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A multi-epoch spectrophotometric atlas of symbiotic stars*,**

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Abstract. A multi-epoch, absolute-fluxed spectral atlas extending from about 3200 to 9000 Å is presented for 130 symbiotic stars, including members of the LMC, SMC and Draco dwarf galaxies. The fluxes are accurate to better than 5% as shown by comparison with Tycho and ground-based photometric data. The spectra of 40 reference objects (MKK cool giant standards, Mira and Carbon stars, planetary nebulae, white dwarfs, hot sub-dwarfs, Wolf-Rayet stars, classical novae, VV Cep and Herbig Ae/Be objects) are provided to assist the interpretation of symbiotic star spectra. Astrometric positions and counterparts in astrometric catalogues are derived for all program symbiotic stars. The spectra are available in electronic form from the authors.

Key words. stars: binaries: symbiotic – atlases

1. Introduction

Allen's (1984) atlas offered the first comprehensive spectroscopic view of symbiotic stars. It included spectra covering the 3400-7500 Å range for 114 objects (validated and possible, corresponding to 72% of the total number known at the time), which however were not fluxed, of low resolution and low dynamic range. Nevertheless, Allen's catalogue has been extensively used in all studies of symbiotic stars, even in those concerning single objects, because its single-epoch spectra could be compared with later observations in order to study the marked spectral variability of these binaries.

Other compilations of symbiotic star optical spectra are available. The larger ones since Allen's atlas are Blair et al. (1983; 16 objects, absolute fluxes), Ipatov & Yudin (1986; 14, absolute), Kenyon & Fernandez-Castro (1987; 11, absolute), Acker et al. (1988; 10, relative) Múrset et al. (1996; 12, absolute), Gutierrez-Moreno et al. (1999; 14, absolute) and Medina Tanco & Steiner (1995; 45, relative). Meier et al. (1994) assembled an atlas of ultraviolet IUE spectra for 32 symbiotic stars, Schulte-Ladbeck (1988) of 16 objects in the near-IR and Schild et al. (1992) of 8 objects in the IR. Van Winckel et al. (1993) surveyed emission line profiles for 59 objects and Ivison et al. (1994) for 35. Pereira et al. (1999) presented Bowen-fluorescence dominated blue spectra for 8 symbiotic stars and Schmid and Schild (1994) surveyed Raman-scatter dominated red spectra for 15 objects.

Here we present the largest optical spectroscopic atlas of symbiotic stars since Allen's one. Compared to Allen's atlas, our spectra cover a comparable number of objects (130 in all, 75 observed from ESO, 40 from Asiago, and 15 from both places) but are better resolved , extend over a wider wavelength range, offer a higher dynamical range, are absolutely fluxed, are multi-epoch (half of the targets re-observed one or more times over a three year period), and are available in electronic form (from the authors upon request).

The spectra presented in this atlas are planned to become the input data for future follow-up studies:
– given the high accuracy of the absolute fluxes and the wide wavelength range covered, optical magnitudes will be derived from the spectra and combined into a unique multi-epoch $UBV(RI)_C$ photometric catalogue with the results of CCD photometry of 60 symbiotic stars obtained by Henden and Munari (2000, 2001a, 2001b) while calibrating their comparison sequences;
– the rich emission line spectrum of symbiotic stars will be studied in a global approach;
– properties of the cool giants will be derived from the absorption spectrum in the red region.

2. The data

The list of program stars and the journal of observations is given in Table 1. The number of symbiotic stars (validated and probable) observed for this atlas is 130, with a total of 213 spectra presented in Figures 4–216. Spectra of 40 reference stars

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* Based on observations collected with the telescopes of the European Southern Observatory (ESO, Chile) and of the Padova & Asiago Astronomical Observatories (Italy)
** Tables 2 and 3 and Figures 4–256 are only available in electronic form (*a*) at the CDS via anonymous ftp to cdsarc.u-strasbg.fr (130.79.128.5) or via http://cdsweb.u-strasbg.fr/Abstract.html, and (*b*) from the personal home page http://ulisse.pd.astro.it/symbio-atlas/

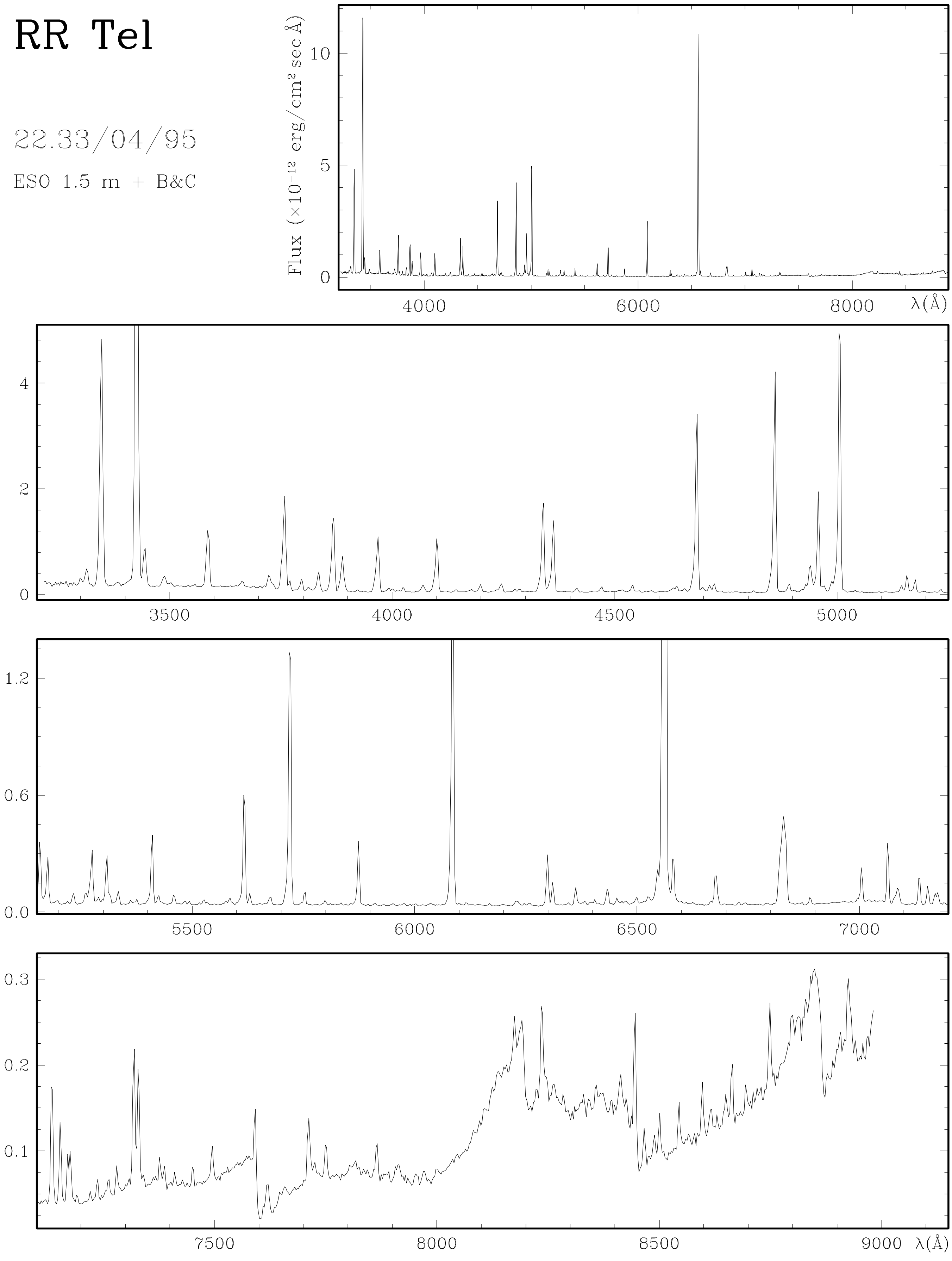

Fig. 1. The spectrum of the symbiotic star RR Tel. This is an example for the Figures 4-256 available electronically only.

Table 1. List of program stars and the journal of observations, separately for ESO and Asiago observations.

Name	α_{J2000} h m s	δ_{J2000} ° ′ ″	l (°)	b (°)	obs. date	expt (sec)	obs. date	expt (sec)	fig. N.
		ESO 1.5 m + B&C + CCD, 3200–9100 Å, 2.5 Å/pix spectra							
		validated symbiotic stars:							
SMC 1	00 29 10.800	–74 57 39.91	304.87	–42.08	15.16/10/94	180 1800			4
SMC 2	00 42 47.975	–74 41 59.88	303.70	–42.42	16.16/10/94	180 1800			5
SMC 3	00 48 20.05	–73 31 52.2	303.24	–43.59	17.02/10/94	180 1800			6
LHA 115-N 60	00 57 05.867	–74 13 16.27	302.40	–42.91	16.30/10/94	180 1800			7
Lin 358	00 59 12.259	–75 05 17.50	302.24	–42.03	17.09/10/94	180 1800			8
LHA 115-N 73	01 04 39.289	–75 48 24.78	301.85	–41.30	18.11/10/94	180 1800			9
StHA 32	04 37 45.618	–01 19 11.77	197.48	–30.04	18.29/10/94	180 1200			10
LMC 1	05 25 01.080	–62 28 48.67	271.82	–33.77	15.36/10/94	180 1200			11
LHA 120-N 67	05 36 07.653	–64 43 22.46	274.36	–32.35	20.00/04/95	600 1200	31.96/05/96	60 1500	12, 13
Sanduleak's	05 45 19.741	–71 16 07.08	281.91	–30.87	17.21/10/94	180 1800			14
LHA 120-S 63	05 48 43.502	–67 36 10.60	277.63	–30.88	17.25/10/94	180 1800			15
WRAY 15-157	08 06 34.860	–28 32 00.00	246.60	+1.95	29.97/05/96	60 900			16
RX Pup	08 14 12.313	–41 42 29.16	258.50	–3.93	31.99/05/96	10 100			17
AS 201	08 31 42.890	–27 45 31.60	249.08	+6.97	29.95/05/96	60 600			18
KM Vel	09 41 13.671	–49 23 27.92	274.19	+2.58	01.00/06/96	60 900			19
V366 Car	09 54 43.292	–57 18 52.97	280.81	–2.24	01.20/06/96	10 30 240			20
SS 29	11 08 27.48	–65 47 21.1	292.63	–5.00	28.96/05/96	1200			21
BI Cru	12 23 25.991	–62 38 16.12	299.72	+0.06	30.96/05/96	60 420			22
SS 38	12 51 26.21	–64 59 58.3	302.93	–2.13	30.98/05/96	60 900			23
Hen 3-863	13 07 43.897	–48 00 19.50	305.75	+14.78	20.19/04/95	300	29.99/05/96	300 900	24, 25
V840 Cen	13 20 49.65	–55 50 18.0	307.07	+6.79	20.22/04/95	1800	30.04/05/96	2700	26, 27
Hen 3-905	13 30 37.182	–57 58 20.47	308.12	+4.50	20.24/04/95	300	31.01/05/96	60 900	28, 29
V852 Cen	14 11 52.093	–51 26 24.37	315.48	+9.46	22.08/04/95	30 300			30
V835 Cen	14 14 09.415	–63 25 46.86	312.03	–2.03	22.06/04/95	30 180 180			31
IV Vir	14 16 34.308	–21 45 50.10	327.88	+36.95	21.09/04/95	30 360	30.07/05/96	60 600	32, 33
Hen 2-127	15 24 49.817	–51 49 52.44	325.53	+4.19	22.09/04/95	30 480	30.10/05/96	60 600 1800	34, 35
Hen 3-1092	15 47 10.517	–66 29 16.31	319.22	–9.35	21.13/04/95	60 600	31.03/05/96	60 900	36, 37
HD 330036	15 51 15.9311	–48 44 58.532	330.78	+4.15	21.15/04/95	30 300	31.05/05/96	30 150	38, 39
Hen 2-139	15 54 44.382	–55 29 34.22	326.91	–1.40	31.08/05/96	3600			40
T CrB	15 59 30.1611	+25 55 12.601	42.37	+48.16	30.14/05/96	30 90			41
V347 Nor	16 14 01.10	–56 59 28.0	327.92	–4.30	21.16/04/95	60 1200	30.17/05/96	1800	42, 43
UKS Ce-1	16 15 29.535	–22 12 16.16	353.02	+20.25	14.99/10/94	180 1500			44
Hen 2-171	16 34 04.231	–35 05 26.23	346.03	+8.55	22.18/04/95	30 600	31.11/05/96	60 1800	45, 46
Hen 2-176	16 41 31.190	–45 13 04.52	339.39	+0.74	01.30/06/96	30 120 480			47
AS 210	16 51 20.388	–26 00 26.81	355.51	+11.55	22.20/04/95	60 600			48
CL Sco	16 54 52.000	–30 37 18.33	352.32	+8.09	21.25/04/95	60 480	30.25/05/96	30 60 180	49, 50
Hen 3-1342	17 08 54.965	–23 23 37.50	0.08	+9.92	20.28/04/95	480	01.32/06/96	30 240	51, 52
Hen 3-1410	17 29 06.20	–29 43 17.7	357.41	+2.61	01.33/06/96	60 480			53
V2116 Oph	17 32 02.162	–24 44 44.02	1.94	+4.79	22.22/04/95	180 1800			54
Th 3-30	17 33 43.373	–28 07 21.87	359.30	+2.65	20.32/04/95	1800	01.35/06/96	60 1200	55, 56
H 1-25	17 35 22.237	–29 45 19.59	358.12	+1.46	21.27/04/95	60 1200			57
RT Ser	17 39 51.993	–11 56 38.22	13.89	+9.97	30.18/05/96	60 600			58
V2110 Oph	17 43 33.366	–22 45 35.91	5.03	+3.62	31.18/05/96	3600			59
H 1-36	17 49 48.24	–37 01 30.3	353.51	–4.92	22.26/04/95	20 120 300			60
RS Oph	17 50 13.165	–06 42 28.47	19.80	+10.37	29.21/05/96	60 480			61
WRAY 16-312	17 50 16.639	–30 57 35.01	358.79	–1.91	31.22/05/96	600 3600			62
V745 Sco	17 55 19.09	–33 15 03.9	357.36	–4.00	29.25/05/96	2400			63
AS 255	17 57 08.72	–35 15 37.8	355.79	–5.32	20.41/04/95	600	01.39/06/96	60 300	64, 65
SS 122	18 04 41.28	–27 09 13.6	3.66	–2.73	30.26/05/96	15 60 300			66
H 2-38	18 06 01.19	–28 17 05.1	2.81	–3.54	22.36/04/95	30 360			67
SS 129	18 07 05.54	–29 36 29.7	1.77	–4.39	16.00/10/94	180 1200	01.43/06/96	60 360	68, 69
Hen 3-1591	18 07 32.03	–25 53 43.5	5.07	–2.68	01.42/06/96	60 420			70

Table 1. (*continues*)

Name	α_{J2000} h m s	δ_{J2000} ° ′ ″	l (°)	b (°)	obs. date	expt (sec)	obs. date	expt (sec)	fig. N.
YY Her	18 14 34.207	+20 59 21.02	48.14	+17.24	01.28/06/96	30 150 420			71
FG Ser	18 15 07.096	–00 18 52.21	28.48	+7.93	29.34/05/96	15 180			72
Hen 3-1674	18 20 19.15	–26 22 47.0	6.01	–5.43	31.42/05/96	600	01.38/06/96	900	73, 74
V3929 Sgr	18 20 58.851	–26 48 25.09	5.70	–5.76	22.39/04/95	600 1080	31.28/05/96	1200	75, 76
V3811 Sgr	18 23 28.955	–21 53 09.62	10.34	–3.98	31.37/05/96	600 1800			77
V4018 Sgr	18 25 26.845	–28 35 57.49	4.55	–7.46	22.30/04/95	30 360			78
K 3-9	18 40 24.117	–08 43 57.80	23.91	–1.54	22.41/04/95	300 600			79
StHA 154	18 43 27.928	+19 30 05.43	49.60	+10.45	19.96/04/95	30 600			80
V4368 Sgr	18 54 40.32	–19 41 59.8	15.59	–9.53	18.42/04/95	150 600	01.32/06/96	30 90	81, 82
V1413 Aql	19 03 51.685	+16 28 31.74	49.02	+4.77	29.29/05/96	60 600			83
Ap 3-1	19 10 36.126	+02 49 28.69	37.64	–2.97	21.41/04/95	120 1080			84
HM Sge	19 41 57.083	+16 44 39.92	53.57	–3.15	22.35/04/95	10 120			85
V1016 Cyg	19 57 05.027	+39 49 36.13	75.17	+5.68	22.40/04/95	5 15 60			86
RR Tel	20 04 18.459	–55 43 32.27	342.16	–32.24	22.33/04/95	5 30			87
PU Vul	20 21 13.330	+21 34 19.31	62.58	–8.52	21.38/04/95	5 20 60 240	30.34/05/96	10 30 150	88, 89
StHA 176	20 22 42.25	–21 07 54.9	22.65	–29.10	18.05/10/94	180 1200			90
LT Del	20 35 57.244	+20 11 27.60	63.40	–12.15	21.39/04/95	30 420			91
ER Del	20 42 46.504	+08 41 12.09	54.46	–20.00	30.35/05/96	80			92
V1329 Cyg	20 51 01.27	+35 34 54.1	77.80	–5.56	29.37/05/96	30 420			93
CD –43.14304	21 00 06.38	–42 38 44.9	358.65	–41.10	19.43/04/95	30 180	30.36/05/96	5 120	94, 95
StHA 190	21 41 44.891	+02 43 54.41	58.42	–35.43	16.12/10/94	30 180 600			96
AG Peg	21 51 01.9749	+12 37 32.113	69.28	–30.89	29.39/05/96	3 10			97
R Aqr	23 43 49.4616	–15 17 04.202	66.52	–70.33	30.43/05/96	1			98
possible symbiotic stars or closely related objects									
Ma 51	00 43 34.160	–73 13 24.67	303.72	–43.89	15.19/10/94	180 1800			99
Ma 250	00 48 43.194	–73 03 11.57	303.21	–44.07	17.06/10/94	180 1800			100
Ma 285	00 49 13.624	–72 54 28.96	303.16	–44.22	18.08/10/94	180			101
Ma 642	00 53 04.092	–72 16 16.56	302.76	–44.86	16.20/10/94	180 1800			102
Ma 832	00 55 17.486	–72 03 10.92	302.52	–45.08	16.23/10/94	180 1200			103
Ma 966	00 56 52.98	–72 21 11.3	302.35	–44.77	16.25/10/94	180 1800			104
Ma 1591	01 06 32.257	–72 17 18.50	301.31	–44.80	18.14/10/94	180 1800			105
Ma 1858	01 18 35.682	–72 42 21.78	300.12	–44.27	17.12/10/94	180 1800			106
StHA 55	05 46 42.079	+06 43 47.41	199.34	–11.12	19.24/10/94	180			107
V704 Cen	13 54 55.738	–58 27 16.53	311.17	+3.40	21.07/04/95	1200	29.00/05/96	600 1200	108, 109
V417 Cen	14 15 59.744	–61 53 49.53	312.71	–0.64	20.25/04/95	30	30.06/05/96	60 600	110, 111
V748 Cen	14 59 36.679	–33 25 03.97	331.51	+22.24	30.09/05/96	60 600			112
HD 149427	16 37 42.613	–55 42 26.21	331.13	–5.77	01.27/06/96	10 30 210			113
V1017 Sgr	18 32 04.167	–29 23 12.64	4.48	–9.11	28.43/05/96	600			114
AS 325	18 50 03.570	–26 24 15.38	8.96	–11.42	19.01/10/94	30 180			115
Asiago 1.82 m + B&C + CCD, 3400–7700 Å, 7.5 Å/pix spectra									
validated symbiotic stars:									
EG And	00 44 37.1869	+40 40 45.707	121.54	–22.17	15.02/10/95	4 11 20	07.77/02/96	10 30 90	116, 117
AX Per	01 36 22.693	+54 15 02.29	129.53	–8.04	15.03/10/95	20 40	07.78/02/96	90 300	118, 119
V471 Per	01 58 49.661	+52 53 48.59	133.12	–8.64	15.04/10/95	20 180 350	07.80/02/96	90 900	120, 121
BD Cam	03 42 09.3250	+63 13 00.501	140.84	+6.44	15.91/10/95	1 3	07.82/02/96	1 3 4	122, 123
UV Aur	05 21 48.881	+32 30 43.15	174.22	–2.35	15.91/10/95	10 90	07.81/02/96	15 45 90	124, 125
BX Mon	07 25 22.777	–03 35 50.76	220.04	+5.88	10.81/03/95	60 250	07.85/02/96	60 240	126, 127
V694 Mon	07 25 51.289	–07 44 08.09	223.76	+4.05	07.86/02/96	60 240			128
NQ Gem	07 31 54.5207	+24 30 12.567	194.63	+19.35	10.80/03/95	10 30 150	07.84/02/96	30 90	129, 130
RW Hya	13 34 18.133	–25 22 48.89	314.99	+36.49	11.08/03/95	20 60 200			131
IV Vir	14 16 34.310	–21 45 50.21	327.88	+36.95	11.09/03/95	20 300			132

Table 1. (*continues*)

Name	α_{J2000} h m s	δ_{J2000} ° ′ ″	l (°)	b (°)	obs. date	expt (sec)	obs. date	expt (sec)	fig. N.
T CrB	15 59 30.1611	+25 55 12.601	42.37	+48.16	27.82/07/93	25 180 480	10.99/03/95	120 180	133, 134
					15.76/10/95	30 120	08.08/02/96	90 190 320	135, 136
AG Dra	16 01 41.0135	+66 48 10.139	100.29	+40.97	11.13/03/95	20 300	15.77/10/95	3 40	137, 138
					08.06/02/96	10 30 45			139
Hen 3-1341	17 08 36.556	–17 26 30.19	5.02	+13.39	27.84/07/93	40 900			140
Draco C-1	17 19 57.655	+57 50 05.68	86.27	+34.76	12.90/08/90	7200	10.86/07/96	855 3600	141, 142
M 1-21	17 34 17.220	–19 09 22.87	6.96	+7.36	27.87/07/93	600			143
RT Ser	17 39 51.993	–11 56 38.22	13.89	+9.97	27.88/07/93	360			144
Pt 1	17 38 49.552	–23 54 05.43	3.48	+3.94	27.85/07/93	900			145
RS Oph	17 50 13.165	–06 42 28.47	19.80	+10.37	27.88/07/93	30 600	15.72/10/95	20 120	146, 147
V343 Ser	18 12 22.153	–11 40 07.17	18.08	+3.20	27.89/07/93	600	15.73/10/95	60 420	148, 149
FG Ser	18 15 07.096	–00 18 52.21	28.48	+7.93	11.20/03/95	300	14.74/10/95	60 600	150, 151
					10.94/07/96	600			152
YY Her	18 14 34.207	+20 59 21.02	48.14	+17.24	11.09/03/95	60 420	14.75/10/95	60 600	153, 154
V443 Her	18 22 07.849	+23 27 19.96	51.23	+16.59	11.10/03/95	20 300	14.85/10/95	60 120	155, 156
					15.78/10/95	20 120			157
MWC 960	18 47 55.858	–20 05 51.13	14.53	–8.27	27.90/07/93	30 900			158
AS 327	18 53 16.673	–24 22 59.29	11.14	–11.23	27.93/07/93	30 600			159
FN Sgr	18 53 54.776	–18 59 39.86	16.15	–9.06	27.94/07/93	30 900			160
Pe 2-16	18 54 10.11	–04 38 53.9	29.10	–2.72	27.96/07/93	900	15.74/10/95	60 720	161, 162
CM Aql	19 03 35.124	–03 03 14.28	31.59	–4.09	27.98/07/93	30 900	11.20/03/95	180	163, 164
					15.75/10/95	45 900			165
V919 Sgr	19 03 45.130	–16 59 55.19	19.01	–10.32	27.95/07/93	30 900			166
V1413 Aql	19 03 51.685	+16 28 31.74	49.02	+4.77	11.18/03/95	30 240	14.86/10/95	30 240	167, 168
					15.79/10/95	30 300			169
Ap 3-1	19 10 36.126	+02 49 28.69	37.64	–2.97	14.82/10/95	180 3600			170
BF Cyg	19 23 53.506	+29 40 29.22	62.93	+6.70	11.14/03/95	60 420	14.87/10/95	60 300	171, 172
CH Cyg	19 24 33.0681	+50 14 29.128	81.86	+15.58	11.13/03/95	6 15 75	14.96/10/95	5 13	173, 174
					11.05/07/96	10 30			175
HM Sge	19 41 57.083	+16 44 39.92	53.57	–3.15	14.88/10/95	20 150			176
QW Sge	19 45 49.54	+18 36 47.6	55.65	–3.02	11.17/03/95	30 600	14.88/10/95	60 600	177, 178
					11.04/07/96	60 180 300			179
CI Cyg	19 50 11.8339	+35 41 03.003	70.90	+4.74	11.16/03/95	30 150	14.92/10/95	20 120	180, 181
V1016 Cyg	19 57 05.027	+39 49 36.13	75.17	+5.68	11.16/03/95	6 30 150	14.93/10/95	10 75	182, 183
PU Vul	20 21 13.330	+21 34 19.31	62.58	–8.52	11.18/03/95	15 240	14.89/10/95	15 240	184, 185
					10.95/07/96	10 20 90			186
LT Del	20 35 57.244	+20 11 27.60	63.40	–12.15	11.19/03/95	300	14.91/10/95	60 600	187, 188
					10.95/07/96	600			189
Hen 2-468	20 41 18.991	+34 44 52.33	75.94	–4.44	14.93/10/95	90 1200	10.96/07/96	900	190, 191
V1329 Cyg	20 51 01.27	+35 34 54.1	77.80	–5.56	14.97/10/95	30 163	11.01/07/96	60 120	192, 193
V407 Cyg	21 02 09.84	+45 46 32.6	86.99	–0.49	11.21/03/95	30 240	14.98/10/95	30 250 500	194, 195
AG Peg	21 51 01.9749	+12 37 32.113	69.28	–30.89	14.91/10/95	5 36	11.00/07/96	20	196, 197
Z And	23 33 39.9505	+48 49 05.947	109.98	–12.09	15.01/10/95	10 22	07.73/02/96	60 600	198, 199
R Aqr	23 43 49.4616	–15 17 04.202	66.52	–70.33	14.90/10/95	20 90 180			200
				possible symbiotic stars or closely related objects					
V641 Cas	00 09 26.339	+63 57 14.13	118.34	+1.46	15.88/10/95	5 30	07.76/02/96	30 180	201, 202
GH Gem	07 04 12.801	+12 03 34.26	203.57	+8.23	10.96/03/95	600 1200			203
ZZ CMi	07 24 13.9987	+08 53 51.777	208.64	+11.30	10.79/03/95	30 120 700	07.84/02/96	30 90	204, 205
TX CVn	12 44 42.065	+36 45 50.68	130.93	+80.26	10.98/03/95	180 200	08.03/02/96	90 360 600	206, 207
V503 Her	17 36 40.461	+23 18 12.01	47.00	+26.23	15.77/10/95	60 300			208
XX Oph	17 43 56.4972	–06 16 08.750	19.41	+11.95	15.72/10/95	10 70			209
V335 Vul	19 23 14.108	+24 27 39.97	58.22	+4.40	24.72/11/93	60 360	21.72/11/97	30 300	210, 211
Hen 2-442	19 39 43.36	+26 29 33.0	61.80	+2.13	15.81/10/95	90 1200			212
OY Cyg	19 54 43.859	+39 17 57.85	74.48	+5.80	15.83/10/95	60 420			213
V627 Cas	22 57 40.967	+58 49 12.49	108.66	–0.86	14.73/10/95	30 300	07.74/02/96	600	214, 215
V630 Cas	23 48 51.956	+51 27 39.32	113.10	–10.21	15.86/10/95	60 420			216

are given in Figures 217–256, with Table 2 listing their relevant properties. Figure 1 gives an example of Figures 4–256 available electronically only. Of the 90 symbiotic stars observed from ESO, 22 have been re-observed about one year later. Fifty-five are instead the symbiotics observed from Asiago, 21 of which were re-observed once, 9 twice and 1 three times over a two and a half year period. For some systems our observations document the spectral changes induced by an outburst state, as for CL Sco (during the 1995 quiescence in Fig. 49, and at 1996 outburst in Fig. 50), or their interplay with the pulsation activity of the cool giant, as for the carbon symbiotic Mira UV Aur (at Mira's minimum in Fig. 124, and at Mira's maximum in Fig. 125).

The program stars have been selected among those listed in Allen's (1984) catalogue and those discovered later (and summarized in the new catalogue of symbiotic stars by Belczynski et al. 2000), including objects from the Meyssonnier & Azzopardi (1993) survey of SMC.

The object names (as given in Table 1 and the first column of Table 3) are sometimes different from those used in the literature, because either (i) a variable star name has been assigned since (for example V1413 Aql for AS 338), or (ii) there have been re-organizations in the name coding within SIMBAD (for example, He 2-468 was replaced by Hen 2-468, or Hen 1591 is now Hen 3-1591). A list of correspondences is given in Table 3, where column 2 contains Allen (1984) names for the systems renamed subsequently.

The spectrophotometric observations have been performed with B&C + CCD spectrographs at ESO and Asiago. All spectra have been reduced with the IRAF software package. Standard procedures (including bias and flat field correction, wavelength and flux calibration) have been applied. Cosmic rays on the stellar tracing were cleaned manually on the extracted spectrum after inspection of the original two dimensional frames. For the vast majority of the program stars we have obtained more than one spectrum per night (with the aim of appropriately exposing the continuum as well as avoiding saturation of the strongest emission lines), and their intercomparison greatly assisted during the manual cleaning of cosmic-rays.

2.1. Astrometry

Historically inaccurate or erroneous coordinates of several symbiotic stars are still present in the current literature. Moreover, correspondence between symbiotic stars and entries in astrometric catalogues has not been systematically explored yet. The latter is an important task because, once the correspondence is established, coordinates of symbiotic stars will be automatically improved every time the catalogues are re-calibrated (like USNO-A1 that has been recalibrated into USNO-A2 when the Hipparcos/Tycho reference stars have become available) or cross-referenced toward newer and higher precision catalogues.

Correspondence with sources in astrometric catalogues is established in Table 3 (last column) for all the program stars. Help has been provided by the *Aladin* graphical interface at CDS (http://aladin.u-strasbg.fr/aladin.gml) that allows overplotting of astrometric catalogues over the digitized DSS-I and DSS-II plates. The astrometric identification has been searched for and taken from the following catalogues, in order of preference: Hipparcos, Tycho-2, USNO-A2.0, GSC-1, 2MASS. Only 6 objects lack any astrometric identification, while 14 and 24 objects are included in the Hipparcos and Tycho-2 catalogues, respectively.

Coordinates of program stars in Table 1 have not been adapted or re-processed from the existing literature, but recompiled from scratch. Hender and Munari (2000, 2001a) give astrometrically measured accurate positions for 40 of our program stars (linked to the USNO-A2.0 reference system). For the remaining targets the positions as given in the appropriate astrometric catalogues (following identifications in Table 3) have been adopted. For the 6 objects without an entry in the surveyed astrometric catalogues, coordinates have been measured by us on the digitized DSS-II plates (or, if not available, on the DSS-I ones). All coordinates are on J2000.0 equinox, but epochs are those of the corresponding catalogues (this should not be a major concern given the minimal proper motions typical for most symbiotic stars).

2.2. ESO observations

The ESO observations have been performed with the B&C + CCD spectrograph at the 1.5 m telescope under photometric conditions (sparse data from non optimal nights have not been used in the present atlas). We used a 400 l/mm grating (# 25) and a 2 arcsec slit, always aligned along the parallactic angle for pointings at zenital distances larger than 35°. The CCD was a 2048×2048, 15 μm size, thinned and back-illuminated to enhance UV sensitivity. The dispersion was $\sim$2.5 Å/pix, with a FWHM(PSF)$\sim$2 pixels. The covered spectral range changes somewhat from one observing run to another, with the extremes of 3200–8900 and 3400–9100 Å. The seeing during the observing nights was always smaller than the slit width (as can be derived from the simultaneous absolute measurements with the La Silla Meteo Monitor and from the measured FWHM perpendicular to the dispersion on the recorded stellar spectra). For a non–marginal part of the time the seeing was better than 1 arcsec. Several spectrophotometric standards were observed each night in order to achieve absolute flux calibration and monitor stable transparency conditions.

2.3. Asiago observations

The Asiago observations were secured with the Boller & Chivens spectrograph attached to the 1.82 m telescope operated by Osservatorio Astronomico di Padova atop of Mount Ekar (Asiago, Italy), during nights of suitable photometric conditions. The detector was a Thompson TH7882 UV-coated CCD, 580x388 pixels of 23μm size. We used a 150 ln/mm grating giving a dispersion of 7.5 Å/pixel, generally covering the wavelengths 3350-7550 Å (exact limits variable according to the observing runs). The slit width was $\sim$2.0 arcsec, giving a FHWM(PSF)$\sim$2 pixels. When the object's zenith distance ex-

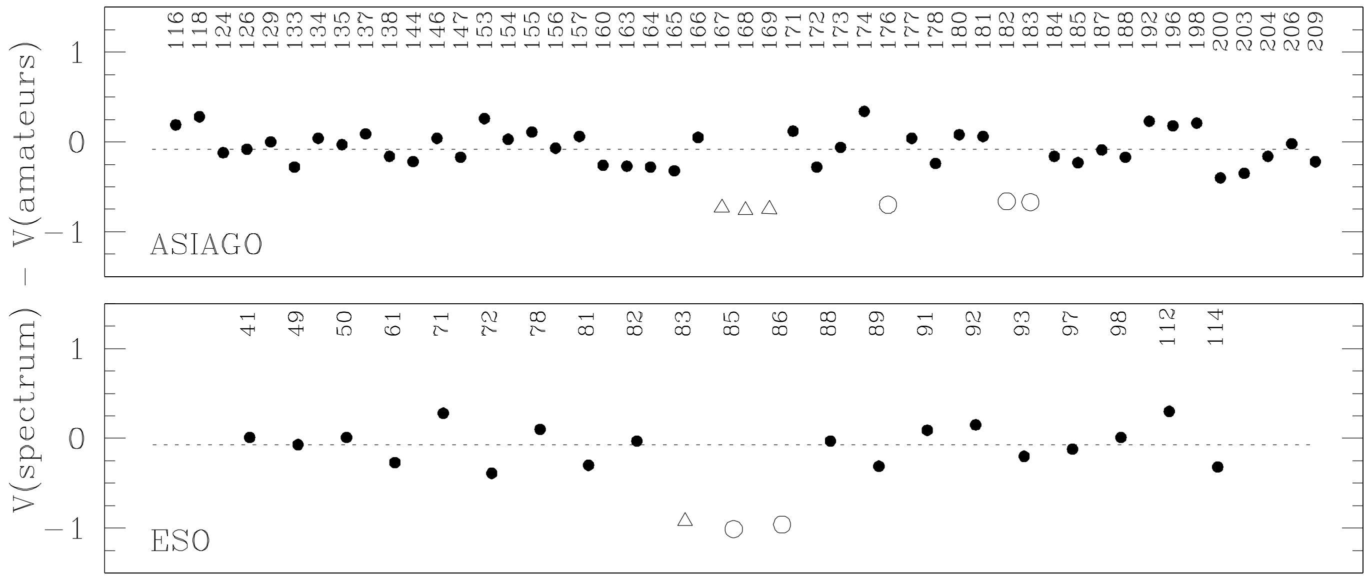

Fig. 2. Comparison of V magnitudes of symbiotic stars as estimated by amateur astronomers (VSNET, VSOLJ, AFOEV databases) and as derived from flux calibrated spectra in this atlas. To identify the given symbiotic star and its particular spectrum, the upper row in each panel lists the corresponding Figure number (cf. Table 1). See text for details (sect. 2.6).

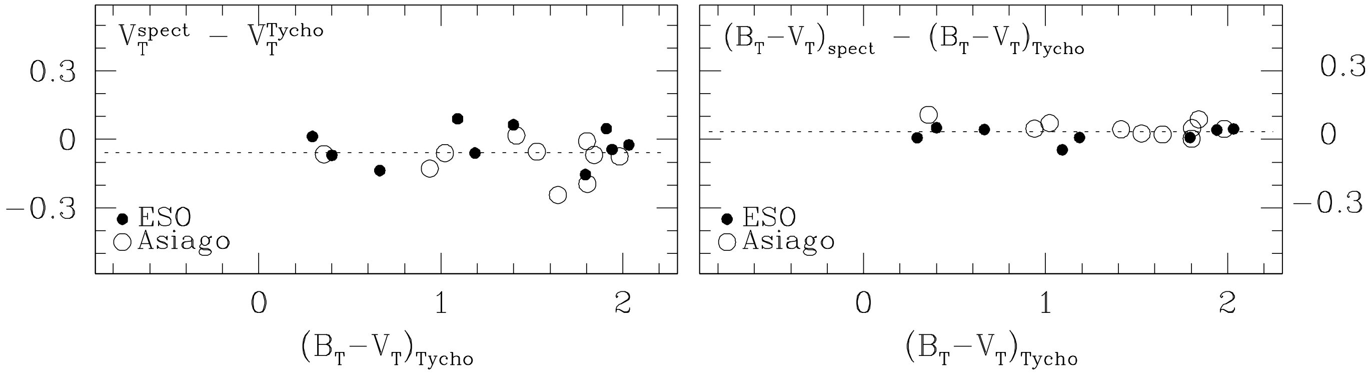

Fig. 3. Comparison of V_T magnitudes and $(B_T - V_T)$ colors of template stars in Table 2 as measured by Hipparcos/Tycho and as derived from spectra in this atlas. See text for details (sect. 2.6).

ceeded 45°, the slit was aligned along the parallactic angle. Each night at least four spectrophotometric standard stars were observed more than once at different airmasses for flux calibration.

2.4. Reference objects

A number of spectra of reference objects have been secured with the same instrumentation during symbiotic star observing runs. The reference objects include MKK cool giant standards, Miras, planetary nebulae, Wolf Rayet stars, white dwarfs, hot sub-dwarf, classical novae, and are intended to assist inspection and interpretation of symbiotic star spectra. They are listed in Table 2 and their spectra are presented in Figures 217–256.

2.5. Flux accuracy

It appears appropriate to quantify the accuracy of absolute fluxes in this atlas. For symbiotic stars no optical photometry was carried out simultaneously with the spectroscopic observations. However, a number of program symbiotic stars are regularly observed by several organizations of amateur astronomers. We have consulted the on-line databases of VSNET, VSOLJ and AFOEV and found useful data to support comparison with 70 of the spectra presented in this atlas (49 Asiago spectra and 21 ESO spectra, reflecting the predominance of amateurs in the northern hemisphere and higher brightness of average symbiotic stars known in the northern hemisphere). When possible the amateurs' lightcurves have been interpolated/extrapolated to derive the visual magnitude for the date of the given spectral observation. In a few cases an estimate was found in the amateurs' archives for the exact date of the spectral observations. Such estimates have been adopted unless an eye inspection of the whole light-curve rendered them unreliable.

The V magnitude was derived from our spectra by convolving them with the V band-pass profile (taken from Ažusienis & Straižys 1969). The comparison between the spectroscopic and amateurs' V magnitudes is presented in Figure 2 separately for the Asiago and ESO data. The comparison gives for the ESO spectra:

$$V_{spectrum} - V_{amateurs} = -0.06; \quad \sigma = 0.21 \qquad (1)$$

and similarly for the Asiago spectra:

$$V_{spectrum} - V_{amateurs} = -0.05; \quad \sigma = 0.19 \qquad (2)$$

The offset is small and can be easily accounted for by a number of possibilities, the first and the most obvious one being the difference between the eye response and the V band profile.

ESO and Asiago observations appear equally accurate, as seen in Figures 2 and 3, with an average 0.20 mag scatter that deserves some comment. Several mechanisms contribute to it, including [*a*] errors in the comparison sequences used by amateurs (σ_{cs}), [*b*] errors in estimating the magnitude by the amateurs and uncertainties in interpolating/extrapolating their lightcurve to the desired date (σ_{est}), [*c*] day-by-day random variability of symbiotic stars (σ_{var}), and obviously [*d*] the errors in fluxing our spectra (σ_{flux}). Because these errors are unrelated and follow normal distributions we write

$$\sigma^2 = (0.20)^2 = \sigma^2_{cs} + \sigma^2_{est} + \sigma^2_{var} + \sigma^2_{flux} \qquad (3)$$

Based on common experience it may be assumed that $\sigma_{cs} \geq 0.05$, $\sigma_{est} \geq 0.15$, and $\sigma_{var} \sim 0.1$ ($\sigma_{cs} = 0.05$ is obviously an underestimate, at least because magnitudes of comparison stars on amateur finding charts are given to one decimal figure only). So $\sigma_{flux} \leq 6\%$, i.e. the fluxes of each individual spectrum are on the average accurate better than 6%. This is in fair agreement with results of inter-calibrations of spectrophotometric standard stars observed every night that suggest an accuracy of 5% or better.

Certain points in Figure 3 are marked with open circles and triangles. The open circles refer to HM Sge and V1016 Cyg that have spectra resembling planetary nebulae. Minimal differences between the V band and eye response curves around the immensely strong Hα and [OIII] lines fully account for the $\sim$0.7 mag systematic difference of both Asiago and ESO spectra versus amateurs' estimates. The open triangles refer to V1413 Aql that shows the same $\sim$0.8 mag systematic difference between the Asiago and ESO spectra vs. amateurs' estimates: the reason may be an error in the comparison sequence around V1413 Aql used by the amateurs.

Another independent way to estimate the flux accuracy is offered by the spectra of the reference objects listed in Table 2. Selecting those not carrying a variable star name among those observed by Hipparcos/Tycho, we found

$$V_T^{spectra} - V_T^{Tycho} = -0.06; \quad \sigma = 0.08 \qquad (4)$$

$$(B-V)_T^{spectra} - (B-V)_T^{Tycho} = +0.03; \quad \sigma = 0.03 \qquad (5)$$

Here the spectra were convolved with the B_T and V_T band profiles as given in the *Hipparcos Catalogue* (ESA SP-1200, June 1997, pag 42; slightly modified transmission profiles are suggested by Bessell 2000). The uncertainties in the shutter aperture time ($\sim$0.1 sec in both Asiago and ESO observations) become notable in the observations of the bright template stars in Table 2 with an average exposure time of only 2.5 sec. Also, non-perfect placement of such bright objets on the slit, which is compensated for faint objects by guiding, may contribute to the scatter in Eq.(5). Finally, it is worth remembering that Tycho data for bright stars are accurate to 0.012 mag in V_T and 0.02 mag in $(B-V)_T$.

In light of these considerations it seems safe to argue that the fluxes in this atlas are generally correct within

$$\sigma_{flux} \lesssim 5\% \qquad (6)$$

at least for the B, V and R band wavelength ranges. A lower accuracy is probable for faint red objects at $\lambda \leq$3800 Å or for pure emission line spectra at $\lambda \geq$8700 Å.

3. The atlas

Each spectral observation listed in Tables 1 and 2 is presented by a separate figure. The format of the figures is identical to Figure 1. UT dates are in the DD.dd/MM/YY format.

