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CCD spectrophotometry of CVs

IV. 3430−7850 Å atlas for 27 faint systems

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Abstract. CCD fluxed spectra are presented for 27 objects from the Downes & Shara (1993) catalogue of Cataclysmic Variables (CVs). The stars have been selected among those listed as lacking published spectra. As for previous papers in this series, the aim is to check the CV status of the objects and to provide spectrophotometric data over a wide wavelength range. Integrated $BVR_{\rm C}$ magnitudes, continuum fluxes at selected wavelengths and integrated fluxes of emission lines are derived for the programme stars. Among the 27 programme stars, 18 show a spectrum supporting the CV classification.

Key words: Novae: cataclysmic variables — white dwarfs

1. Introduction

Downes & Shara (1993, hereafter DS93) have compiled a very useful catalogue and atlas of the Cataclysmic Variables discovered through February 1992. A similar work for classical novae was presented by Duerbeck (1987, hereafter D87). DS93 listed references to published quiescence spectra for 271 objects and to outburst spectra for additional 123 systems (in both cases a significant fraction belonging to the *pre-digital* era), but for 359 objects ($\sim$ half of the total) they have been unable to locate published spectra.

In Papers I, II and III of this series (Zwitter & Munari 1994-1996) we have begun to present CCD spectra for CVs listed by DS93 as lacking published spectroscopy.

The results of Papers I, II and III confirm the conclusion of DS93 and D87 that the classification of an object as a CV using exclusively the information from photometric observations and/or automated spectral surveys may be misleading. The large fraction of mis–classifications we have encountered so far supports the need for a spectroscopic survey to prune the excellent DS93 catalogue from mis-entries.

In this paper we present flux-calibrated CCD spectra for additional 31 faint systems selected among those without published quiescence spectra according to the DS93 catalogue. The programme continues and observations of additional targets will be presented in future papers of this series.

Beside the confirmation of the CV status, our spectra are intended to expand the set of validated CVs with flux calibrated spectra. A physical analysis of spectral characteristics of the whole investigated sample is postponed to a final paper in this series.

2. Observations

The observations listed in Table 1 have been obtained with the B&C+CCD spectrograph attached to the 1.82 m telescope operated on Mt. Ekar (Asiago) by the Astronomical Observatory of Padua (Italy). All spectra of programme stars and spectrophotometric standards have been obtained in slitless mode for optimal flux calibration. The observations have been secured during nights with photometric conditions. The covered wavelength range is 3430 − 7550 Å. The spectral resolution is dominated by the dimension of the seeing PSF, on the average 20 Å. The Asiago spectra are presented in Figs. 1 to 5.

The objects listed in Table 2 have been observed with the BFOSC+CCD Imager & Spectrograph attached to the 1.5 m telescope operated in Loiano by the Astronomical Observatory of Bologna (Italy). The slit spectrograph was

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Table 1. Journal of observations of programme stars observed at Asiago. Type, Max and Min as listed by DS93. Code for spectral information available in literature as given by DS93: N = no spectral information; D = only a glass plate tracing or a description of the quiescence spectrum. Status of the object when we have observed it: Q = quiescence; Out = outburst

Name	$\alpha_{2000.0}$	$\delta_{2000.0}$	Type	Max (mag)		Min (mag)		Code	Observ. date	UT	Expt. time	Status
V513 Cas	00 18 15.05	+66 18 12.7	ugZ:	15.5	p	<17.2	p	N	02.11.95	22 06	30	Q
V410 Cas	00 23 27.75	+61 46 27.7	NL*	15.5	p	18	p	N	02.11.95	23 00	30	Q
AM Cas	02 26 23.41	+71 18 32.2	ugz	12.3	p	15.2	p	D	03.11.95	00 07	30	Out
KW And	02 35 18.12	+41 14 01.6	UG	14.8	p	22	p	N	03.11.95	01 06	30	Out
PV Per	02 42 53.57	+38 04 02.6	ug	14.9	p	20	:p	D	03.11.95	23 28	30	Q
MY Per	04 09 12.33	+48 22 06.1	UG	16	p	<18	p	N	04.11.95	02 00	30	Q
V1062 Tau	05 02 27.54	+24 45 22.1	dq	15.6	V			N	04.11.95	01 30	30	Q
V1504 Cyg	19 28 57.	+43 05 36.	ugsu	13.5	p	17.4	p	N	02.11.95	19 18	30	Out
1H 1933+510	19 34 36.63	+51 07 37.3	nl	17.5	V			N	03.11.95	18 21	30	Q
V811 Cyg	19 48 23.42	+36 26 22.7	ugSS	12.7	p	<17.7	p	N	03.11.95	18 56	30	Q
V1075 Cyg	21 29 18.47	+42 19 16.9	UGSS	16.4	p	<18	p	N	03.11.95	20 00	30	Out ?
NQ Lac	22 28 43.94	+56 14 57.9	UG	16.2	p	<17.7	p	N	03.11.95	21 06	30	Out ?
CG Cep	23 10 26.17	+66 33 30.6	ugSS	14.5	p	17.2	p	N	03.11.95	21 43	30	Out ?
LM Cas	23 12 59.71	+56 51 16.5	ugSS	15.8	p	<19	p	N	03.11.95	22 18	30	Q

Table 2. Journal of observations of programme stars observed at Loiano. Type, Max and Min as listed by DS93. Code for spectral information available in literature as given by DS93: N = no spectral information; D = only a glass plate tracing or a description of the quiescence spectrum

