THE OPTICAL SPECTRUM OF NOVA LW SERPENTIS 1978

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ABSTRACT. We present optical spectroscopic data on the nova LW Serpentis 1978, covering its diffuse-enhanced phase until the onset of [OI] flash. The spectra cover a range of 4000-8700 A, at dispersions ranging from 83-675 A mm^{-1}.

1. INTRODUCTION

Nova LW Serpentis 1978 was discovered by Honda on 1978 March 5 at a visual brightness of 8.3 magnitudes (Honda 1978). It appears that the nova was already past maximum at the time of its discovery. It was a moderately fast nova with t_2 = 35 days. Though studied extensively in the infrared (Szkody et al.1979; Gehrz et al.1980), the published optical observations are scanty. Herbig (1978) and Prabhu (1978) describe briefly the optical spectrum a few days after the maximum. Cohen and Rosenthal (1983) measured the width of emission lines from a spectrogram obtained a few years after the nova event.

We present here the spectroscopic data obtained at the Vainu Bappu Observatory, Kavalur, which had unfortunately remained unpublished so far.

2. OBSERVATIONS

The spectrograms were recorded using the Cassegrain image-tube spectrograph at the 1-m reflector of the Vainu Bappu Observatory, Kavalur. Occasionally, the H-alpha profile was observed at a dispersion of 30 A mm^{-1}. All the spectra were calibrated for relative intensity using an auxiliary spectrograph and a rotating sector. The dispersion ranged from 83 A mm^{-1} to 675 A mm^{-1} in the wavelength range of 4000 A - 8700 A over the period 1978 March 10 - April 7.

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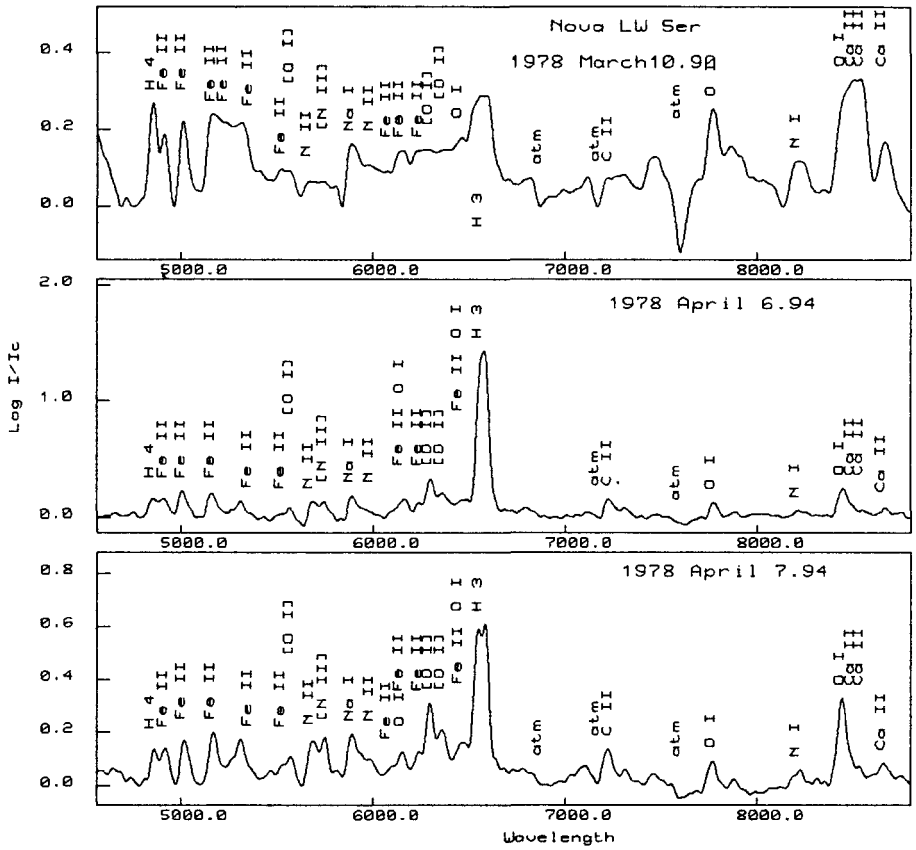

Figure 1 The spectra of LW Ser. The lines at 6300 and 6363 A signifying the [OI] flash are evident on April 6 and 7.