At upper right a full-scale, compressed view of the whole recorded spectrum is given, and the units for absolute fluxes are indicated. The same units are valid for the other panels that present zoomed-in portions of the spectrum.

For ESO spectra the first zoomed-in panel always runs from 3200 to 5250 Å, the second from 5150 to 7200 Å, and the third from 7100 to 9150 Å. For Asiago spectra, given the shorter wavelength range covered, two zoomed-in panels suffice, the first from 3250 to 5600 Å, the second from 5350 to 7600 Å.

Stronger emission lines are generally truncated in the zoomed-in panels to emphasize the visibility of finer details. The full height of emission lines can be read from the compressed view of the whole spectrum at the upper right.

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Table 2. Spectra of template objects

Name	α_{J2000}	δ_{J2000}	V_T	$B_T - V_T$	template for:	fig.
		ESO 1.5 m + B&C + CCD, 3200–9100 Å, 2.5 Å/pix spectra				
HD 159876	17 37 35.2015	–15 23 54.806	3.553	+0.294	F0 III	217
HD 171802	18 36 27.836	+09 07 21.05	5.419	+0.401	F5 III	218
HD 78791	09 05 08.8139	–72 36 09.739	4.536	+0.664	F9 II	219
HD 93497	10 46 46.1782	–49 25 12.919	2.815	+1.092	G5 III	220
HD 82734	09 33 12.4599	–21 06 56.601	5.117	+1.187	K0 III	221
HD 112985	13 02 16.2633	–71 32 55.879	3.736	+1.399	K2 III	222
HD 78647	09 07 59.7585	–43 25 57.322	2.379	+2.033	K4 II	223
HD 92305	10 35 28.1062	–78 36 28.029	4.277	+1.909	M0 III	224
HD 133216	15 04 04.2155	–25 16 55.073	3.459	+1.941	M3 III	225
HD 118767	13 39 59.8073	–49 56 59.840	6.044	+1.794	M5 III	226
LQ Sgr	18 28 29.011	–27 55 21.72			Mira variable	227
HD 51208	06 54 26.6837	–42 21 56.058	6.609	+2.935	Carbon star	228
EK TrA	15 14 01.47	–65 05 31.3			cataclysmic variable	229
M 1-12	07 19 21.3	–21 43 55			high N_e Plan. Neb.	230
M 1-13	07 21 14.4	–18 08 34			low N_e Plan. Neb.	231
HD 136488	15 24 11.3087	–62 40 37.567	9.292	+0.279	WR-C	232
HD 165763	18 08 28.4686	–21 15 11.191	7.693	+0.162	WR-C	233
HD 50896	06 54 13.0441	–23 55 42.011	6.721	–0.059	WR-N	234
HD 96548	11 06 17.2021	–65 30 35.242	7.710	+0.146	WR-N	235
Nova Cen 1995	13 02 32.16	–60 11 40.3			Nova	236
Nova Cir 1995	14 44 53.60	–63 53 56.0			Nova	237
Nova Lup 1993	14 31 50.20	–51 10 33.1			Nova	238
BD +28.4211	21 51 11.0222	+28 51 50.364	10.529	–0.382	sdO	239
LTT 7987	20 10 56.8453	–30 13 06.639	12.912	–0.811	WD-DA	240
		Asiago 1.82 m + B&C + CCD, 3400–7700 Å, 7.5 Å/pix spectra				
HD 55052	07 12 26.3778	+24 07 42.937	5.889	+0.357	F5 III	241
HD 88639	10 13 49.7051	+27 08 08.949	6.142	+0.939	G3 III	242
HD 75958	08 56 37.4420	+64 36 13.793	5.660	+1.022	G6 III	243
HD 91810	10 37 20.5506	+56 25 52.829	6.667	+1.415	K1 III	244
HD 64960	07 56 59.4517	+15 47 25.013	5.944	+1.528	K3 III	245
HD 115521	13 17 36.2827	+05 28 11.530	4.976	+1.982	M1 III	246
HD 109896	12 38 22.4057	+01 51 16.784	5.883	+1.842	M3 III	247
HD 112300	12 55 36.2078	+03 23 50.893	3.577	+1.805	M3 III	248
HD 76830	08 59 10.7295	+18 08 05.520	6.518	+1.803	M4 III	249
HD 175865	18 55 20.1013	+43 56 45.919	4.355	+1.643	M5 III	250
Nova Aql 1993	19 13 06.80	+01 34 23.3			Nova	251
Nova Cas 1993	23 41 47.25	+57 30 59.7			Nova	252
Nova Cas 1995	01 05 05.45	+54 00 40.5			Nova	253
VV Cep	21 56 39.1437	+63 37 32.006	5.363	+1.804	VV Cep	254
V594 Cas	00 43 18.2567	+61 54 40.131	10.659	+0.565	Herbig Ae/Be	255
4U 2206+54	22 07 56.237	+54 31 06.40	9.898	+0.299	MXRB	256

Table 3. Object names and astrometric reference

V641 Cas	BD +63.3	TYC 4022 444 1
SMC 1	MH 183	USNO A2.0 0150-00209887
SMC 2		USNO A2.0 0150-00378466
Ma 51		USNO A2.0 0150-00387899
EG And	HD 4174	HIC 3494
SMC 3	Ma 218	2MASS 0048200-733152
Ma 250		USNO A2.0 0150-00468274
Ma 285		USNO A2.0 0150-00477257
Ma 642		USNO A2.0 0150-00543884
Ma 832	LHA 115-N 55	USNO A2.0 0150-00583836
Ma 966		2MASS 0056529-722111
LHA 115-N 60	Lin 323	USNO A2.0 0150-00620679
Lin 358		USNO A2.0 0075-00186878
LHA 115-N 73	Lin 445	USNO A2.0 0075-00204655
Ma 1591	LHA 115-S 50	USNO A2.0 0150-00767008
Ma 1858	Lin 521	USNO A2.0 0150-00920738
AX Per	MWC 411	TYC 3671 247 1
V471 Per	M 1-2	USNO A2.0 1425-02730716
BD Cam	HR 1105	HIC 17296
StHA 32		USNO A2.0 0825-01093877
UV Aur	HD 34842	HIC 25050
LMC 1		USNO A2.0 0225-01939330
LHA 120-N 67		USNO A2.0 0225-02186337
Sanduleak's		USNO A2.0 0150-03643722
StHA 55		USNO A2.0 0900-01956287
LHA 120-S 63		USNO A2.0 0150-03733940
GH Gem		USNO A2.0 0975-04533929
ZZ CMi	BD +09.1633	HIC 35915
BX Mon	AS 150	TYC 4821 2893 1
V694 Mon	MWC 560	TYC 5396 1135 1
NQ Gem	HD 59643	HIC 36623
WRAY 15-157		USNO A2.0 0600-09030509
RX Pup	HD 69190	TYC 7668 2915 1
AS 201	Hen 3-172	USNO A2.0 0600-10606304
KM Vel	Hen 2-34	USNO A2.0 0375-08602217
V366 Car	Hen 2-38	USNO A2.0 0300-08269192
SS 29		
BI Cru	Hen 3-782	TYC 8979 1266 1
TX CVn	BD +37.2318	TYC 2533 1168 1
SS 38	CD –64.665	
Hen 3-863		USNO A2.0 0375-17419971
V840 Cen		GSC 0866601230
Hen 3-905	SS 40	USNO A2.0 0300-18631625
RW Hya	HD 117970	TYC 6718 1146 1
V704 Cen	Hen 2-101	USNO A2.0 0300-19804624
V852 Cen	Hen 2-104	USNO A2.0 0375-20288119
V835 Cen	Hen 2-106	USNO A2.0 0225-19557196
V417 Cen	Hen 3-977	USNO A2.0 0225-19652384
IV Vir	BD-21 3873	USNO A2.0 0675-13193332
V748 Cen	CD –32.10517	TYC 7302 2324 1
Hen 2-127	SS 45	USNO A2.0 0375-24414179
Hen 3-1092	SS 46	USNO A2.0 0225-23774941
HD 330036	Cn 1-1	HIC 77662
Hen 2-139	PK 326-01.1	USNO A2.0 0300-25265081
T CrB	HD 143454	HIC 78322
AG Dra	BD +67.922	HIC 78512
V347 Nor	Hen 2-147	2MASS 1614010-565927
UKS Ce-1		USNO A2.0 0675-15441041
Hen 2-171	SS 59	USNO A2.0 0525-23211045
HD 149427	Hen 3-1223	USNO A2.0 0300-29044634
Hen 2-176	PK 339+00.1	USNO A2.0 0375-28425196
AS 210	SS 66	USNO A2.0 0600-21912720
CL Sco	AS 213	USNO A2.0 0525-24662596
Hen 3-1341	SS 75	USNO A2.0 0675-17961561
Hen 3-1342	SS 77	USNO A2.0 0600-24462740

Draco C-1		USNO A2.0 1425-08754924
Hen 3-1410	Th 3-20	2MASS 1729061-294317
V2116 Oph	GX 1+4	USNO A2.0 0600-27473698
Th 3-30	Hen 2-243	USNO A2.0 0600-27567427
M 1-21	Hen 2-247	USNO A2.0 0675-20267041
H 1-25	SS 92	USNO A2.0 0600-27686948
V503 Her		TYC 2076 1528 1
Pt 1	PK 003+03.3	USNO A2.0 0600-27918316
RT Ser	MWC 265	USNO A2.0 0750-11651424
V2110 Oph	AS 239	USNO A2.0 0600-28373042
XX Oph	HD 161114	HIC 86777
H 1-36	Hen 2-289	
RS Oph	HD 162214	TYC 5094 550 1
WRAY 16-312	PK 358-01.2	USNO A2.0 0525-29804644
V745 Sco		2MASS 1755190-331503
AS 255	SS 111	2MASS 1757087-351537
SS 122		
H 2-38	SS 128	
SS 129	PK 001-04.3	2MASS 1807055-293629
Hen 3-1591	SS 132	GSC 0684600296
V343 Ser	AS 289	USNO A2.0 0750-12799421
YY Her	AS 297	USNO A2.0 1050-10009575
FG Ser	AS 296	TYC 5098 731 1
Hen 3-1674	SS 153	GSC 0685203439
V3929 Sgr	Hen 2-390	USNO A2.0 0600-32494082
V443 Her	MWC 603	TYC 2093 472 1
V3811 Sgr	Hen 2-396	USNO A2.0 0675-25398033
V4018 Sgr	AS 304	TYC 6869 806 1
V1017 Sgr		USNO A2.0 0600-34620611
K 3-9		USNO A2.0 0750-14036081
StHA 154		USNO A2.0 1050-11430579
MWC 960	SS 174	USNO A2.0 0675-29781813
AS 325	WRAY 15-1882	TYC 6867 437 1
AS 327	Hen 3-1730	USNO A2.0 0600-37952583
FN Sgr	AS 329	USNO A2.0 0675-30481453
Pe 2-16		
V4368 Sgr	Wakuda's	2MASS 1854403-194159
CM Aql		USNO A2.0 0825-14237330
V919 Sgr	AS 337	USNO A2.0 0675-31312070
V1413 Aql	AS 338	TYC 1585 1511 1
Ap 3-1	PK 037-02.1	USNO A2.0 0900-14085307
V335 Vul	AS 356	USNO A2.0 1125-12426148
BF Cyg	MWC 315	TYC 2137 234 1
CH Cyg	HD 182917	HIC 95413
Hen 2-442	M 4-16	2MASS 1939433+262933
HM Sge		TYC 1602 1636 1
QW Sge	AS 360	2MASS 1945495+183647
CI Cyg	MWC 415	HIC 97594
OY Cyg		USNO A2.0 1275-12710500
V1016 Cyg	AS 373	TYC 3141 533 1
RR Tel	Hen 3-1811	TYC 8780 1277 1
PU Vul		TYC 1643 1021 1
StHA 176		GSC 0634001115
LT Del	Hen 2-467	USNO A2.0 1050-18149955
Hen 2-468	PK 075-04.1	USNO A2.0 1200-15635065
ER Del	BD +08.4506	TYC 1089 194 1
V1329 Cyg	HBV 475	GSC 0269600977
CD –43.14304	Hen 3-1924	GSC 0797300869
V407 Cyg	AS 453	GSC 0358802258
StHA 190		TYC 547 712 1
AG Peg	HD 207757	HIC 107848
V627 Cas	AS 501	TYC 3997 1169 1
Z And	HD 221650	HIC 116287
R Aqr	HR 8992	HIC 117054
V630 Cas		USNO A2.0 350-18714761