Name	$\alpha_{2000.0}$	$\delta_{2000.0}$	Type	Max (mag)		Min (mag)		Code	Observ. date	UT	Expt. time
AM Cas	02 26 23.41	+71 18 32.2	ugz	12.3	p	15.2	p	D	07.02.95	20 59	90
V344 Ori	06 15 19.02	+15 30 58.6	UGZ	14.2	p	17.5:	p	N	08.02.96	20 01	120
SY Gem	06 40 37.	+31 11 26.	n::	9.2	v	<13	v	N	14.10.94	01 13	10
AQ CMi	07 14 34.84	+08 48 05.0	UG:	14.5	p	<16.5	p	N	06.02.95	20 39	45
EG Cnc	08 43 04.12	+27 51 48.6	nl/ug:	11.9	v	17:	v	N	09.02.96	20 03	150
1H 0928+500	09 32 15.03	+49 50 53.4	nl	16.3	V			N	15.02.96	22 51	60
PG 1002+506	10 05 29.40	+50 20 39.0	cv	15.4	B			N	08.02.96	23 38	60
1H 1025+220	10 28 00.15	+21 48 12.9	nl	16.2	V			N	16.02.96	22 13	90
PG 1146+228	11 49 00.64	+22 31 03.6	cv	15.0	B			N	07.02.95	23 53	45
IR Lyr	18 23 53.62	+39 18 58.9	UG:	14.6	p	16.0	p	N	03.10.94	21 16	90
EY Cyg	19 54 36.85	+32 21 53.8	ugSS	11.4	v	15.5	v	D	04.07.94	01 49	35
V476 Cyg	19 58 24.57	+53 37 07.1	na	2.0	p	17.2	B	D	01.08.94	00 56	120
HR Del	20 42 20.18	+19 09 40.3	nb	3.5	v	12.0	v	D	06.06.94	01 52	30
V751 Cyg	20 52 12.91	+44 19 25.2	nl/vy	13.2	v	14.5	v	N	04.10.94	21 29	90

set to 2 arcsec, for a resolution of 12 Å and a covered wavelength range between 4000 and 7850 Å. In several cases the Loiano observations have been obtained in non-photometric conditions and thus the zero point of the flux scale is not accurate and no absolute fluxes and V magnitude are derived. The Loiano spectra are presented in Figs. 6 to 10.

Table 4 gives the classification of the programme stars based on our spectra, Table 5 the integrated flux of selected emission lines, Table 6 the continuum fluxes (at the same reference wavelengths as in Papers I, II and III) and Table 7 the BVR_C magnitudes as derived on our spectra from convolution with the band transmission profiles.

3. Notes on individual objects

1H 1025+220, 1H 1933+510. Blue continua with Hα, Hβ and He I 5876 Å in emission.

1H 0928+500. Blue continuum with bright emission lines and He II 4686 Å stronger than Hβ.

PG 1002+506. Our spectrum is remarkably similar to the unpublished one by Ringwald (1993), with Hα in emission but higher Balmer lines in deep, relatively narrow absorption onto of a blue continuum. Hβ and, to a lesser extent, Hγ appear partially filled–in by an emission core.

Table 3. Target objects without recorded spectra because at the time of our observations they were too faint. Type, Max and Min as listed by DS93. The scheme for spectral code (from DS93) is the same as in Table 2. Last column: magnitude of the object as estimated on the TV screen of the guiding system of the Asiago 1.82 m telescope

Name	$\alpha_{2000.0}$	$\delta_{2000.0}$	Type	Max (mag)		Min (mag)		Code	UT observ. date	V (mag)
PG 0051+169	00 53 40.19	+17 09 42.8	cv	15.6	B			N	Nov 03.993 1995	≥17.5
V550 Cyg	20 05 04.96	+32 21 22.8	UGSS	14.2	p	<17.0	p	N	Nov 03.739 1995	≥17.0
V1310 Cyg	20 09 33.	+41 00 12.	ugSS	15.9	p	<19	p	N	Nov 03.742 1995	≥17.0
V767 Cyg	20 16 50.07	+53 12 23.6	UGSS	15.0	p	<17.5	p	N	Nov 03.744 1995	≥17.0
V1390 Cyg	20 28 23.46	+39 03 53.4	ugSU	16.0	p	<18.1	p	N	Nov 03.705 1995	≥16.5
V632 Cyg	21 36 04.18	+40 26 18.8	UGSS	12.6	p	17.5	p	N	Nov 02.804 1995	≥15.5
V1089 Cyg	21 44 18.	+47 54 50.	UGSS	15.0	p	18.5	p	N	Nov 03.864 1995	≥17.0
MR Lac	22 24 43.05	+50 31 40.1	ug	15.0	p	<17.3	p	N	Nov 03.868 1995	≥17.0
BV And	23 27 02.19	+50 07 12.1	UGSS	15.2	p	18	p	D	Nov 03.985 1995	≥17.0

Table 4. Classification from spectra of the programme stars

Name		Name		Name		Name	
1H 0928+500	CV	AQ CMi	CV	V476 Cyg	CV	NQ Lac	sdO
1H 1025+220	CV	AM Cas	CV	V751 Cyg	CV	IR Lyr	not a CV
1H 1933+510	CV	LM Cas	CV ?	V811 Cyg	CV	V344 Ori	CV
PG 1002+506	CV ?	V410 Cas	?	V1075 Cyg	CV ?	MY Per	?
PG 1146+228	sdO	V513 Cas	?	V1504 Cyg	CV	PV Per	CV
KW And	CV	CG Cep	CV	HR Del	CV	V1062 Tau	CV
EG Cnc	CV	EY Cyg	CV	SY Gem	?		

Table 5. Integrated flux (in units of 10^{-15} erg cm^{-2} s^{-1}) of the most prominent emission lines

	Hα	Hβ	Hγ	Hδ	He I (4471 Å)	He I (5876 Å)	He I (6678 Å)	He I (7065 Å)	He II (4686 Å)
V513 Cas	6								
AM Cas *(Loiano)*	25	20	15						
MY Per	3								
V1062 Tau	24	10							
V811 Cyg	50	52	46	43	20	17	7	5	10
CG Cep	12								
V751 Cyg	18	7	8						
PG 1002+506	20								
EY Cyg	9	6							
1H 1025+220	10	7							
1H 0928+500	6	6	7						10
V476 Cyg	5	6							3
AQ Cmi	3								

Ringwald found a fine sinusoidal modulation of the Hα radial velocity with an amplitude of 30 km s^{-1} and a period of 7.6 hours. However he dismissed a CV classification for PG 1002 + 506 and ascribed the RV modulation to some sort of noise and/or uneven sampling of the data.