3. REDUCTIONS

The spectrograms were digitized using a Carl-Zeiss microdensitometer automated in the laboratories of IIA (Ananth 1985). The digitized data were reduced using the VAX 11/780 system at the Vainu Bappu Observatory, using an interactive package developed during the course of these reductions.

The grain noise in the spectra was filtered using an optimal filter in the Fourier domain (Brault and White 1971), assuming gaussian line profiles. The image-tube background was subtracted in the intensity domain. Regularization was achieved by fixing a pseudocontinuum defined by the points of minimum intensities after deleting strong absorption features. In the case of higher-resolution spectra showing a number of weaker absorption components, the continuum was defined as a least-square polynomial fit to the points of minima. The wavelength calibration was done by identifying stellar emission and atmospheric absorption features using a peak and dip finding routine. The spectra were brought to a linear scale of

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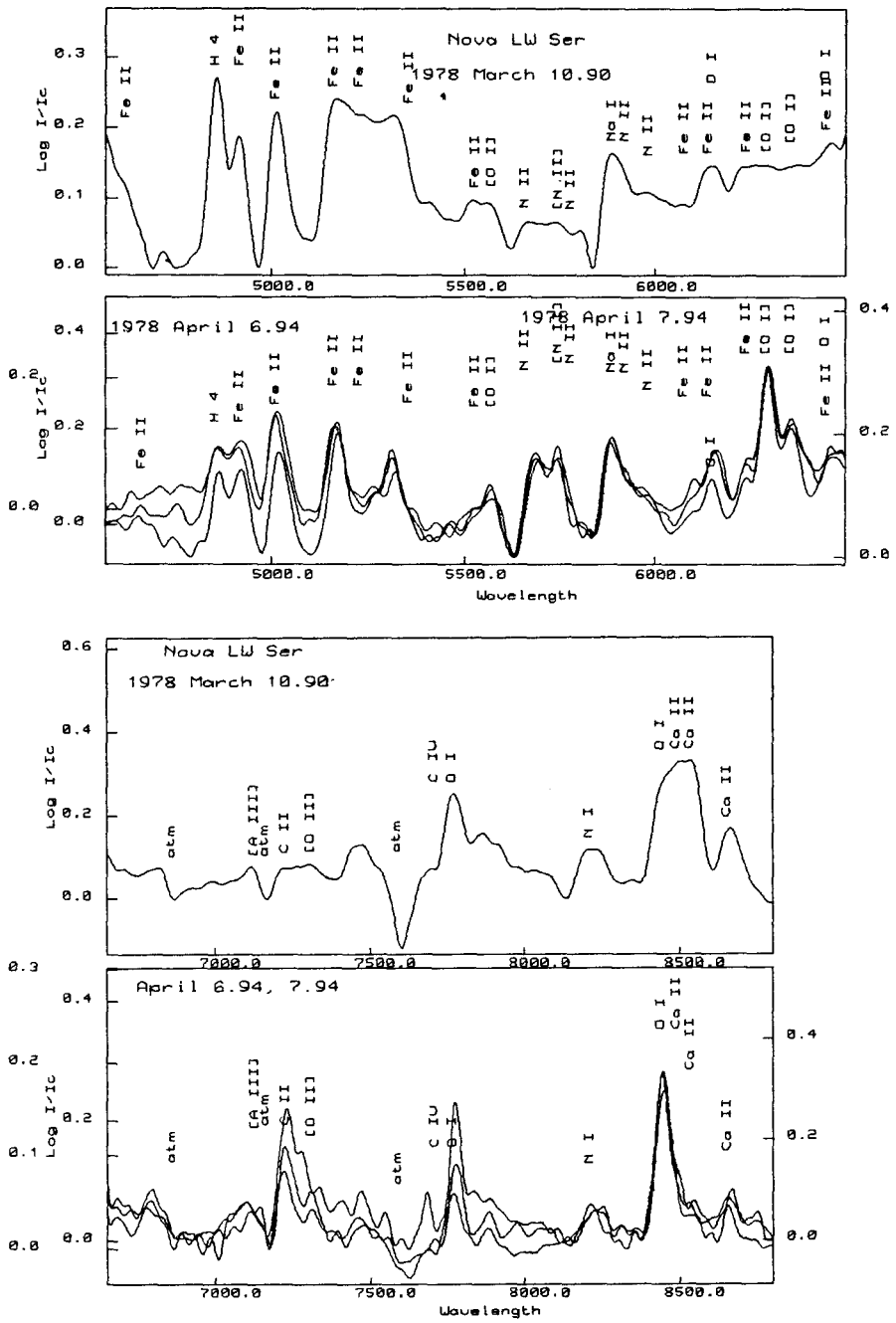

Figure 2 Portions of the spectra in Figure 1 shown at increased scale in intensities. The spectra of April 6.94 were traced at two different locations along the slit. The scale marks for these appear on the left. The differences in the zero level and the scale exemplify the photometric errors of widely differing exposures. The ratios of different lines,however,appear to be very reliable.