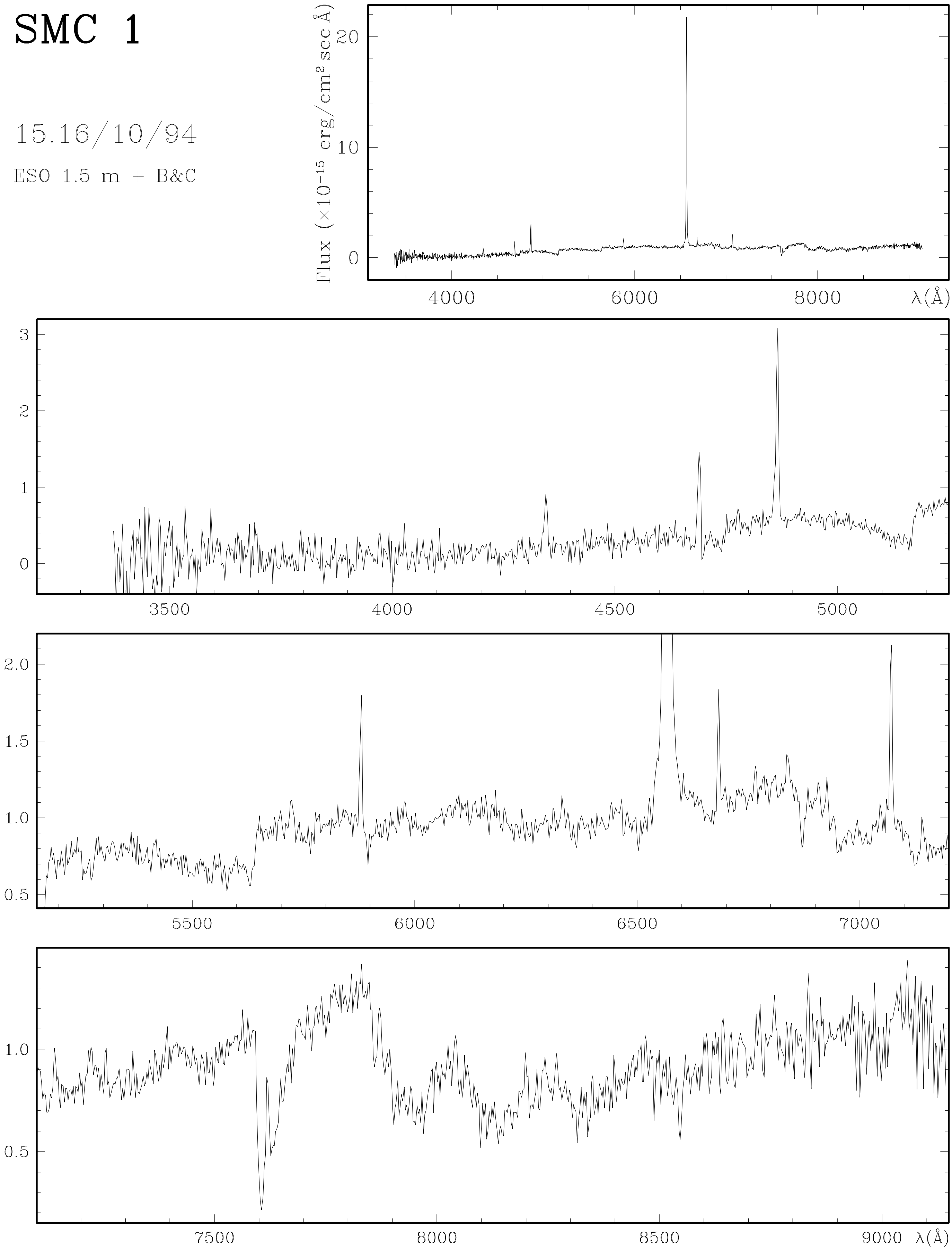


Fig. 4. ESO 1.5m + B&C spectrum of SMC 1

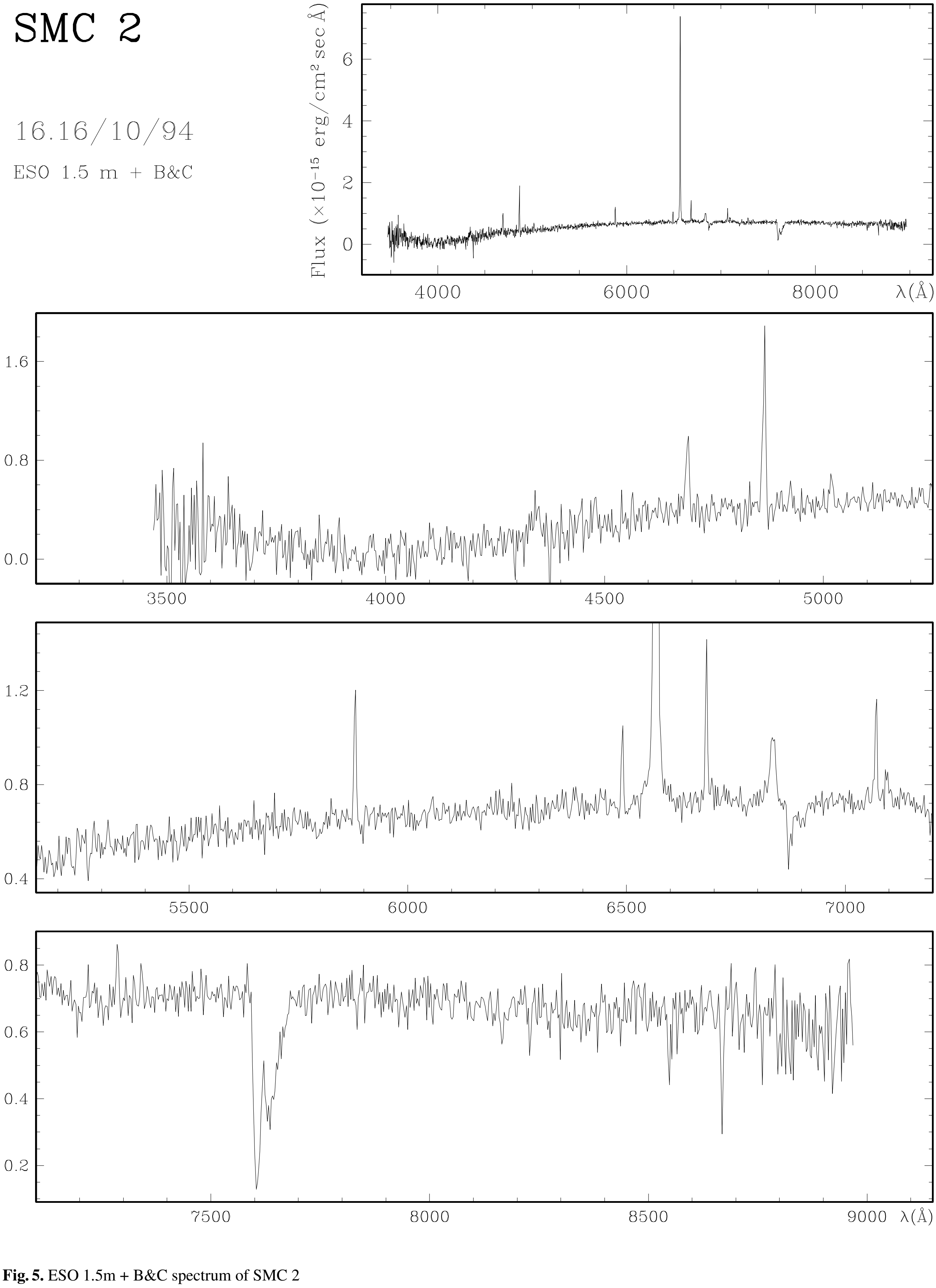


Fig. 5. ESO 1.5m + B&C spectrum of SMC 2

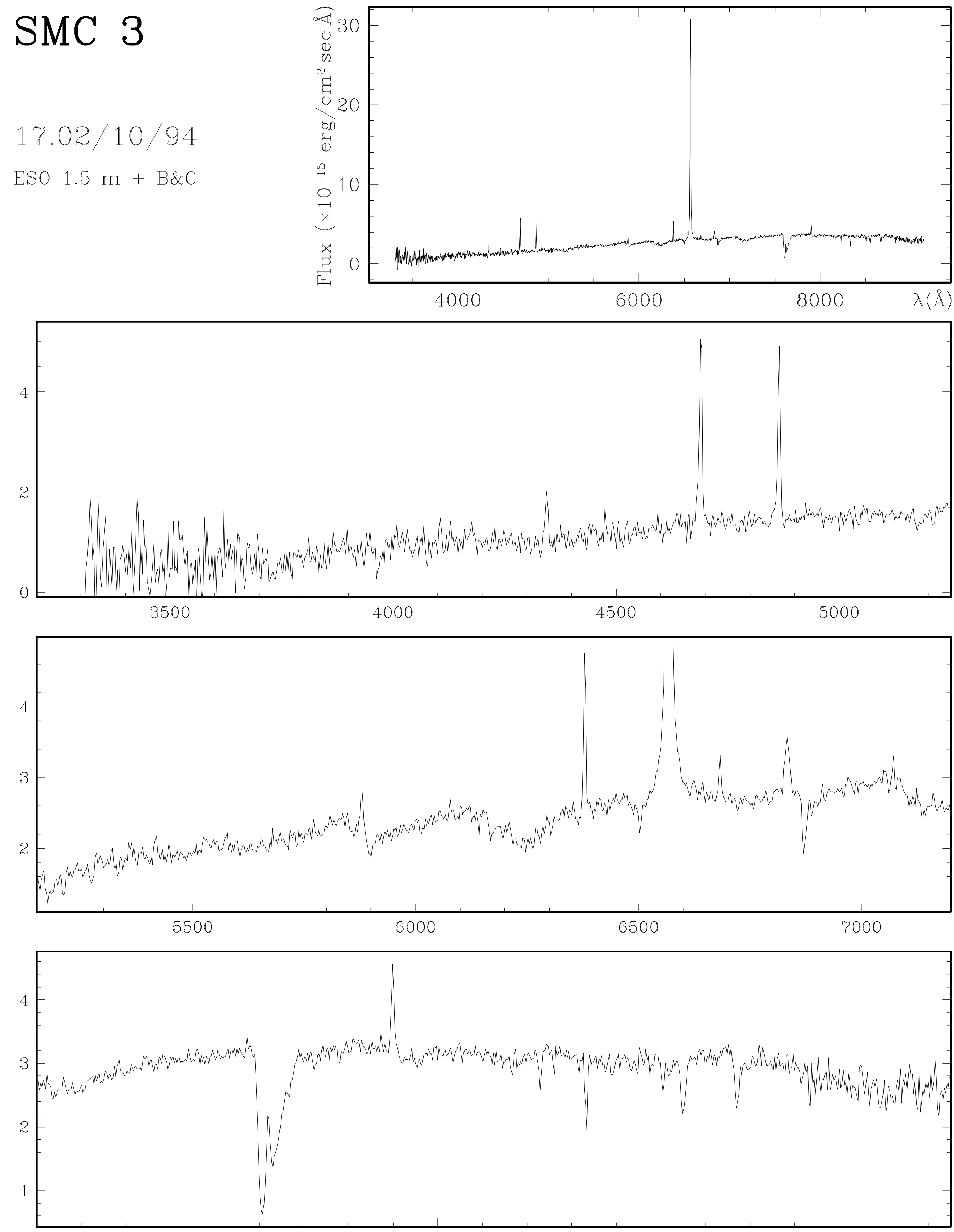


Fig. 6. ESO 1.5m + B&C spectrum of SMC 3

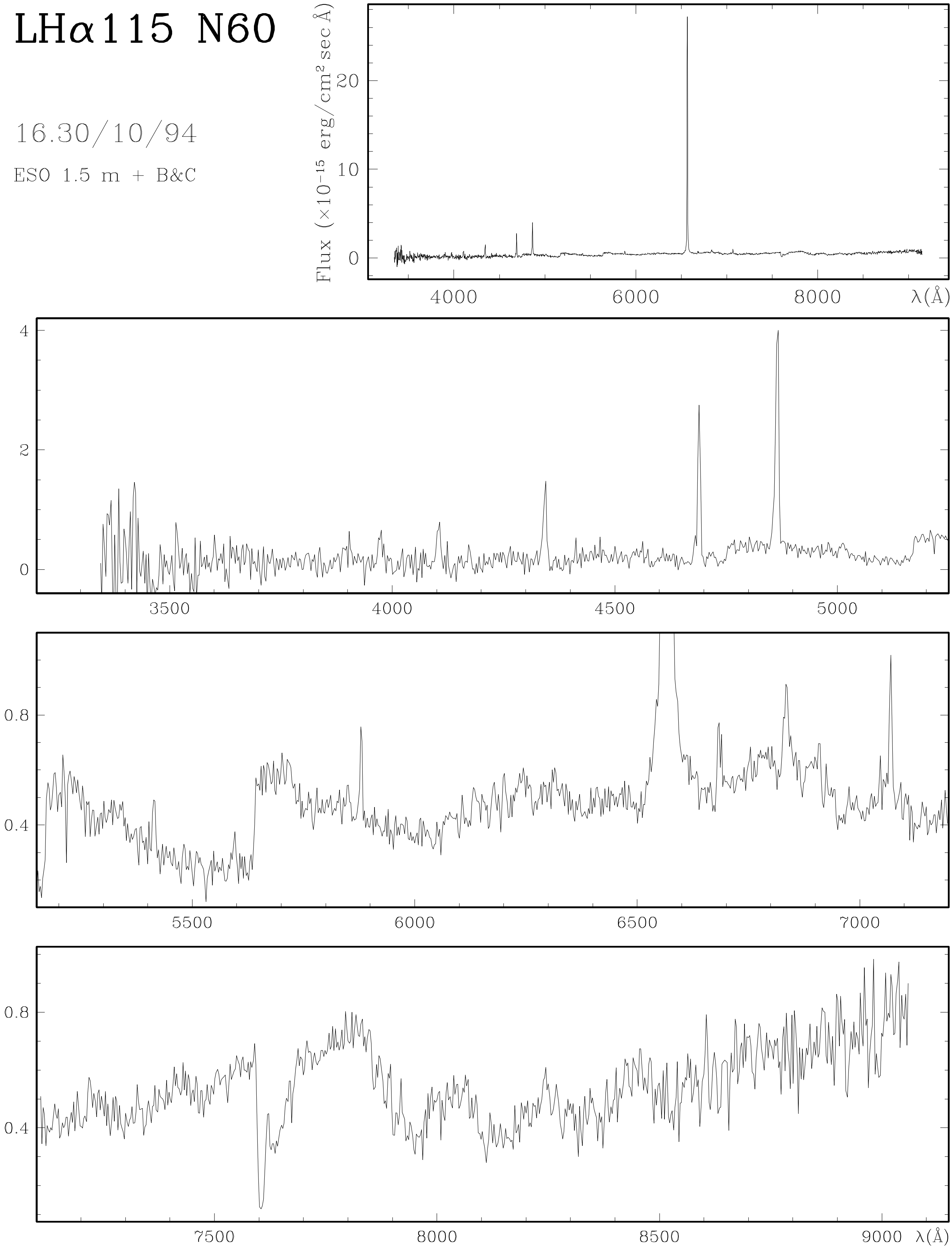


Fig. 7. ESO 1.5m + B&C spectrum of LHA 115-N 60

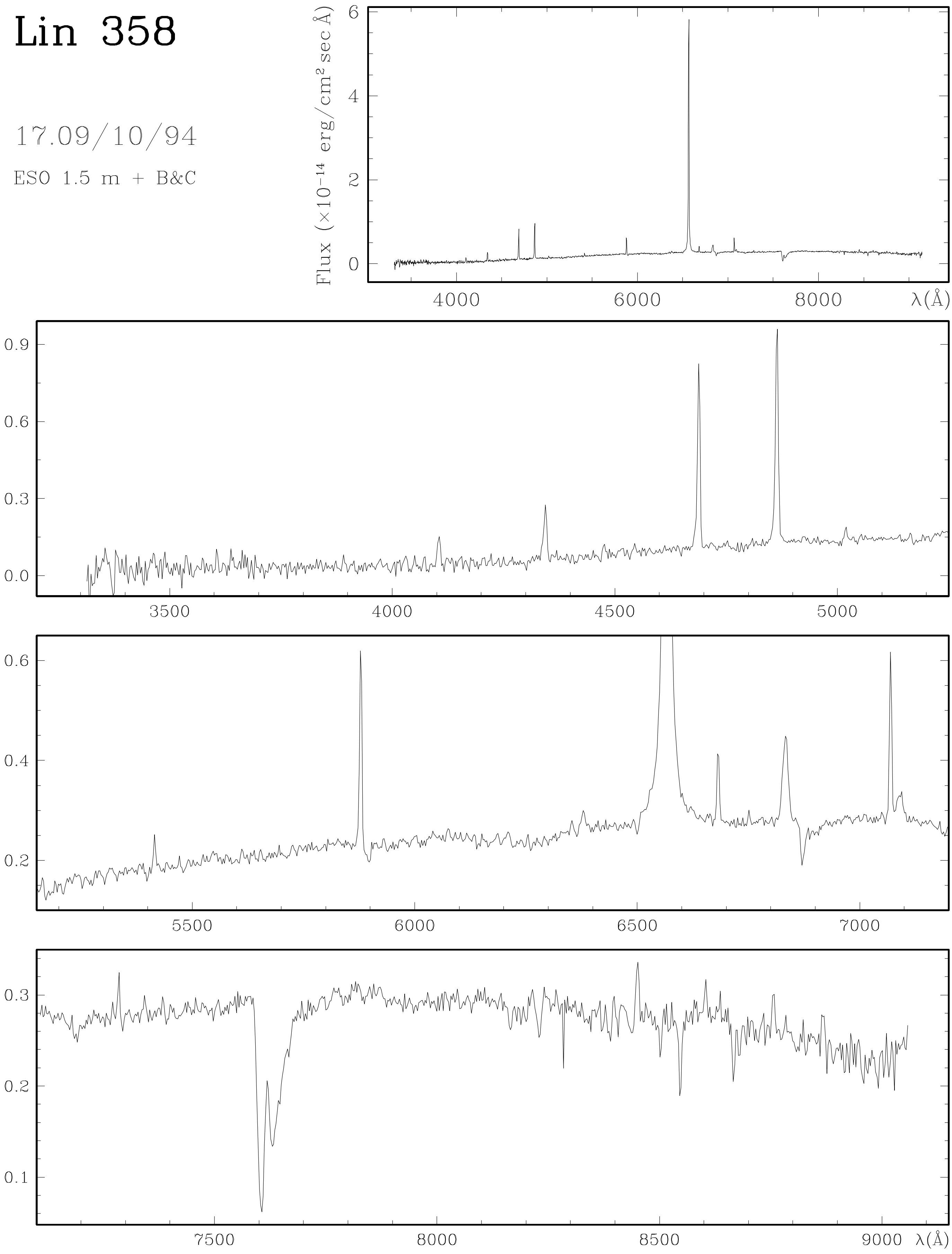


Fig. 8. ESO 1.5m + B&C spectrum of Lin 358

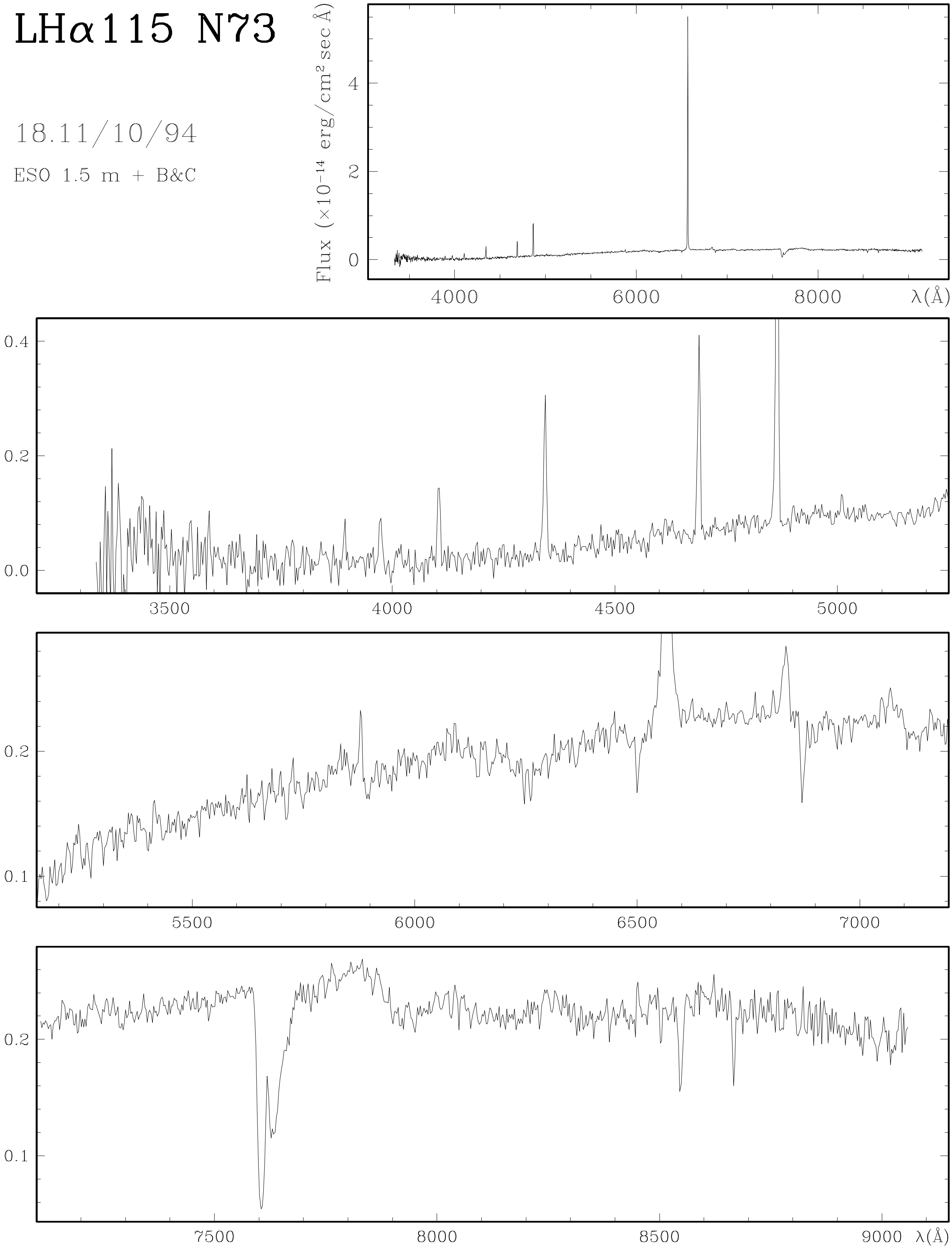


Fig. 9. ESO 1.5m + B&C spectrum of LHA 115-N 73

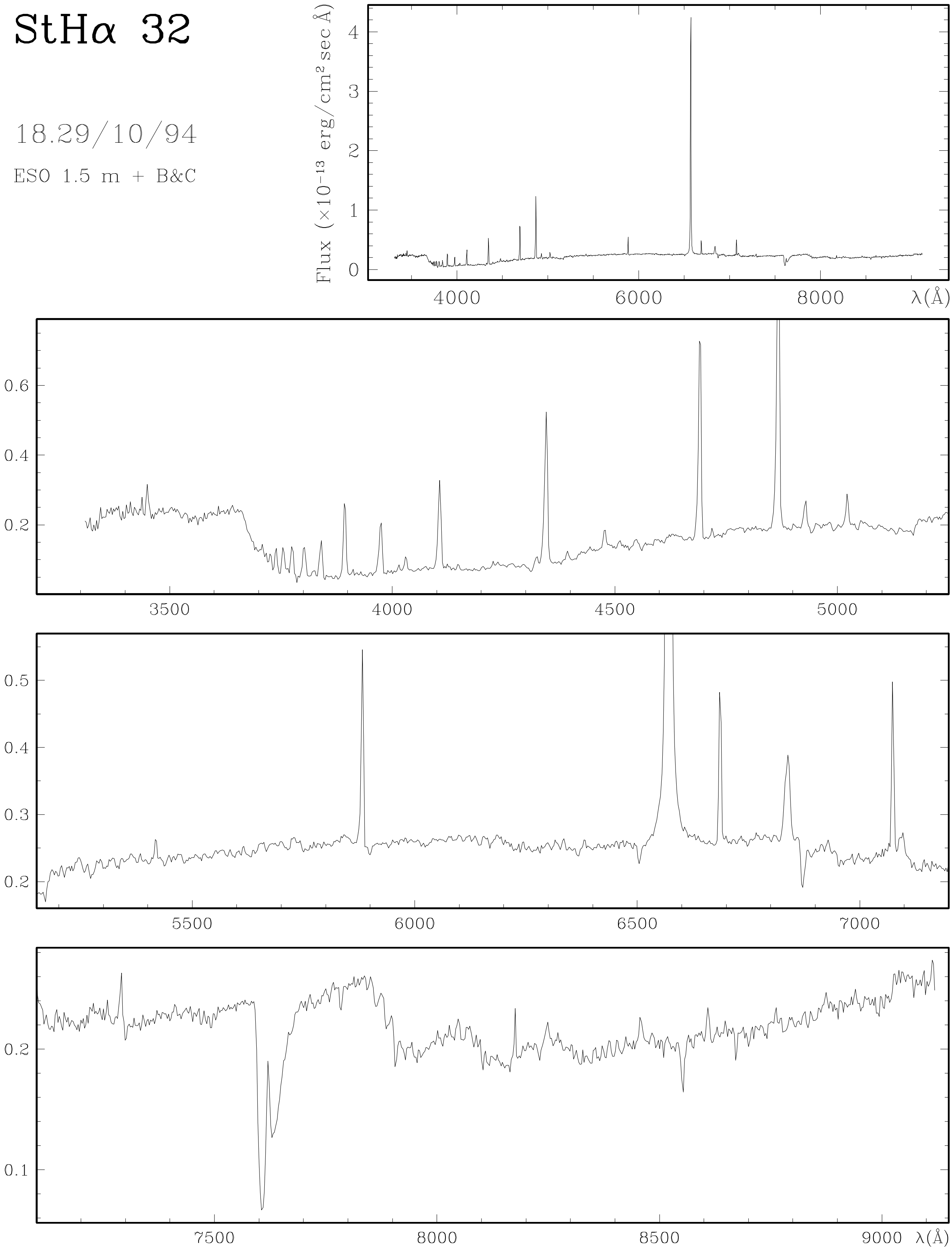


Fig. 10. ESO 1.5m + B&C spectrum of StHA 32

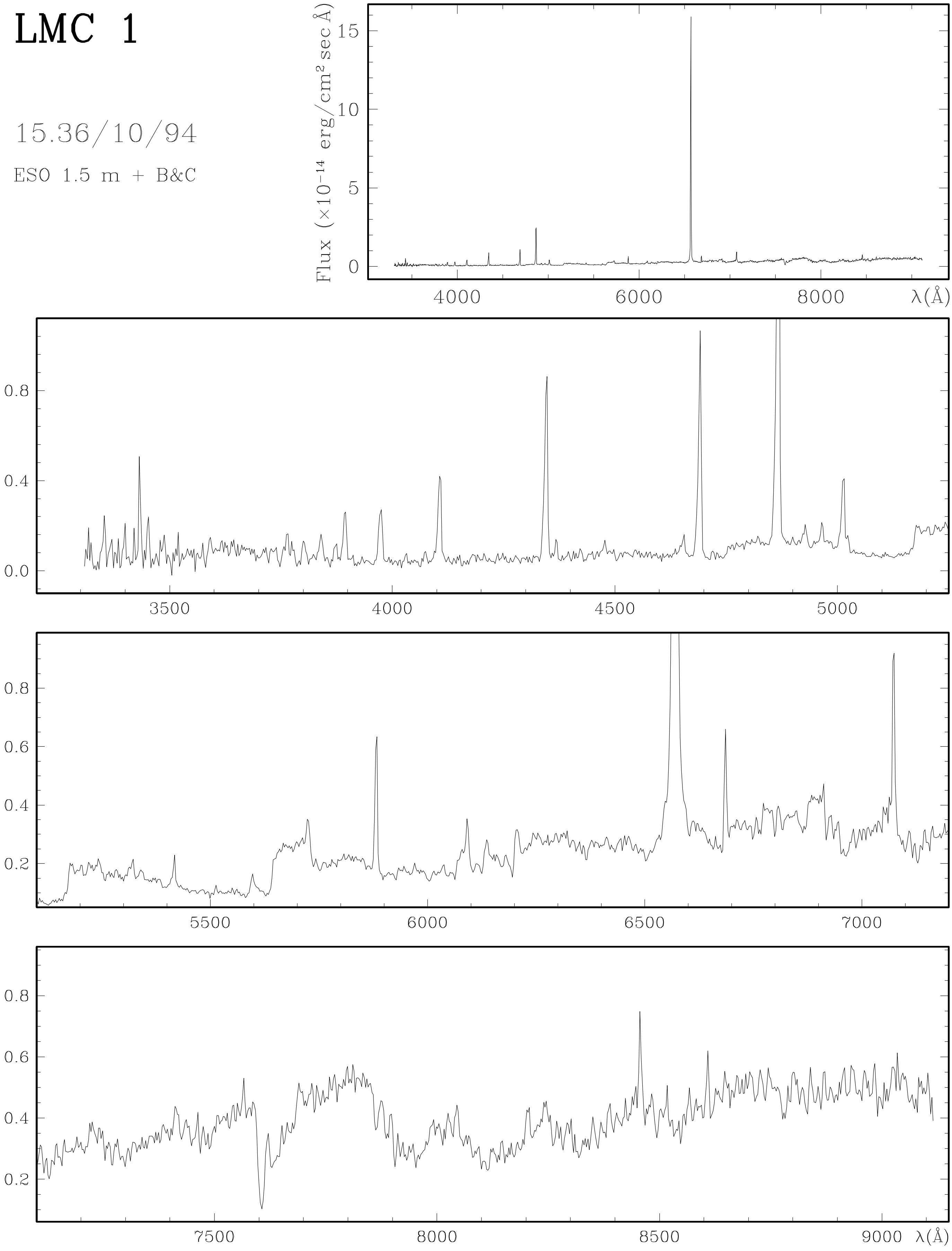


Fig. 11. ESO 1.5m + B&C spectrum of LMC 1

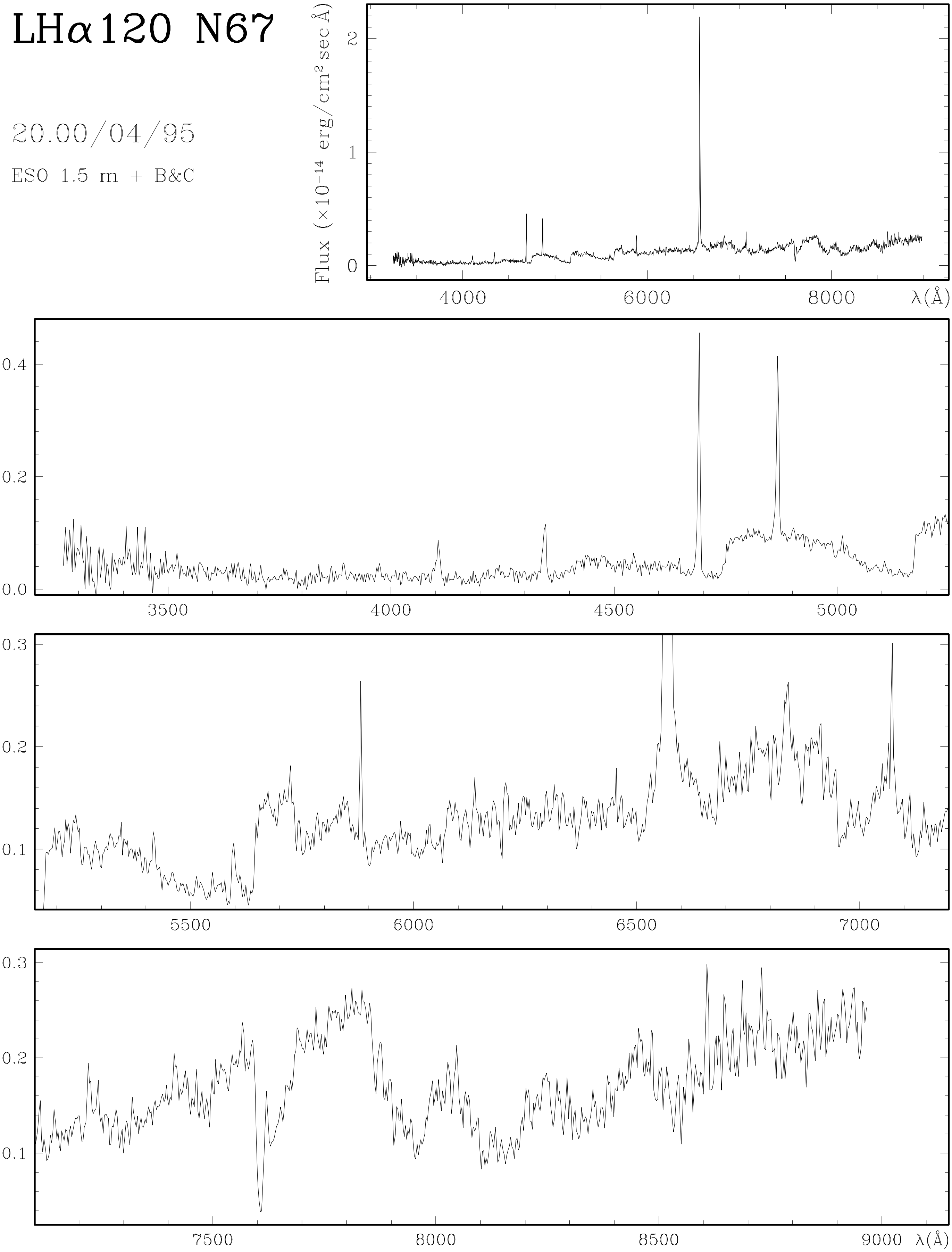


Fig. 12. ESO 1.5m + B&C spectrum of LHA 120-N 67

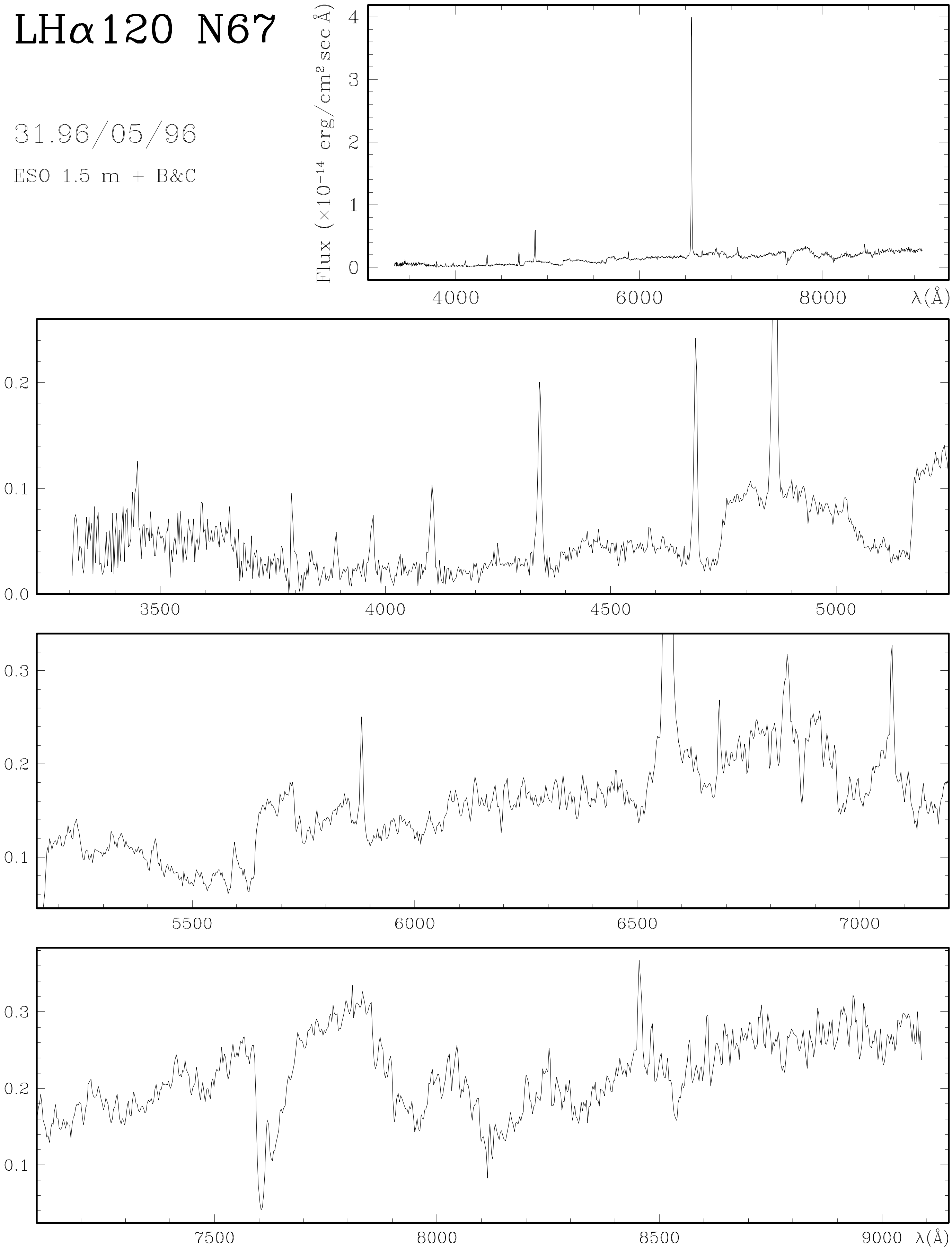


Fig. 13. ESO 1.5m + B&C spectrum of LHA 120-N 67

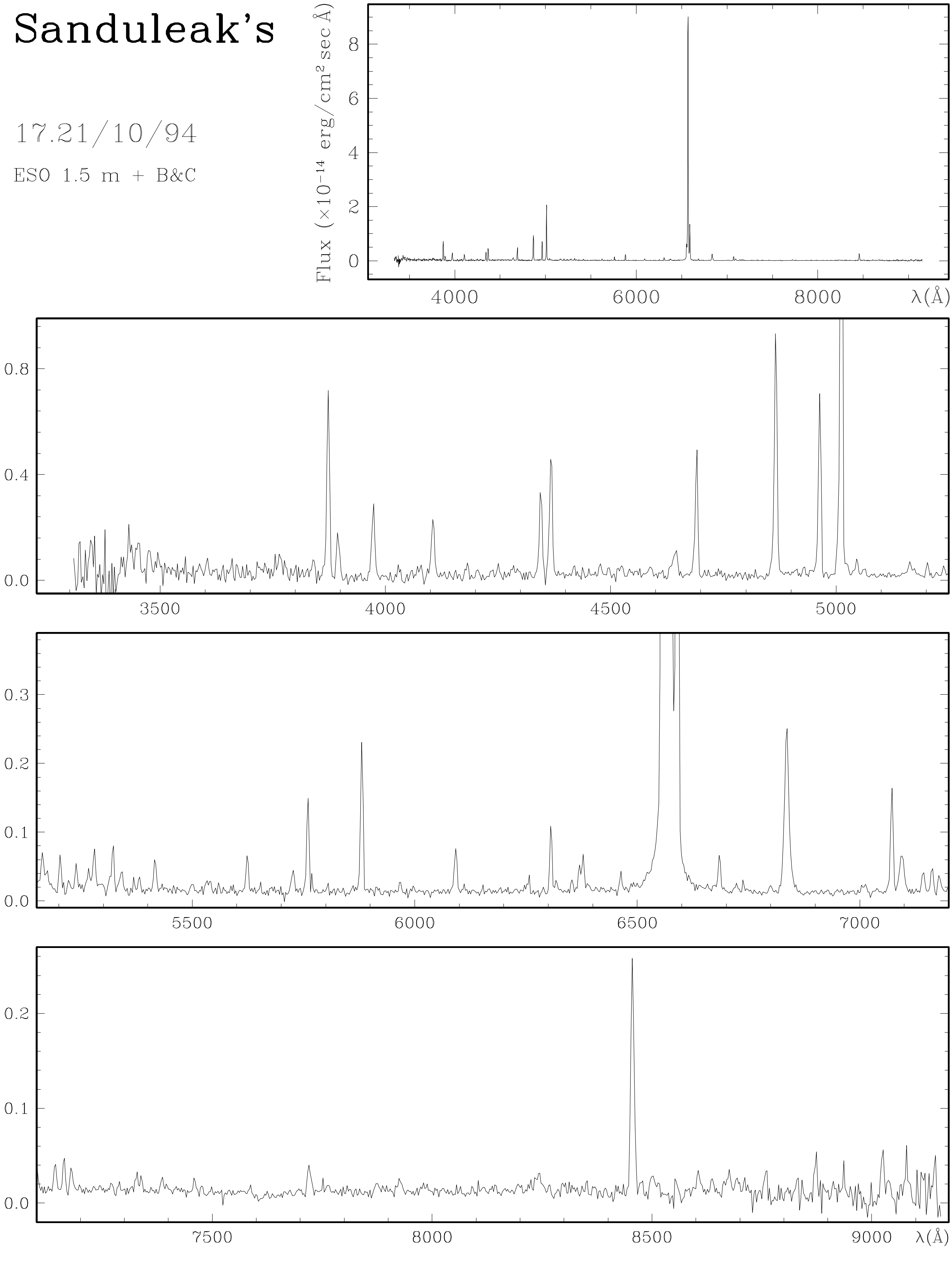


Fig. 14. ESO 1.5m + B&C spectrum of Sanduleak's

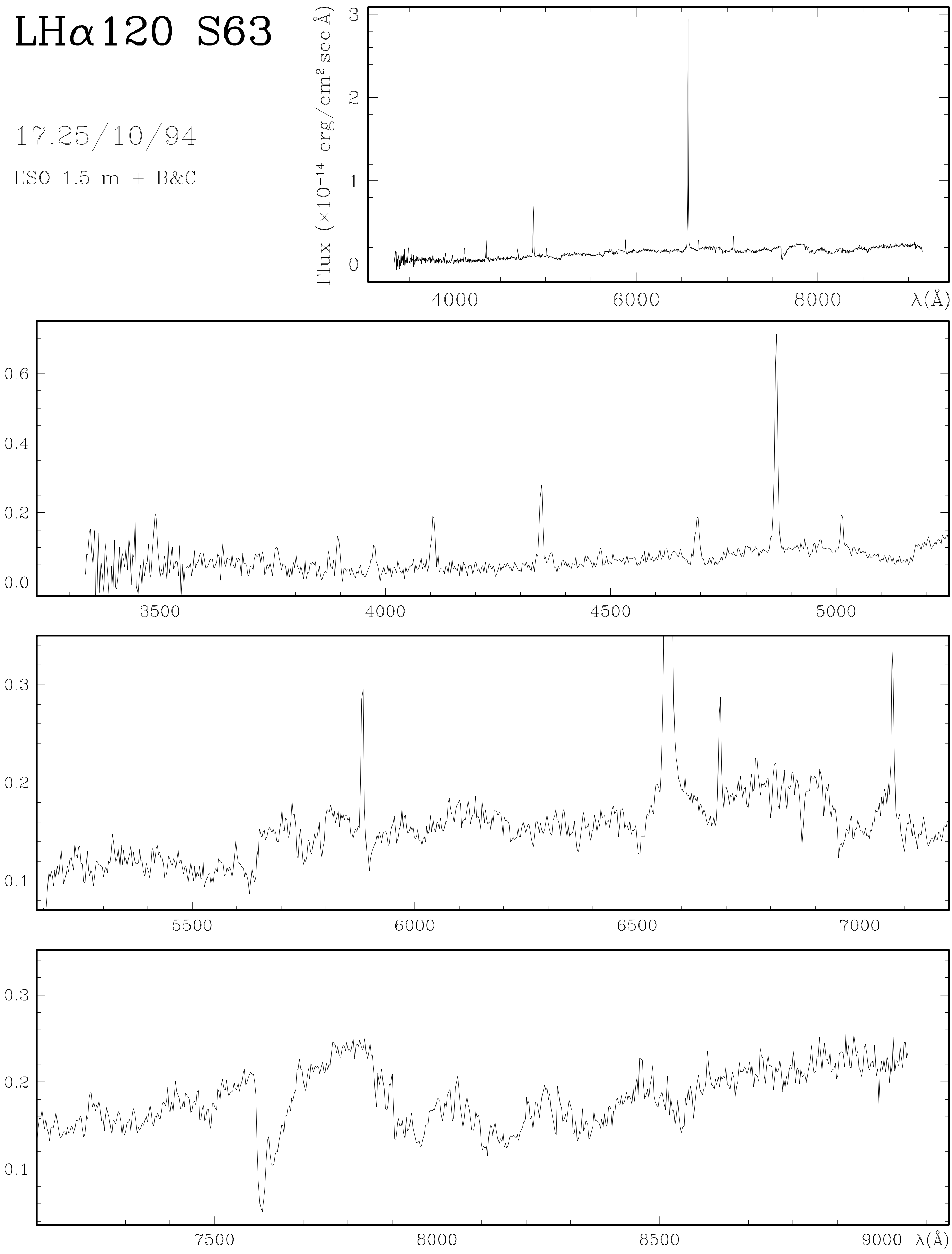


Fig. 15. ESO 1.5m + B&C spectrum of LHA 120-S 63

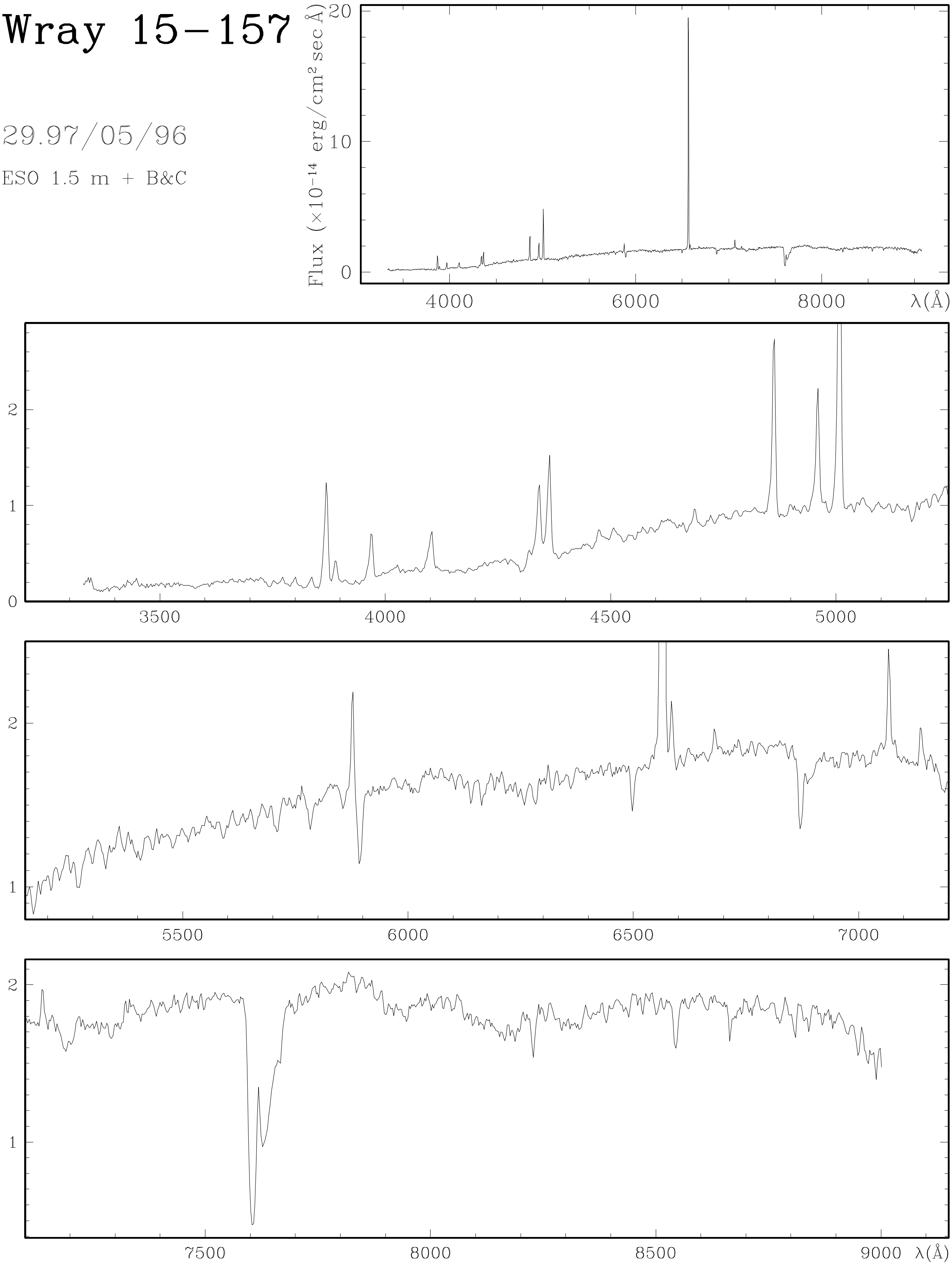


Fig. 16. ESO 1.5m + B&C spectrum of WRAY 15-157