The colors of our spectrum suggest little or absent reddening, in agreement with the very high galactic latitude ($b = +51°$). With an observed $V = 15.5$ mag the object would lie at $d \sim 10$ kpc if an analogue of an Herbig Ae/Be star, with an implausible large $z \sim 8$ kpc for a young object. Alternatively, it could be a sdB–O star in a close binary or more probably a CV seen nearly pole–on (in agreement with the sharpness of absorption lines). The object deserves further investigation.

PG 1146+228. Again our spectrum is identical with the unpublished one by Ringwald (1993), with a blue continuum and absorption lines by hydrogen and possibly He II

Table 6. Continuum fluxes for the programme stars. The fluxes have been scaled to Flux (5200 Å) = 1.00. They were computed averaging over 50 Å wide bins centered at the given wavelength

Name	Continuum Fluxes								
	3450	3750	4000	4400	4800	5200	5600	6000	7050
Asiago spectra									
V513 Cas		0.58	0.75	0.85	0.91	1.00	1.09	1.06	1.10
V410 Cas	0.18	0.49	1.09	1.14	1.05	1.00	0.91	0.81	0.60
AM Cas		1.34	1.63	1.48	1.26	1.00	0.85	0.70	0.47
PV Per			1.56	1.40	1.23	1.00	1.11	1.09	0.87
V1062 Tau	1.18	1.16	1.03	0.87	0.90	1.00	1.09	1.12	1.09
V1504 Cyg	1.44	2.18	1.97	1.67	1.33	1.00	0.80	0.64	0.40
1H 1933+510		2.06	1.57	1.63	1.14	1.00	0.82	0.74	0.46
V811 Cyg		3.21	2.05	1.26	1.06	1.00	0.90	0.82	0.86
V1075 Cyg		1.44	1.38	1.27	1.25	1.00	0.90	0.79	0.55
NQ Lac	0.66	0.88	0.90	0.86	1.05	1.00	1.19	1.32	1.64
CG Cep	0.63	1.22	1.22	1.15	1.09	1.00	0.91	0.86	0.70
LM Cas		0.61	0.72	0.99	1.06	1.00	1.05	1.03	0.91
Loiano spectra									
AM Cas				1.27	1.11	1.00	0.91	0.79	0.60
SY Gem #1				0.69	1.01	1.00	1.09	1.09	0.97
SY Gem #2				1.23	1.16	1.00	0.92	0.81	0.61
EG Cnc				1.64	1.25	1.00	0.67	0.44	0.37
1H 0928+500				1.47	1.18	1.00	0.88	0.76	0.50
PG 1002+506				1.96	1.35	1.00	0.78	0.61	0.37
1H 1025+220				1.40	1.18	1.00	0.82	0.68	0.41
PG 1146+228				1.46	1.22	1.00	0.85	0.72	0.49
IR Lyr				1.23	1.16	1.00	0.89	0.75	0.49
EY Cyg				0.72	1.10	1.00	1.09	1.09	1.03
V476 Cyg				1.42	1.34	1.00	0.92	0.83	0.66
HR Del				1.60	1.19	1.00	0.81	0.68	0.48
V751 Cyg				1.21	1.05	1.00	0.91	0.78	0.59

4686 Å. With a galactic latitude $b = +75°$ and $V = 15.5$ the object must be a sdO.

KW And. Blue continuum with possible weak Hα emission. Comparing with the magnitude range quoted by DS93, our observation at $V = 18.7$ suggests the object was in between quiescence and outburst states.

AQ Cmi, V344 Ori, EG Cnc. CV–like spectra, with possibly He II in emission for EG Cnc.

AM Cas. The Asiago spectrum shows an early–type continuum with broad hydrogen lines in deep absorption and only a weak emission core in Hα. This corresponds to an outburst state, as confirmed by the bright $V = 13.6$ magnitude (cf. Table 7) compared with the range of variability of the star listed by DS93. Adopting the intrinsic colors of a B8 V star, the $B - V$ in Table 7 suggests $E_{B-V} = 0.17$ and the $V - R_C$ gives $E_{B-V} = 0.16$.

The Loiano spectrum ($V = 14.6$) was secured when the star was far from an outburst maximum but not yet at flat quiescence conditions. Hydrogen emission lines are stronger and He I could be in weak emission. Broad and shallow absorptions with narrow emission cores dominate at higher Balmer lines. The continuum slope is redder compared with the Asiago outburst observation but still bluer than in the spectrum presented by Downes et al. (1995) which was secured during a flat quiescence phase. In the latter spectrum the broad and shallow absorptions in the higher Balmer lines are absent and the He I lines are in much stronger emission.

LM Cas. Our spectrum has been secured when the object was at $B = 16.8$, against a range from 15.8 to fainter than 19 according to DS93. The spectrum is featureless, except for a wide absorption at Hα. The star could have been caught during an outburst.

Table 7. $B-V$, $V-R_C$ colour indices and V magnitude of the programme stars as derived from our spectrophotometry

Name	V	$B-V$	$V-R_C$	Name	V	$B-V$	$V-R_C$
	Asiago spectra				*Loiano spectra*		
V513 Cas	16.3	0.85	0.50	AM Cas	14.6	0.44	0.22
V410 Cas	15.3	0.43	0.19	V344 Ori		0.37	0.54
AM Cas	13.6	0.09	0.06	SY Gem #1	15.1	1.08	0.45
KW And	18.7	0.42	0.39	SY Gem #2	11.8	0.47	0.22
PV Per	19.1	0.20	0.10	AQ CMi	18.8	0.59	0.15
MY Per	19.8	1.51	0.67	EG Cnc		0.17	–0.05
V1062 Tau	16.6	0.70	0.46	1H 0928+500	17.1:	0.42	0.16
V1504 Cyg	15.2	–0.08	0.00	PG 1002+506	15.5	0.02	0.00
1H 1933+510	18.0	0.16	0.16	1H 1025+220	16.8:	0.29	0.06
V811 Cyg	16.8	0.10	0.32	PG 1146+228		0.23	0.13
V1075 Cyg	16.2	0.22	0.17	IR Lyr	14.4	0.30	0.13
NQ Lac	15.7	0.78	0.62	EY Cyg	15.8	0.77	0.45
CG Cep	15.2	0.38	0.26	V476 Cyg	17.6	0.25	0.20
LM Cas	16.1	0.73	0.36	HR Del		0.14	0.11
				V751 Cyg	14.3	0.36	0.20