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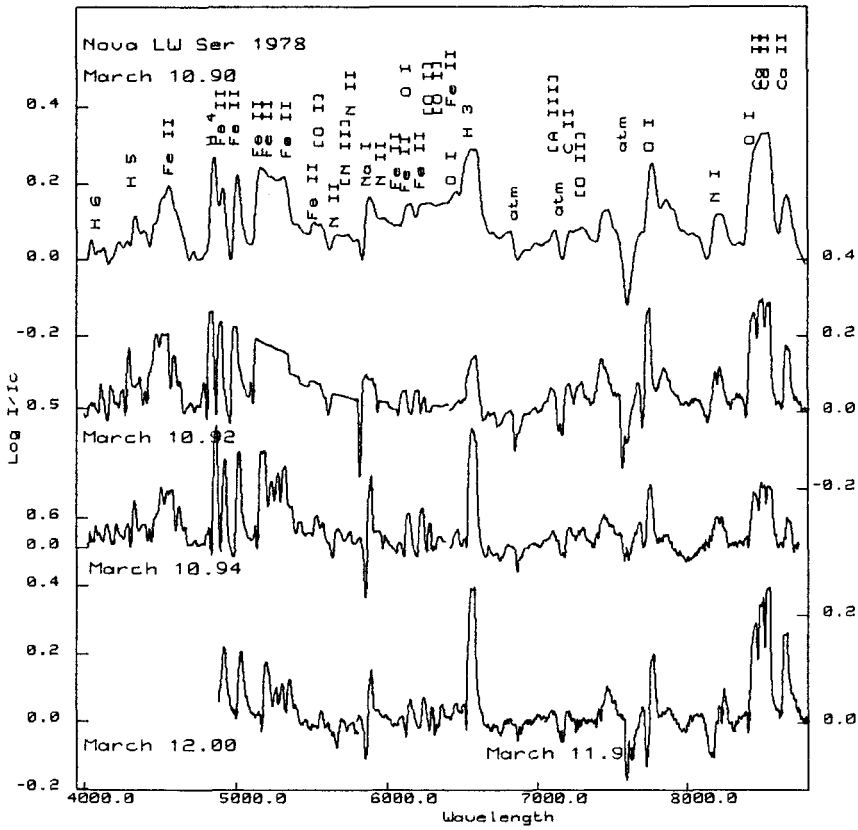

Figure 3 Spectra obtained at different dispersions between March 10 and 12. Dispersions from the top panel downwards are 675, 360, 160 and 83 A mm^{-1}, respectively.

wavelengths by spline interpolation. The ReGIS graphic library (RGL) was extensively used for examining plots on monitor. The Tektronix interactive graphic library (IGL) was employed in the programs used for wavelength identification and in the preparation of final figures.

4. RESULTS

The final spectrum plots are shown in Figures 1-4.

Cohen and Rosenthal (1983) expressed their disbelief in the absorption velocity published by Prabhu (1978), since the widths of emission lines in the spectra obtained by them a few years later were much smaller. Some plates were hence remeasured on the Abbé comparator. The mean absorption velocity deduced is -1303 ± 46 kmS^{-1}. The mean expansion velocity of the envelope may, however, be much lower than the dominant absorption component seen during the diffuse-enhanced stage of evolution.