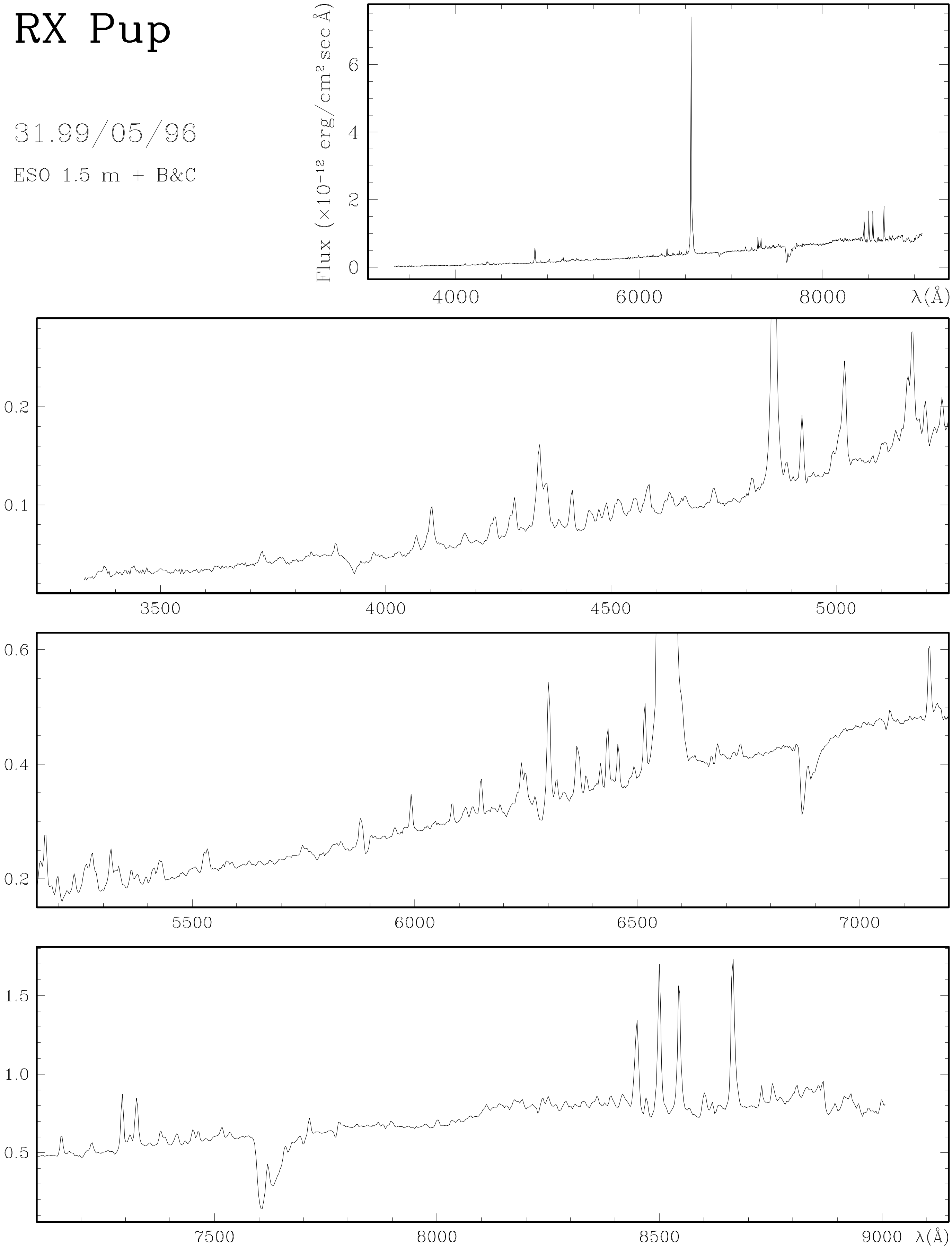


Fig. 17. ESO 1.5m + B&C spectrum of RX Pup

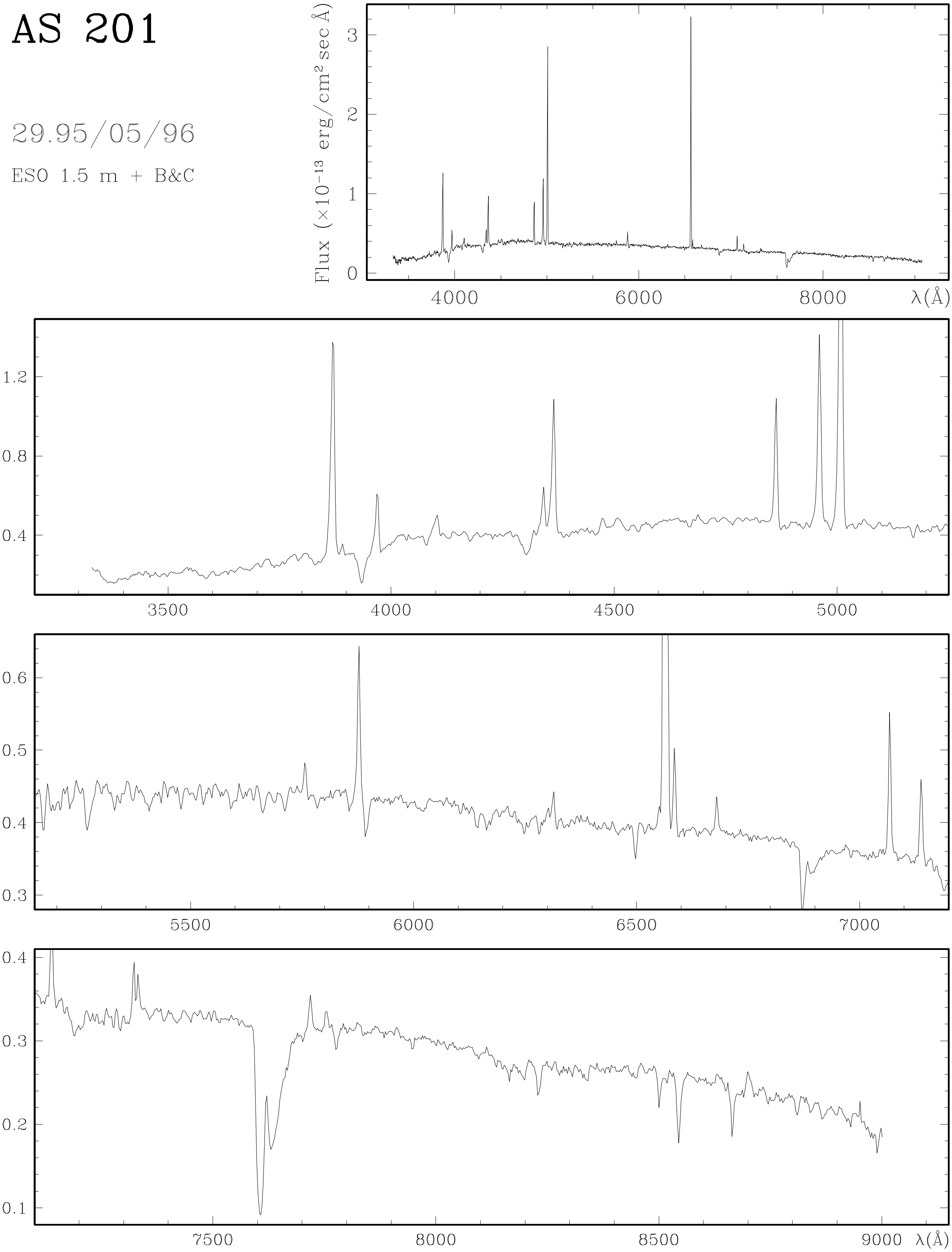


Fig. 18. ESO 1.5m + B&C spectrum of AS 201

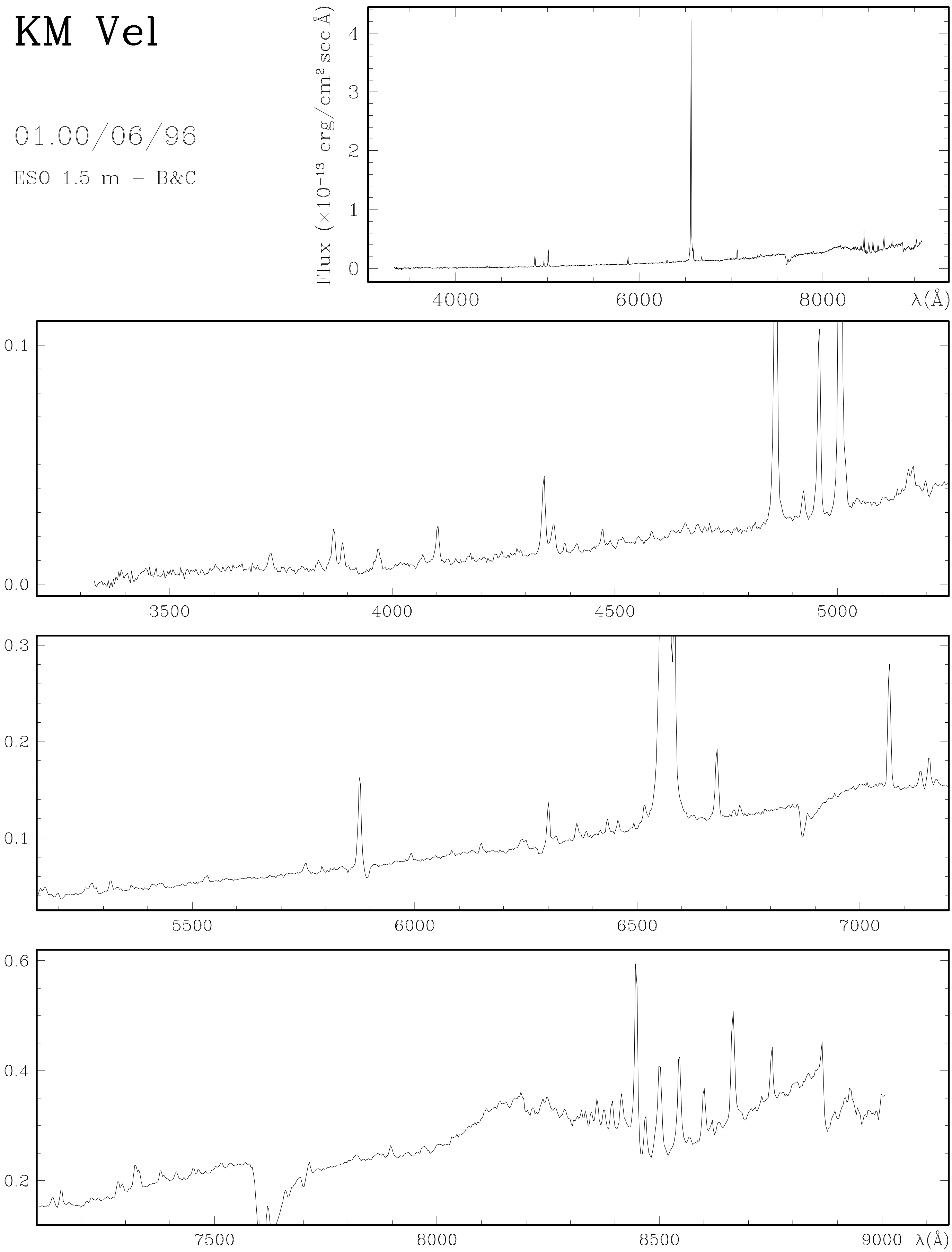


Fig. 19. ESO 1.5m + B&C spectrum of KM Vel

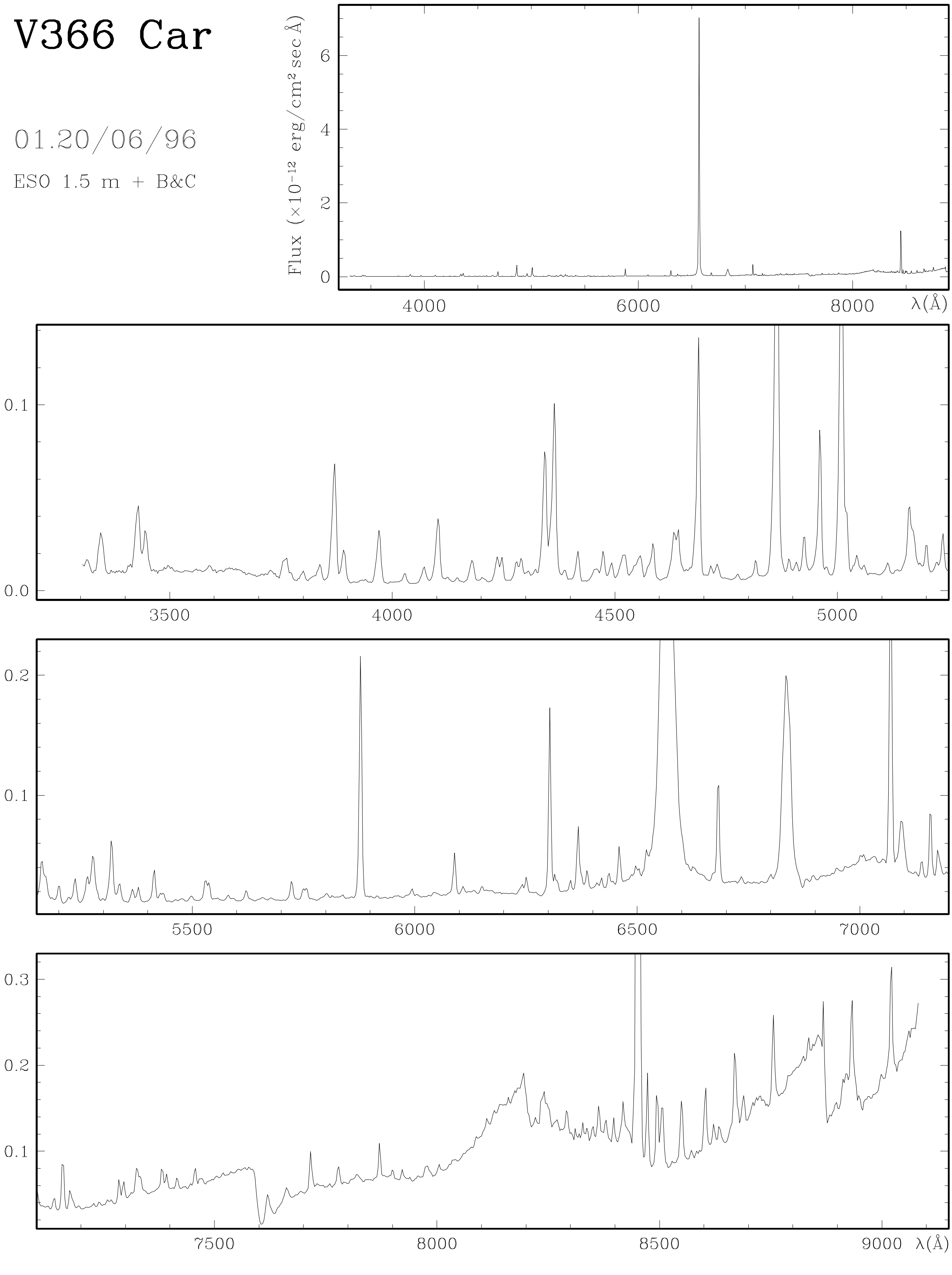


Fig. 20. ESO 1.5m + B&C spectrum of V366 Car

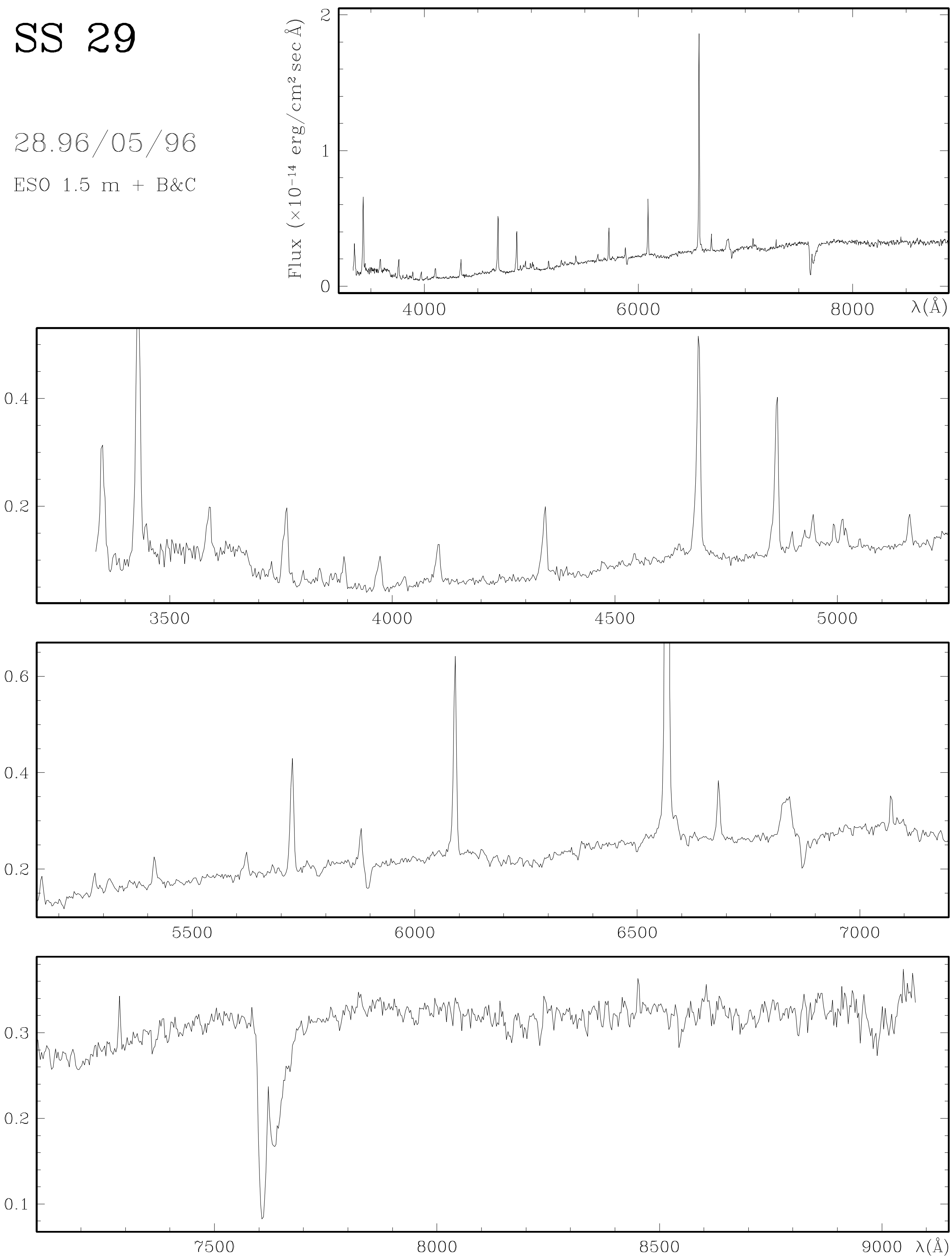


Fig. 21. ESO 1.5m + B&C spectrum of SS 29

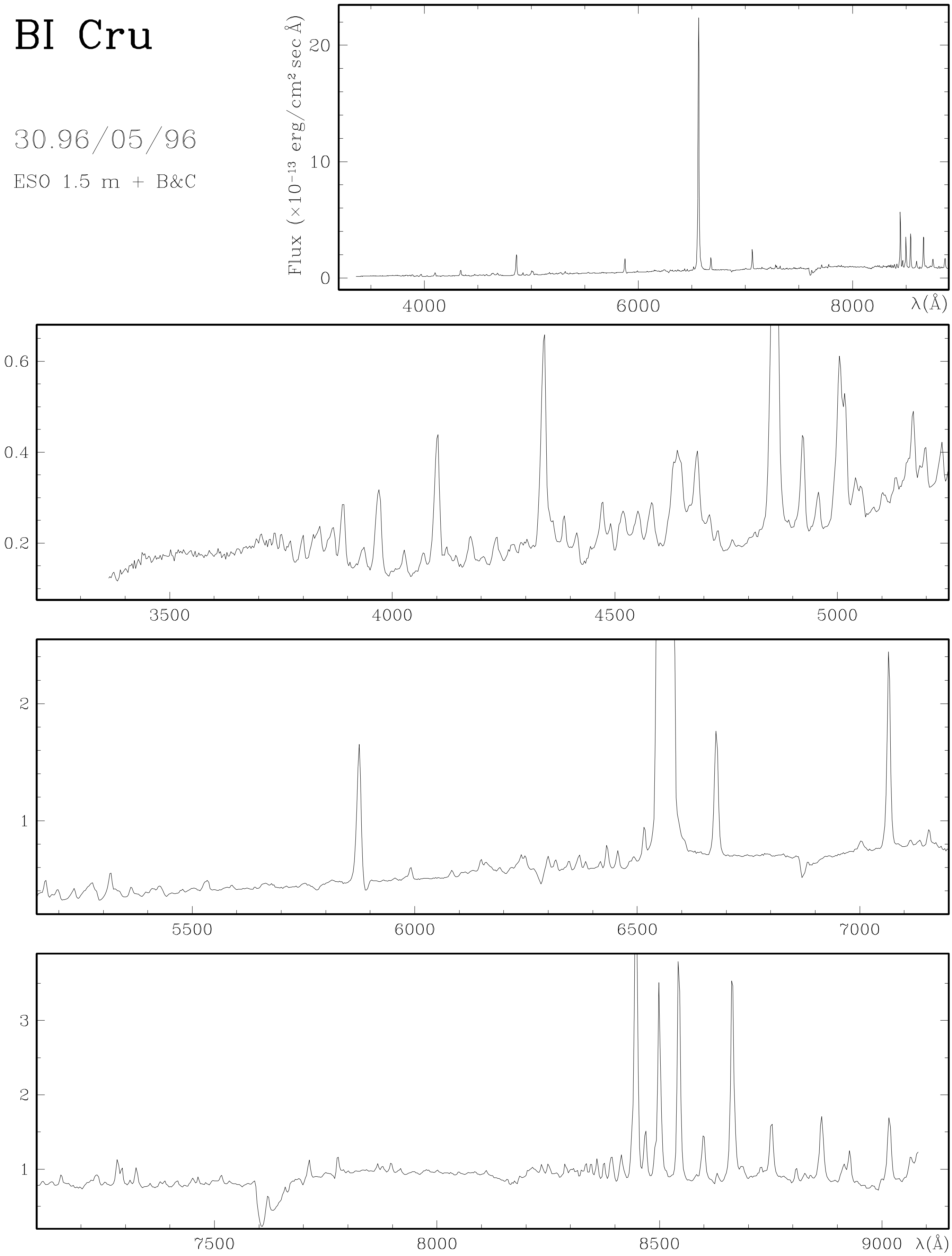


Fig. 22. ESO 1.5m + B&C spectrum of BI Cru

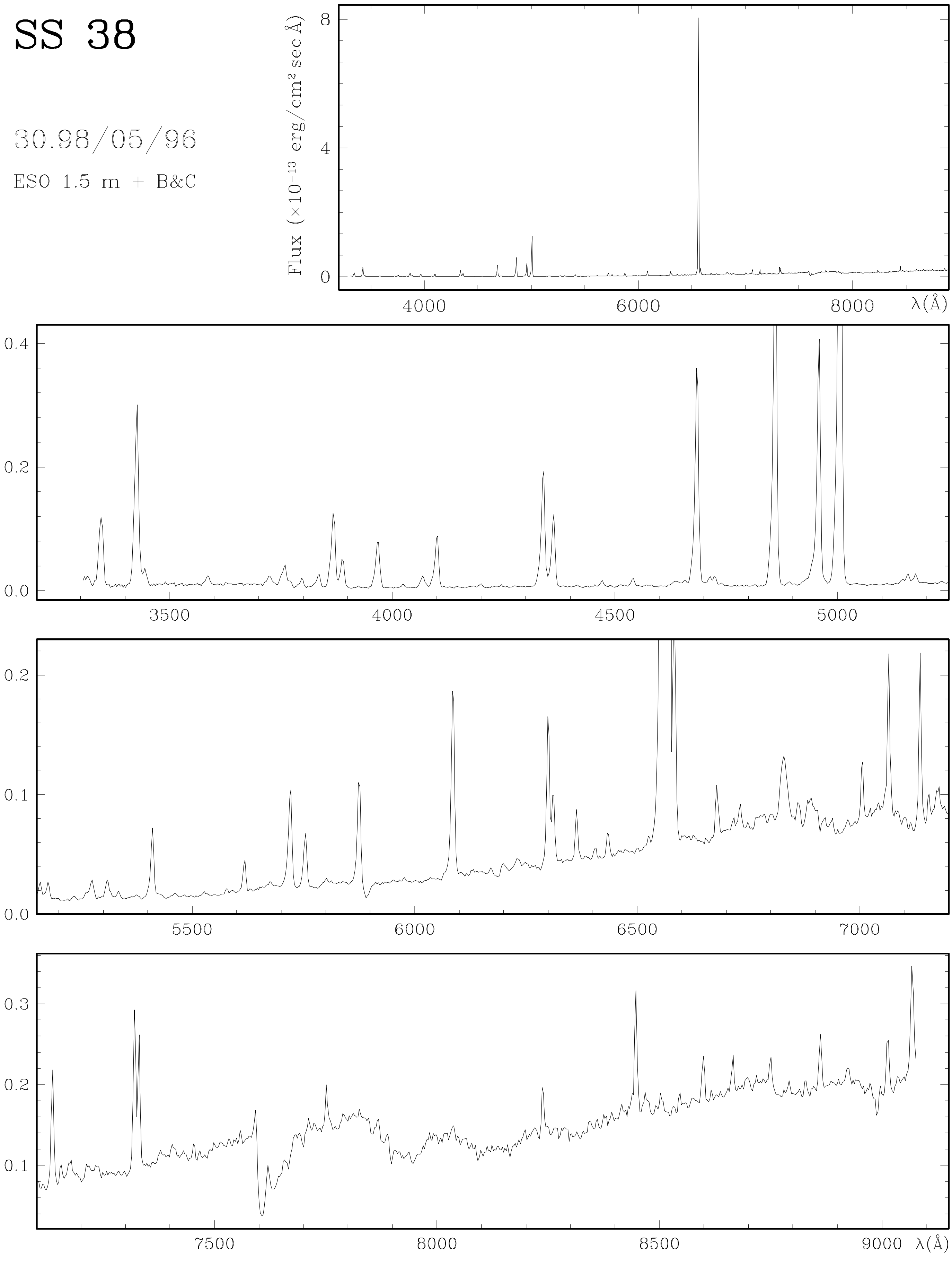


Fig. 23. ESO 1.5m + B&C spectrum of SS 38

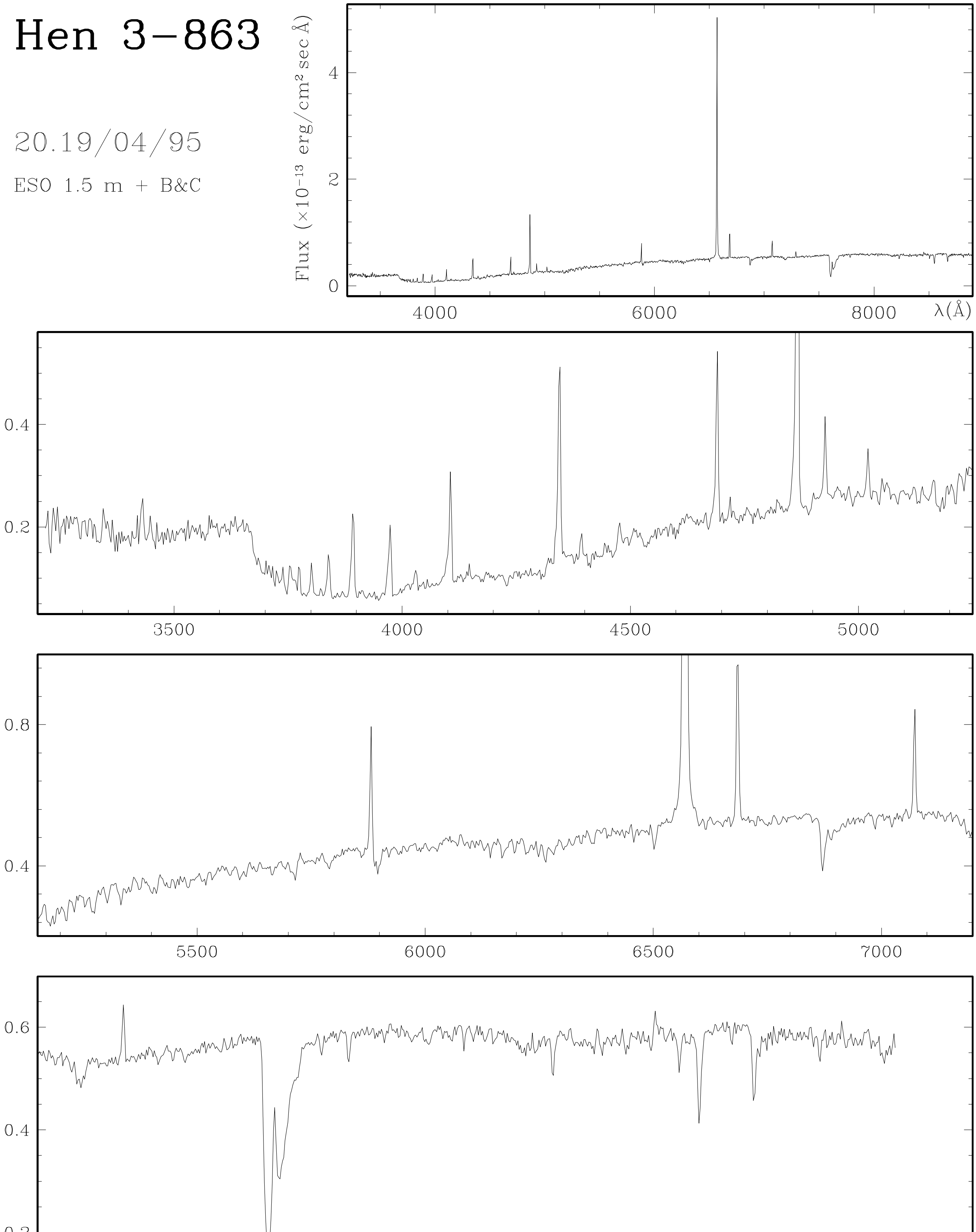


Fig. 24. ESO 1.5m + B&C spectrum of Hen 3-863

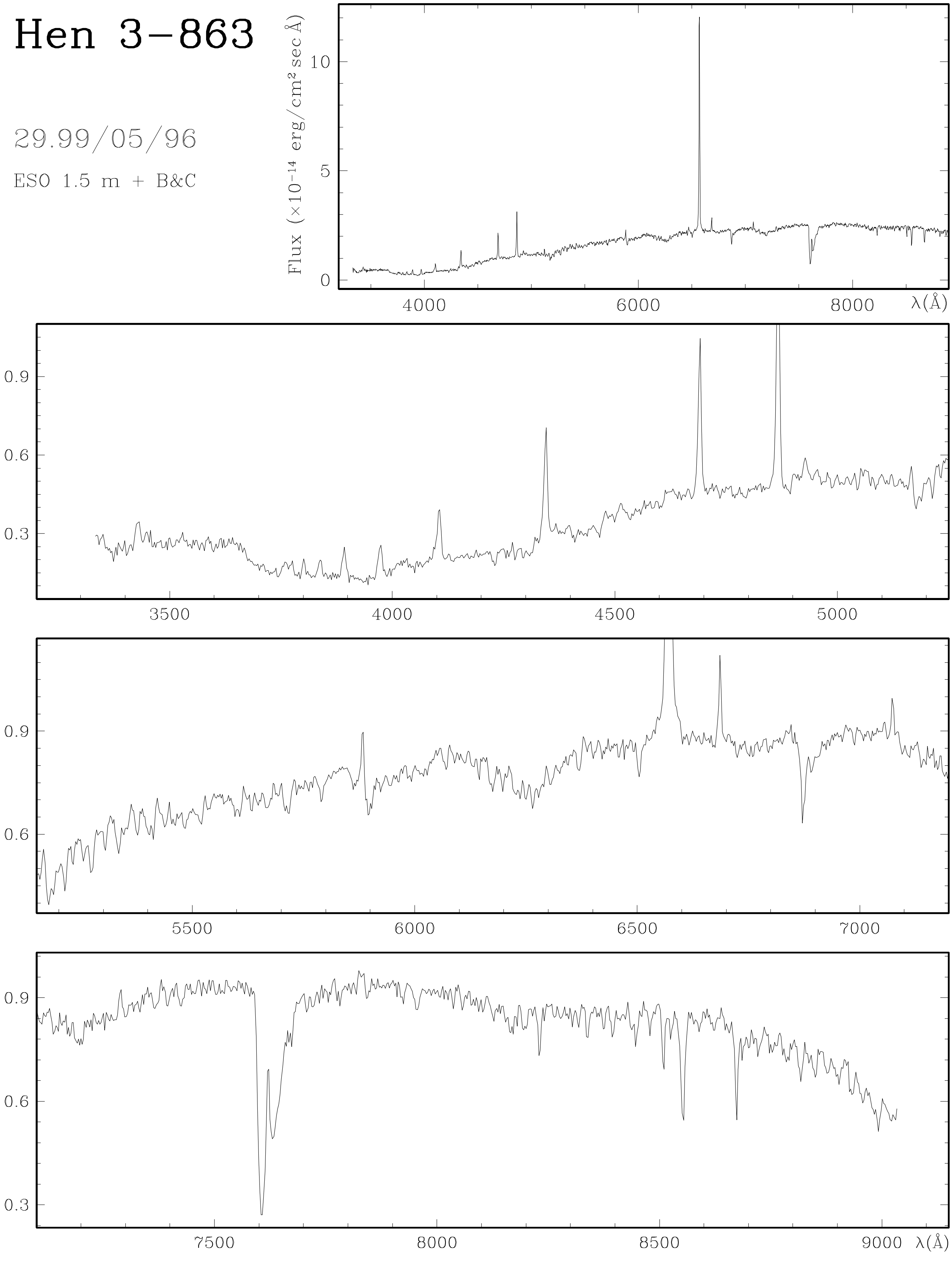


Fig. 25. ESO 1.5m + B&C spectrum of Hen 3-863

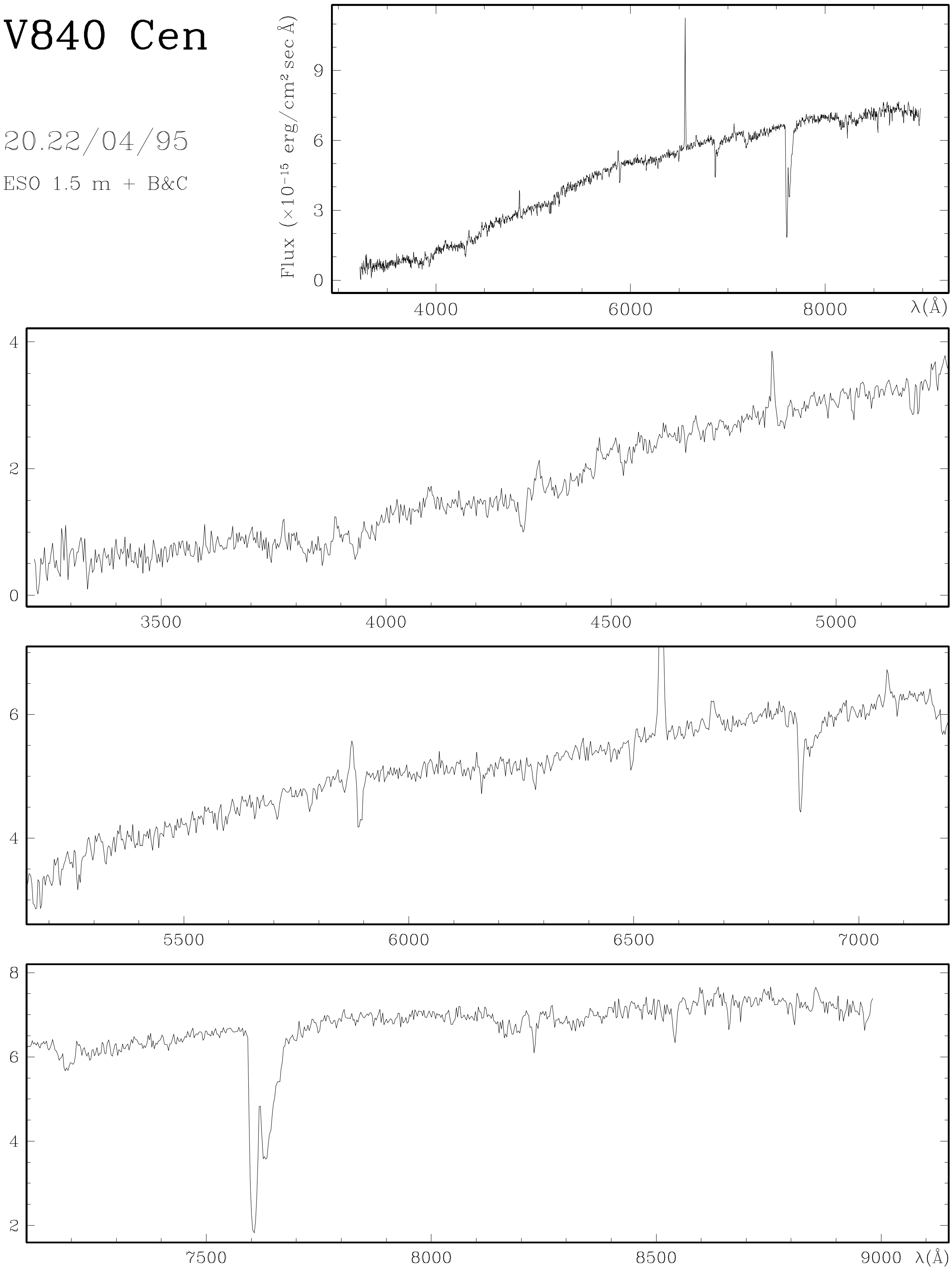


Fig. 26. ESO 1.5m + B&C spectrum of V840 Cen

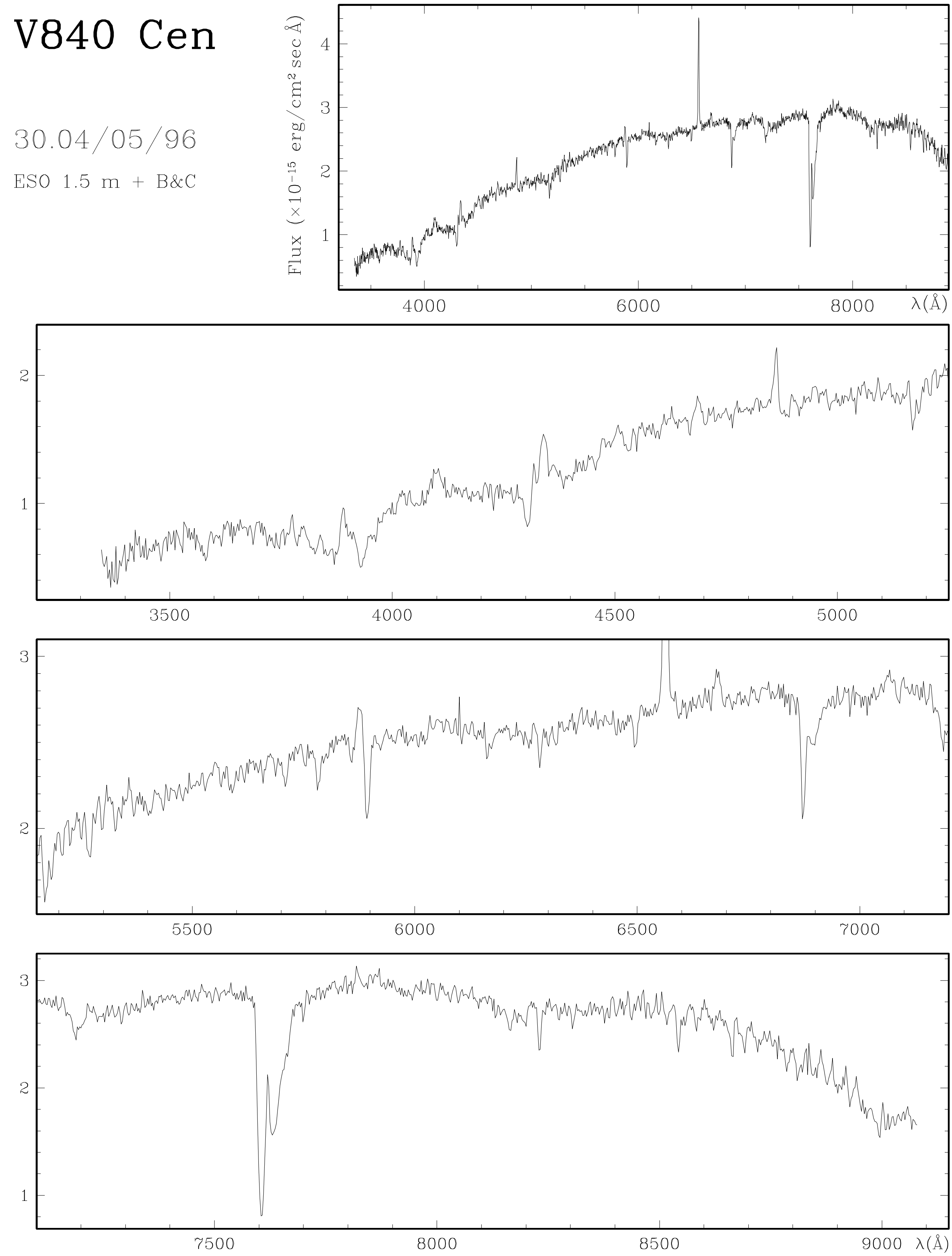


Fig. 27. ESO 1.5m + B&C spectrum of V840 Cen

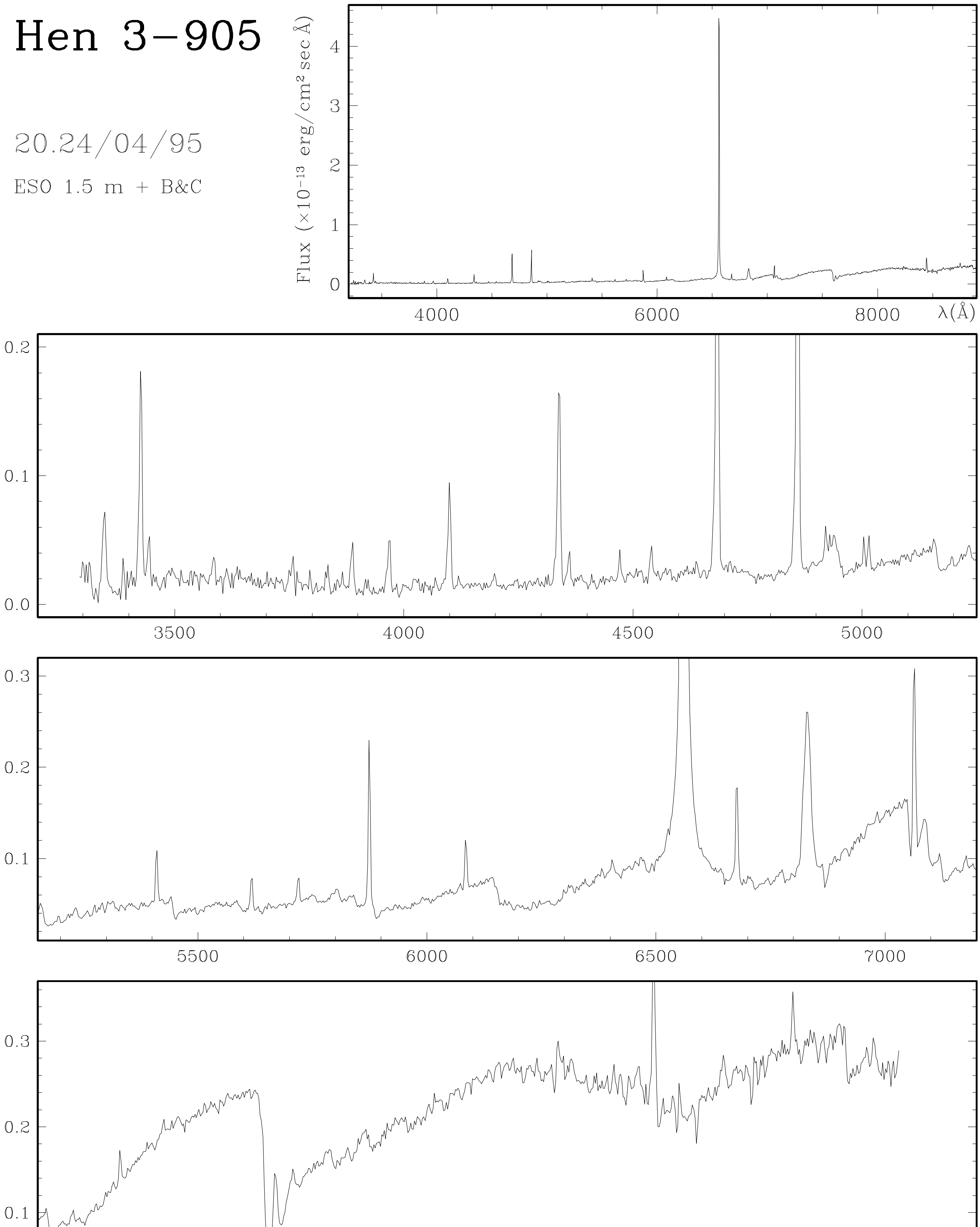


Fig. 28. ESO 1.5m + B&C spectrum of Hen 3-905

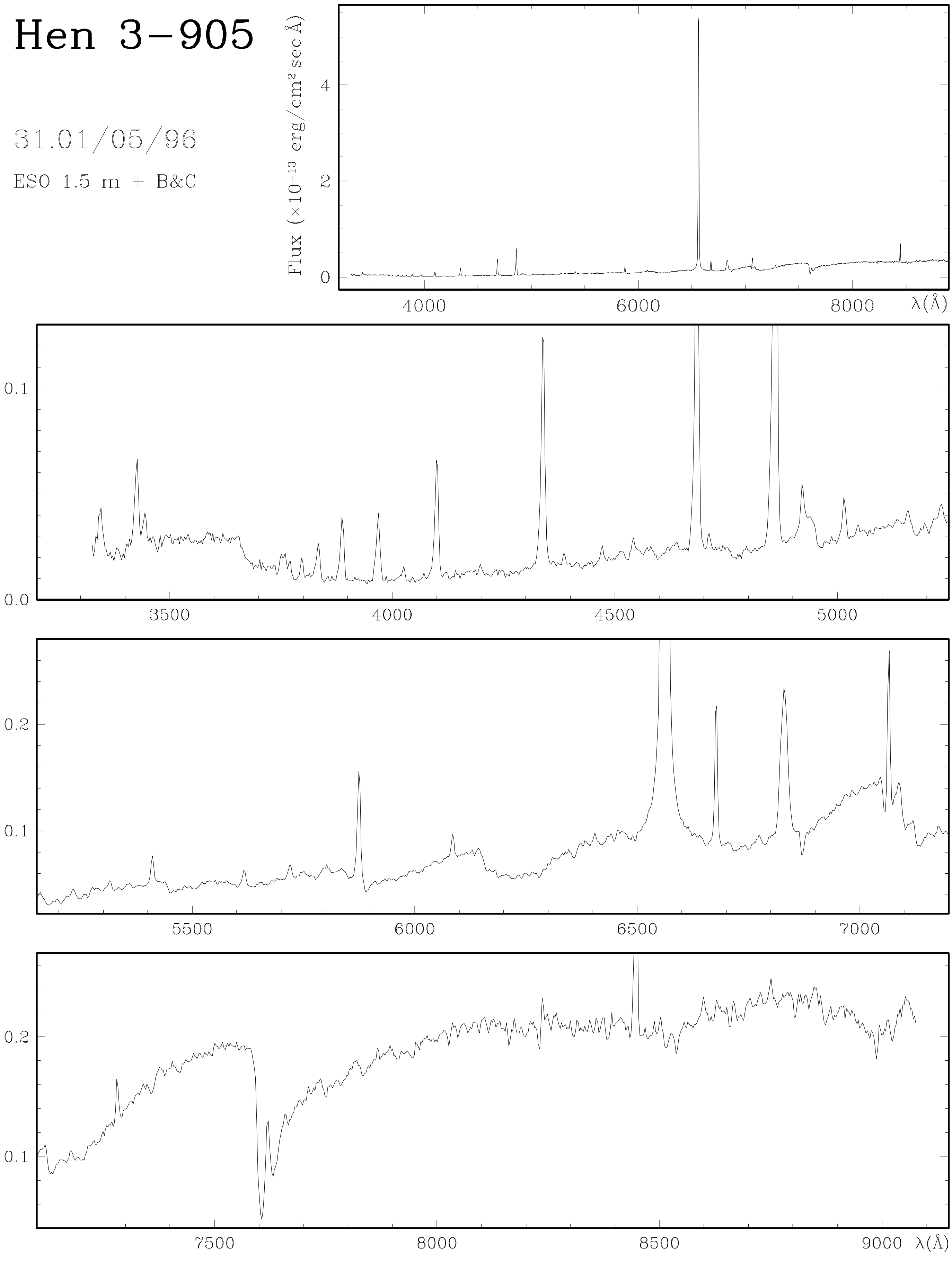


Fig. 29. ESO 1.5m + B&C spectrum of Hen 3-905