V410 Cas. Antipin & Shugarov (1992) described the very unusual lightcurve of this object, characterized by long quiescence (at $B \sim 17 \div 18$ mag) and two major outbursts in 1938 and 1975, when the star rose to $B = 15.5$ Since 1975, the star is at flat maximum. They pointed out photometric similarity with symbiotic novae like PU Vul or HM Sge. Our spectrum is that of a WD of type DA (or possibly that of a CV in outburst, cf. the AM Cas spectrum in the same Fig. 1), with no evidence for emission cores in the broad Balmer absorptions. Object classification is quite obscure given the photometric history. The spectrum has no relation to those of symbiotic stars and symbiotic novae both in quiescence and outbursts, and maximum brightness lasting 20 years makes association with typical CVs very difficult. Enigmatic object deserving further investigations.

V513 Cas. Weak Hα emission on a reddish, featureless continuum. Magnitudes and colors in Table 7 are very close to the values measured by Misselt (1996). Classification uncertain.

CG Cep. At the time of our observation the star was at $B = 15.5$ mag against the variability range reported by DS93 as $14.5 - 17.2$ in blue light. Hα is in moderate emission, Hβ filled–in and Hγ in absorption. The spectrum resembles outburst conditions. Magnitudes and colors index in Table 7 well match those measured by Misselt (1996).

EY Cyg. A clear CV spectrum with He I in emission (He I 5876 Å affected by a cosmic ray), in full agreement with the photographic reproduction of a plate quiescence spectrum by Kraft (1962). A spectrum during decline from maximum has been presented by Szkody et al. (1990), with emission cores onto broad and shallow Balmer lines as above described for AM Cas outburst spectra.

V476 Cyg (= Nova Cyg 1920). A nice CV spectrum for this old nova, with a blue continuum and He II in emission 75 years after the outburst. Magnitude and colors in good agreement with Bruch & Engel (1994).

V751 Cyg. Our quiescence spectrum was secured at a similar flux level as recorded by Downes et al. (1995). Their spectrum shows only H-alpha in emission on a blue continuum, with two absorption features they identify with the G-band and NaI D doublet. Our spectrum suggests that the latter is instead due to He I 5876 Å and the G-band actually is part of the broad and shallow Balmer absorption around the Hγ core in emission. Magnitude and colors from our spectrum are in good agreement with the value reported by Bruch & Engels (1994).

V811 Cyg. Text–book example of a CV spectrum (cf. with Fig. 1 in Paper II), with He II in emission.

V1075 Cyg. Our spectrum shows a blue continuum with no perceptible feature at Hα. We observed the object at $B = 16.4$ mag, at the maximum of the brightness range listed by DS93. It could be a CV caught during an outburst.

V1504 Cyg. Blue continuum without Balmer jump, weak Hα in emission, possible Hγ core in emission inside a broad absorption, higher Balmer lines in absorption. Colors in Table 7 suggest a $E_{B-V} = 0.05$.

HR Del (= Nova Del 1967). Quite surprisingly, such a famous object has no published digital optical spectrum, according to DS93 and the SIMBAD database. The most recent published spectra seems to be the tracings of Kürster & Barwig (1988), obtained on photographic plates or with electronographic Lallemand cameras in the late 70ies. Our spectrum still show broad [OIII] lines but of now much reduced intensity, strong Balmer lines, He II 4686 and the 4640 Å complex (CIII, NIII) in emission. The He II (4686 Å)/Hβ ratio is still close to unity.

SY Gem (= Nova Gem 1856b). Both candidates (stars #1 and #2) from the D87 finding chart have been observed. None of them show a CV–like spectrum, in agreement with the photometric data of Downes & Szkody (1989) and their spectrum description. SY Gem was reported at $V \sim 9.3$ in 1857, 1858, 1904 and 1906, otherwise fainter than mag 10 or 12, a behaviour quite unusual for real novae. It could be a mis–identified object on the D87 finding chart, or a dwarf nova with erratic outbursts (and quiescence spectra dominated by the cool star) or a different type of variable. Downes & Skody reported that a nearby star, of $V = 20.4$ mag, could have the Hα in emission.

NQ Lac. We observed the star at $B = 16.5$, close to the maximum brightness range reported by DS93. The spectrum is relatively featureless, with Balmer lines in weak absorption together with He II 4686 Å. The absence of a strong interstellar NaI D absorption (for a galactic latitude $b = -1$) suggests the object to be a sdO.

IR Lyr. Our spectrum shows an A–type absorption continuum, with no trace of emission lines. It is very similar to the one presented by Downes et al. (1995). The object is not a CV.

MY Per. Weak Hα emission on a quite red continuum without molecular bands. Classification uncertain.

PV Per. Blue continuum with weak Hα emission. Dwarf nova outbursts described by Romano & Minello (1976).

V1062 Tau (=1H 0459+248). Hα, Hβ, He I 6678 Å and possibly Balmer continuum appear in emission onto of a reddish continuum. Major differences with the spectrum presented by Remillar et al. (1994) are He II 4686 Å very weak or absent in our spectrum, marked NaI D absorption and absence of He I 5876 Å.

