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The LV Vulpeculae spectrum before the light maximum

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LV Vulpeculae is a fast nova which bursted in 1968 and reached maximum light of 4,35 mag. on April 17 (R a i k o v a, 1981). We have studied the spectrum of the nova obtained on April 17,08 (F e h r e n b a c h, B l o c h, 1968) immediately before the light maximum.

The spectrum is characterized by very broad absorption lines of ionized metals and the Balmer series of hydrogen. One discerns on the tracings some emission of the first Balmer lines and the strongest FeII lines.

The studied spectra have been taken with the 193 cm telescope of the Haute-Provence Observatory by M. Bloch. The spectrum W4259 (IIa0 plate) of dispersion 9,6 Å/mm covers the wavelength range from 3500 Å to 5000 Å. Unfortunately it is underexposed and for $\lambda<3800$ Å is unusable. The spectrum W 4260 (103aF plate) covers the range 4100 Å-6700 Å with a dispersion of 12,4 Å/mm.

Photographic darkening tracings of the spectra were made by the Lirepho-2 microphotometer at a magnification of 24. Thus we have had resulting dispersions of 0,400 Å/mm and 0,514 Å/mm on the tracings. Two tracings of each plate have been made, the scanned band width being respectively 0,3 Å and 1,0 Å for the plate W 4259 and 0,4 Å and 1,2 Å for the plate W 4260. The broad instrumental profiles on the large slit tracings smoothed the emulsion grain noise without affecting the line profiles since they are very broad. The weak lines are about 3 Å broad.

The comparison spectrum was traced on returning the paper, its precise coincidence with the stellar one at the beginning and at the end being carefully controlled. The line identification has been carried out on using the Tables of M o o r e (1959).

In order to convert the photographic darkening into intensities, four curves have been constructed for each plate. The reduction has been carried out after the Dobrichev method (D o b r i c h e v, 1970). The equivalent widths of the relatively unblended lines which could be used for analysis of the expanding envelope are given in Table 1.

The principal errors in the measured equivalent widths W_λ originate from: (i) the line blending because of their large width; (ii) the inaccuracies in determining the continuum level; (iii) the extrapolation of the calibration curves

Table 1

λ (Å)	Element, multiplet, No		W_λ (Å)	Remarks
1	2		3	5
3849.97	FeI	20	0.610	
3850.82	FeI	22		
3872.50	FeI	20	0.470	
3900.54	TiII	34	2.649	
3905.53	SiI	3	1.055	
3913.46	TiII	34	2.222	
3933.66	CaII	1	9.660	
3947.30	OI	3	0.461	CaII K emission ?
3997.13	VII	9	0.441	
4012.37	TiII	11	1.313	
4025.14	TiII	11	1.007	
4028.33	TiII	87	1.244	
4035.63	VII	32	0.529	
4045.82	FeI	43	0.804	
4053.81	TiII	87	0.828	
4056.21	TiII	11	0.215	
4067.05	NiII	11	0.585	
4071.74	FeI	43	0.636	
4077.71	SrII	1	1.062	
4118.55	FeI	801	0.108	
4122.64	FeII	28	0.684	
4143.87	FeI	43	0.411	
4149.22	ZrII	41	0.276	
4161.52	TiII	21	0.304	
4163.64	TiII	105	0.709	
4178.86	FeII	28	1.924	
4183.44	VII	37	0.323	
4195.33				
4195.41	CrII	161	0.084	
4198.31	FeI	152	0.119	
4202.03	FeI	42	0.253	
4215.57	SrII	1	0.547	
4223.04	NI	5	0.332	
4233.17	FeII	27	1.969	
4242.36	CrII	31	0.638	
4246.83	ScII	7	1.467	
4252.62	CrII	31	0.166	
4254.7	NI	4	0.174	blend CrI ?
4258.16	FeII	28	0.323	
4261.92	CrII	31	0.478	
4275.57	CrII	31	0.469	
4290.22	TiII	41	1.852	
4300.05	TiII	41	2.084	
4320.75	ScII	15	0.784	
4325.01	ScII	15	0.640	
4330.26	TiII	94	0.321	
4351.76	FeII	27	1.511	H_γ emission
4368.30	OI	5	0.835	blend TiII ?
4374.46	ScII	14	0.917	
4395.03	TiII	19	1.733	
4400.36	ScII	14	0.838	
4411.08	TiII	115	0.213	
4443.80	TiII	19	1.853	
4464.46	TiII	40	0.590	
4468.49	TiII	31	2.068	
4481.13	MgII	4	1.436	
4481.33				
4489.19	FeII	37	1.356	
4491.40				