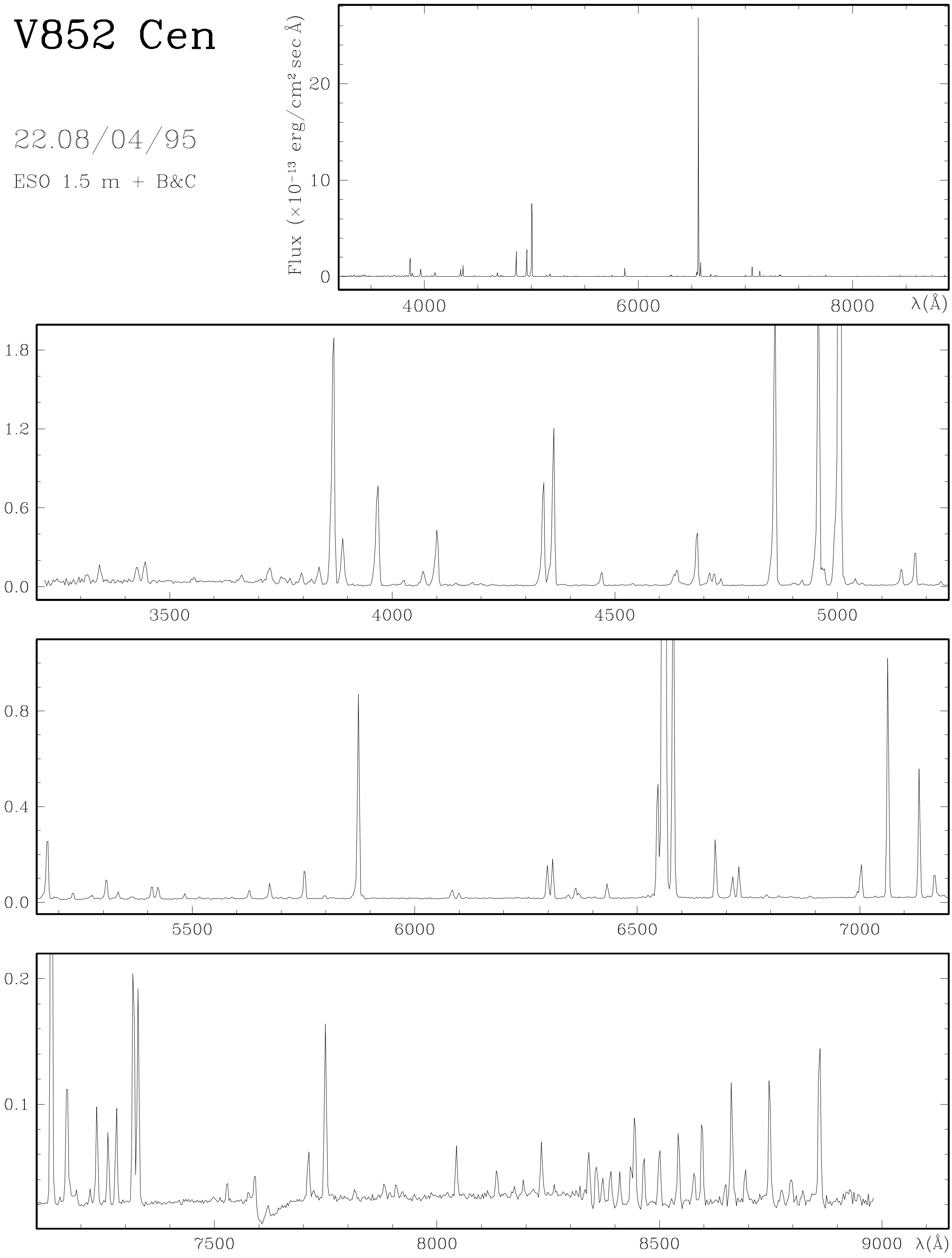


Fig. 30. ESO 1.5m + B&C spectrum of V852 Cen

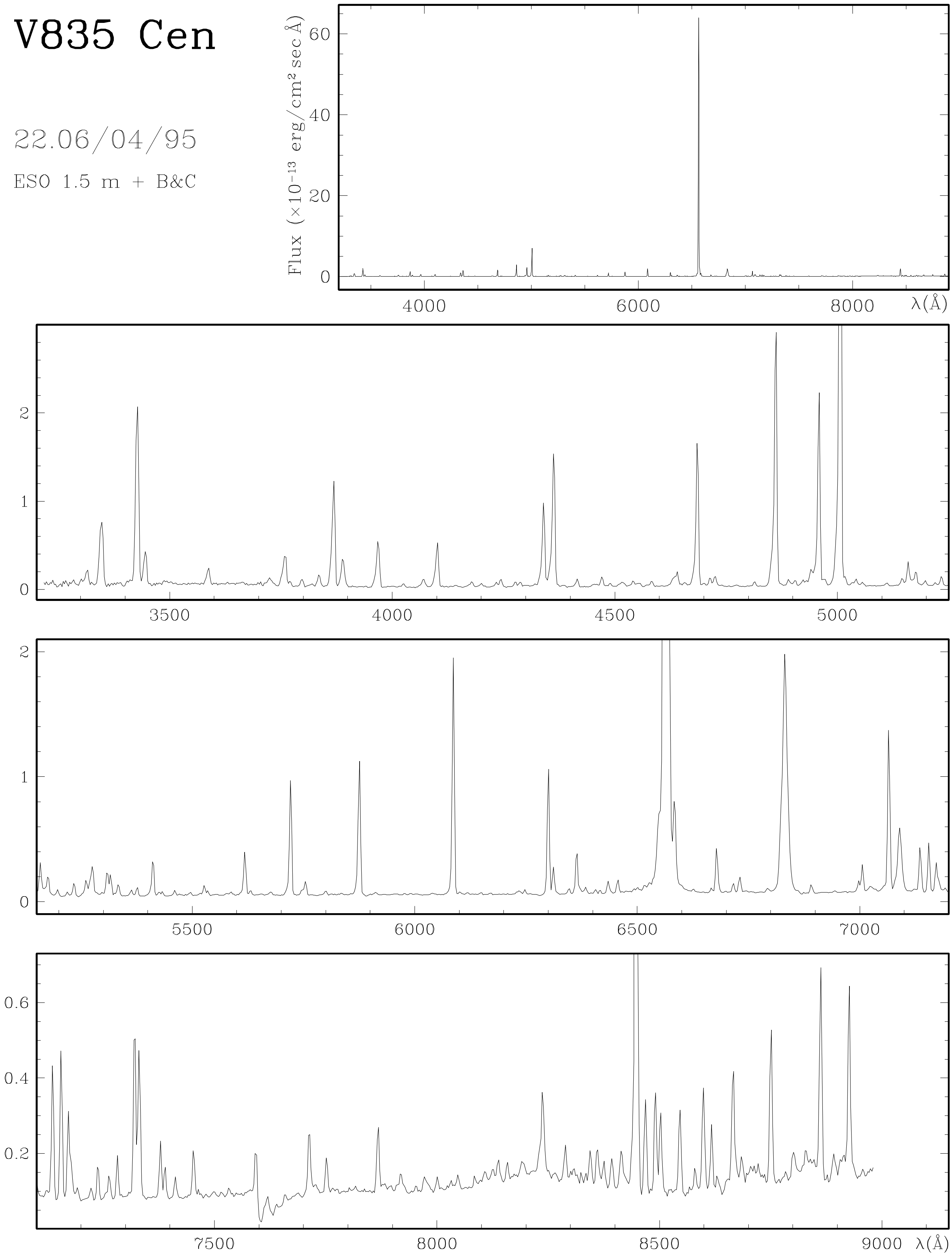


Fig. 31. ESO 1.5m + B&C spectrum of V835 Cen

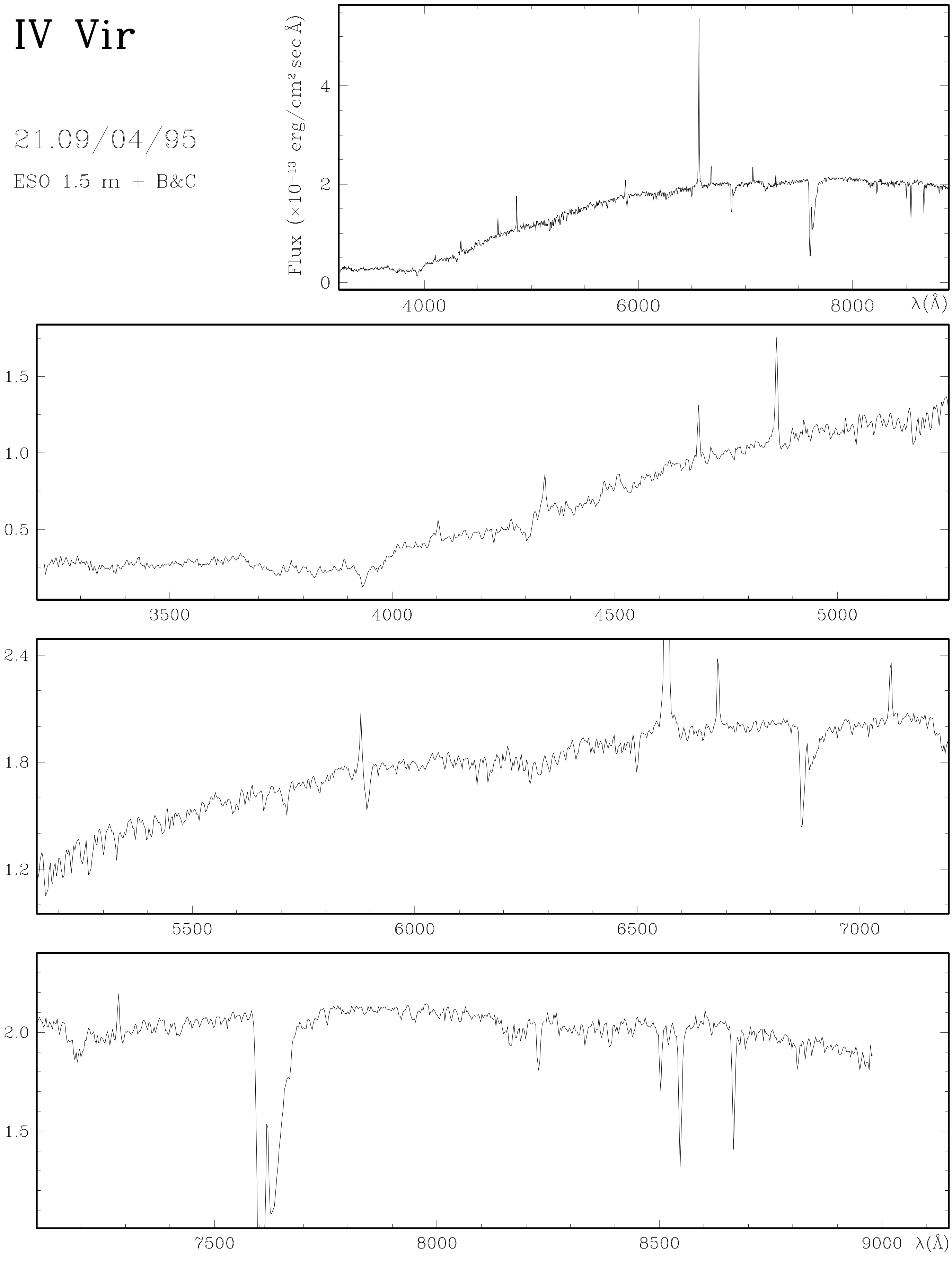


Fig. 32. ESO 1.5m + B&C spectrum of IV Vir

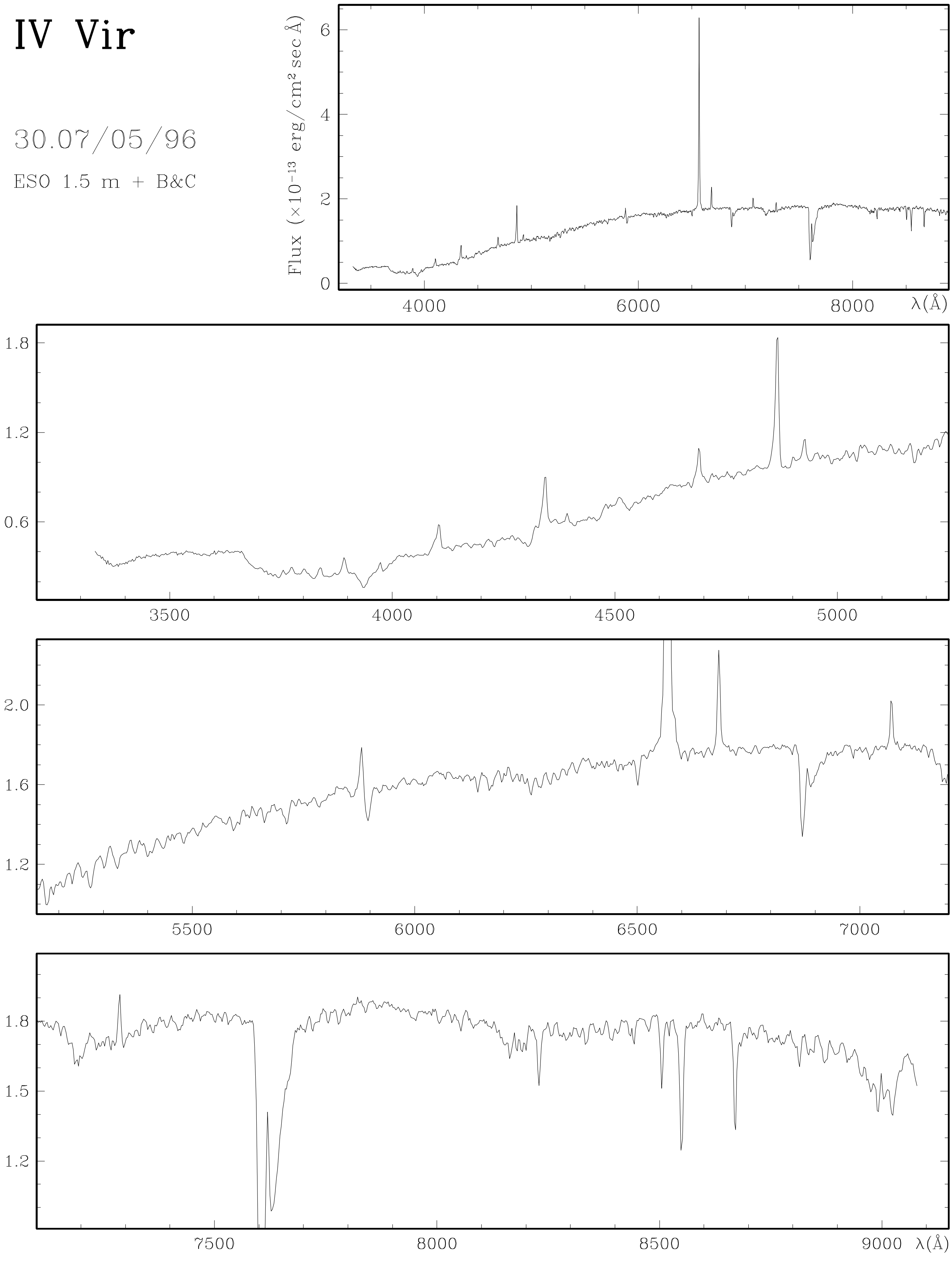


Fig. 33. ESO 1.5m + B&C spectrum of IV Vir

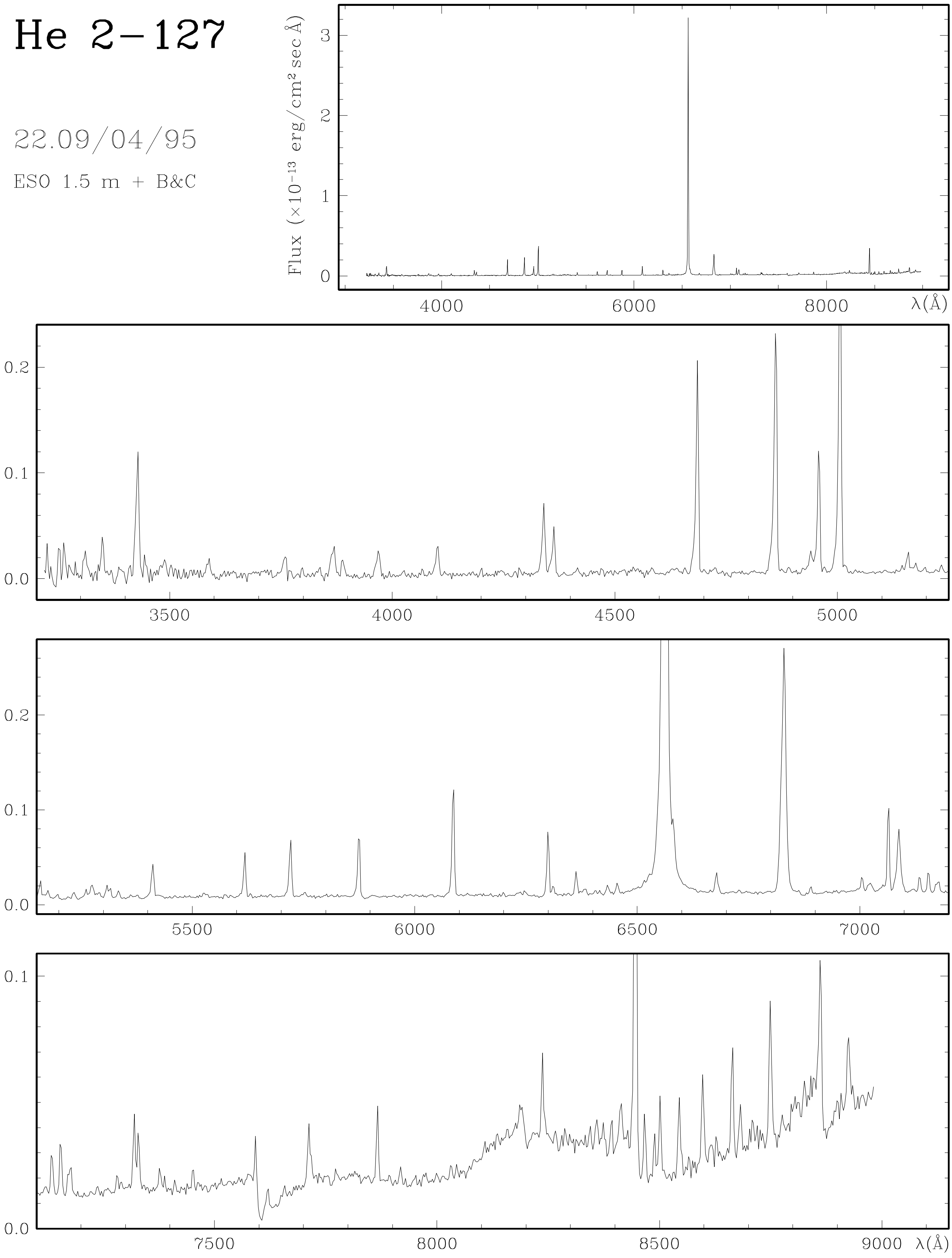


Fig. 34. ESO 1.5m + B&C spectrum of Hen 2-127

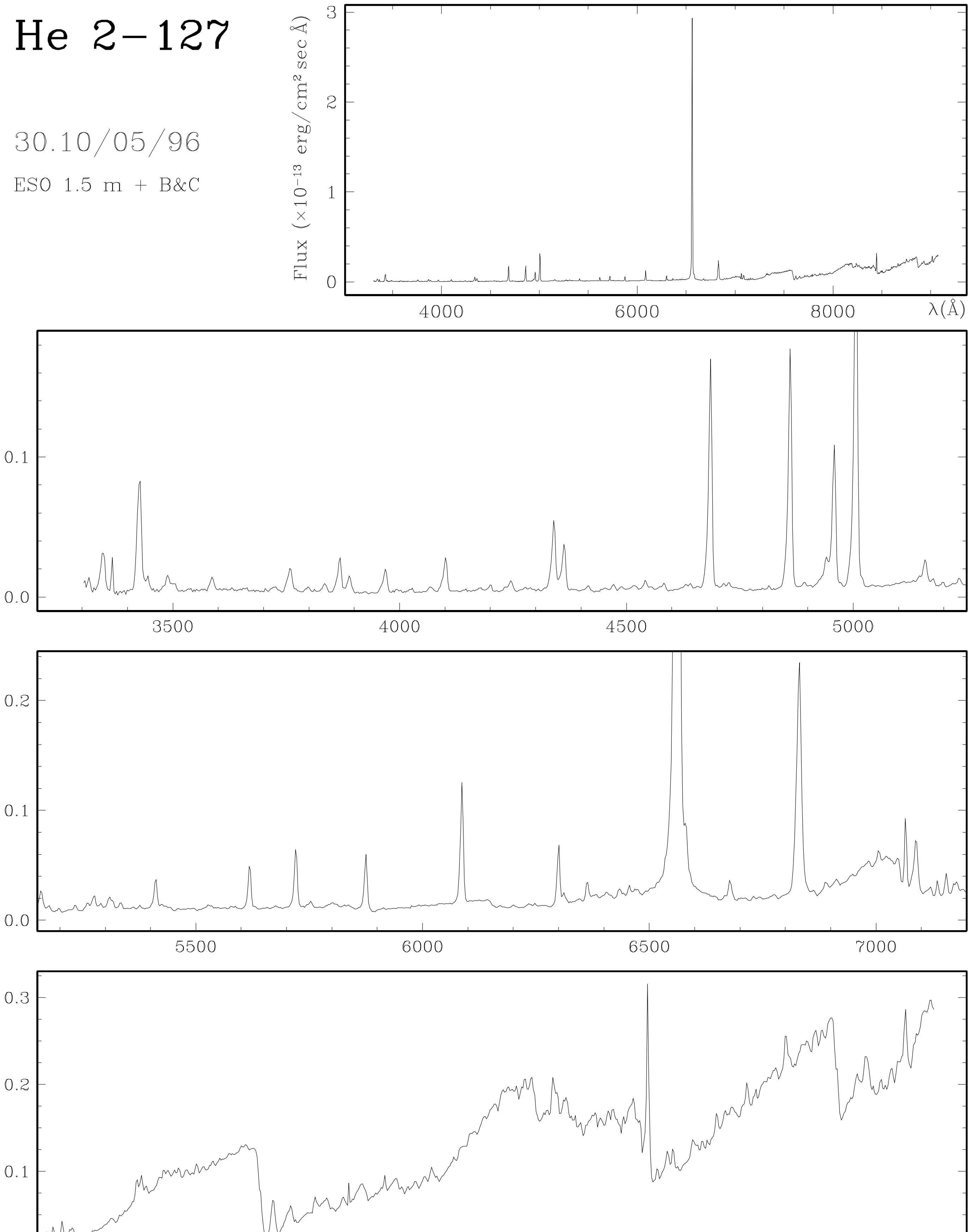


Fig. 35. ESO 1.5m + B&C spectrum of Hen 2-127

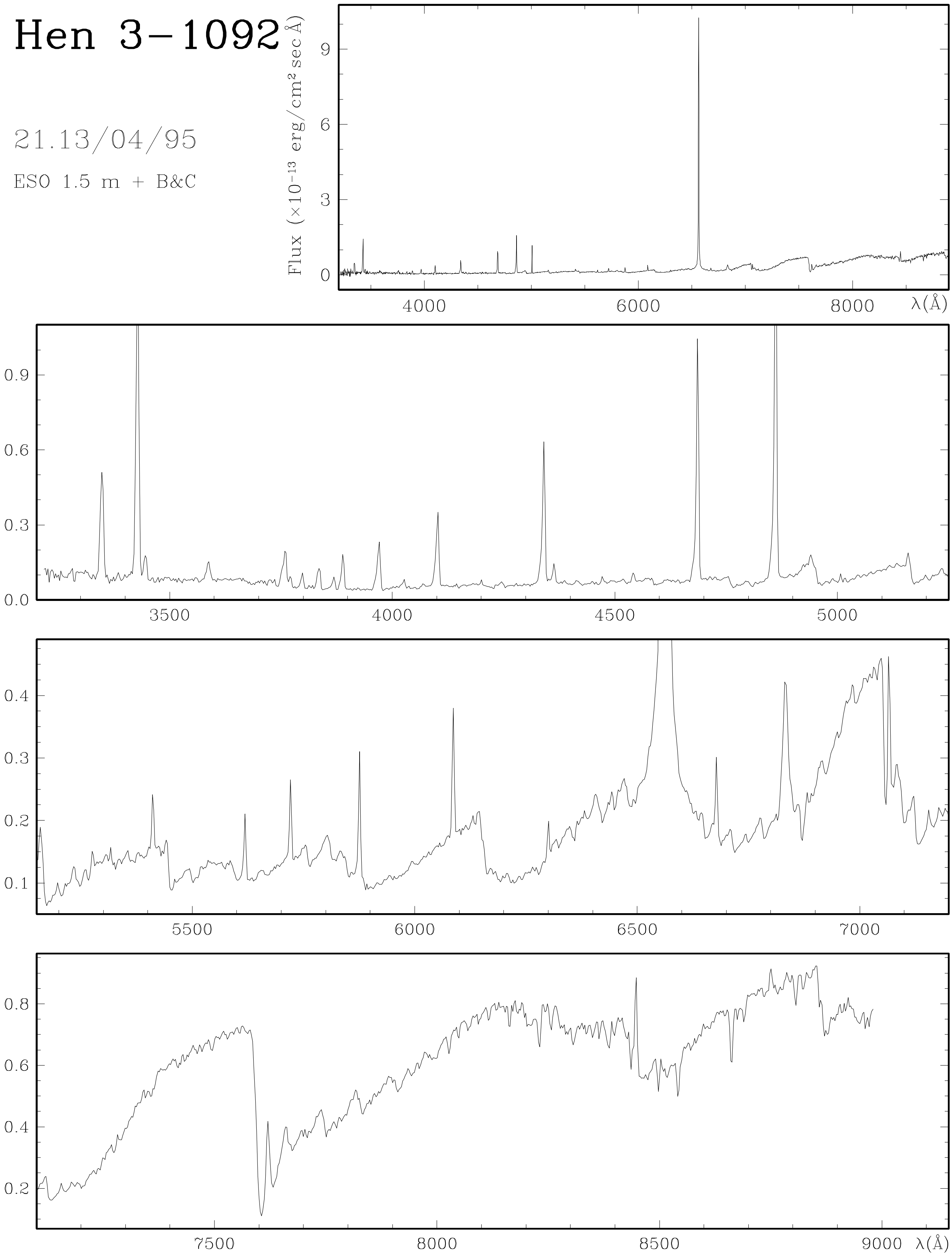


Fig. 36. ESO 1.5m + B&C spectrum of Hen 3-1092

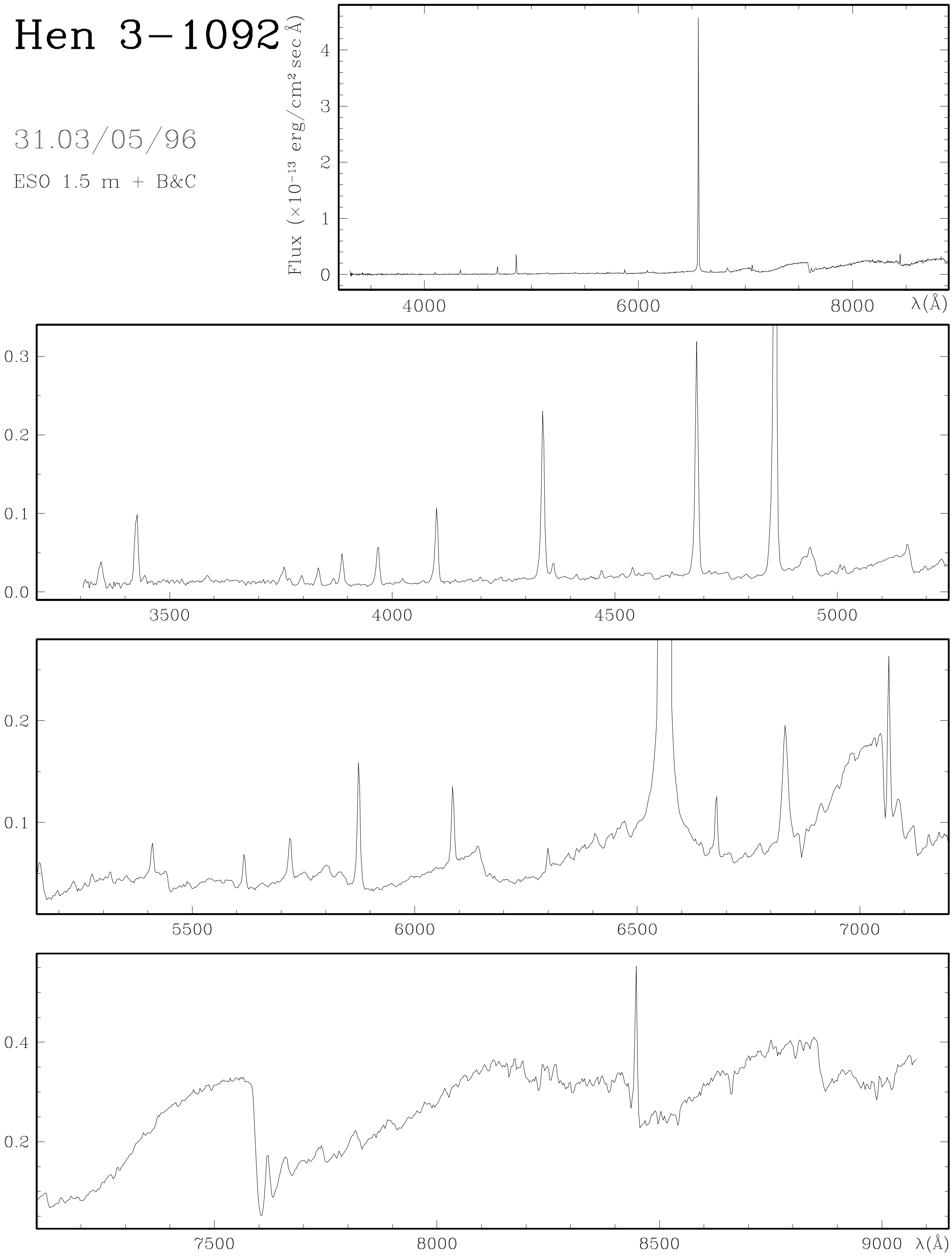


Fig. 37. ESO 1.5m + B&C spectrum of Hen 3-1092

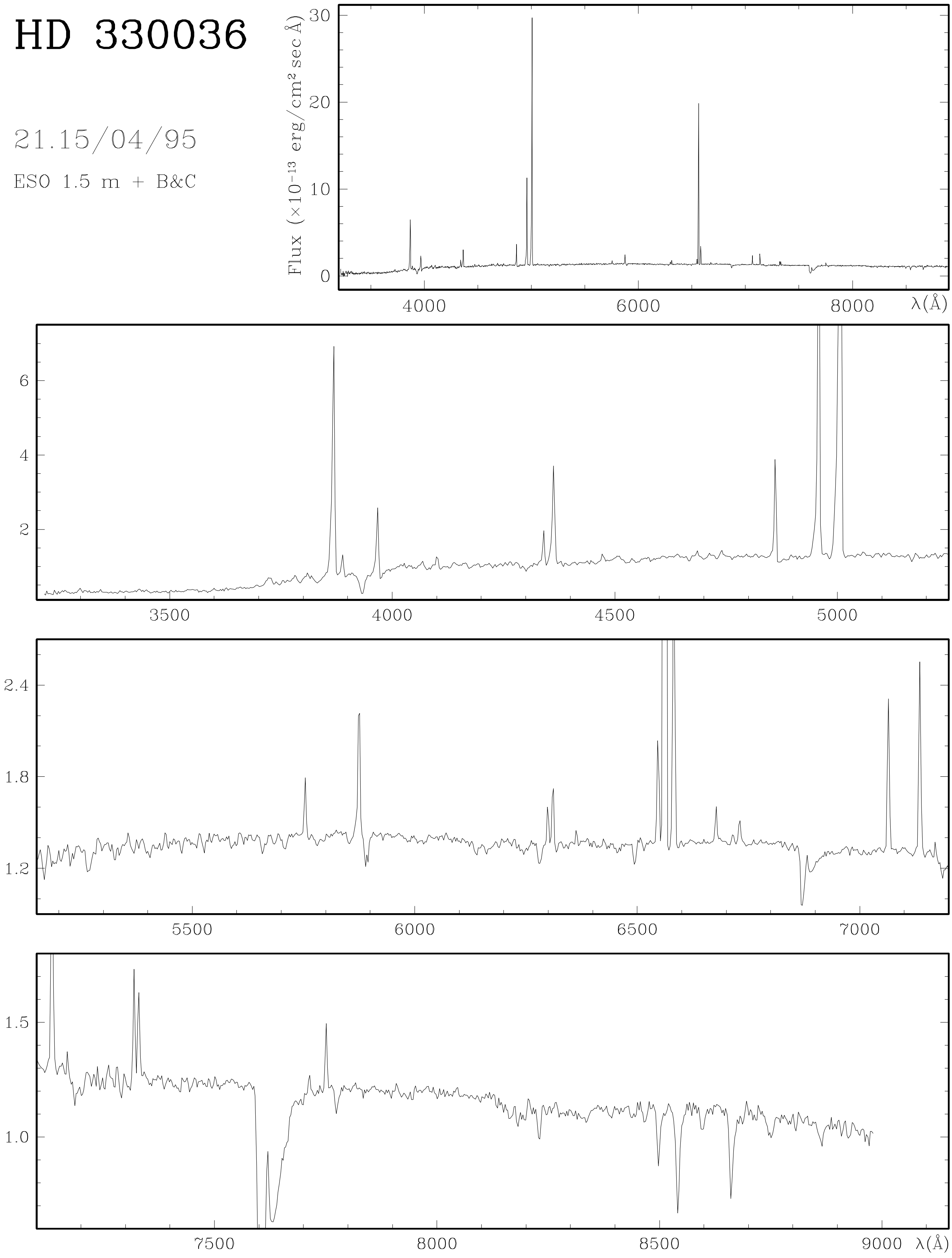


Fig. 38. ESO 1.5m + B&C spectrum of HD 330036

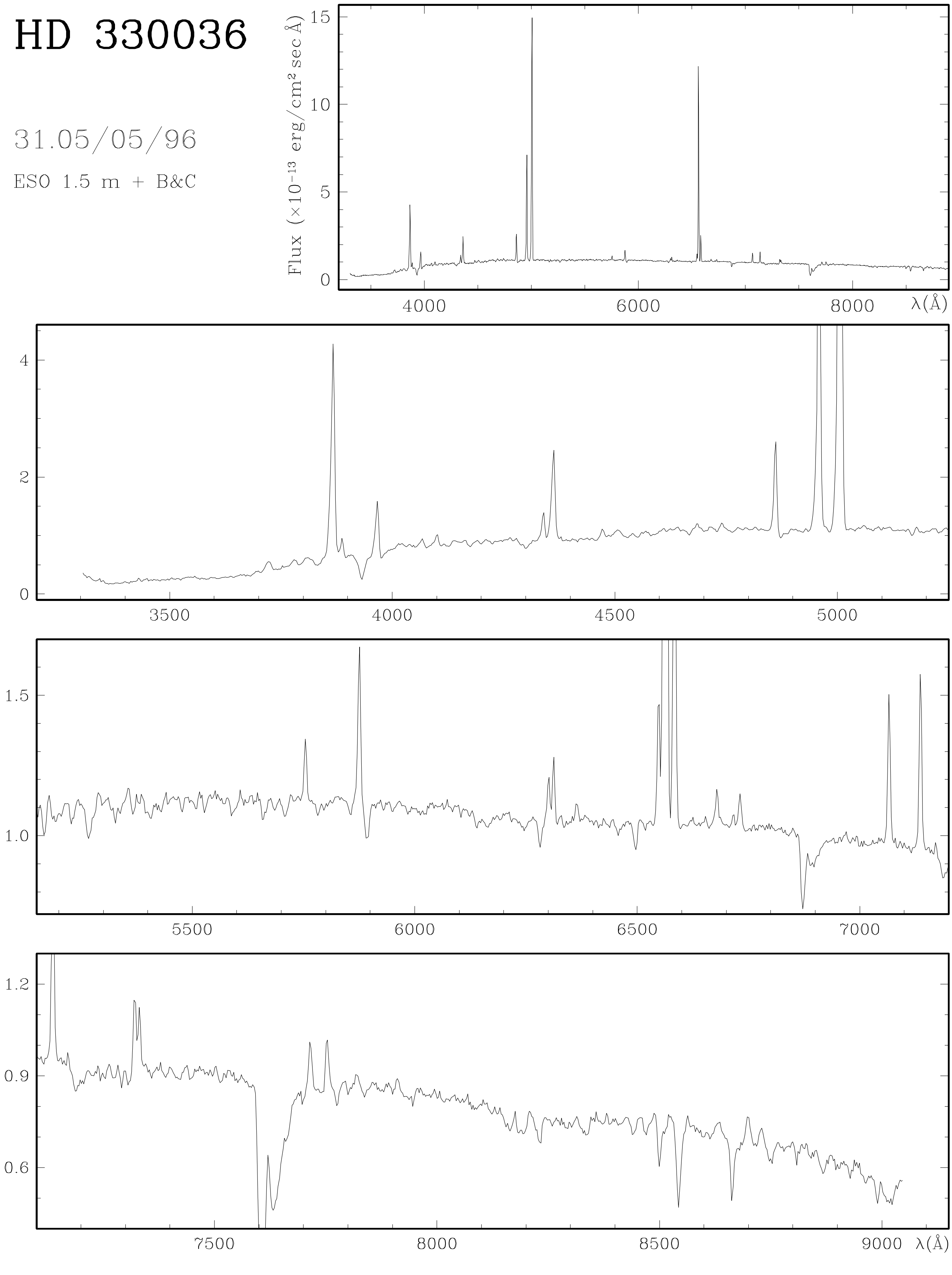


Fig. 39. ESO 1.5m + B&C spectrum of HD 330036

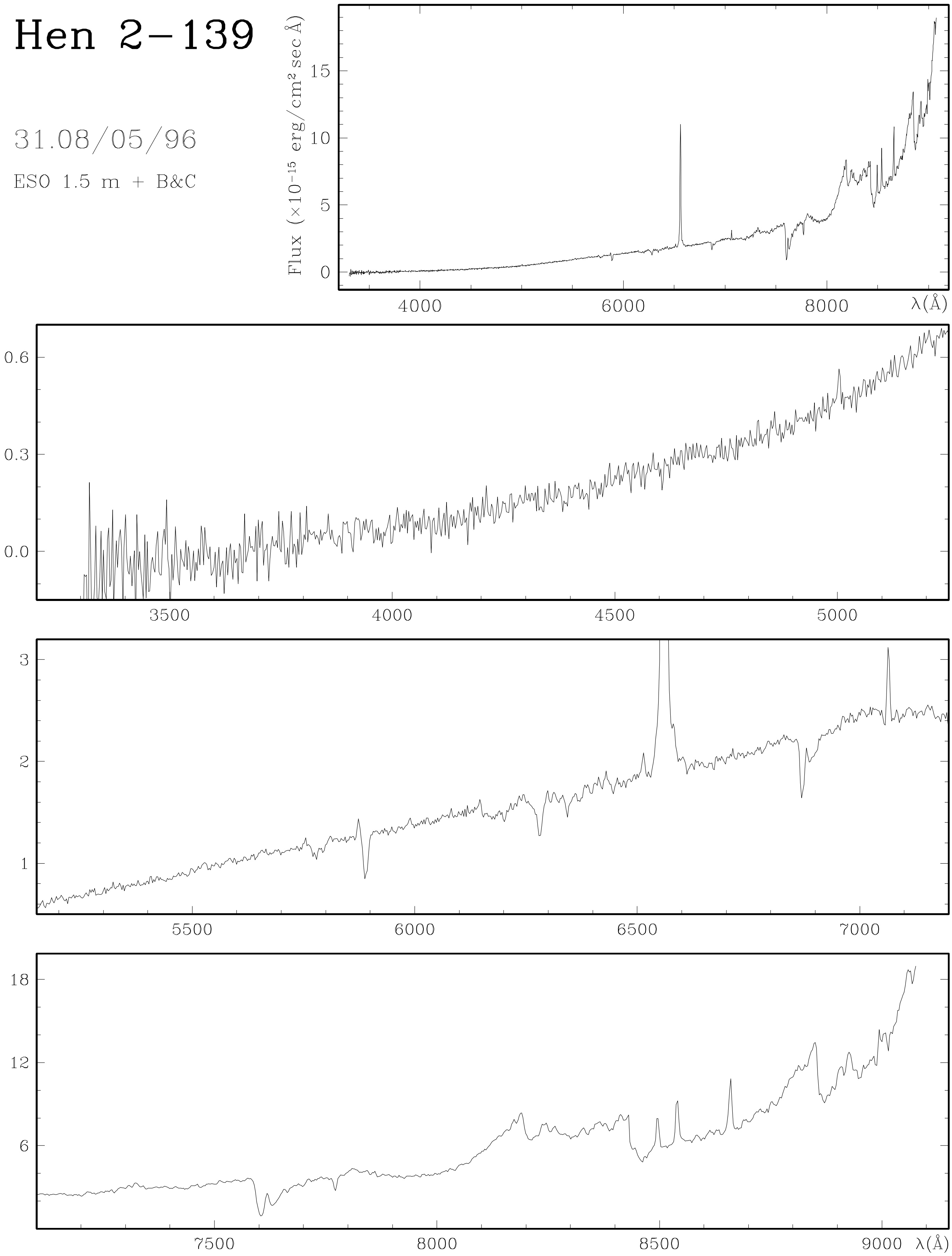


Fig. 40. ESO 1.5m + B&C spectrum of Hen 2-139

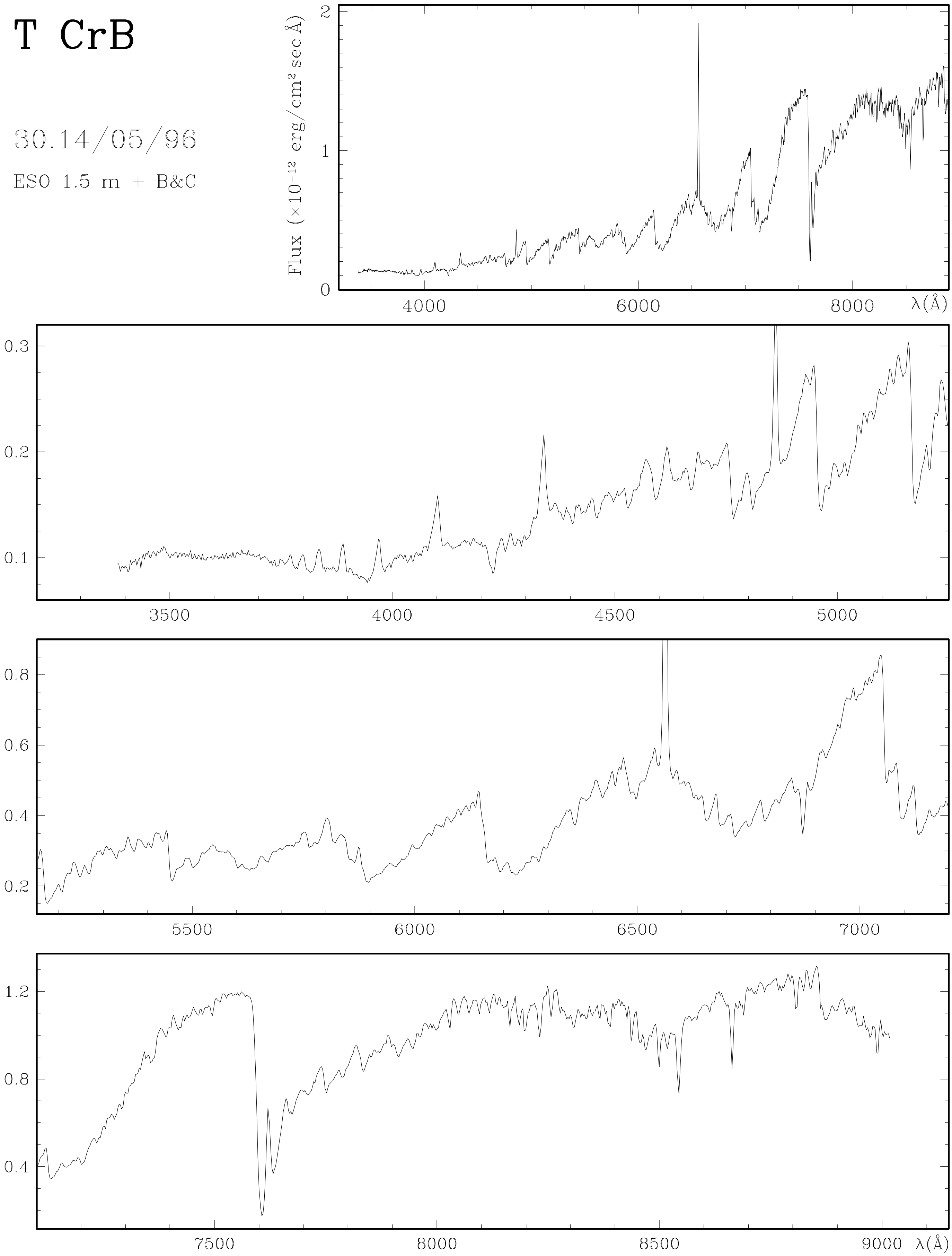


Fig. 41. ESO 1.5m + B&C spectrum of T CrB

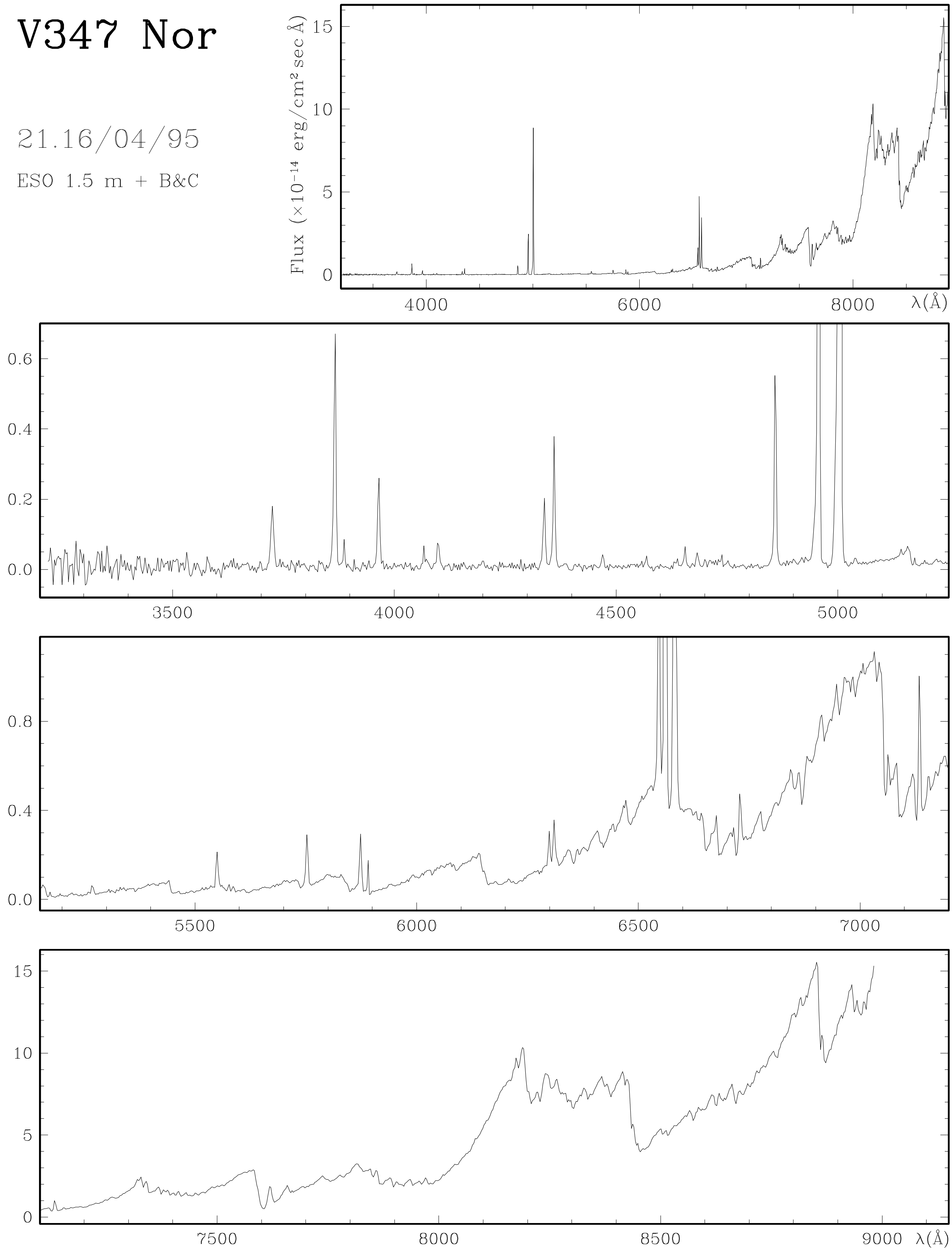


Fig. 42. ESO 1.5m + B&C spectrum of V347 Nor