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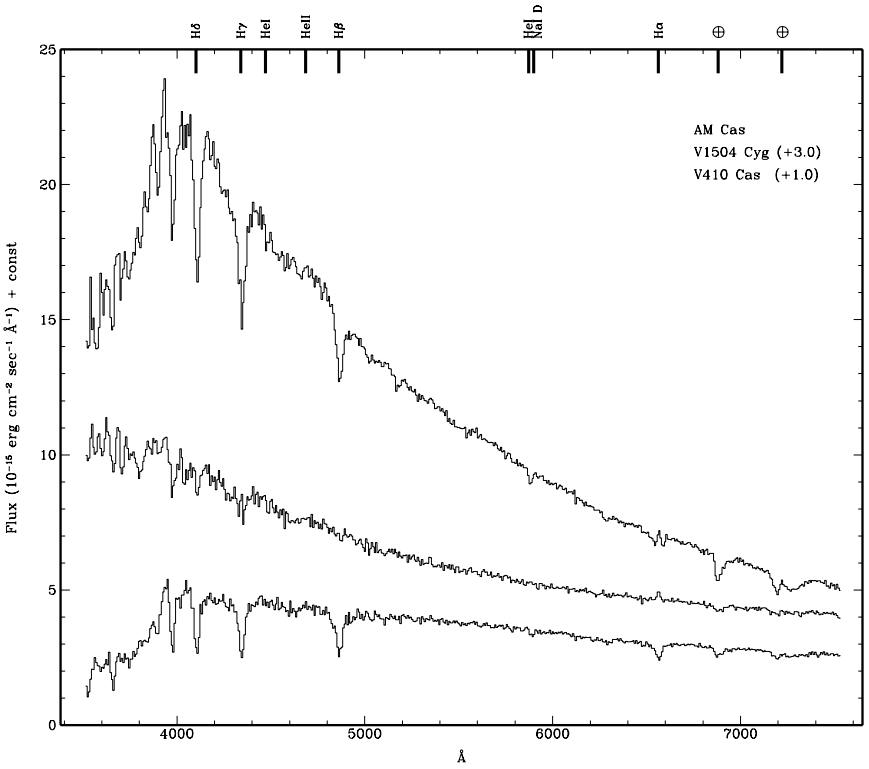

Fig. 1. Spectra of AM Cas (Asiago), V1504 Cyg and V410 Cas. The offset applied for plot clarity is given in brackets next to the star name. The spectra are not corrected for reddening. Fluxes in units of 10^{-15} erg cm^{-2} s^{-1} Å^{-1}

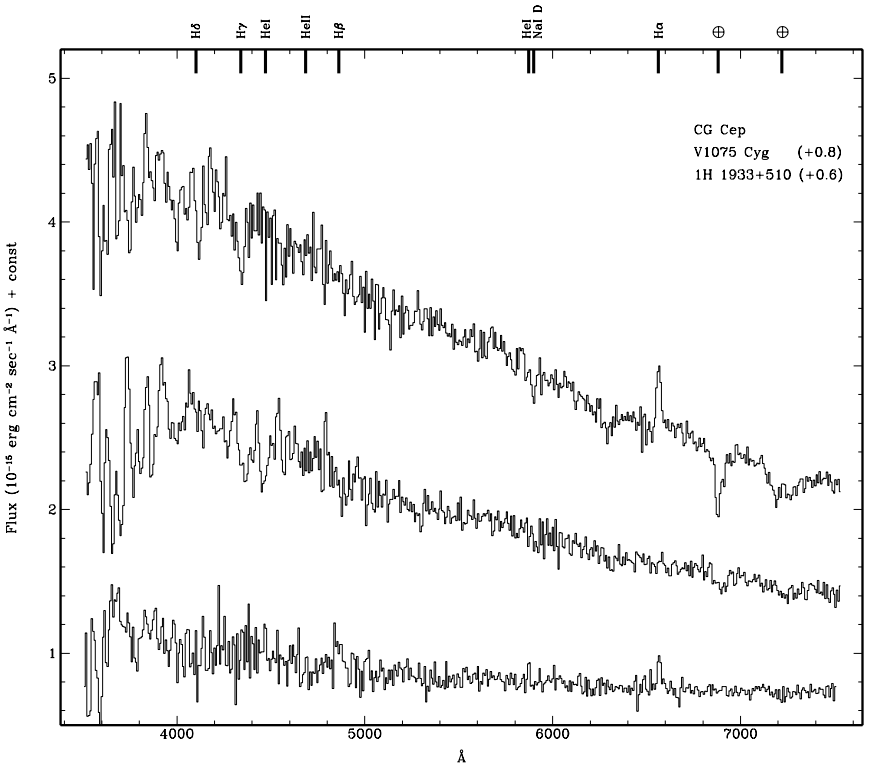

Fig. 2. Spectra of CG Cep, V1075 Cyg and 1H 1933+510. The offset applied for plot clarity is given in brackets next to the star name. The spectra are not corrected for reddening. Fluxes in units of 10^{-15} erg cm^{-2} s^{-1} Å^{-1}

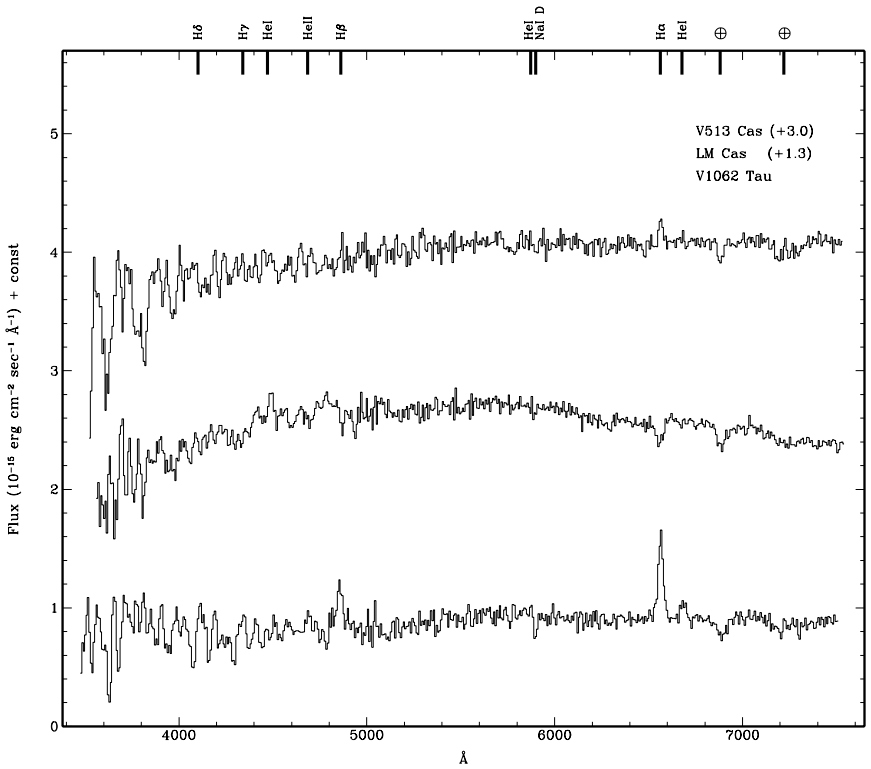

Fig. 3. Spectra of V513 Cas, LM Cas and V1062 Tau. The offset applied for plot clarity is given in brackets next to the star name. The spectra are not corrected for reddening. Fluxes in units of 10^{-15} erg cm^{-2} s^{-1} Å^{-1}

