01
						S	-	.22

In summary, those novae which show large metal overabundances are decreasing in mass while those that show an overabundance of He can be either increasing or decreasing. Obviously, only the latter that are increasing in mass can eventually produce a SNI. U Sco seems to be the best prospect (Starrfield, Sparks, and Truran 1985).

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https://doi.org/10.1017/S0252921100093921 Published online by Cambridge University Press