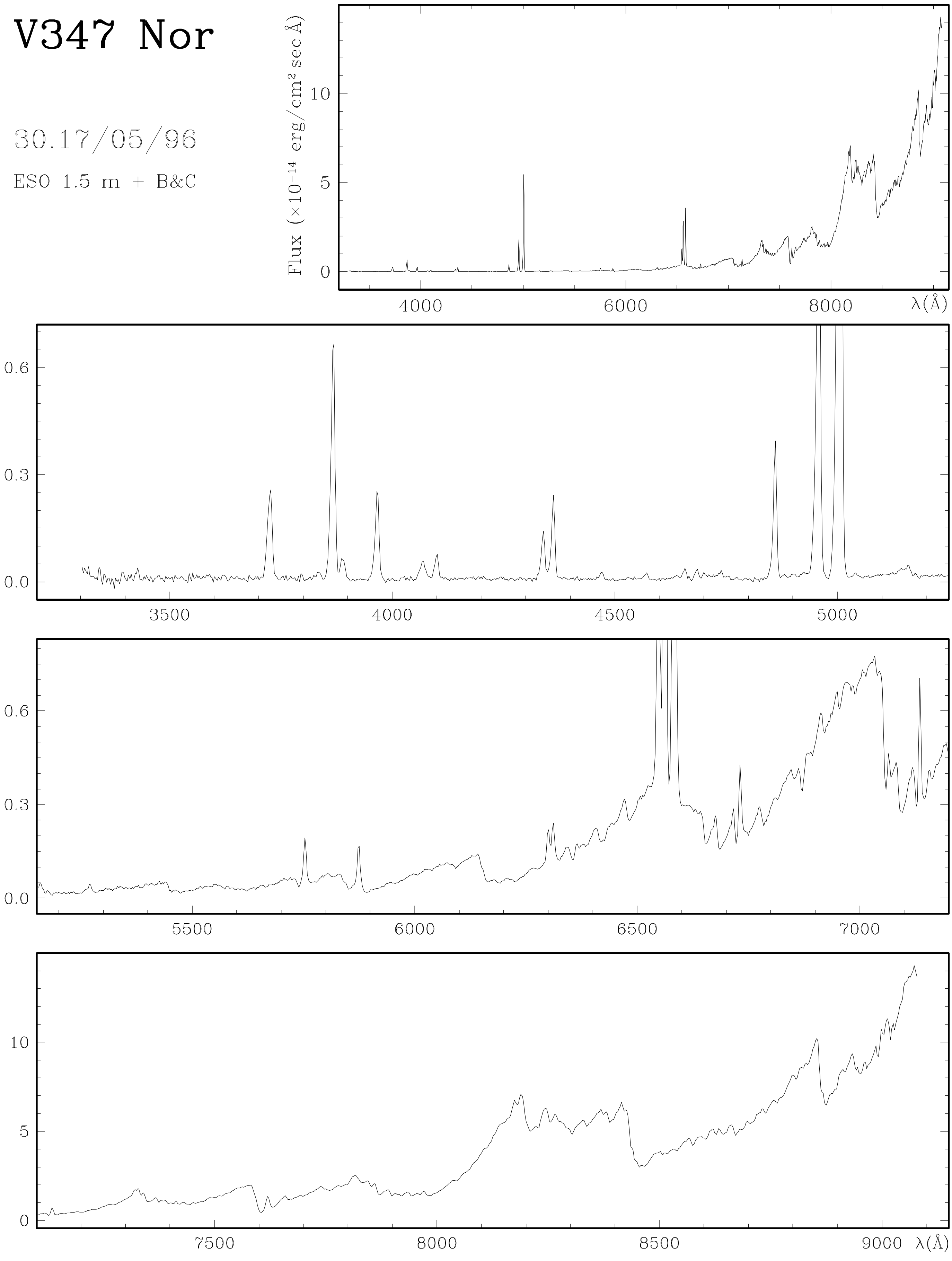


Fig. 43. ESO 1.5m + B&C spectrum of V347 Nor

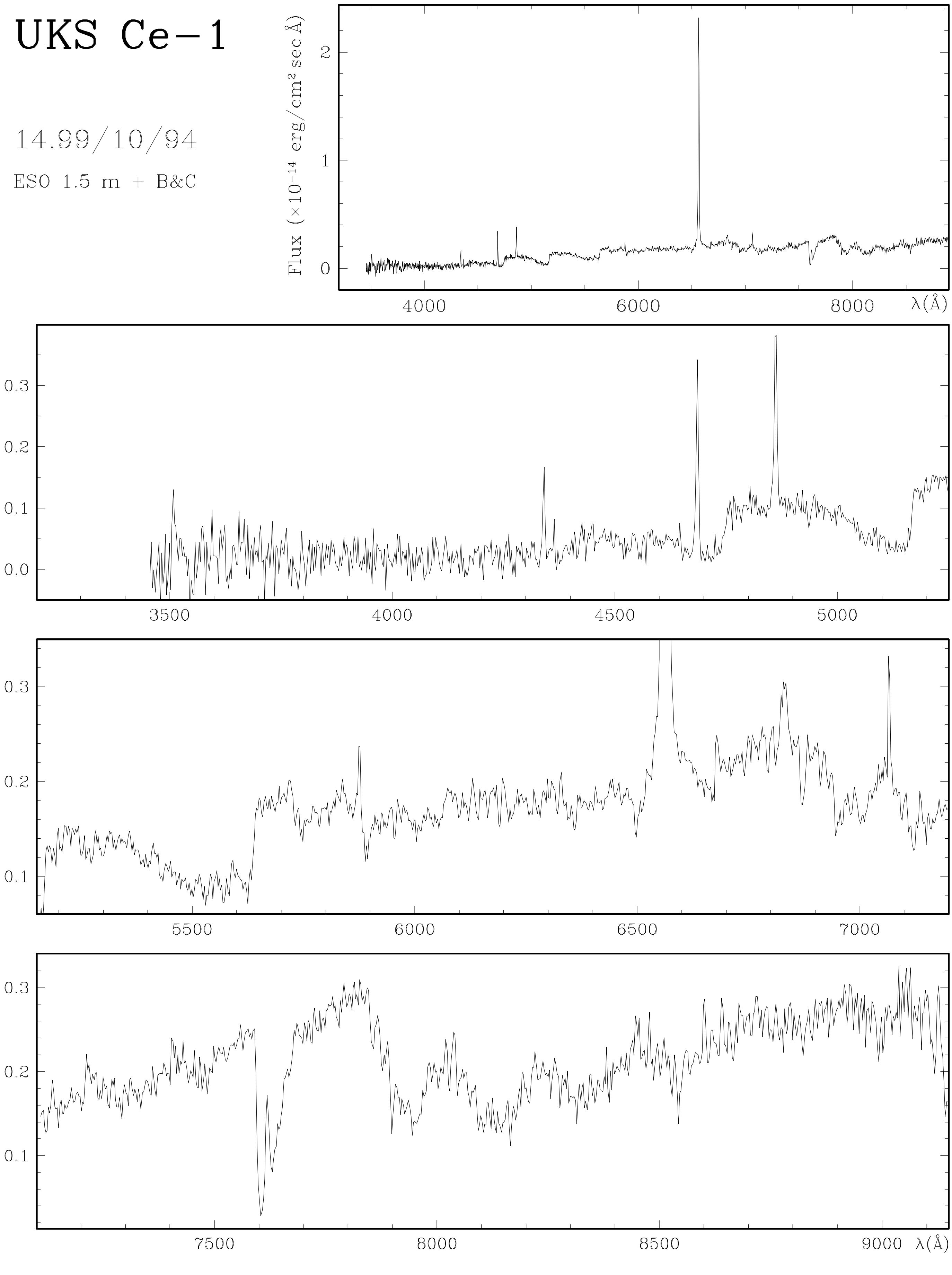


Fig. 44. ESO 1.5m + B&C spectrum of UKS Ce-1

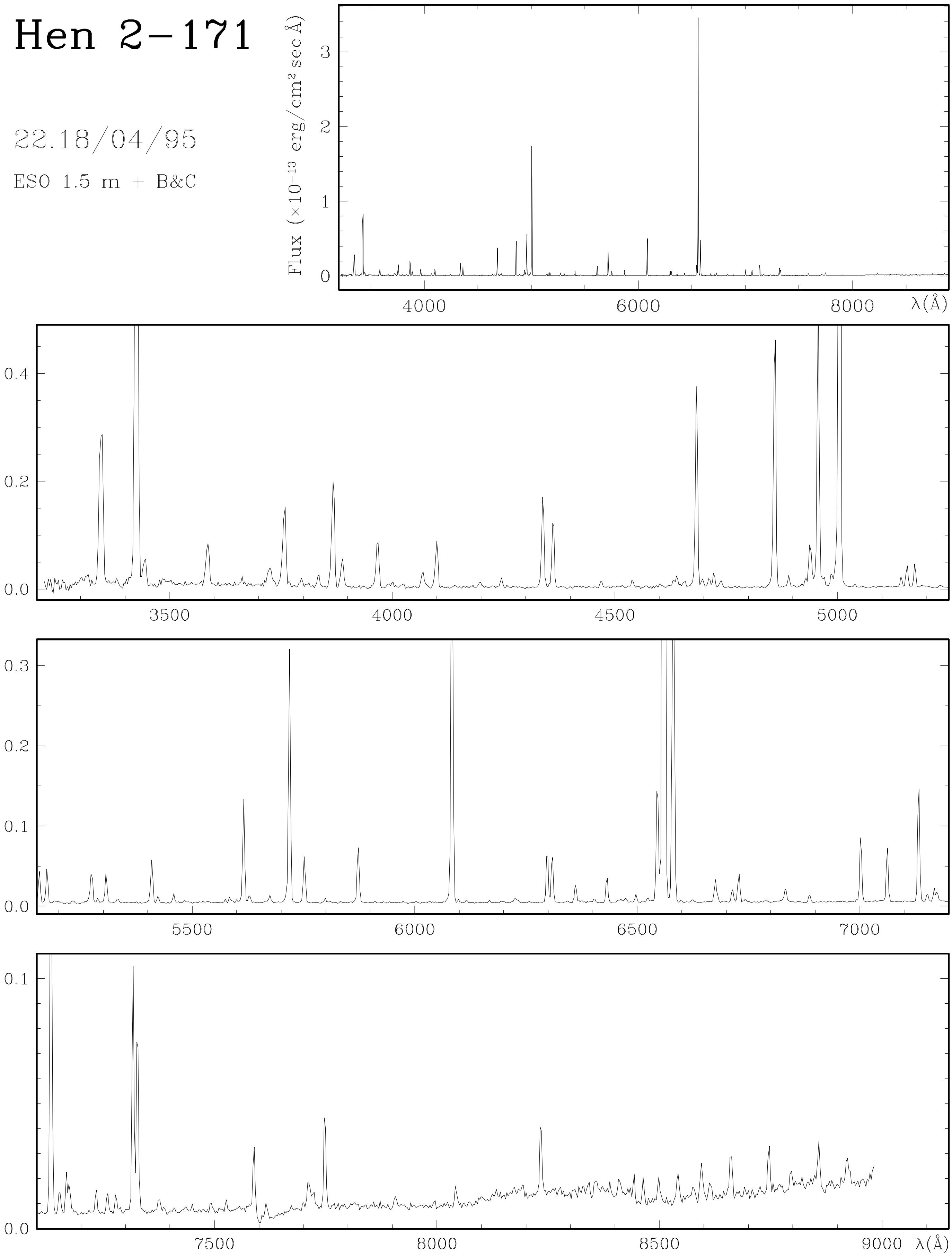


Fig. 45. ESO 1.5m + B&C spectrum of Hen 2-171

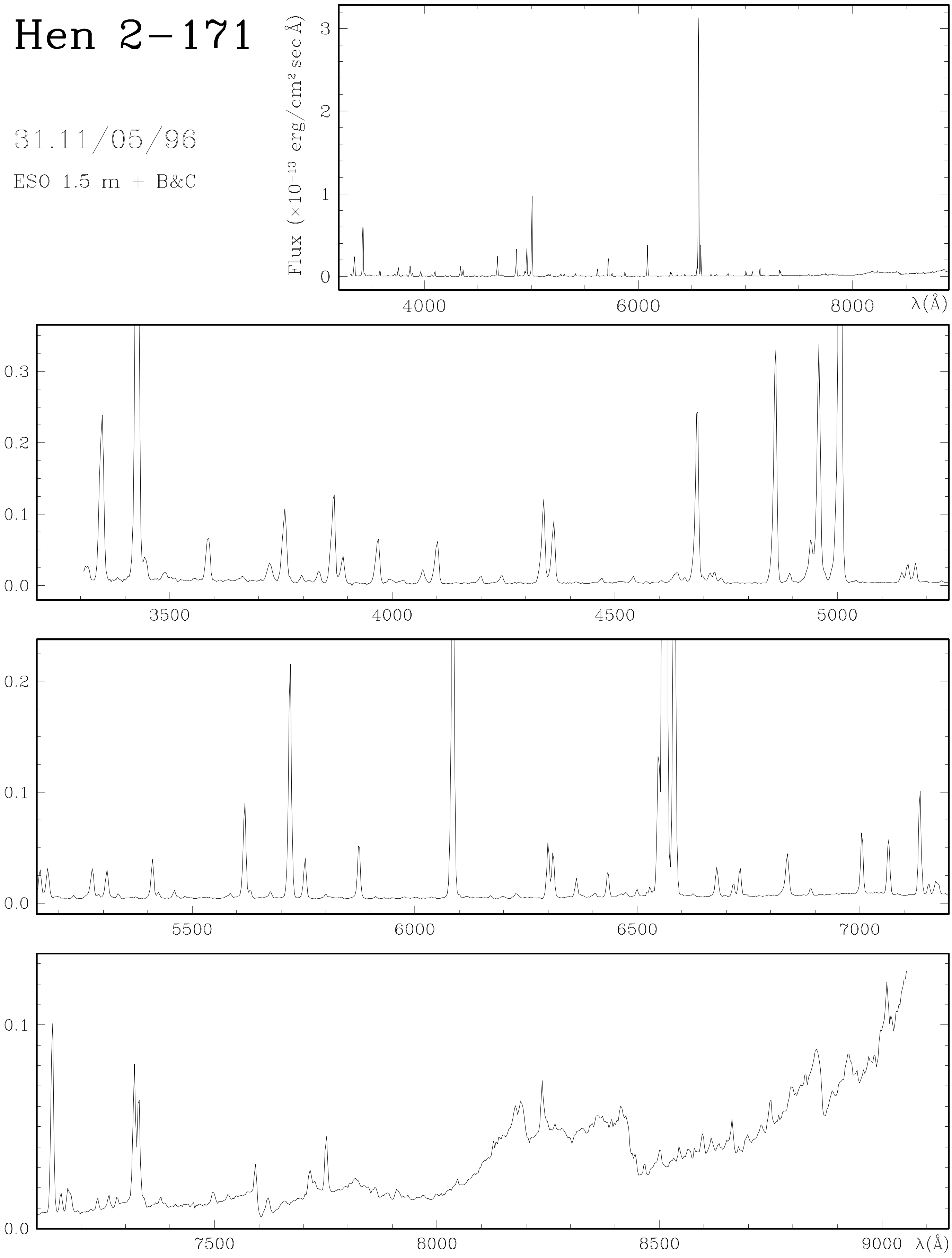


Fig. 46. ESO 1.5m + B&C spectrum of Hen 2-171

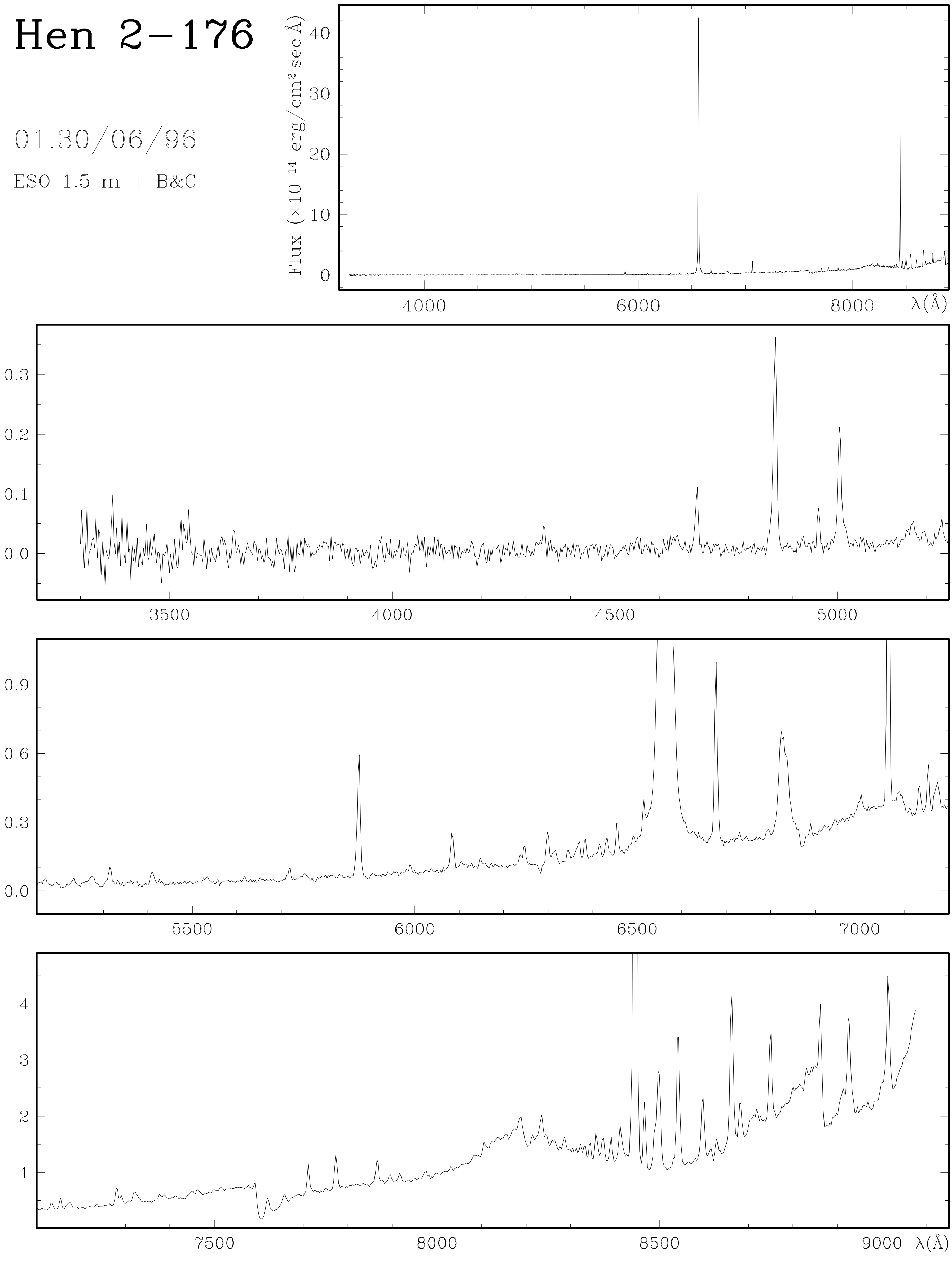


Fig. 47. ESO 1.5m + B&C spectrum of Hen 2-176

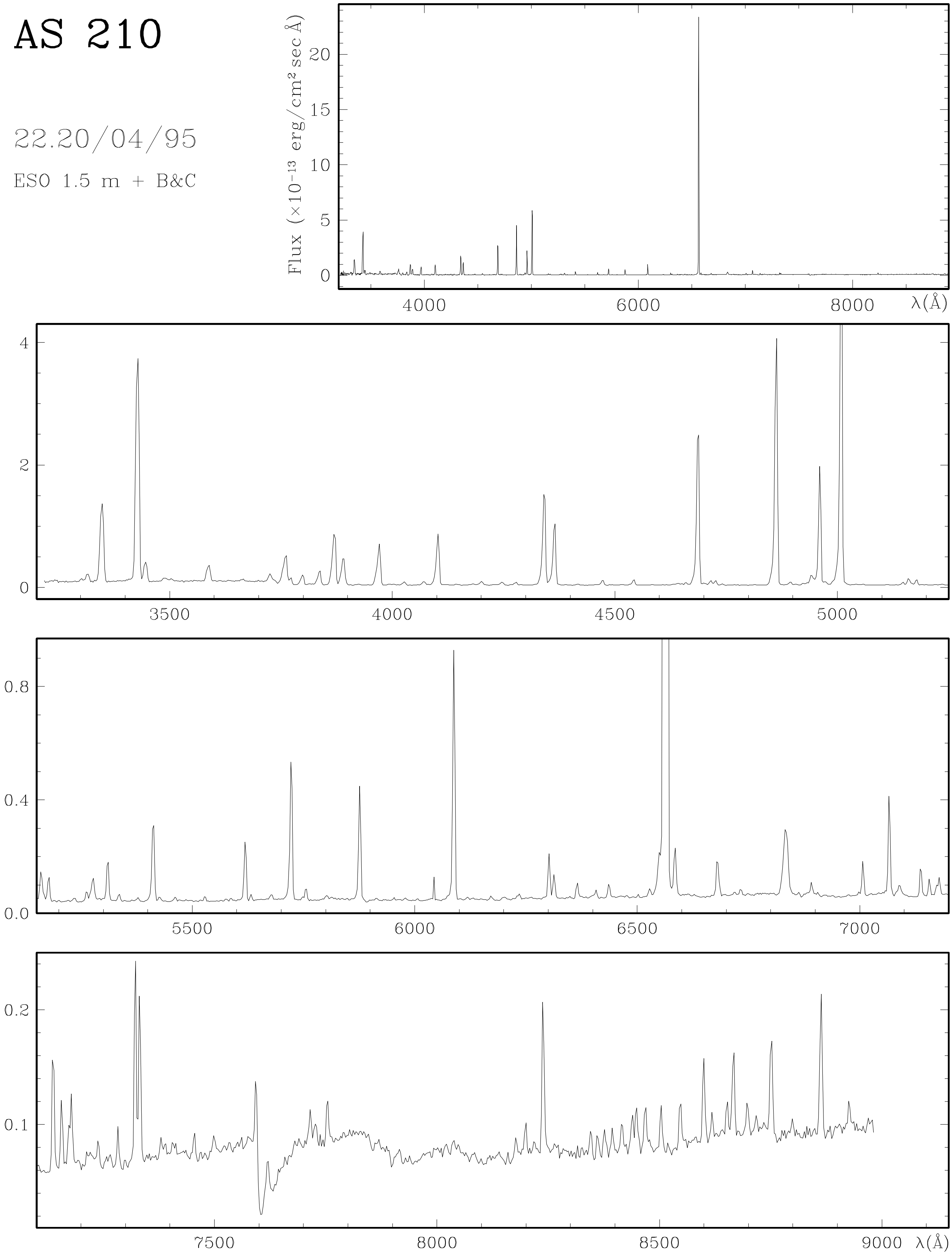


Fig. 48. ESO 1.5m + B&C spectrum of AS 210

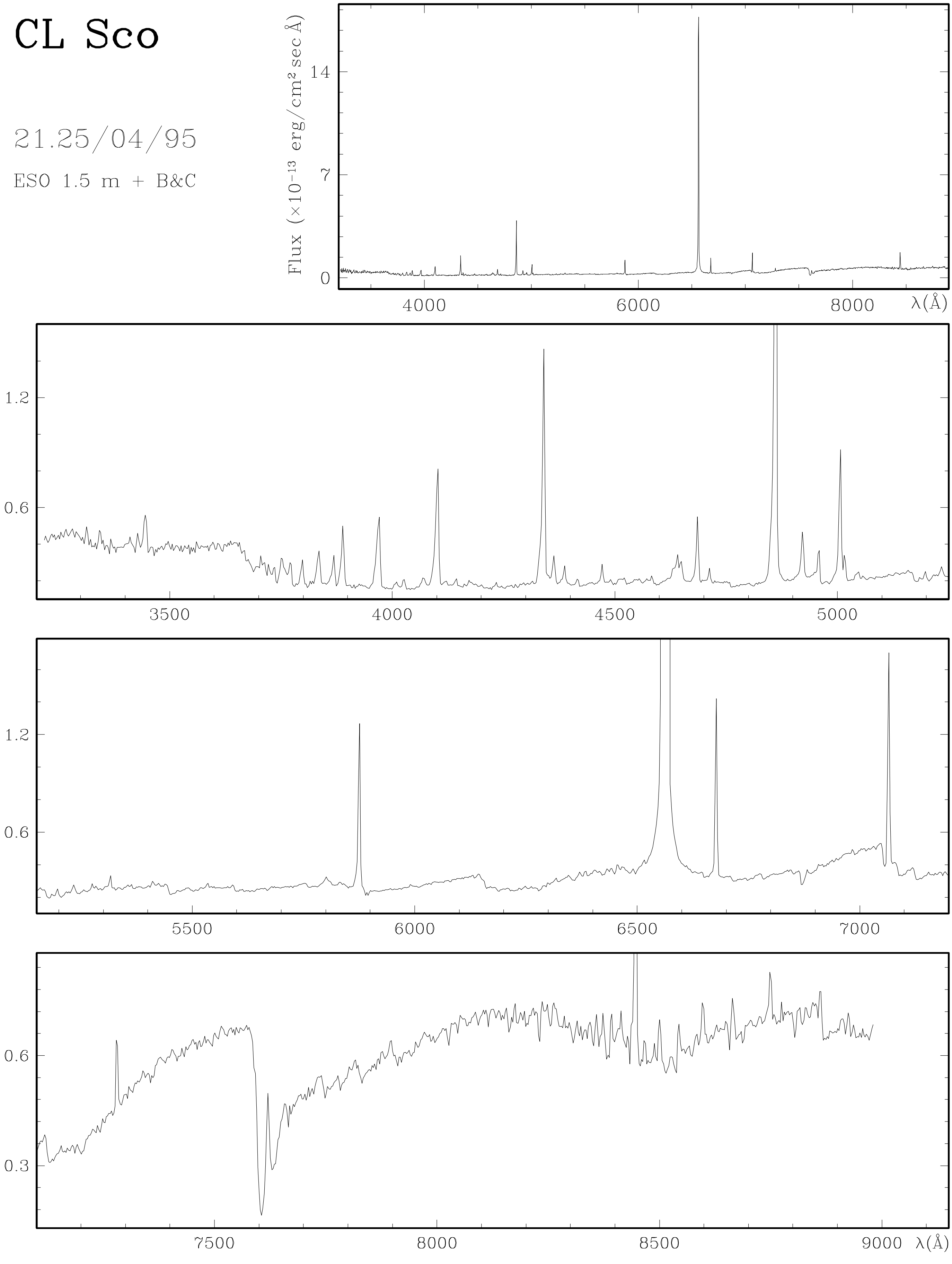


Fig. 49. ESO 1.5m + B&C spectrum of CL Sco

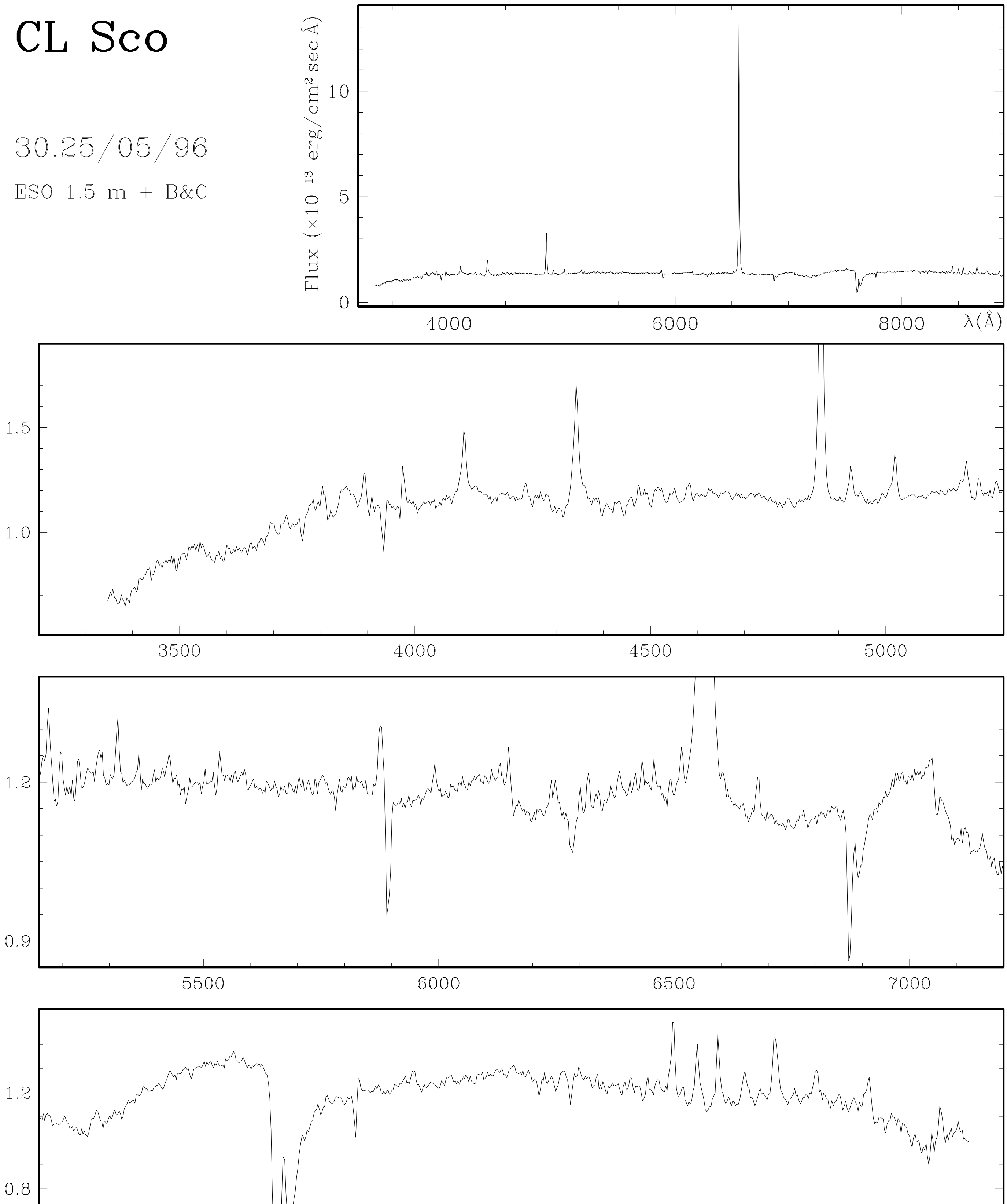


Fig. 50. ESO 1.5m + B&C spectrum of CL Sco

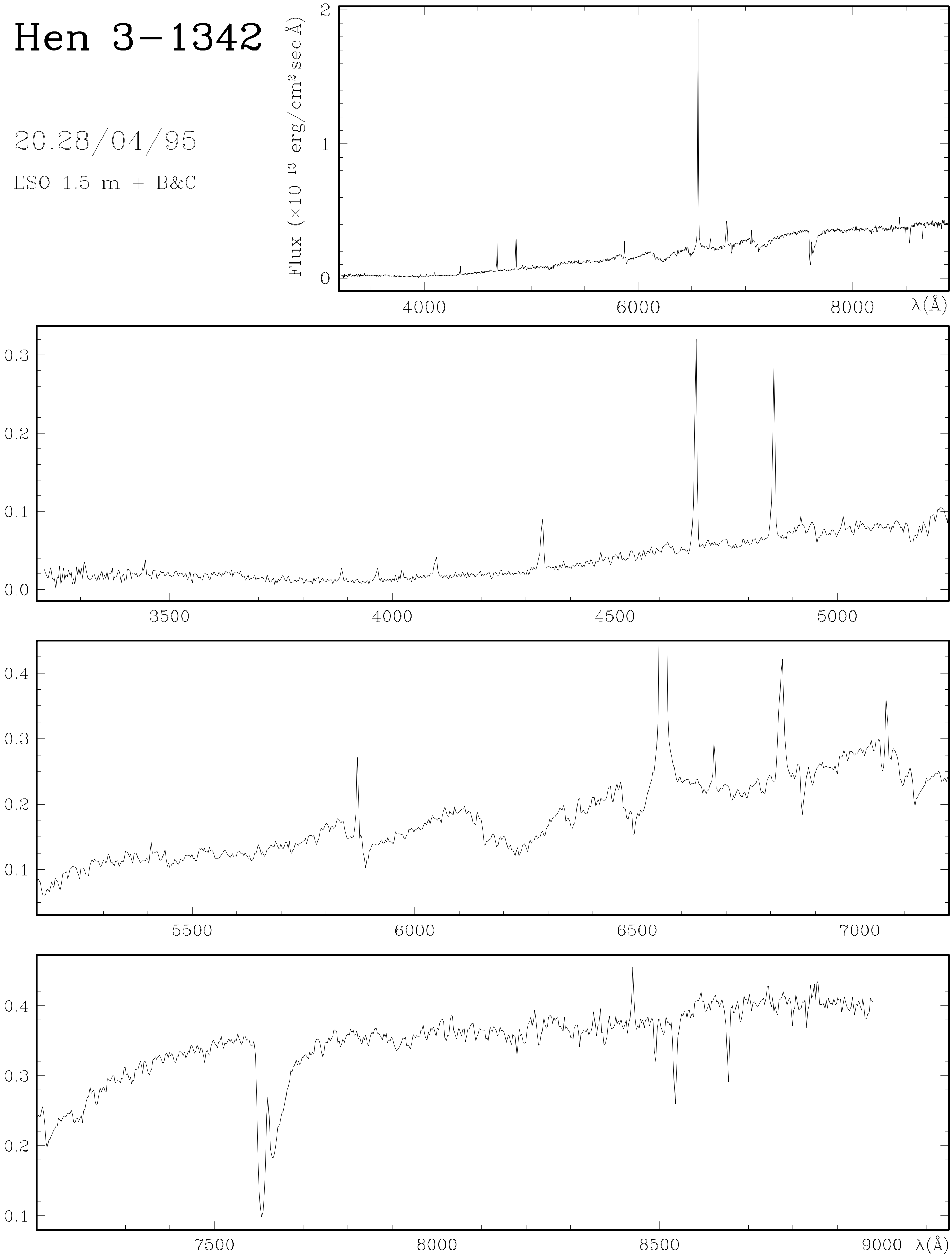


Fig. 51. ESO 1.5m + B&C spectrum of Hen 3-1342

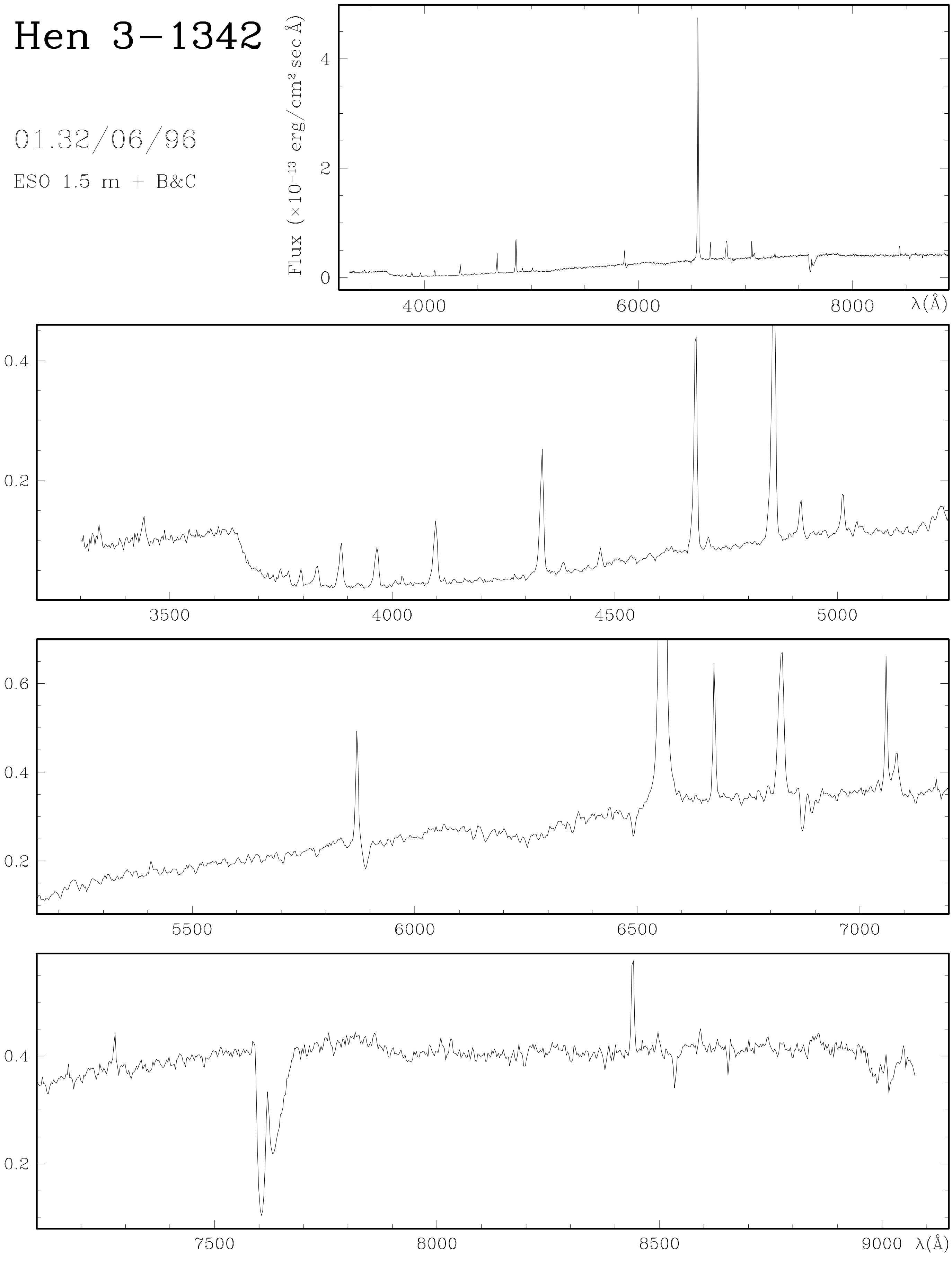


Fig. 52. ESO 1.5m + B&C spectrum of Hen 3-1342

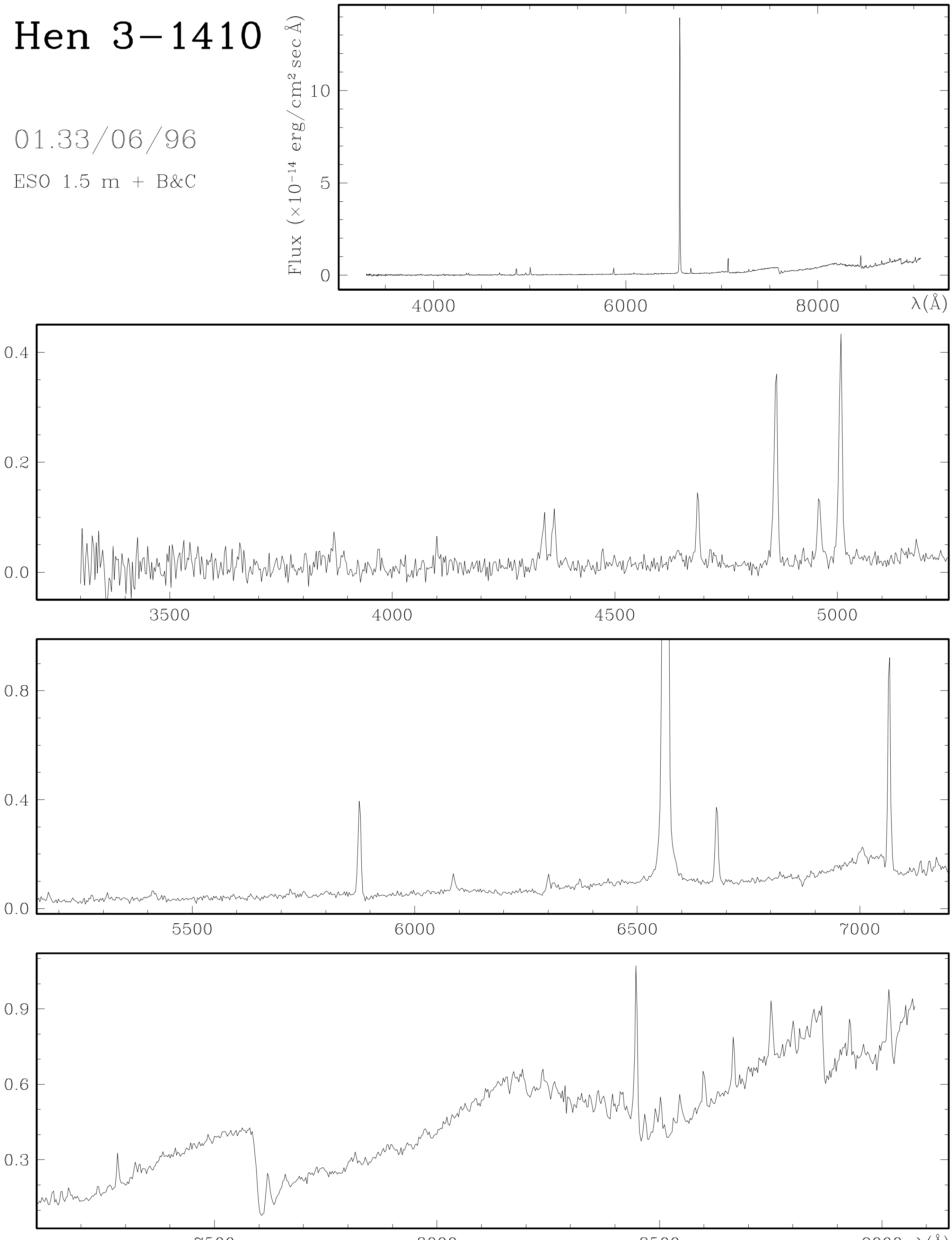


Fig. 53. ESO 1.5m + B&C spectrum of Hen 3-1410

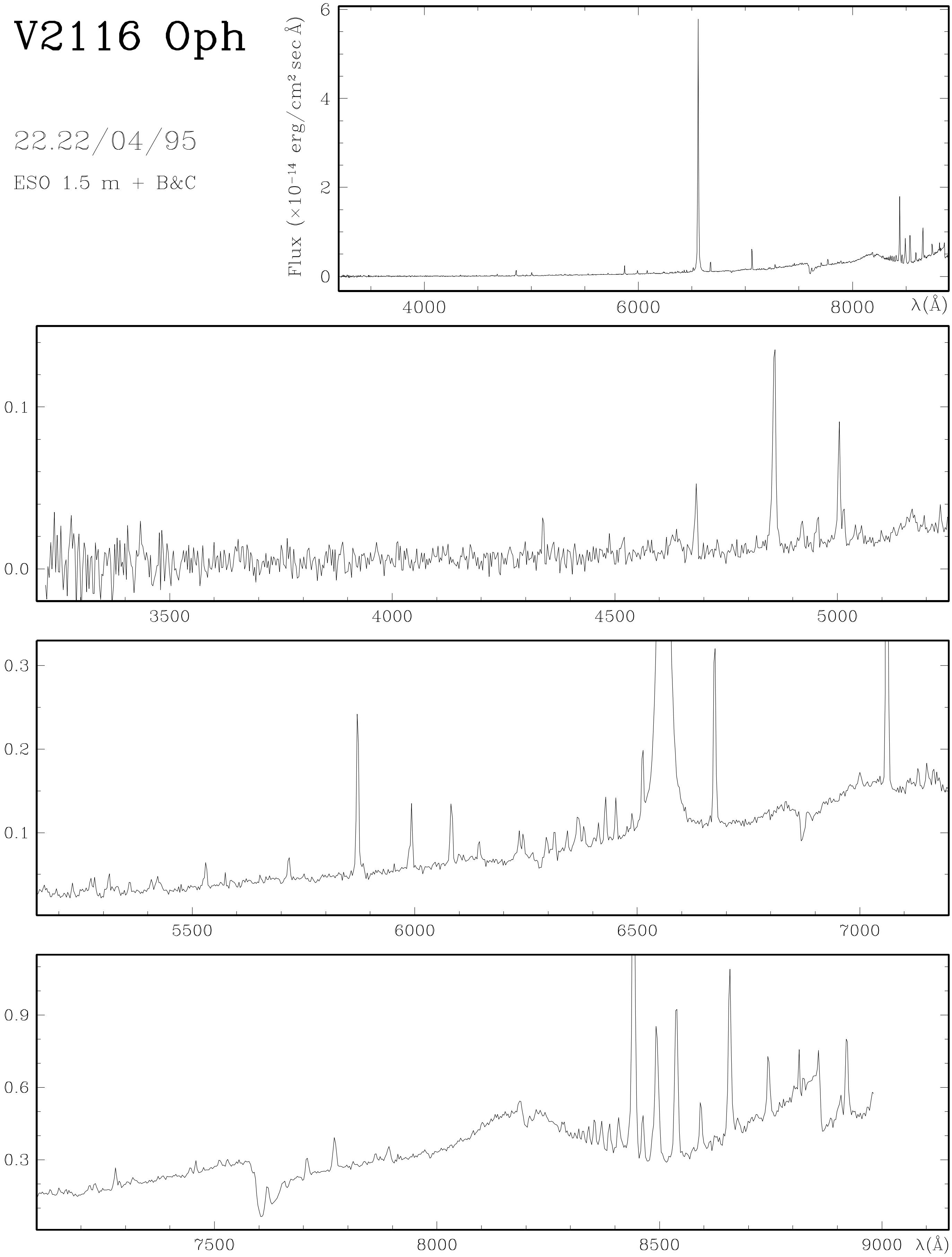


Fig. 54. ESO 1.5m + B&C spectrum of V2116 Oph

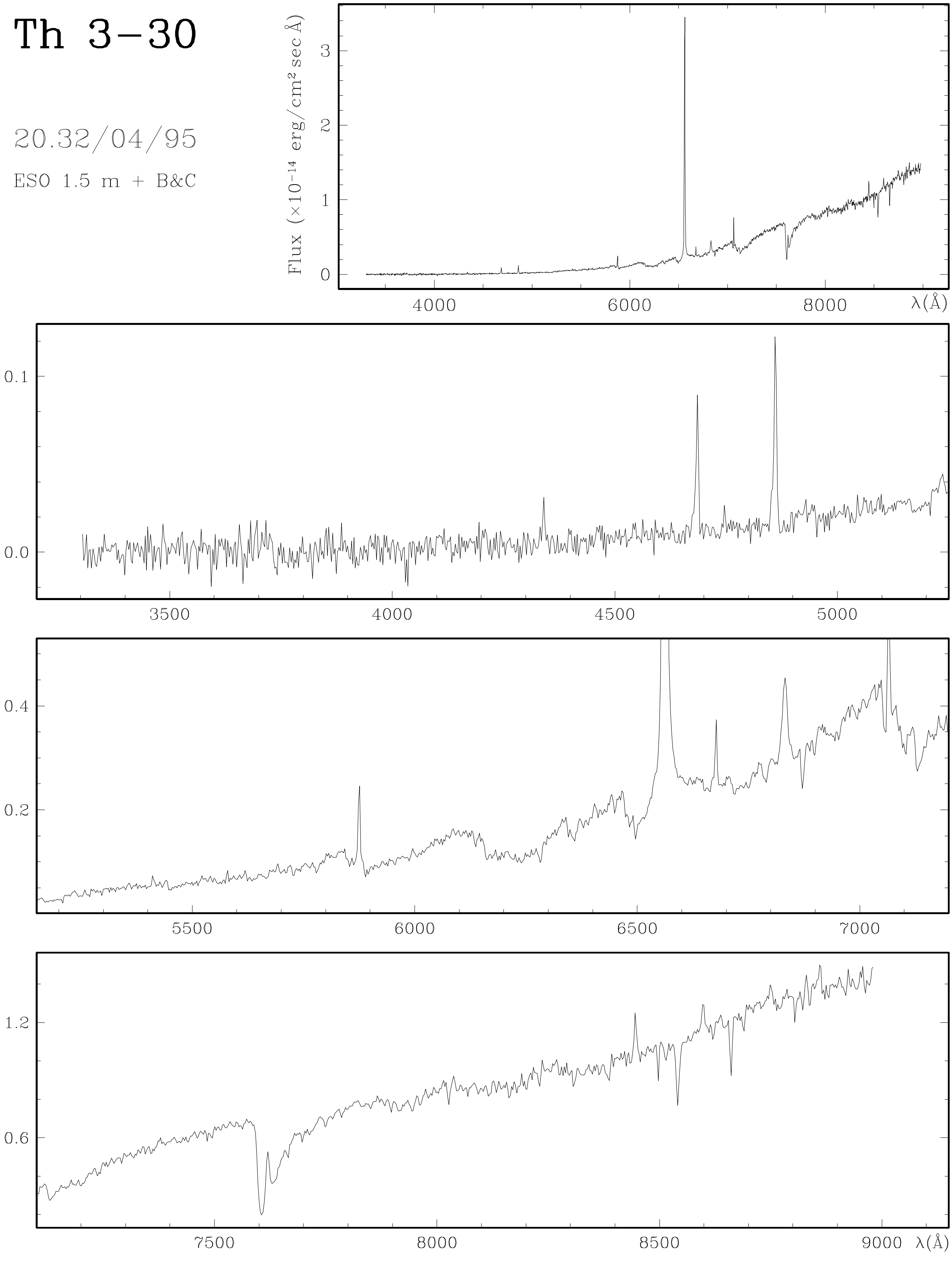


Fig. 55. ESO 1.5m + B&C spectrum of Th 3-30

