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NOVA CENTAURI 1986 - A SPECTROSCOPIC STUDY

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Our observations of Nova Cen 1986 cover the early evolutionary phase as well as the late nebular stage. The spectroscopic data obtained during the nebular phase are suitable for deriving chemical abundances, since the ionization corrections are small and self-absorption effects are unimportant.

The observations were made using the 1.6 m telescope of the National Laboratory for Astrophysics in Brasópolis, Brazil.

Using the observed Hα/Hβ ratio and the recombination theory we derived a color excess of $E_{B-V} = 0.54$. With the empirical relationship between fading time and absolute magnitude, as well as the width of the interstellar Na I lines, we estimated a distance of 1.2 ± 0.2 kpc.

The expansion velocity of the shell at the nebular phase can be estimated from the full-width of non-blended lines; the result obtained is 1400 ± 120 km s^{-1}. In the nebular phase the profiles are clearly asymmetric, suggesting that the ejected shell is not completely spherical. Both forbidden and recombination lines are characterized by a blue-peak at -540 km s^{-1} and a less intense red-peak at 320 km s^{-1}.

Electron density and temperature were estimated using the line ratios [O III]λ4363/λ(4959+5007) and [N II]λ5754/λ(6548+6584). The temporal behavior of the Hβ line indicate that the shell evolves more or less homologously, with the electron density varying in time as $N_e \propto t^{-3}$.

The results for electron density and temperature are:

DAY	N (cm^{-3})	T [O III]	T [N II]
142	1.2×10^7	15000 K	8000 K
207	3.8×10^6	13700 K	9000 K
226	2.9×10^6	11900 K	9400 K
256	2.0×10^6	15080 K	8600 K
470	1.8×10^5	15600 K	15600 K
561	3.2×10^5	13420 K	13420 K

From the observed line ratios and using the electron densitites and temperatures above, we obtained the following elemental abundance ratios:

$$\frac{He}{H} = 0.17 \pm 0.03 \qquad \frac{O}{H} = (2.2 \pm 0.8) \times 10^{-3}$$

$$\frac{N}{H} = (2.1 \pm 0.6) \times 10^{-3} \qquad \frac{Fe}{H} = (3.2 \pm 0.7) \times 10^{-5}$$

These results indicate that helium, nitrogen and oxygen are enhanced in the ejecta, with respect to solar values. The N/O ratio suggests that the outburst was powered by the CNO cycle and that the progenitor was a C-O white dwarf. No significant temporal variations were detected in the abundances within days 142 and 561, except for oxygen whose abundance seems to decrease in time. In view of this result, it is possible that oxygen may partially be depleted into grains.

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