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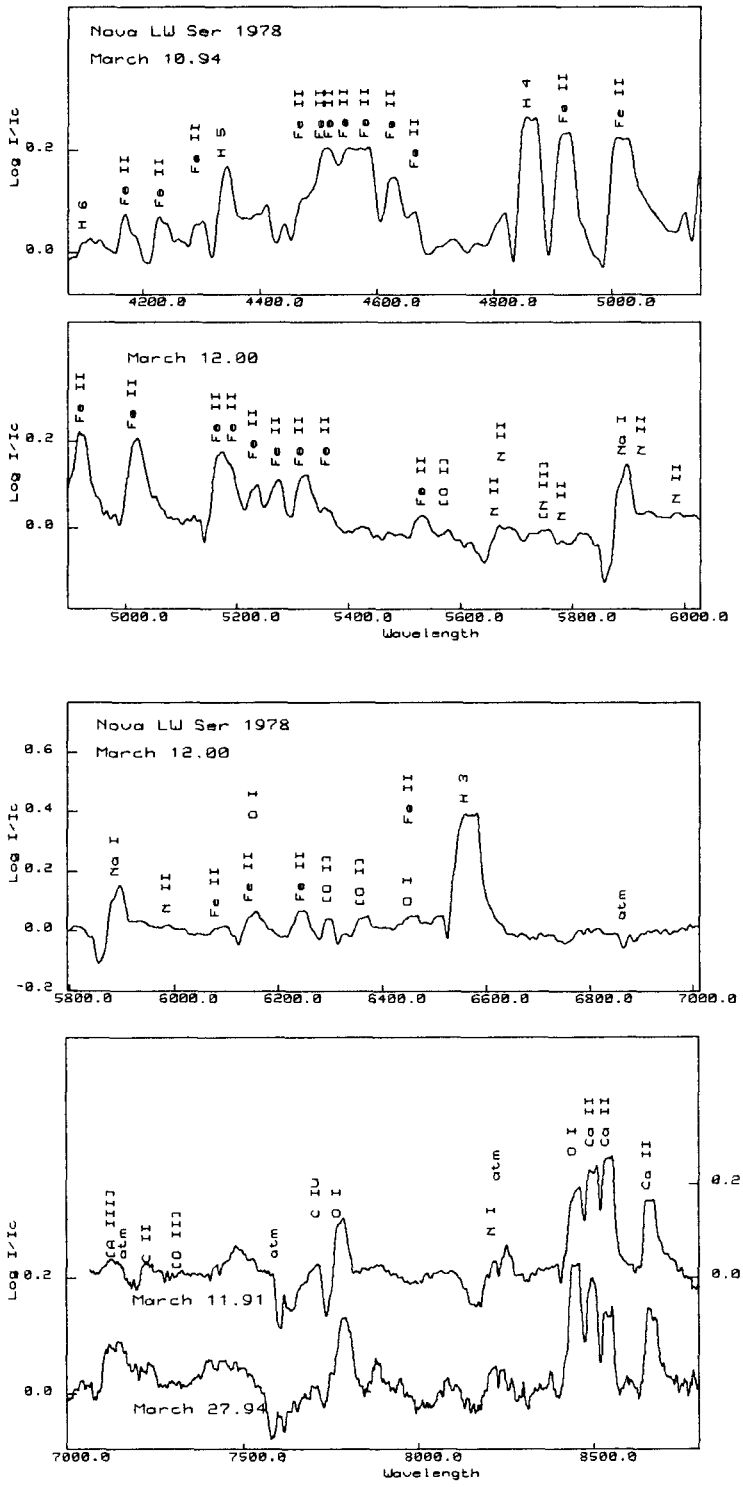

Figure 4 Spectra of LW Ser at higher resolutions.

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During the period of observations, the nova LW Ser was in its diffuse-enhanced phase, the [OI] flash occurring early in 1978 April. The emission lines steadily increased in strength from March to April. The increase was the highest for H α and OI 8446 A. The infrared triplet of Ca II, on the other hand, reduced in intensity. The spectral evolution is in conformity with that of moderately fast novae such as NQ Vul 1976 and V4021 Sgr 1977.

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REFERENCES

Ananth,A.V. : 1985, Kodaikanal Obs.Bull., Ser A, **5**, 37.
Brault,J.W., White,O.R.: 1971,Astron.Astrophys., **13**, 169.
Cohen,J.G., Rosenthal,A.J.: 1983,Astrophys.J., **268**, 689.
Gehrz,R.D., Grasdalen,G.L., Hackwell, J.A., Ney,E.P.: 1980, Astrophys.J., **237**, 855.
Herbig,G.H.: 1978, I.A.U.Circ.,3198.
Honda,M.: 1978,I.A.U.Circ., 3186.
Prabhu,T.P.: 1978,I.A.U.Circ., 3201.
Szkody,P., Dyck,H.M., Capps.R.W., Becklin,E.E., Cruickshank,D.P.: 1979, Astron.J., **84**, 1359.