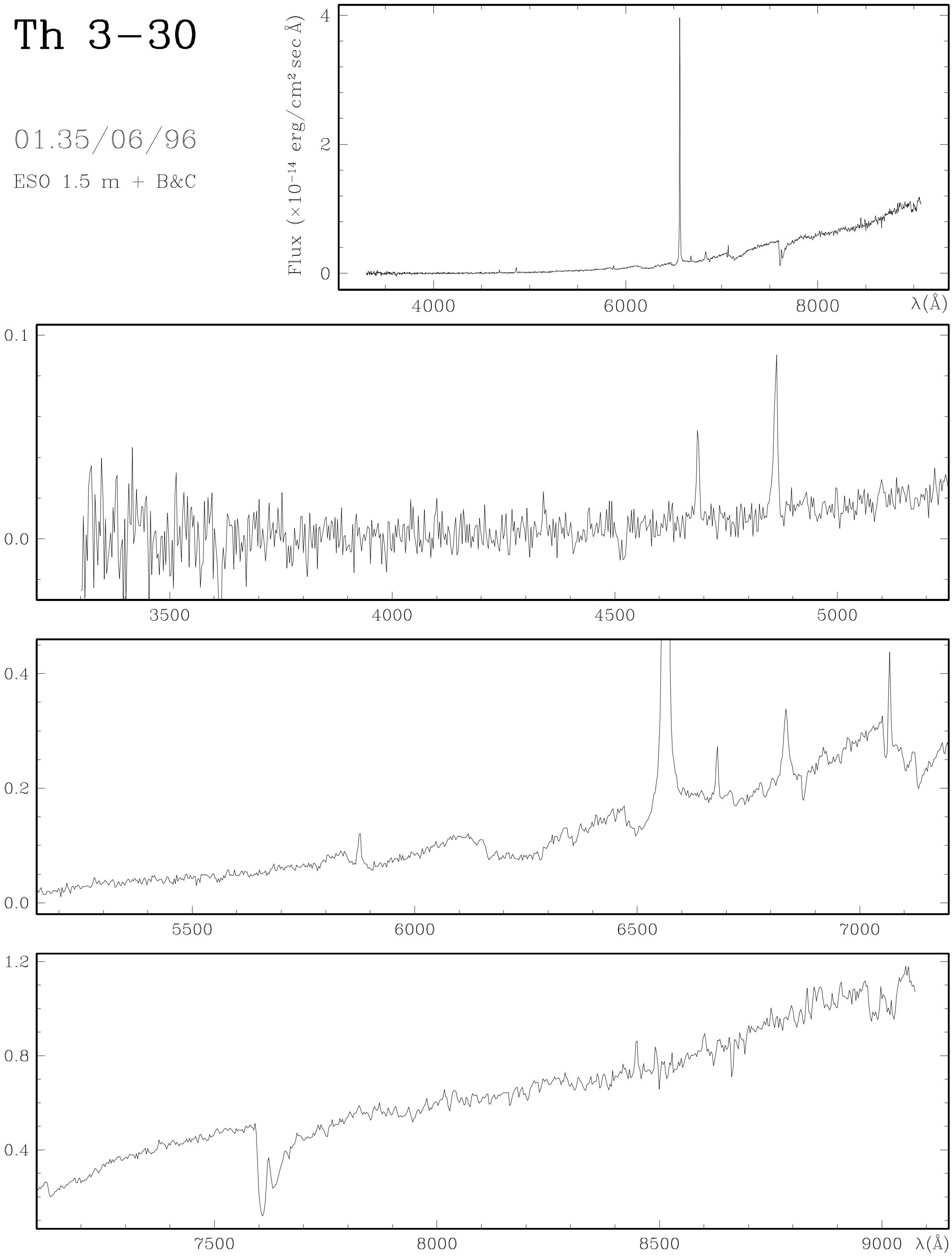


Fig. 56. ESO 1.5m + B&C spectrum of Th 3-30

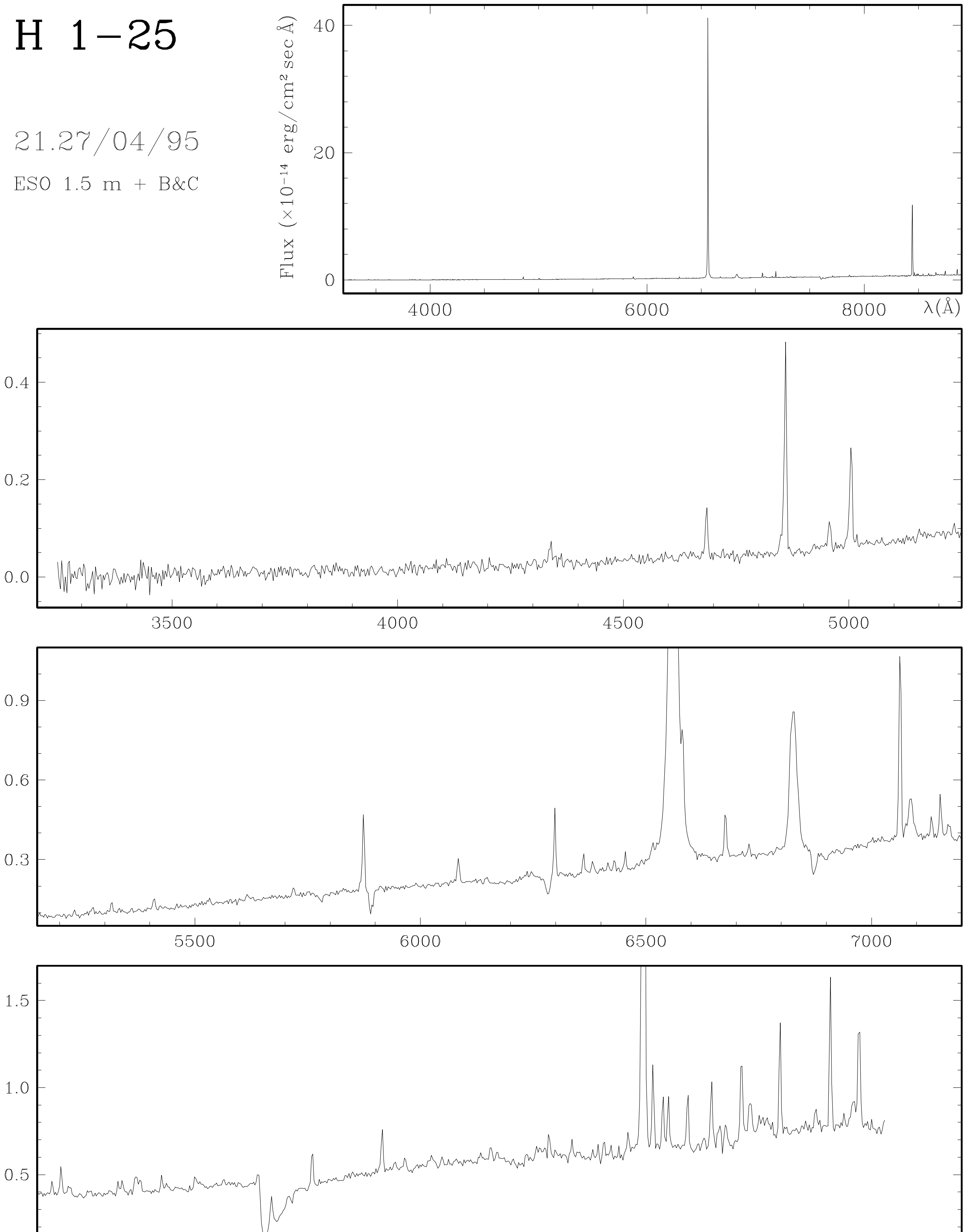


Fig. 57. ESO 1.5m + B&C spectrum of H 1-25

RT Ser

30.18/05/96

ESO 1.5 m + B&C

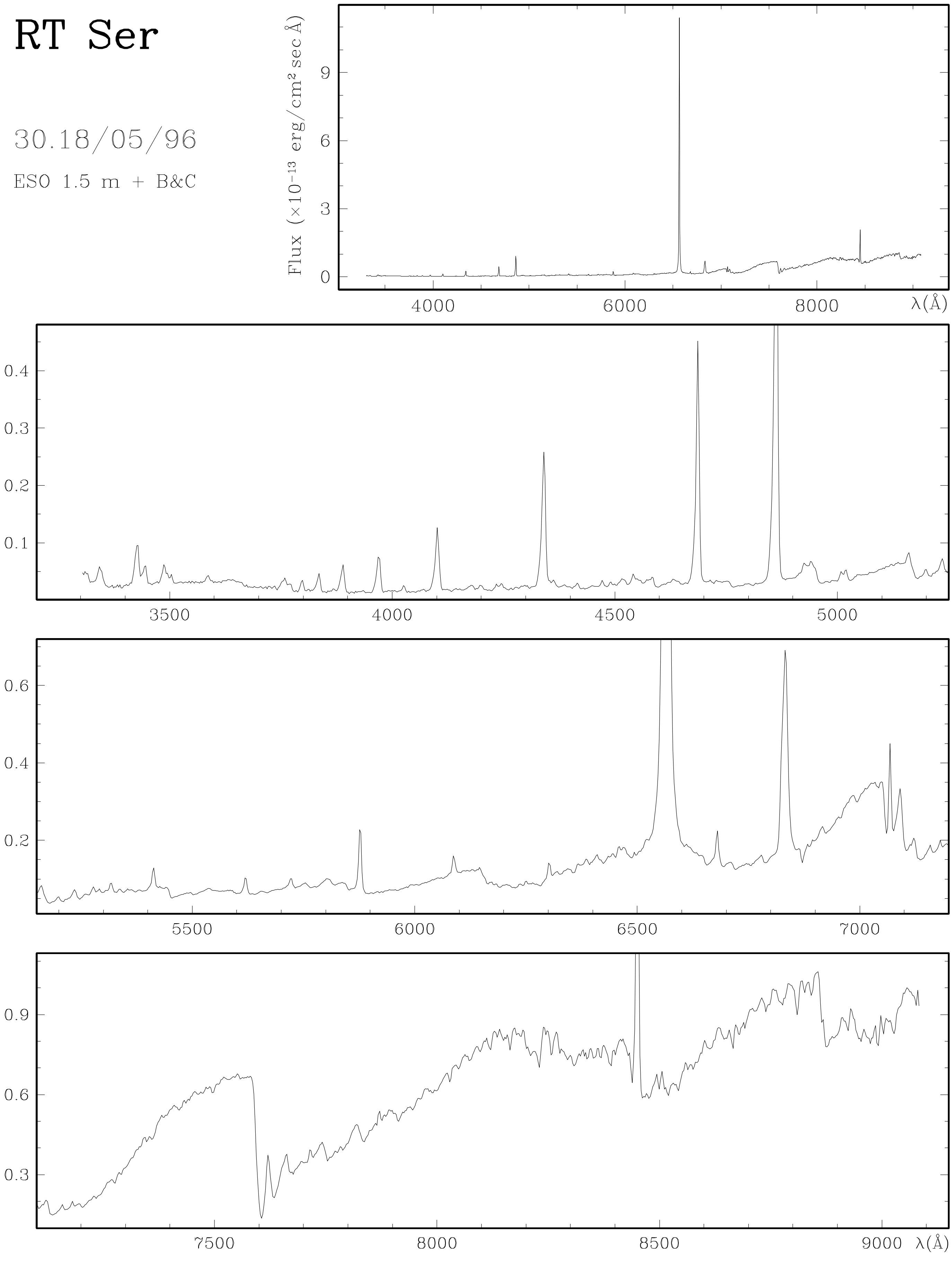


Fig. 58. ESO 1.5m + B&C spectrum of RT Ser

V2110 Oph

31.18/05/96

ESO 1.5 m + B&C

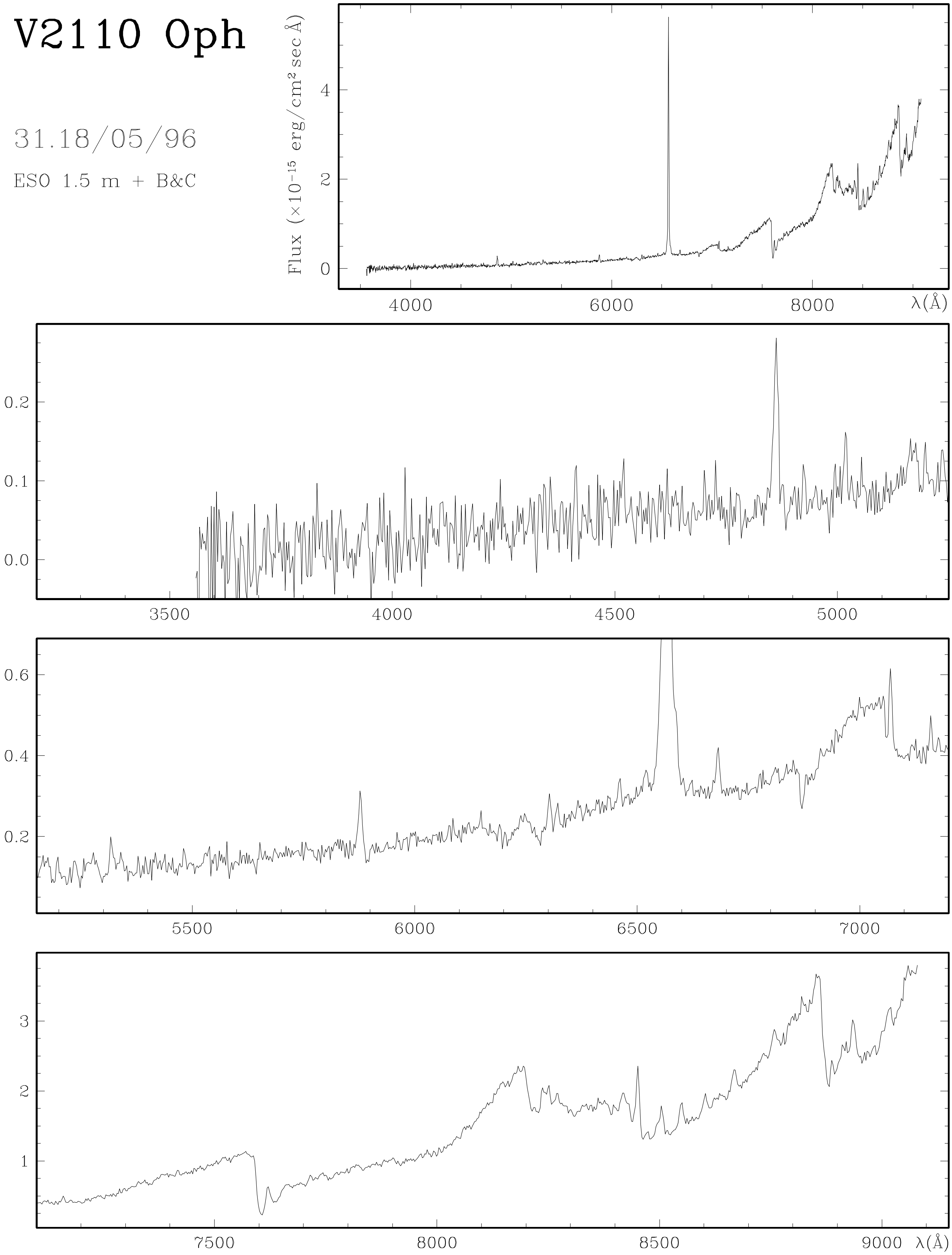


Fig. 59. ESO 1.5m + B&C spectrum of V2110 Oph

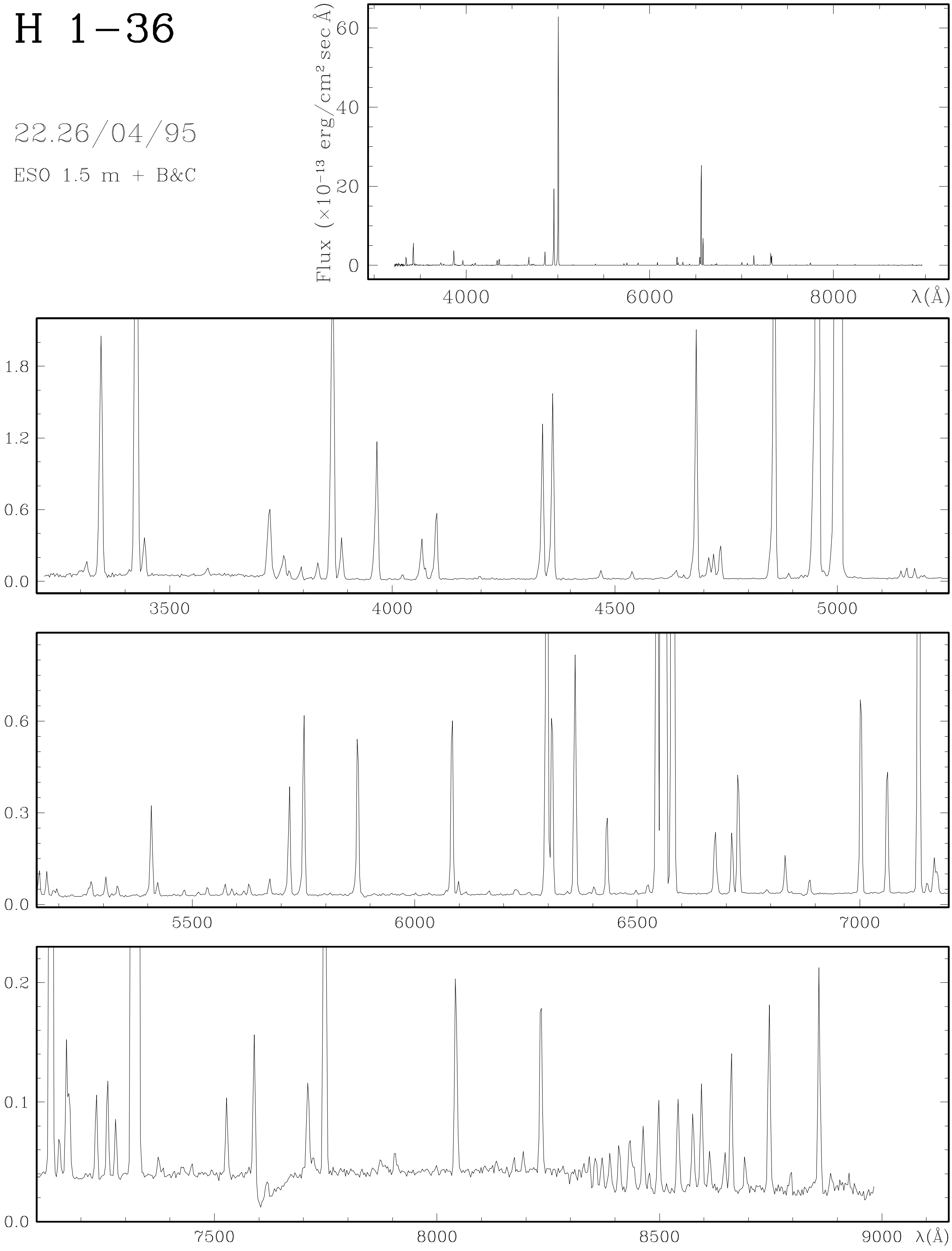


Fig. 60. ESO 1.5m + B&C spectrum of H 1-36

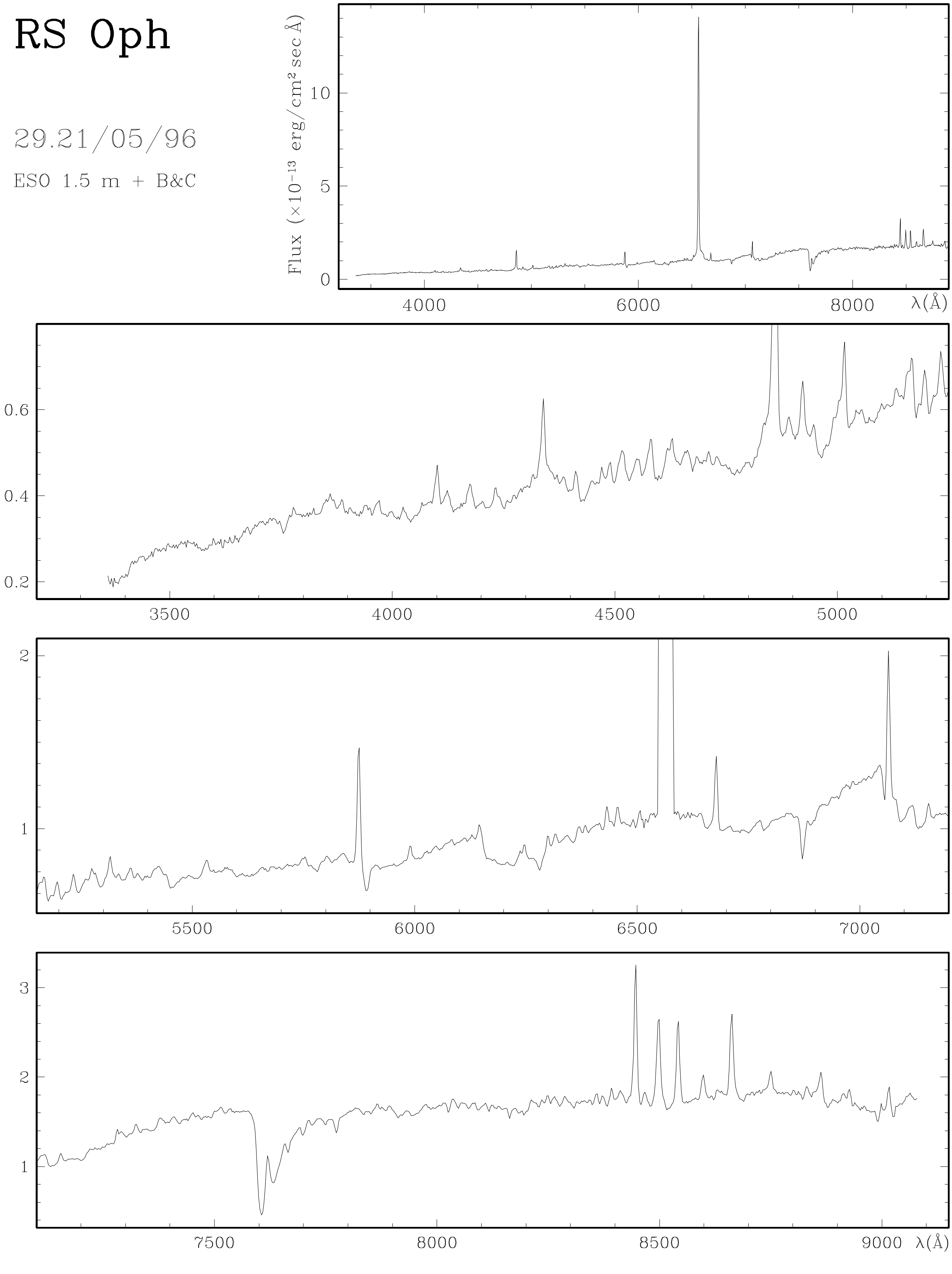


Fig. 61. ESO 1.5m + B&C spectrum of RS Oph

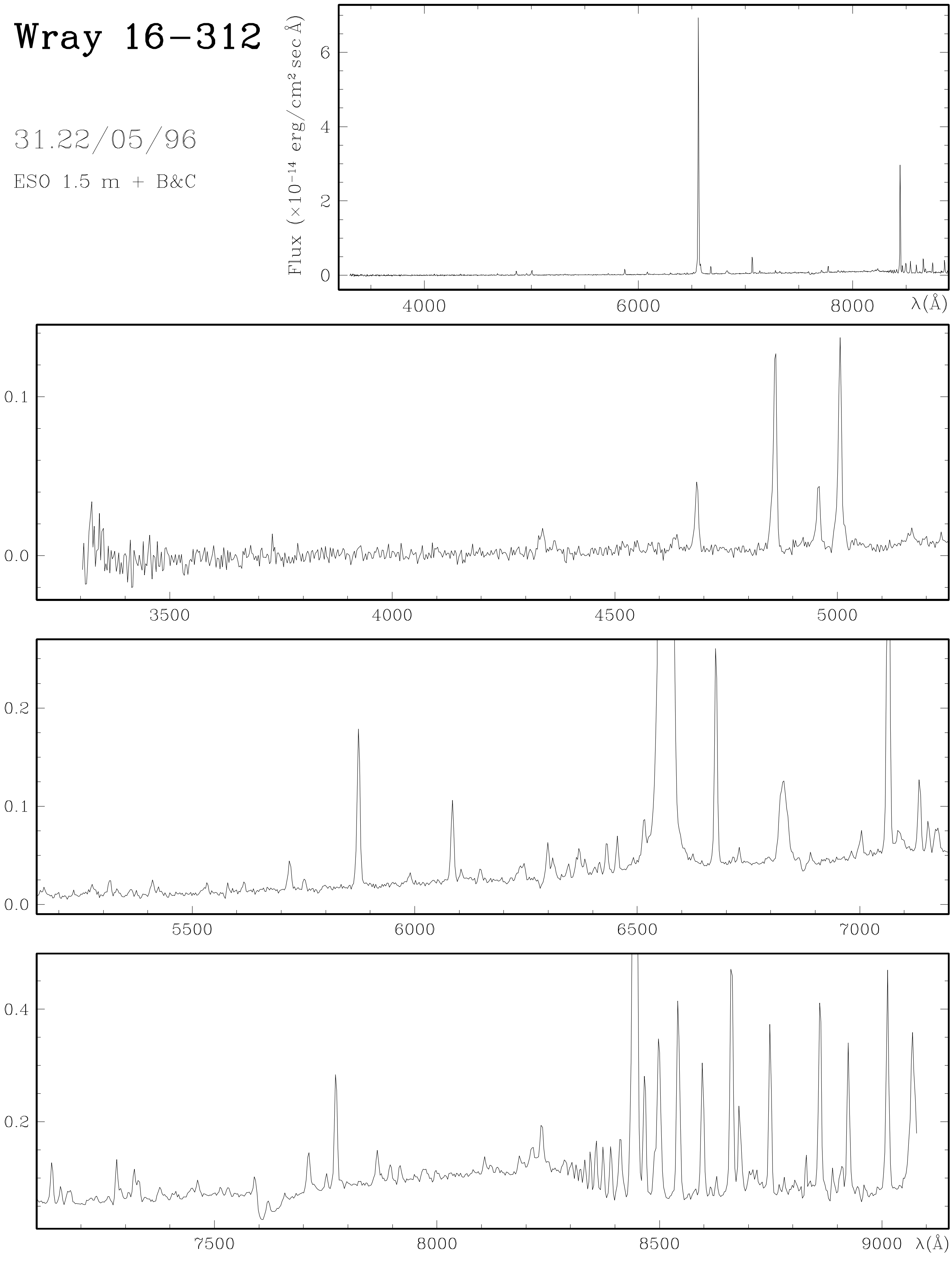


Fig. 62. ESO 1.5m + B&C spectrum of WRAY 16-312

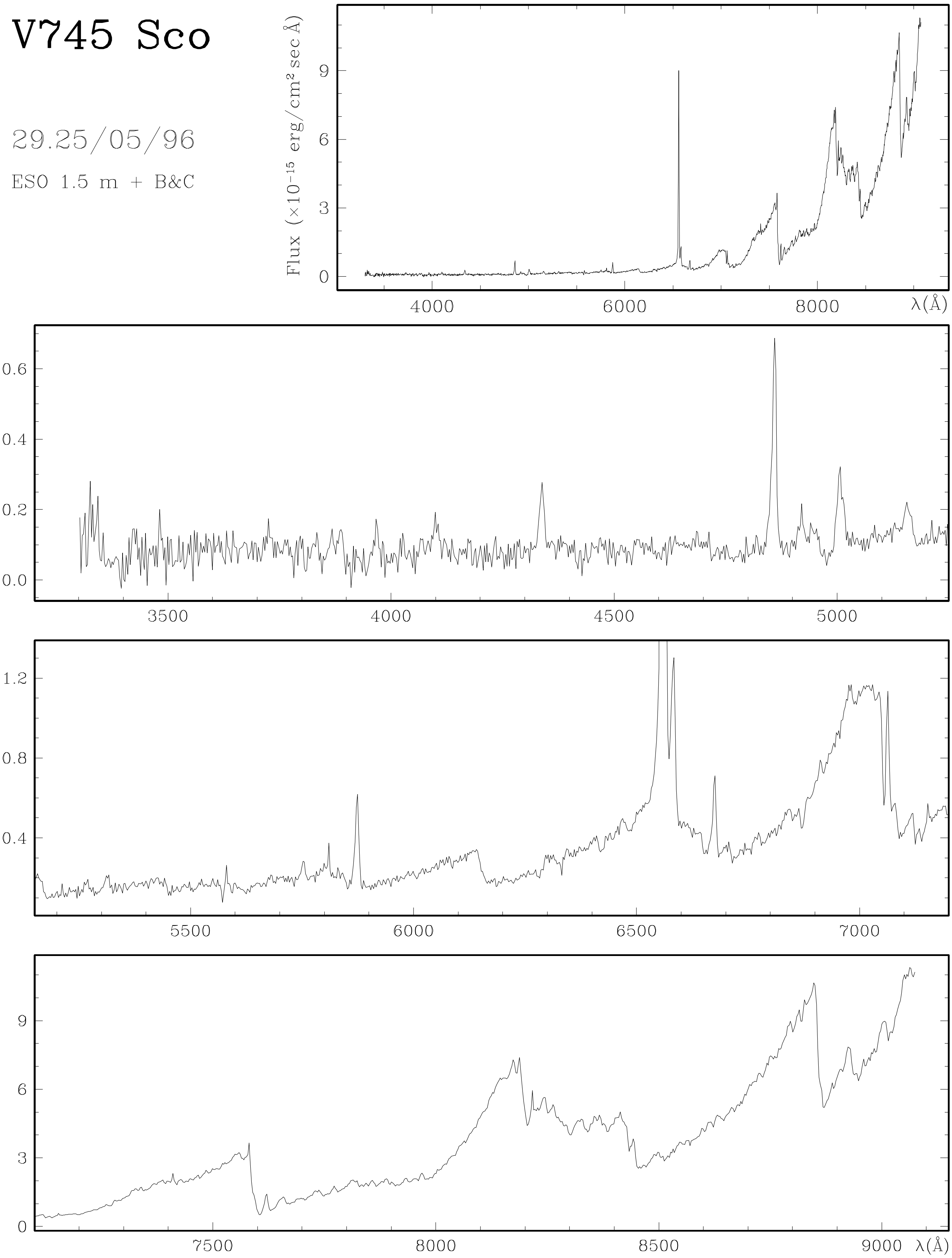


Fig. 63. ESO 1.5m + B&C spectrum of V745 Sco

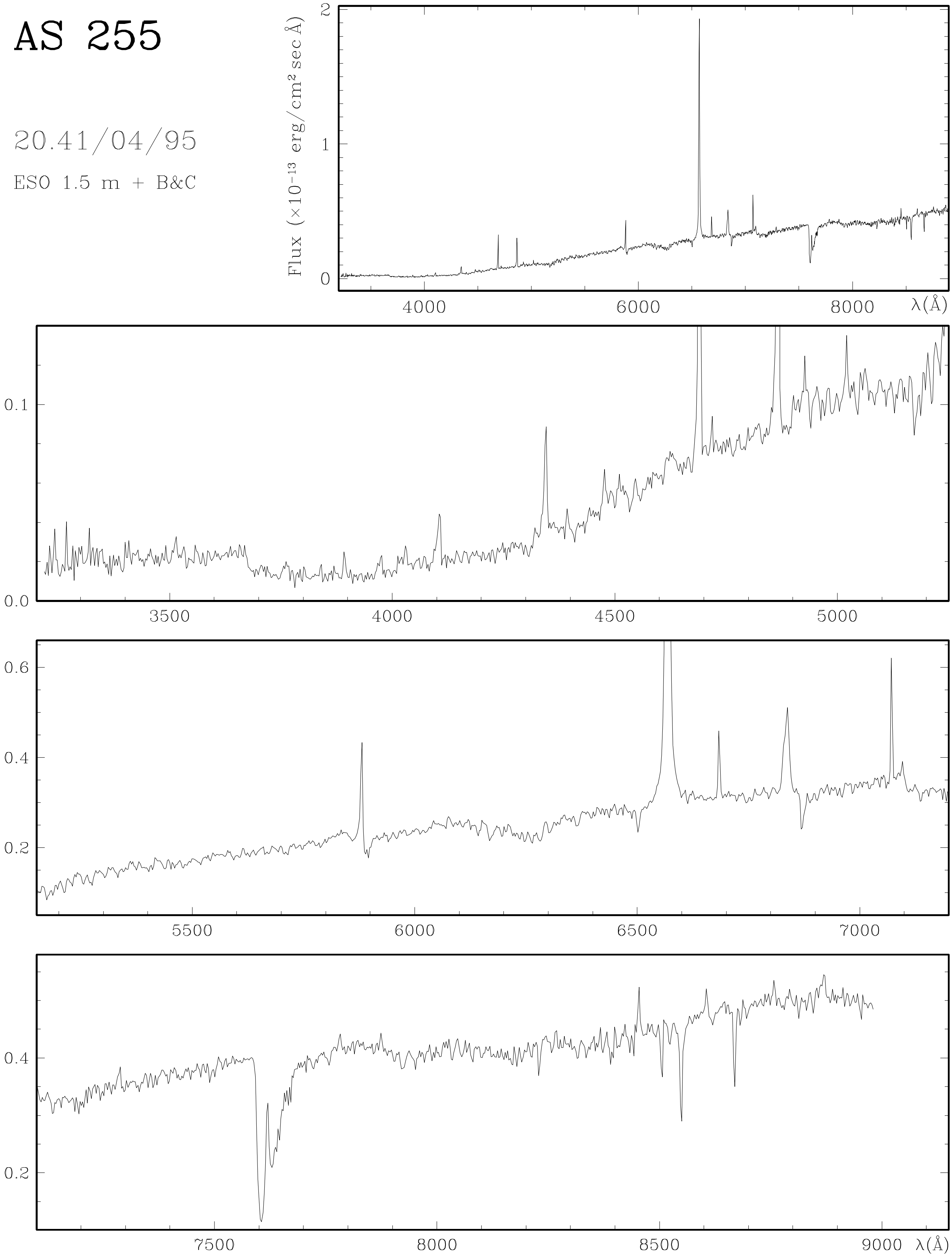


Fig. 64. ESO 1.5m + B&C spectrum of AS 255

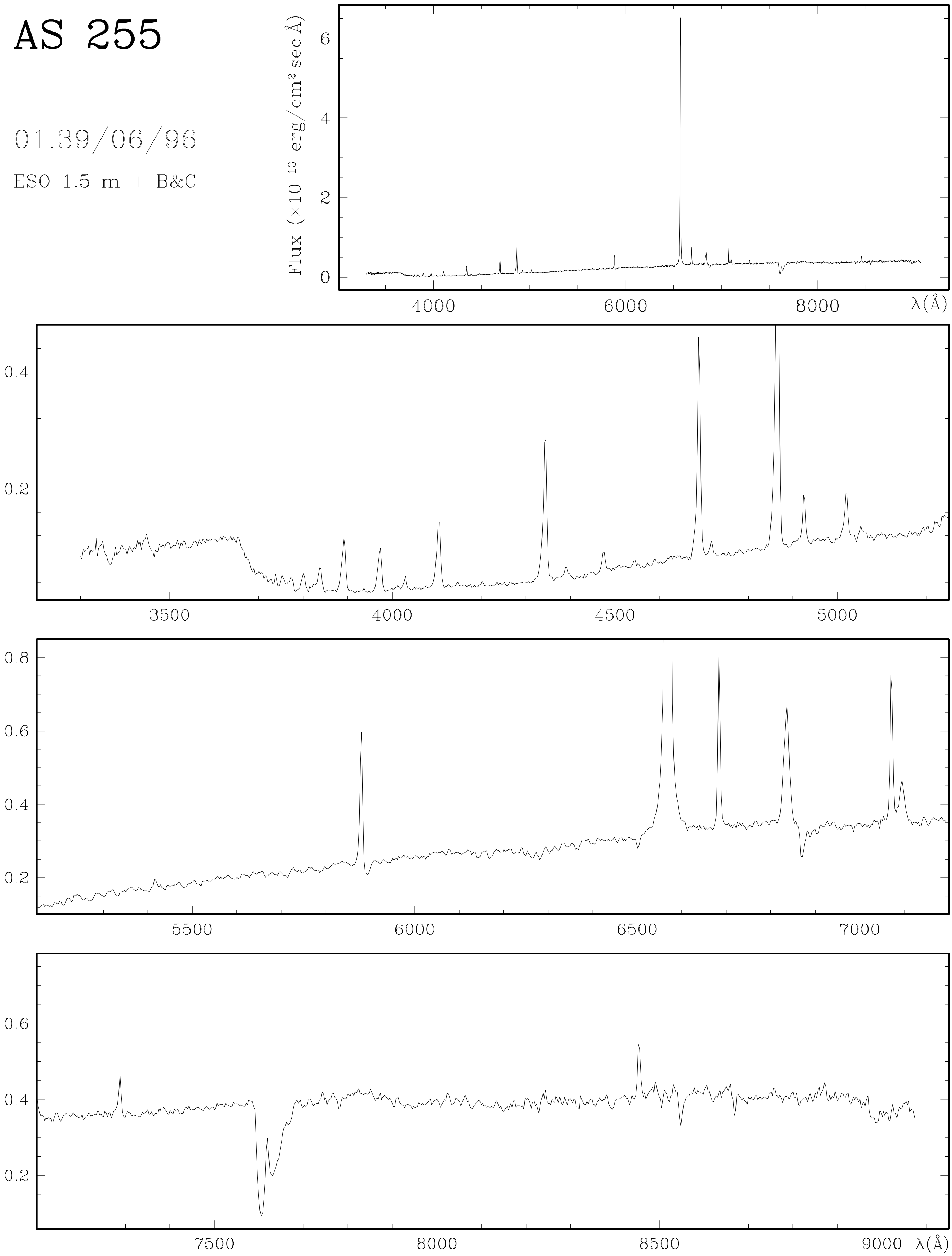


Fig. 65. ESO 1.5m + B&C spectrum of AS 255

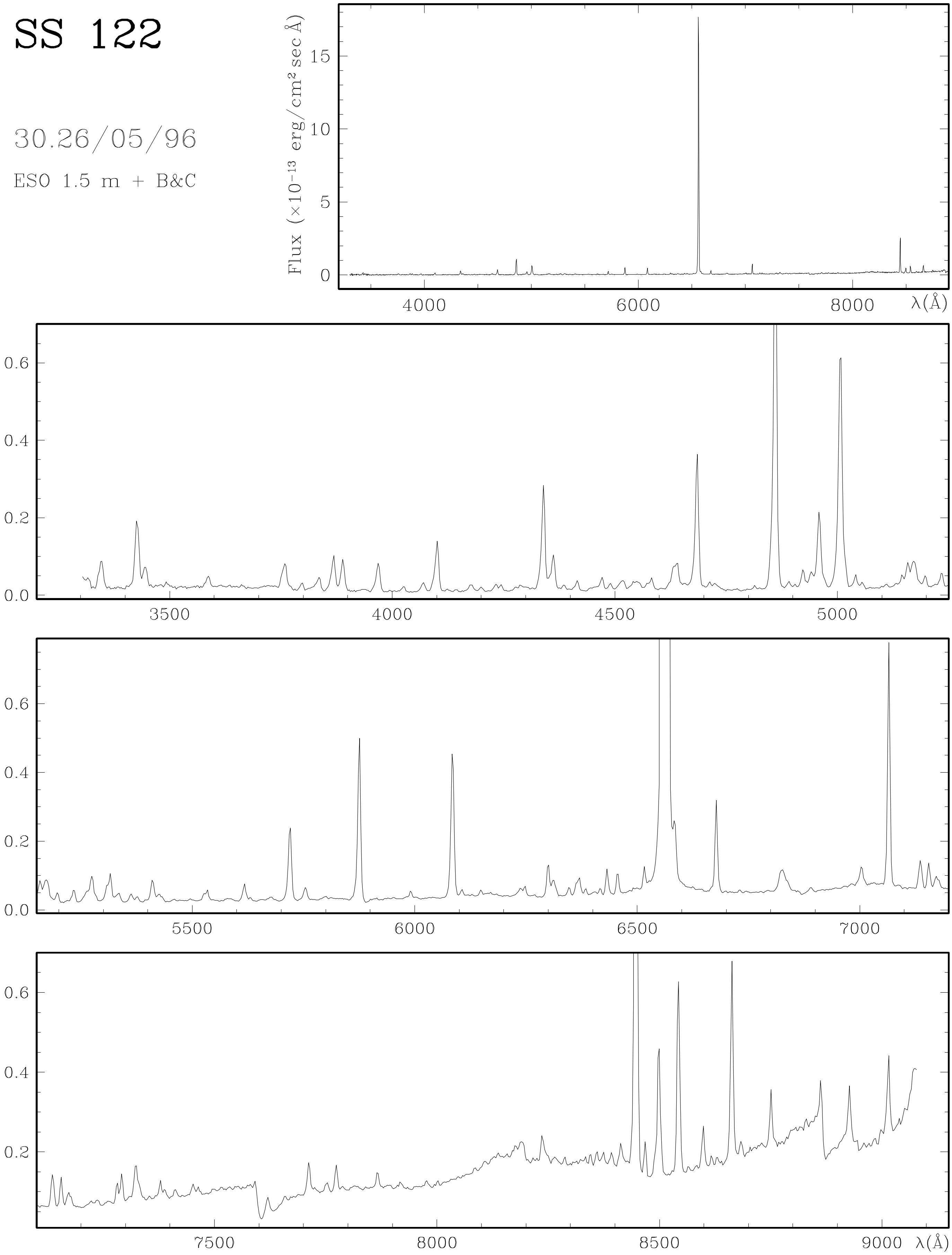


Fig. 66. ESO 1.5m + B&C spectrum of SS 122

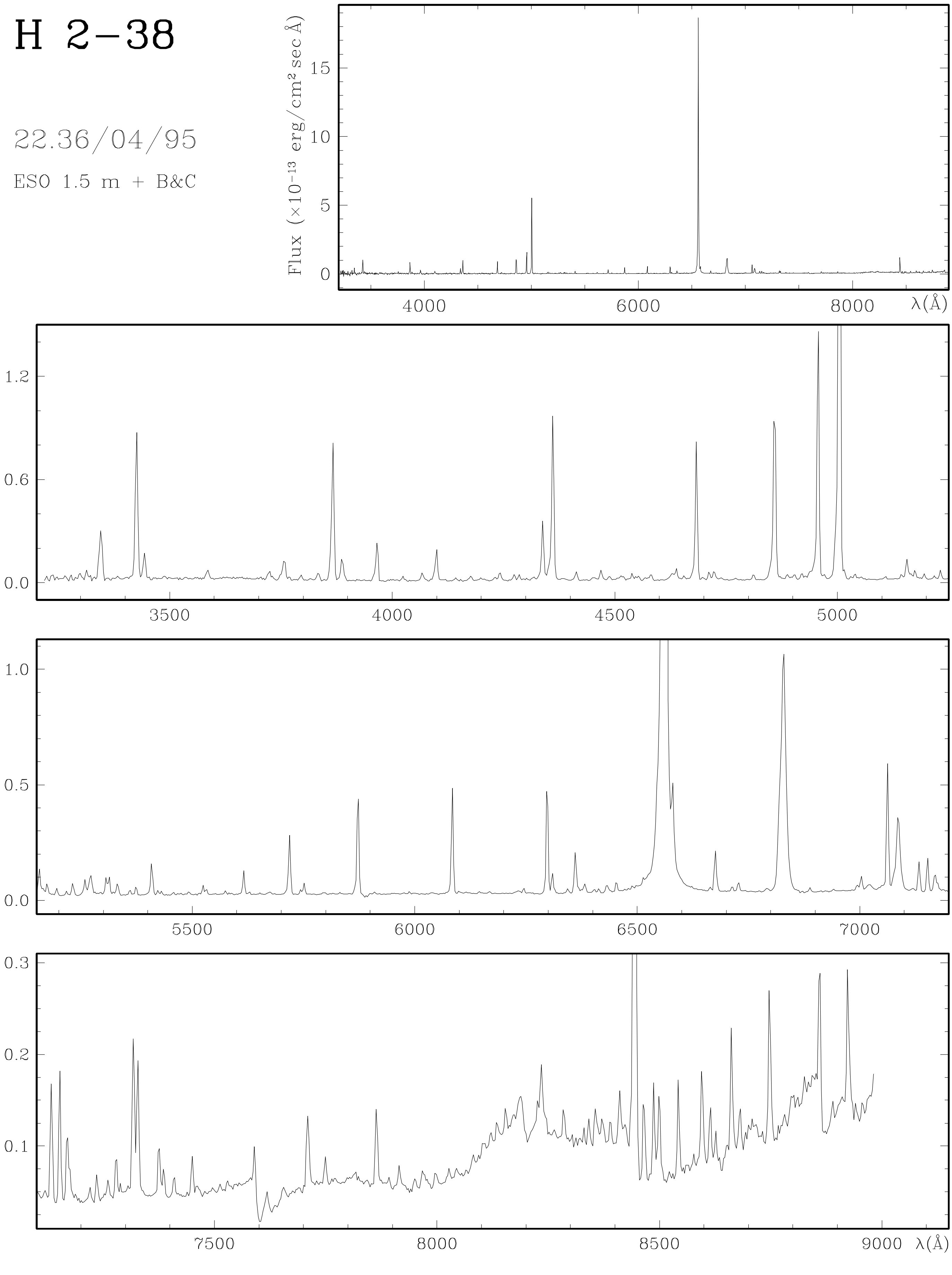


Fig. 67. ESO 1.5m + B&C spectrum of H 2-38