λ (Å)	Element, multiplet, No		W_λ (Å)	Remarks
1	2		3	4
4508.28	FeII	38	0.957	
4515.34	FeII	37	0.694	
4520.23	FeII	37	2.066	
4522.63	FeII	38		
4529.47	TiII	82	0.386	
4533.97	TiII	50	1.536	
4549.47	FeII	38	1.971	
4555.89	FeII	37	0.997	
4558.66	CrII	44	1.901	
4558.83				
4571.92	TiII	82	1.214	
4576.33	FeII	38	0.479	
4582.84	FeII	38	1.827	
4583.83	FeII	37		
4588.22	CrII	44	1.451	
4618.83	CrII	44	1.215	
4629.34	FeII	37	0.967	
4634.11	CrII	44	0.824	
4656.97	FeII	43	0.466	
4666.75	FeII	37	0.432	
4731.44	FeII	43	0.498	
4739.59	MgII	18	0.110	
4766.62	CI	6	0.268	
4771.72	CI	6	0.918	
4775.87	CI	6	0.350	
4779.99	TiII	92	0.678	
4805.11	TiII	92	0.738	
4812.35	CrII	30	0.211	
4815.52	SII	9	0.069	
4824.13	CrII	30	0.868	
4836.22	CrII	30	0.139	
4848.24	CrII	30	1.061	blend MgII?
4876.41	CrII	30	0.453	H_β emission
4884.57	CrII	30	0.234	blend YII ?
4911.21	TiII	114	0.174	
4923.92	FeII	42	2.854	
4935.03	NI	9	0.108	
4957.30	FeI	318	0.162	
4957.60				
4967.40	OI	14	0.427	
4967.86				
4968.76				
5018.43	FeII	42	3.050	
5031.02	ScII	23	0.545	FeII emission
5041.06	SiII	5	0.291	blend CI
5056.02	SiII	5	0.701	
5056.35				
5100.84	FeII	185	0.133	
5129.14	TiII	86	0.556	
5146 06	OI	28,39	0.143	
5183.60	MgI	2	0.996	blend TiII ?
5188.70	TiII	70	1.604	
5197.57	FeII	49	0.856	
5226.53	TiII	70	0.951	
5264.80	FeII	48	0.581	
5275.99	FeII	49	1.915	
5284 09	FeII	41	0.674	
5316.61	FeII	49	2.430	
5316.78	FeII	48		

Table 1 (continued)

1	2		3	4
5328.98 5329.59 5330.66	OI	12	0.903	
5362.86	FeII	48	1.101	
5380.24	CI	11	0.270:	
5405.78	FeI	15	0.140	
5408.84	FeII	184	0.248	
5414.09	FeII	48	0.201	
5425.27	FeII	49	0.462	
5435.16 5435.76 5436.83	OI	11	0.507	
5455.61	FeI	45	0.194	
5478.35	CrII	50	0.231	
5502.05 5502.18	CrII	50	0.209	
5512.71	OI	25	0.178	
5526.81	ScII	31	0.717	
5534.86	FeII	55	0.782	
5616.54	NI	24	0.141	
5623.20	NI	29	0.145	
5640.97	ScII	29	0.098	
5657.87 5658.33	ScII	29	0.449	
5667.16 5669.03	ScII	29	0.192	
5793.51	CI	18	0.503	
5889.95	NaI	1	2.021	
5895.92	NaI	2	2.046	
5978.97	SiII	4	0.245	
5991.38	FeII	46	0.219	
6008.48	NI	16	0.237	FeII emission, blend OI ?
6046.26 6046.46	OI	22	0.110	
6147.74 6149.24	FeII	74	0.675	
6156.78 6158.19	OI	10	2.061	
6238.38	FeII	74	0.556	
6247.56	FeII	74	0.853	
6331.97	FeII	199	0.107	
6347.09	SiII	2	1.980	
6371.36	SiII	2	1.588	
6416.91	FeII	74	0.273	
6456.38	FeII	74	1.249	blend OI ?
6516.05	FeII	40	0.344	
6644.96	NI	20	0.374	
6653.41	NI	20	0.334	