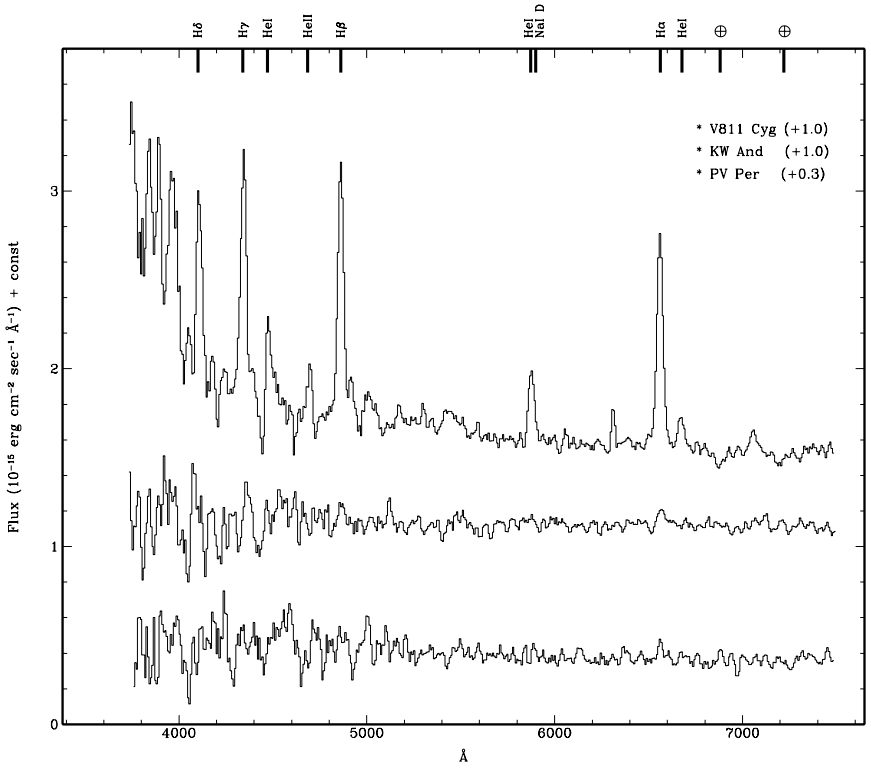

Fig. 4. Spectra of V811 Cyg, KW And and PV Per. The offset applied for plot clarity is given in brackets next to the star name. The asterisk means that a boxcar smoothing (with a window of 3 pixels) has been applied. The spectra are not corrected for reddening. Fluxes in units of 10^{-15} erg cm^{-2} s^{-1} Å^{-1}

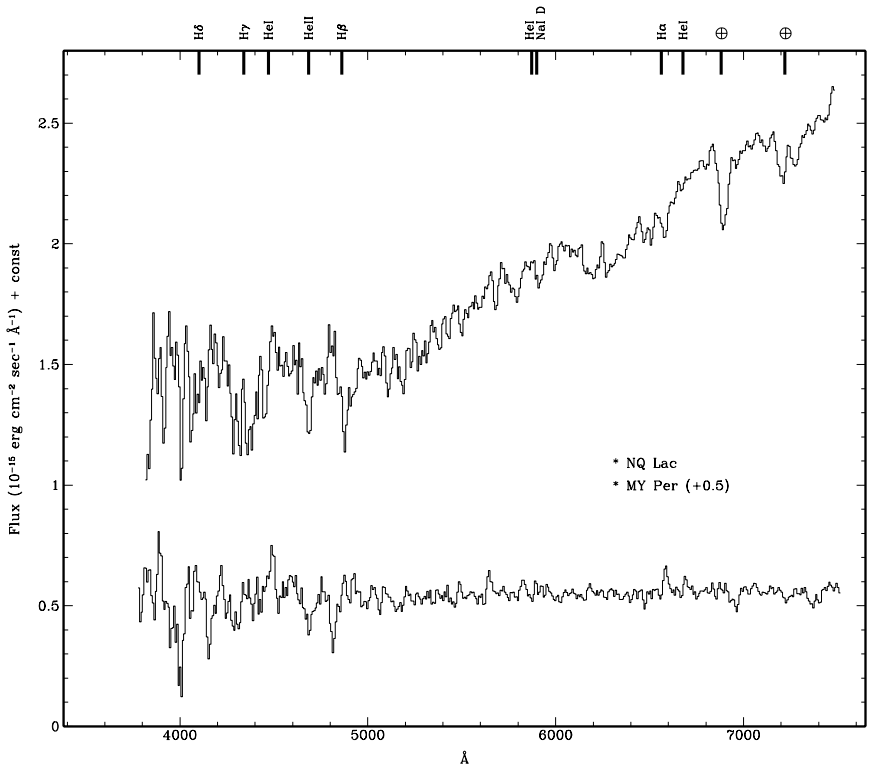

Fig. 5. Spectra of NQ Lac and MY Per. The offset applied for plot clarity is given in brackets next to the star name. The asterisk means that a boxcar smoothing (with a window of 3 pixels) has been applied. The spectra are not corrected for reddening. Fluxes in units of 10^{-15} erg cm^{-2} s^{-1} Å^{-1}

