

## THE OPTICAL SPECTRUM OF NOVA CYGNI 1992

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### ABSTRACT

Spectroscopy of the ONeMg nova Cygni 1992 is presented, based on data obtained at the Vainu Bappu Observatory between 1992 March 13–May 22, and 1993 January 3. Spectra were obtained at five epochs— epoch I: 1992 March 13–14, 20 days after the outburst maximum; epoch II: 1992 March 22–24, 30 days after maximum; epoch III: 1992 April 20, 58 days after maximum; epoch IV: 1992 May 21–22, 90 days after maximum; and epoch V: 1993 January 3, 347 days after maximum. The spectrum during epochs I–II is dominated by strong broad P-Cygni emission lines predominantly of hydrogen Balmer and Fe II lines. Lines due to N II, Mg II and He I are also strong. [O I] auroral and nebular lines are also present. In the red region of the spectrum, O I 7774, 8446 and lines due to Mg II, N I and Ca II are strong, with the strength of O I 8446 line indicating Ly $\beta$  fluorescence and a high optical depth. Epochs III–V show a steady increase in the strength of He I and [O III] lines, while the strength of the other permitted lines steadily decreases. On day 347, [O III] 4959+5007 is 3 times stronger than H $\alpha$  and 8 times stronger than H $\beta$ .

An extinction  $E_{B-V} = 0.31$  is derived from the  $(B-V)$  colours and a distance of 1.6 kpc estimated from magnitude–decay time relations. The density in the nova shell, estimated using the Balmer line fluxes, decreased from a value of  $6.9 \times 10^8 \text{ cm}^{-3}$  on day 20 to  $3 \times 10^5 \text{ cm}^{-3}$  on day 347. The mass of the ionized shell is  $\sim 3 \times 10^{-5} M_{\odot}$ . The temperature rose from a value  $T_e \sim 5000 \text{ K}$  on day 20 to a value  $T_e \sim 10^5 \text{ K}$  on day 347. The ionizing source had a Zanstra temperature  $T_* = 4 \times 10^5 \text{ K}$  and a corresponding radius  $R_* = 0.01 R_{\odot}$  on day 347. The nova remnant evolved from a temperature of  $\sim 4 \times 10^4 \text{ K}$  and a radius  $15 R_{\odot}$  on day 20 to a temperature of  $\sim 1 \times 10^5 \text{ K}$  and radius  $0.2 R_{\odot}$  on day 347, as deduced from the observed continuum flux at  $5450 \text{ \AA}$  and the H $\beta$  emission line flux. The lower value of temperature obtained on day 347, as compared to the Zanstra temperature estimate indicates that the fraction of radiation from the source, intercepted by the nova shell, is smaller than the assumed value of 0.1.

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