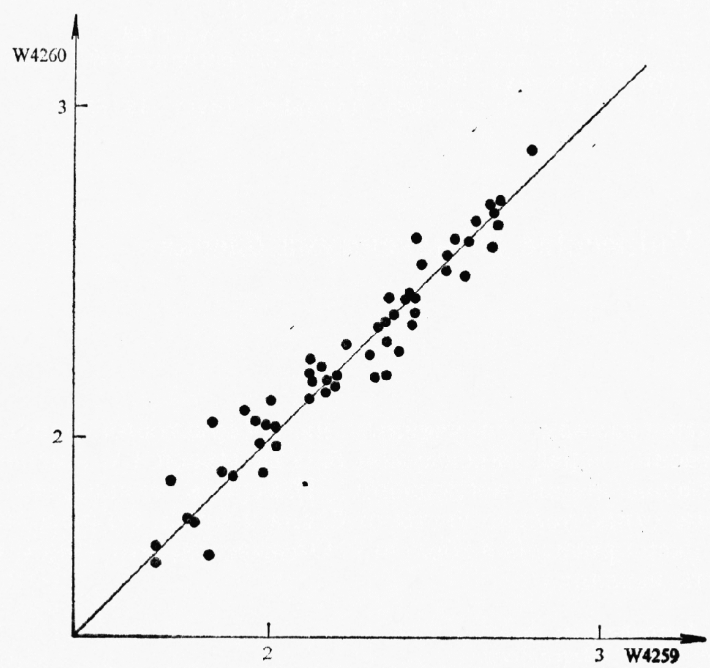

Fig. 1

on a relatively large wavelength range. We have juxtaposed the equivalent widths of the lines in the range 4100 Å - 5000 Å where the two spectra overlap. In Fig. 1 the quantities log $(W_\lambda . 10^6/\lambda)$ measured from the spectrum

W4260 are plotted against those from the spectrum W 4259. There are no systematic differences between the values obtained from both spectra. Therefore the errors arising from the calibration extrapolation are small. The scattering of the points in Fig. 1 about the line of equality gives an approximate estimation of the equivalent width measurement errors.

The radial velocity of the gas where the absorption lines originate has been determined by the tracings, and the value —670 km/s has been found. There is no systematic dependence of measured radial velocity upon the excitation energy or the intensity of the lines, as well as upon the ionization state of the absorbing atoms. This suggests that the layer where the great majority of lines is formed is relatively thin and without any discernable velocity gradient in it. The latter suggestion is supported by the fact that the line profiles show no asymmetry.

A few absorption lines among the relatively unblended ones exhibit some hardly visible features of a two-peak structure. The distance between the two peaks (if real) corresponds to 40-60 km/s.

The Balmer lines show a monotonous decrease of V_r with the increase of the line number. The matter has been discussed in another paper (R a i k o v a, D o b r i c h e v, 1985).

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R e f e r e n c e s

D o b r i c h e v V. 1970. Bull. Depart. Astron., IV, 47.
F e h r e n b a c h Ch., M. B l o c h. 1968. IAU Circ. No 2068.
M o o r e Ch. E. 1959. Revised Multiplet Tables of Astrophysical Interest, NBS, USA.
R a i k o v a D. 1981. Astrophys. Invest., 3, 41.
R a i k o v a D., V. D o b r i c h e v. 1985. Astrophys. Inves., 14, 33

Спектр LV Vulpeculae до максимума блеска

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(Р е з ю м е)

По куде-спектрограммам, полученным на обсерватории Верхнего Прованса непосредственно перед максимумом блеска Новой LV Лисички, проведено отождествление линий поглощения. Измерены эквивалентные ширины линий, которые относительно чисты от бленд и могли бы быть использованы для анализа расширяющейся оболочки. Отмечается, что линии очень широкие и точность невелика.

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