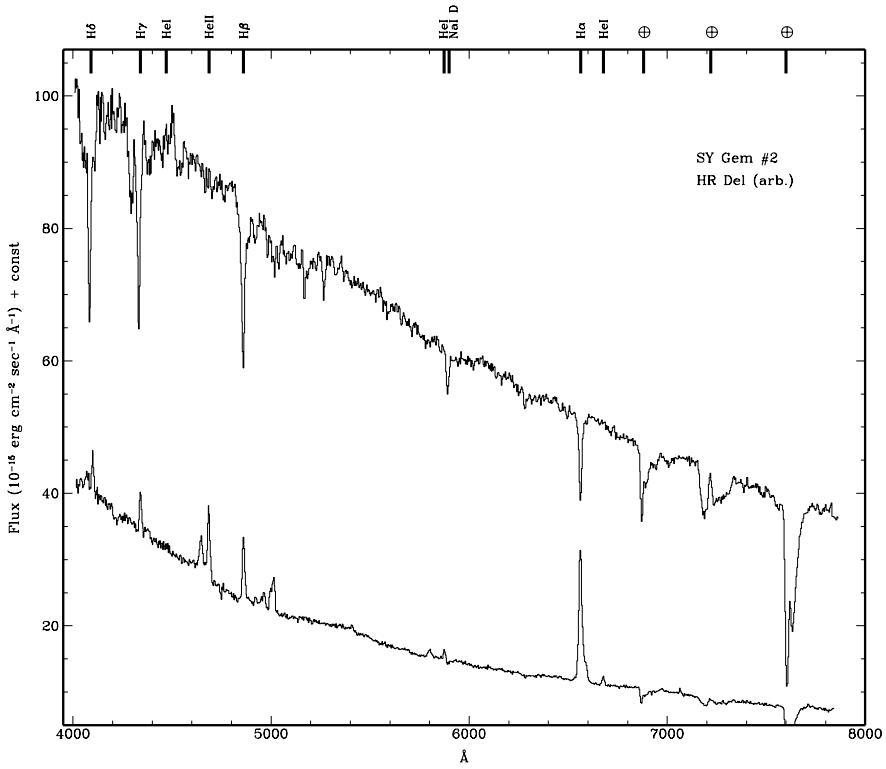

Fig. 6. Spectra of SY Gem #2 and HR Del. The *(arb.)* notation means an arbitary zero point setting in the flux scale. The spectra are not corrected for reddening. Fluxes in units of 10^{-15} erg cm^{-2} s^{-1} Å^{-1}

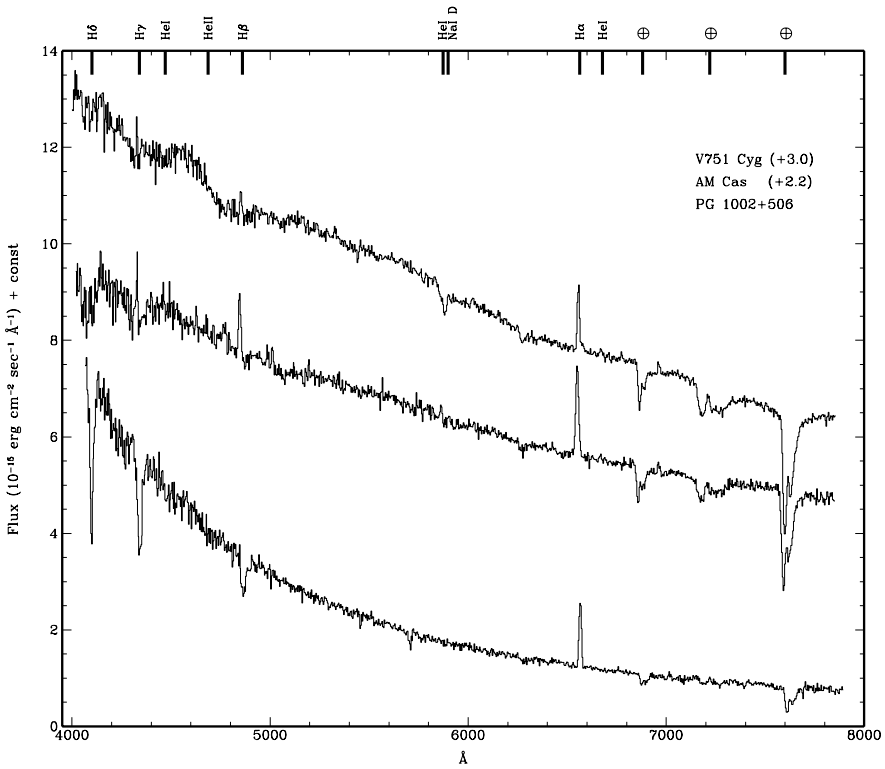

Fig. 7. Spectra of V751 Cyg, AM Cas (Loiano) and PG 1002+506. The offset applied for plot clarity is given in brackets next to the star name. The spectra are not corrected for reddening. Fluxes in units of 10^{-15} erg cm^{-2} s^{-1} Å^{-1}

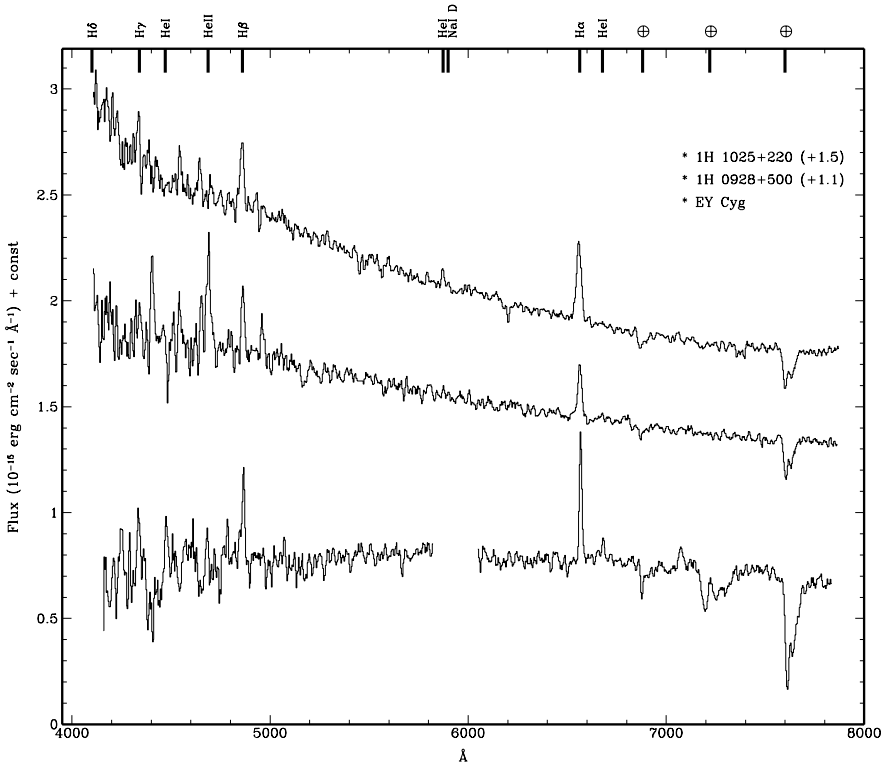

Fig. 8. Spectra of 1H 1025+220, 1H 0928+500 and EY Cyg. The offset applied for plot clarity is given in brackets next to the star name. The asterisk means that a boxcar smoothing (with a window of 3 pixels) has been applied. The spectra are not corrected for reddening. Fluxes in units of 10^{-15} erg cm^{-2} s^{-1} Å^{-1}

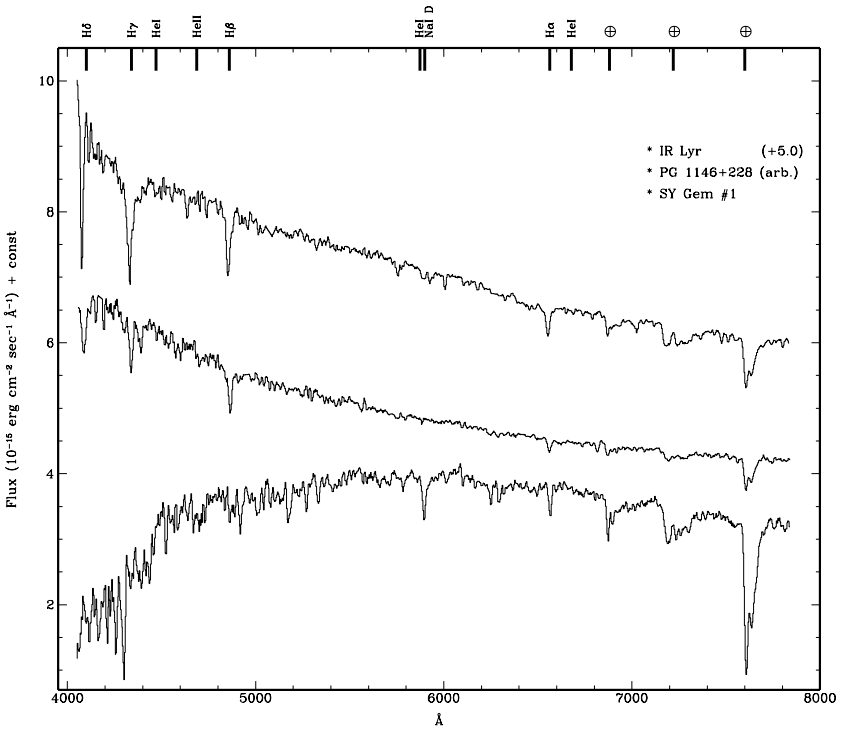

Fig. 9. Spectra of IR Lyr, PG 1146+228 and SY Gem #1. The offset applied for plot clarity is given in brackets next to the star name. The *(arb.)* notation means an arbitary zero point setting in the flux scale. The asterisk means that a boxcar smoothing (with a window of 3 pixels) has been applied. The spectra are not corrected for reddening. Fluxes in units of 10^{-15} erg cm^{-2} s^{-1} Å^{-1}

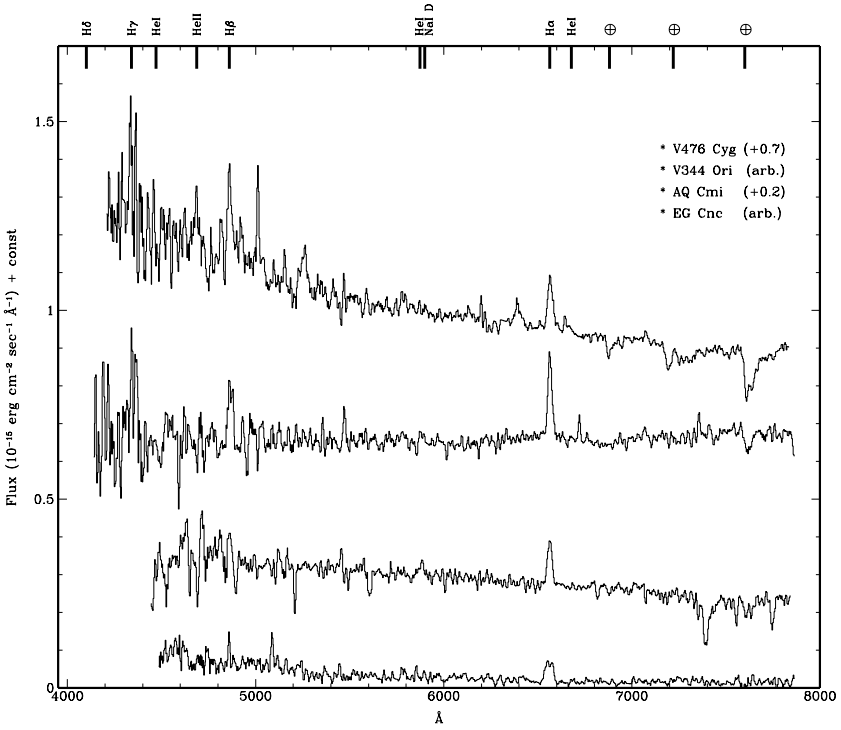

Fig. 10. Spectra of V476 Cyg, V344 Ori, AQ Cmi and EG Cnc. The offset applied for plot clarity is given in brackets next to the star name. The *(arb.)* notation means an arbitary zero point setting in the flux scale. The asterisk means that a boxcar smoothing (with a window of 3 pixels) has been applied. The spectra are not corrected for reddening. Fluxes in units of 10^{-15} erg cm^{-2} s^{-1} Å^{-1}