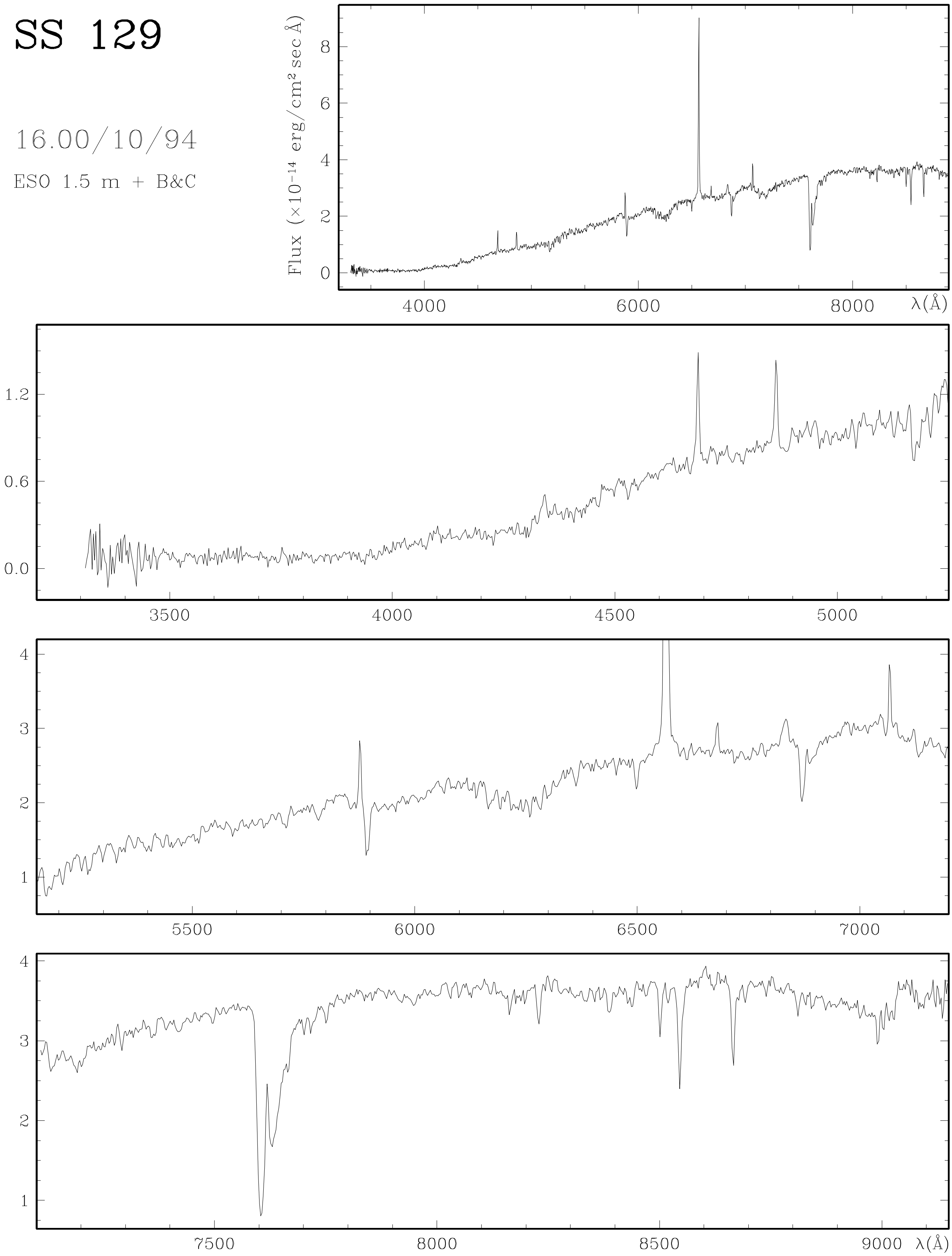


Fig. 68. ESO 1.5m + B&C spectrum of SS 129

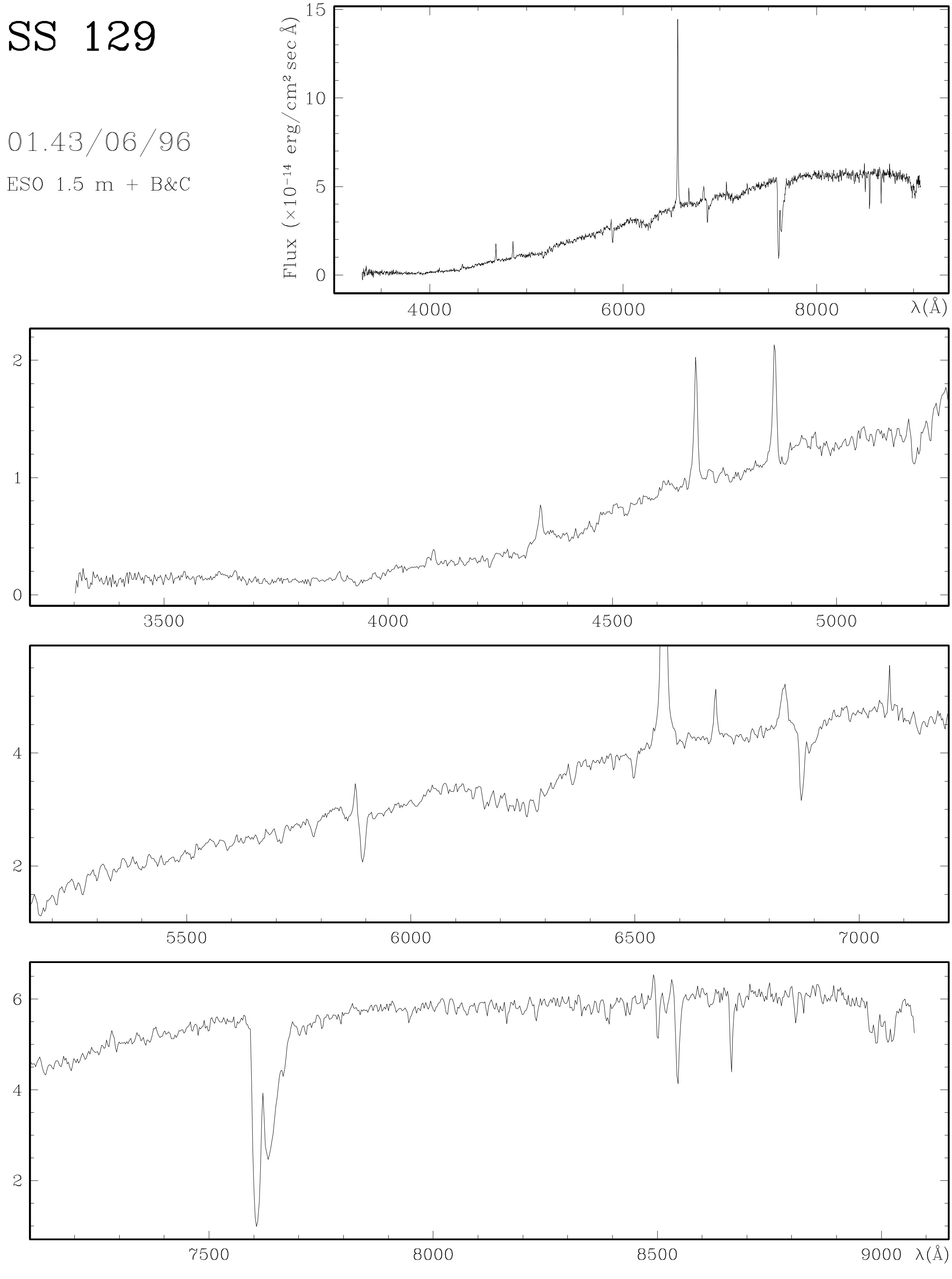


Fig. 69. ESO 1.5m + B&C spectrum of SS 129

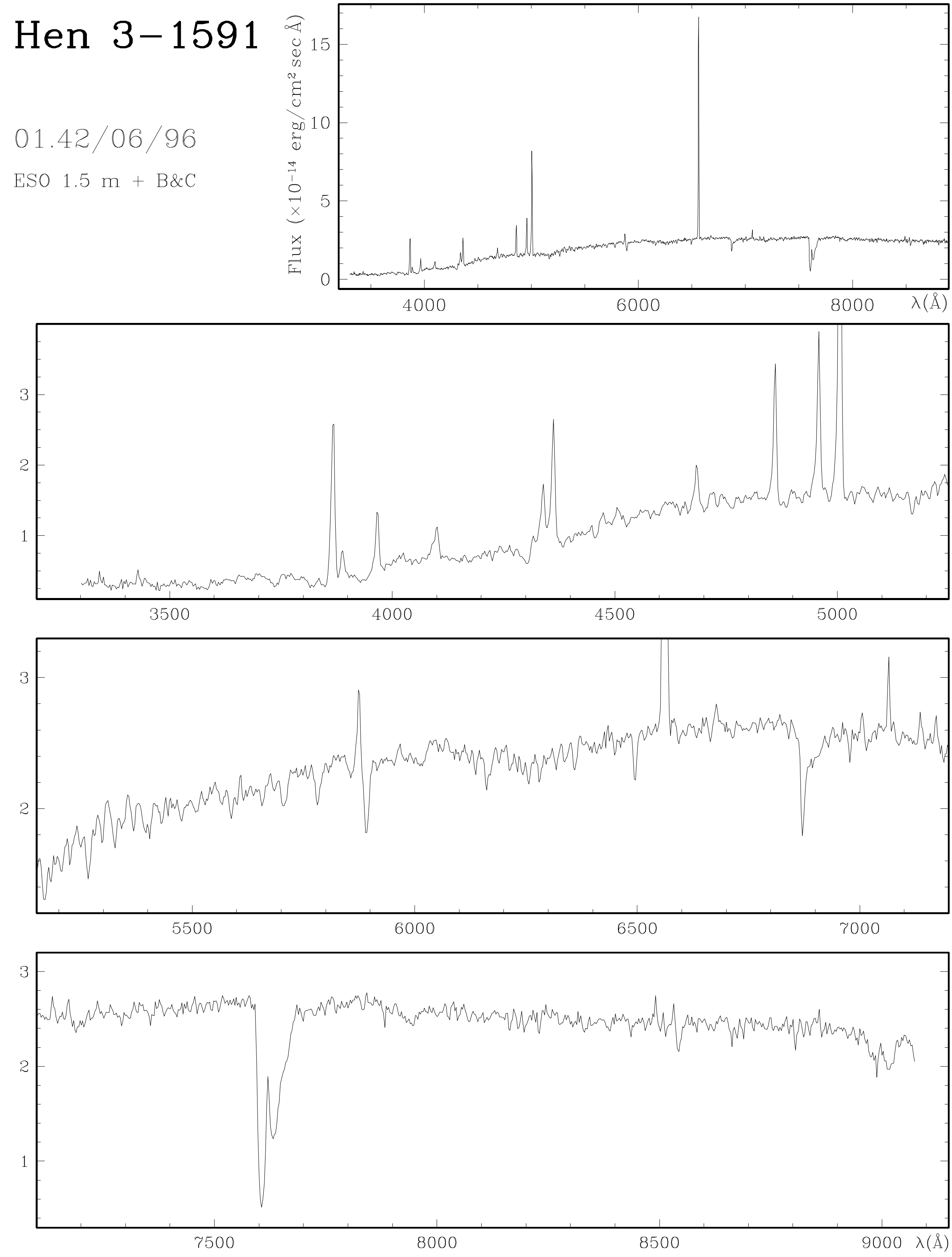


Fig. 70. ESO 1.5m + B&C spectrum of Hen 3-1591

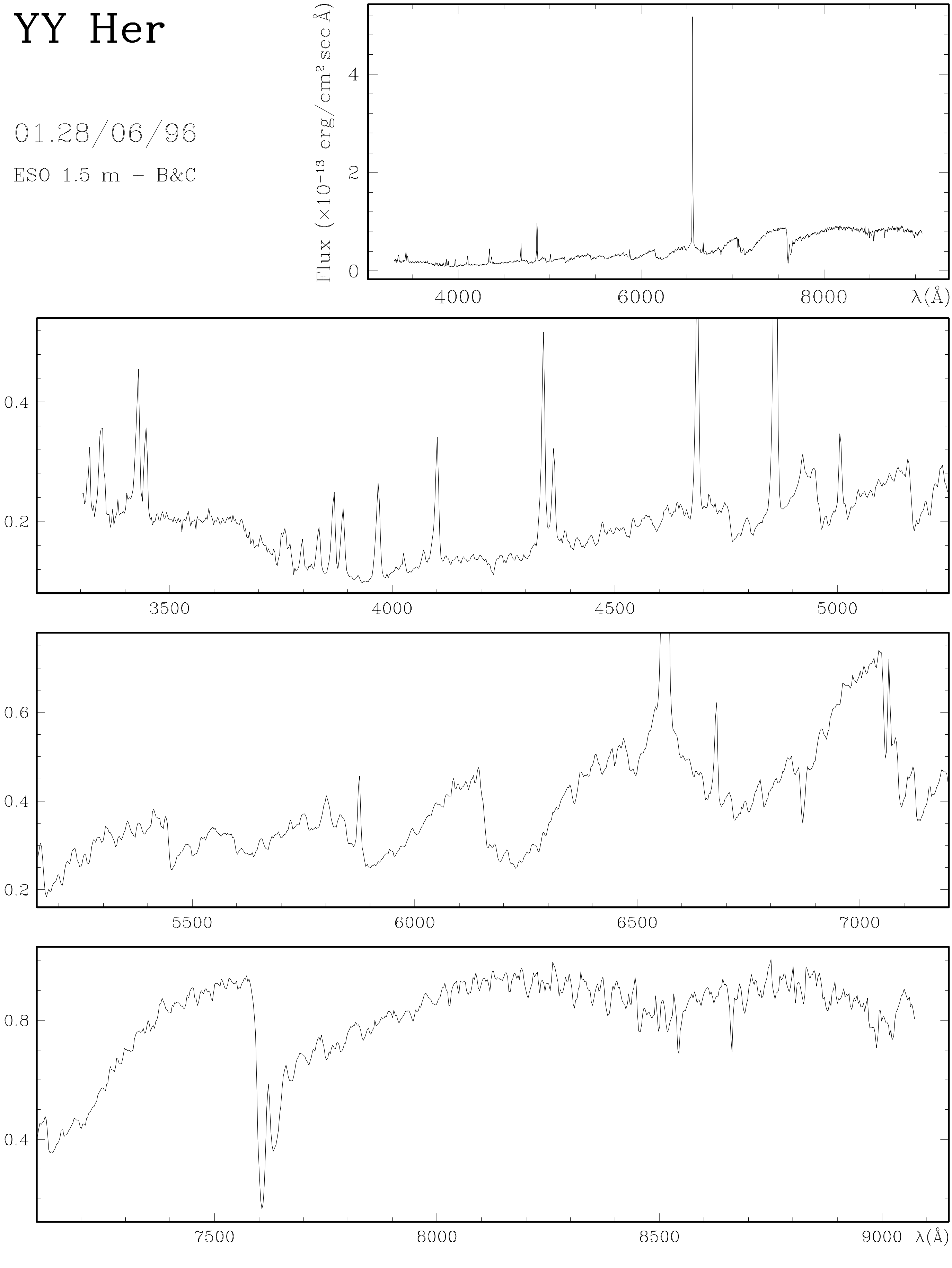


Fig. 71. ESO 1.5m + B&C spectrum of YY Her

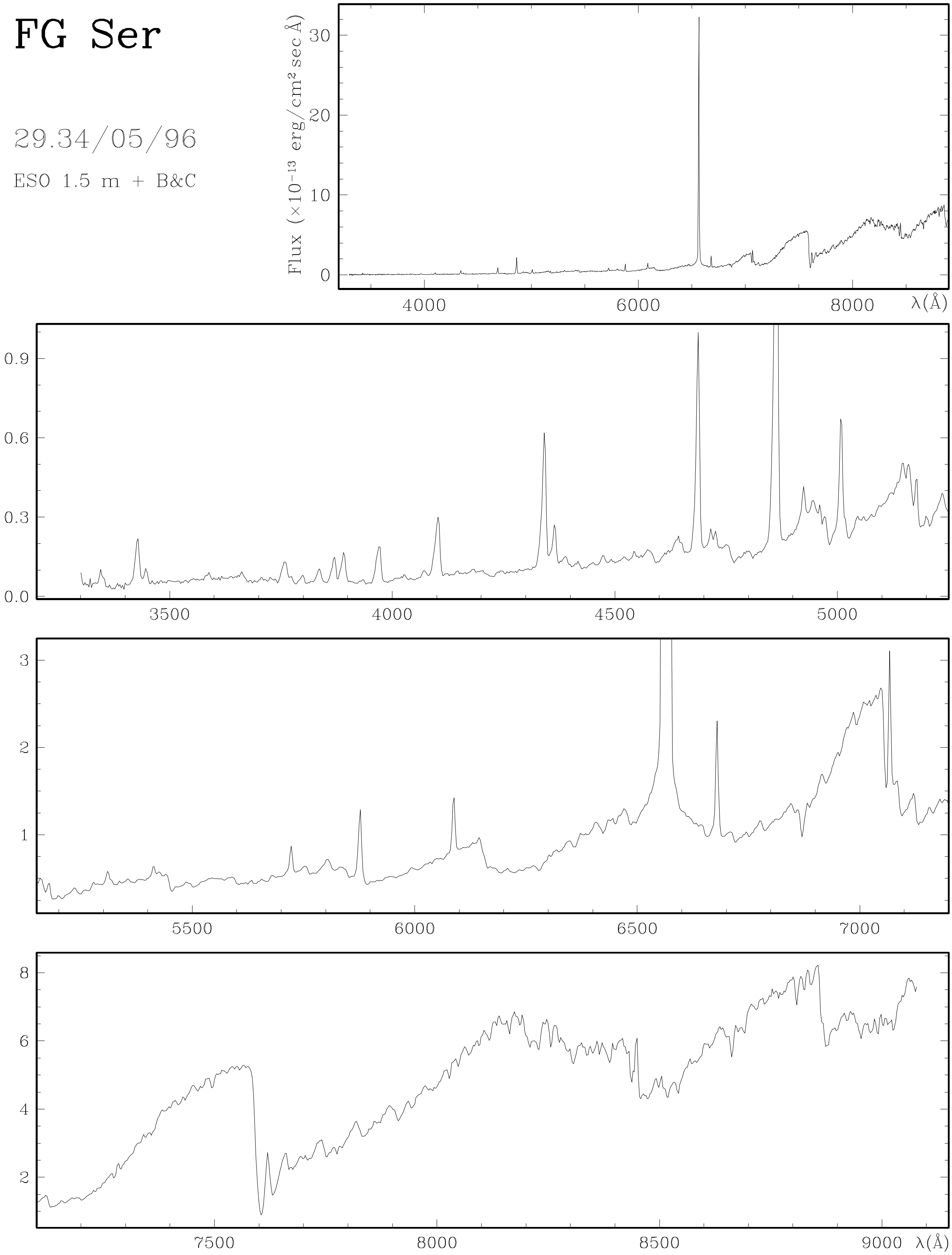


Fig. 72. ESO 1.5m + B&C spectrum of FG Ser

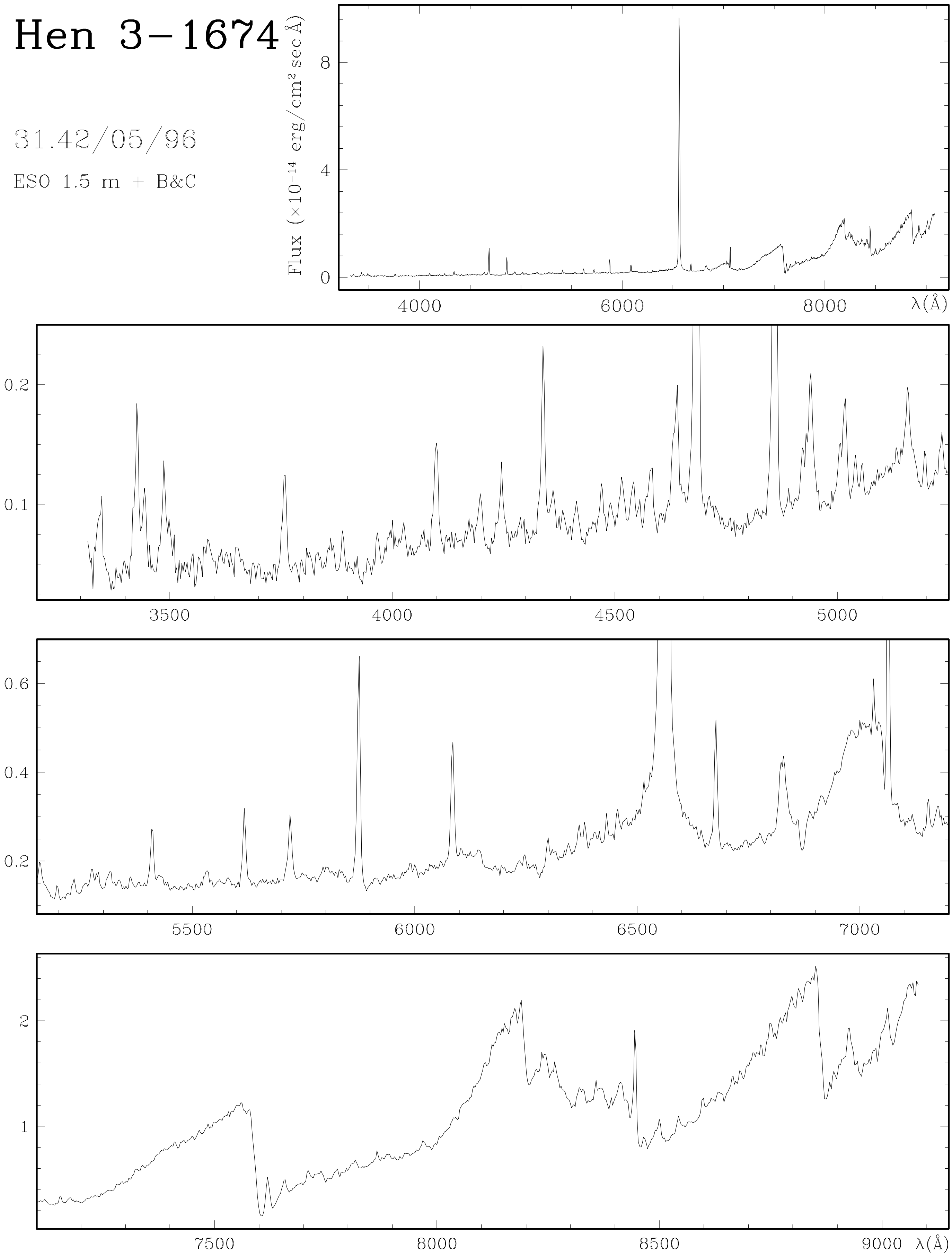


Fig. 73. ESO 1.5m + B&C spectrum of Hen 3-1674

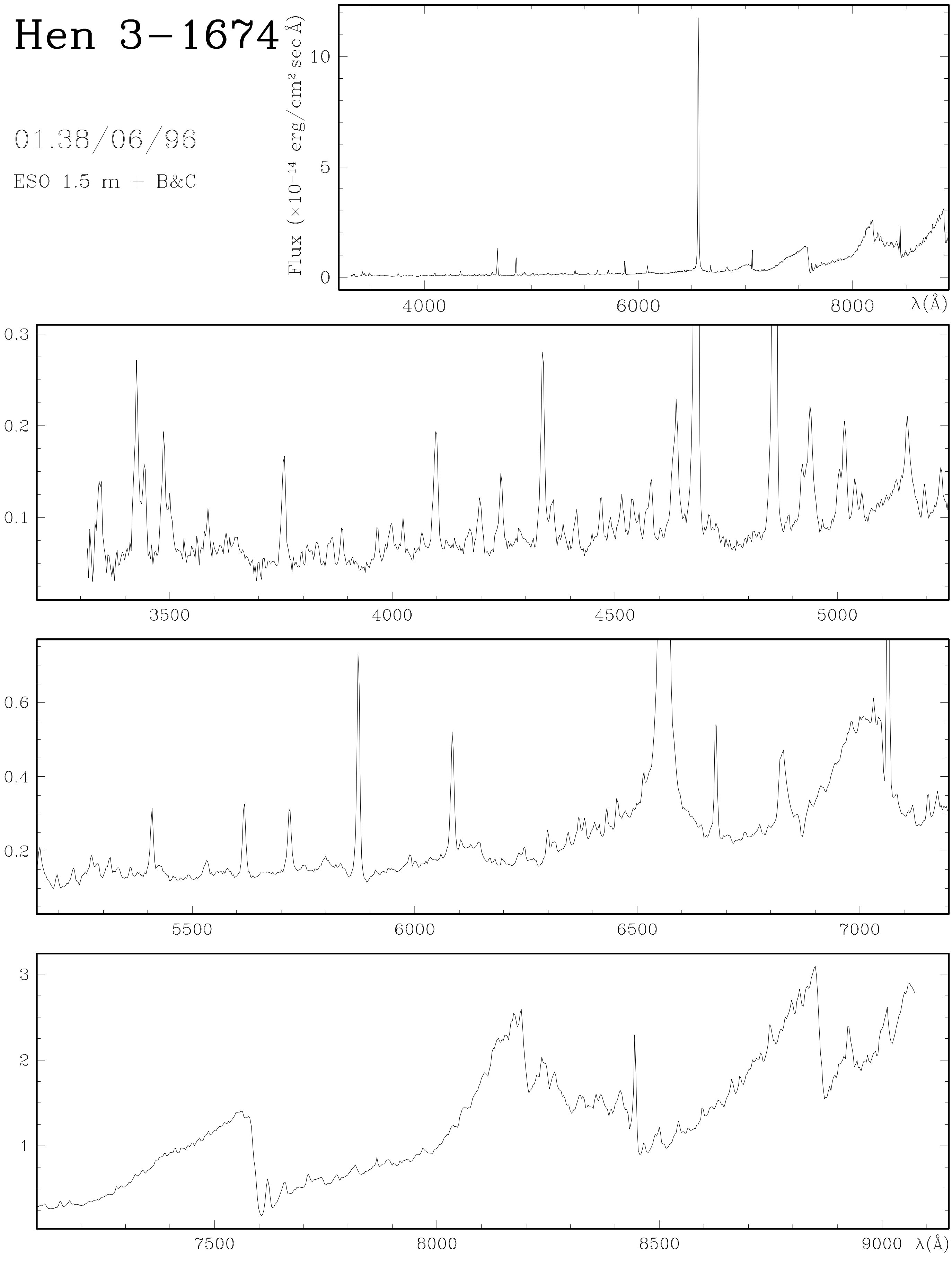


Fig. 74. ESO 1.5m + B&C spectrum of Hen 3-1674

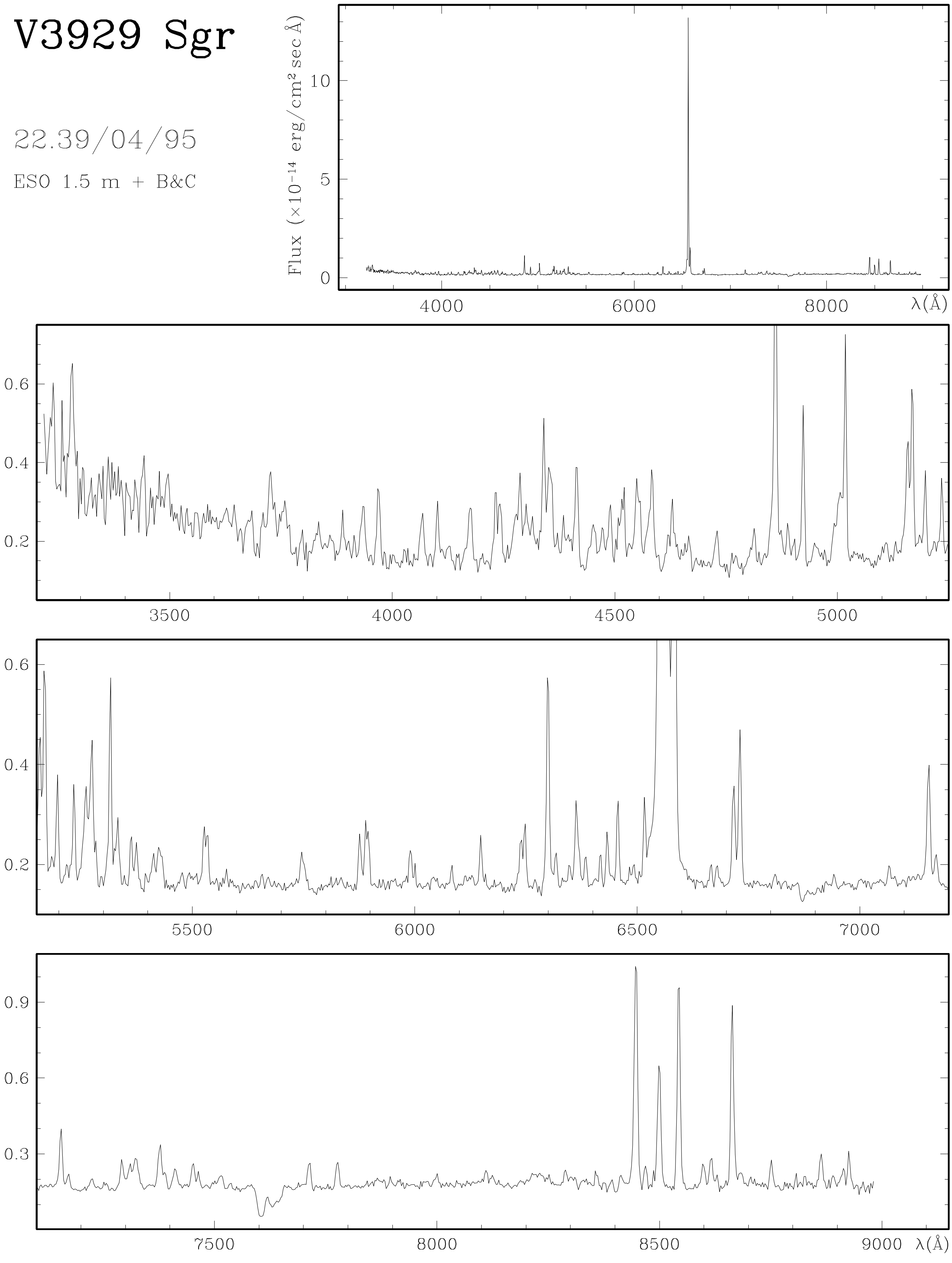


Fig. 75. ESO 1.5m + B&C spectrum of V3929 Sgr

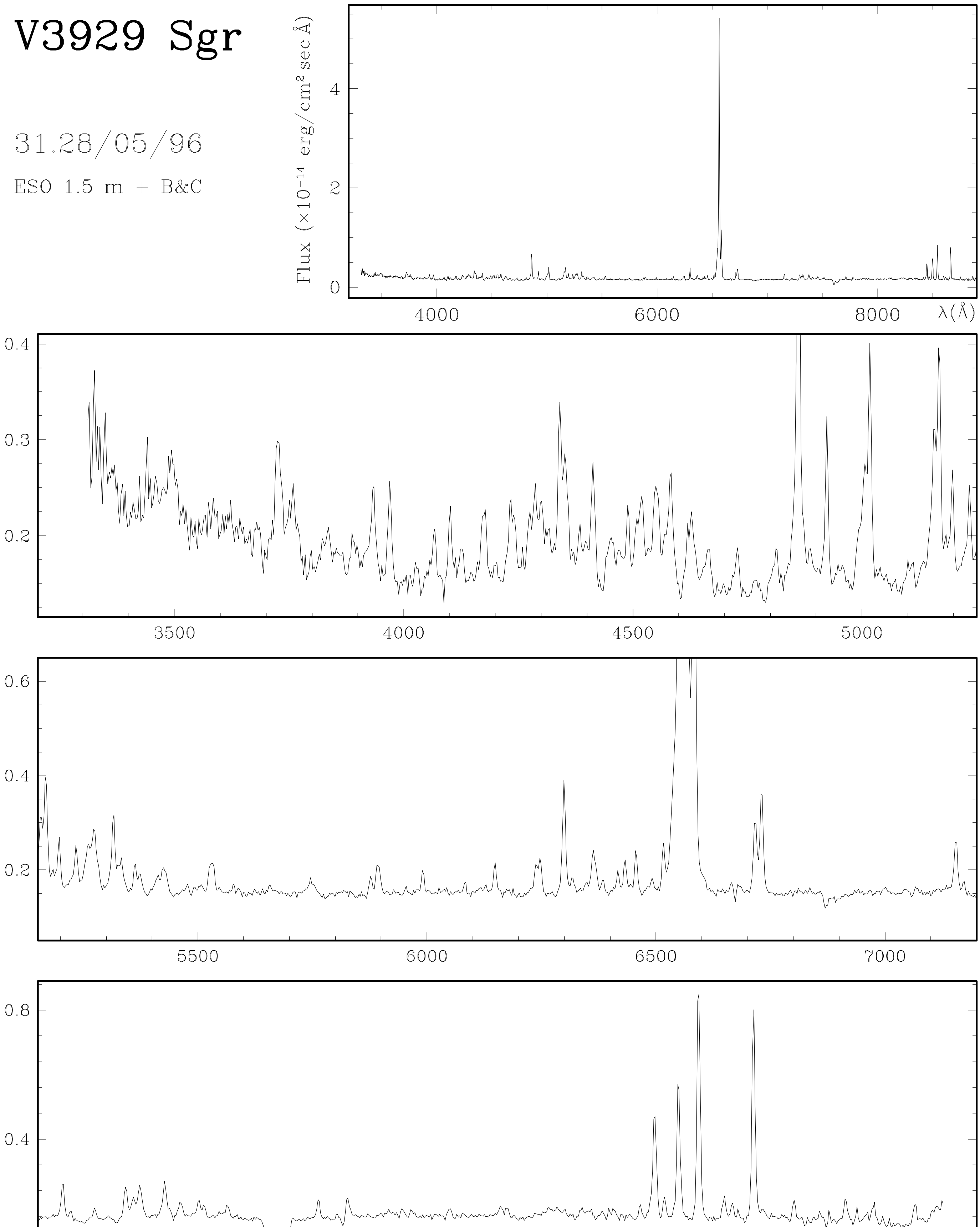
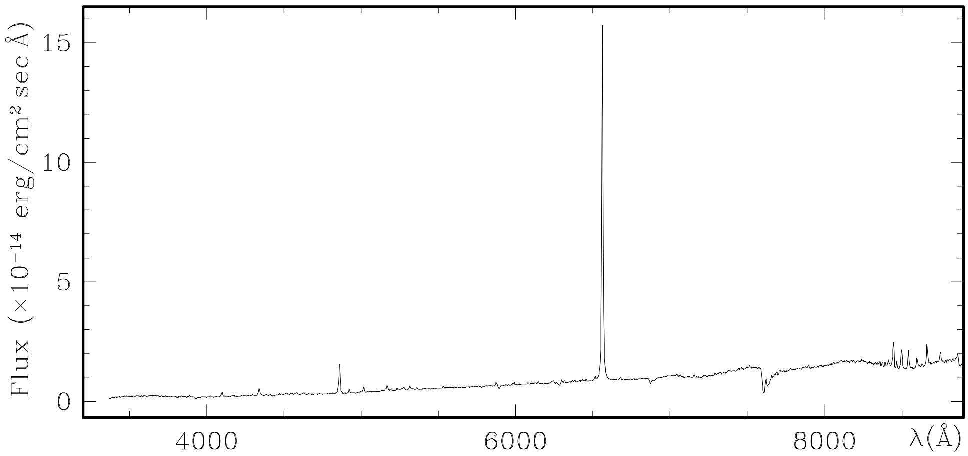


Fig. 76. ESO 1.5m + B&C spectrum of V3929 Sgr

V3811 Sgr

31.37/05/96

ESO 1.5 m + B&C



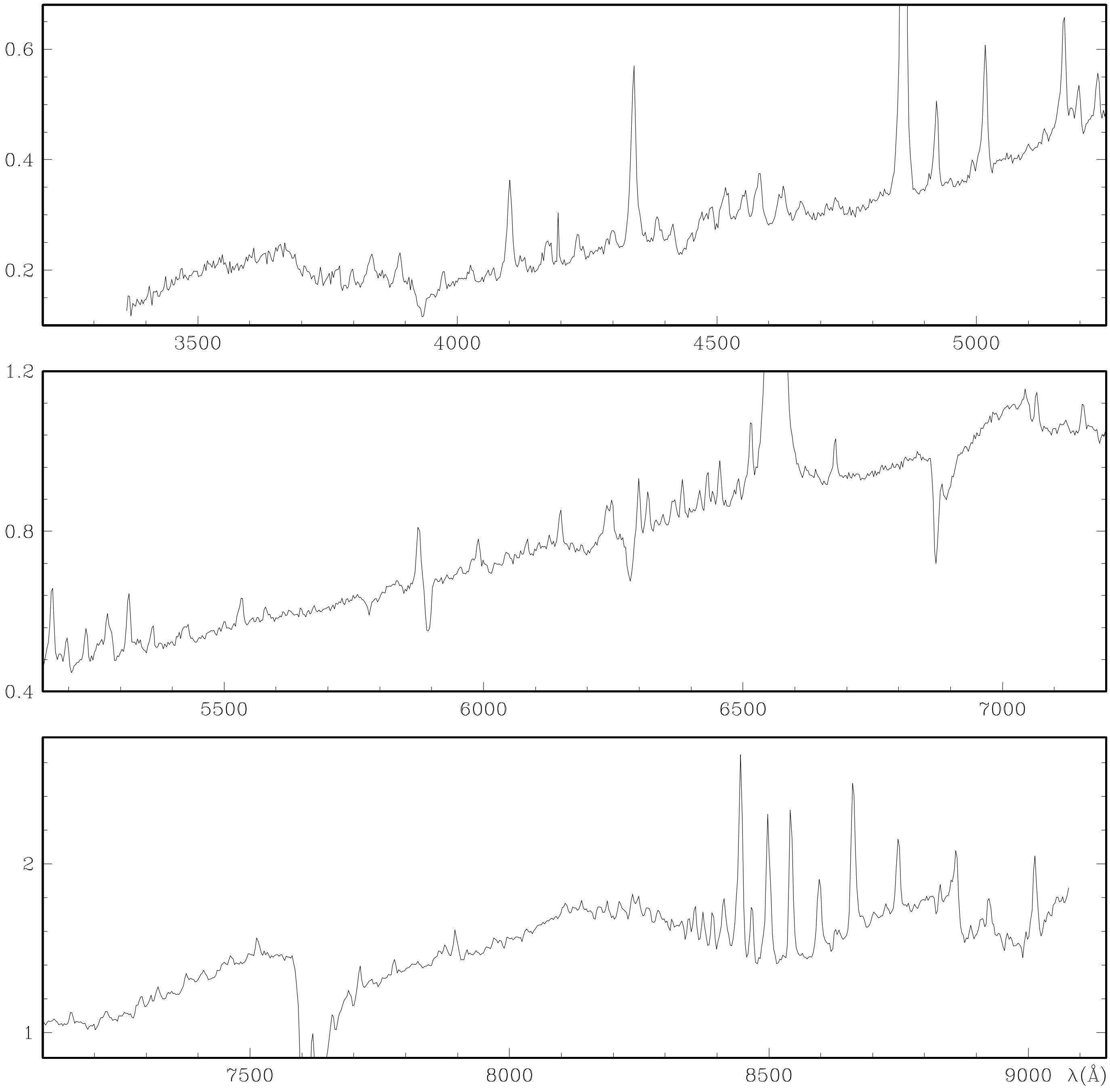


Fig. 77. ESO 1.5m + B&C spectrum of V3811 Sgr

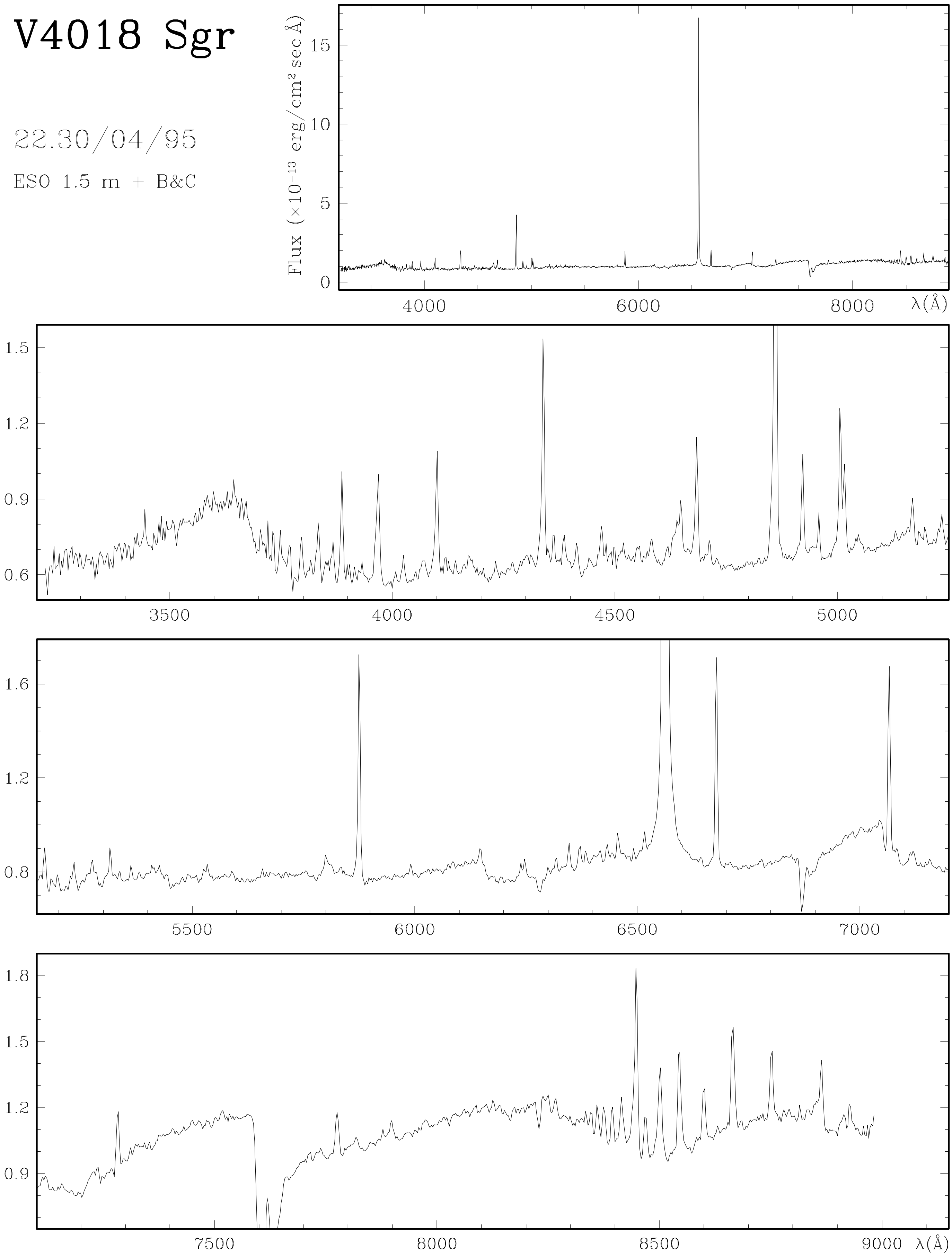


Fig. 78. ESO 1.5m + B&C spectrum of V4018 Sgr

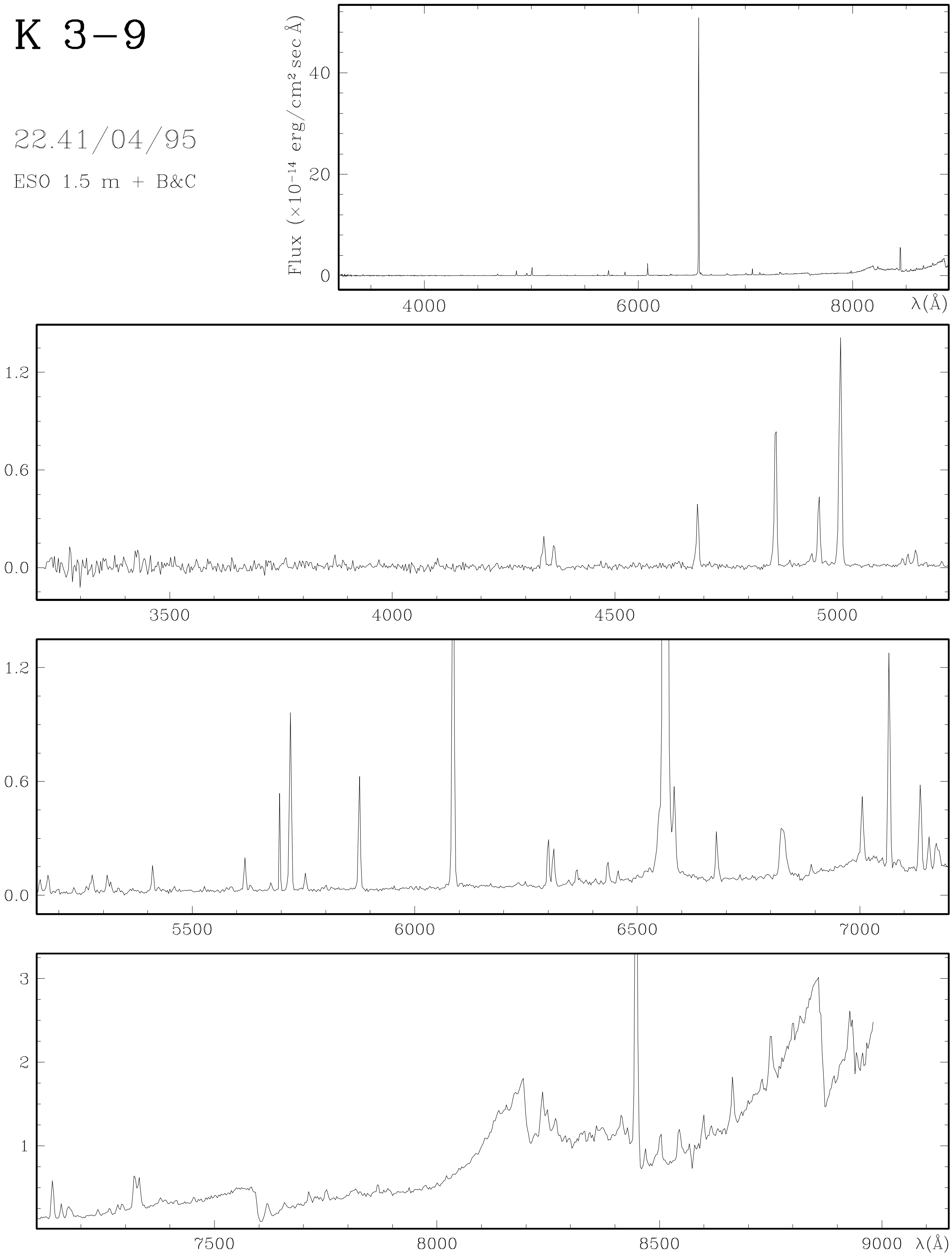


Fig. 79. ESO 1.5m + B&C spectrum of K 3-9

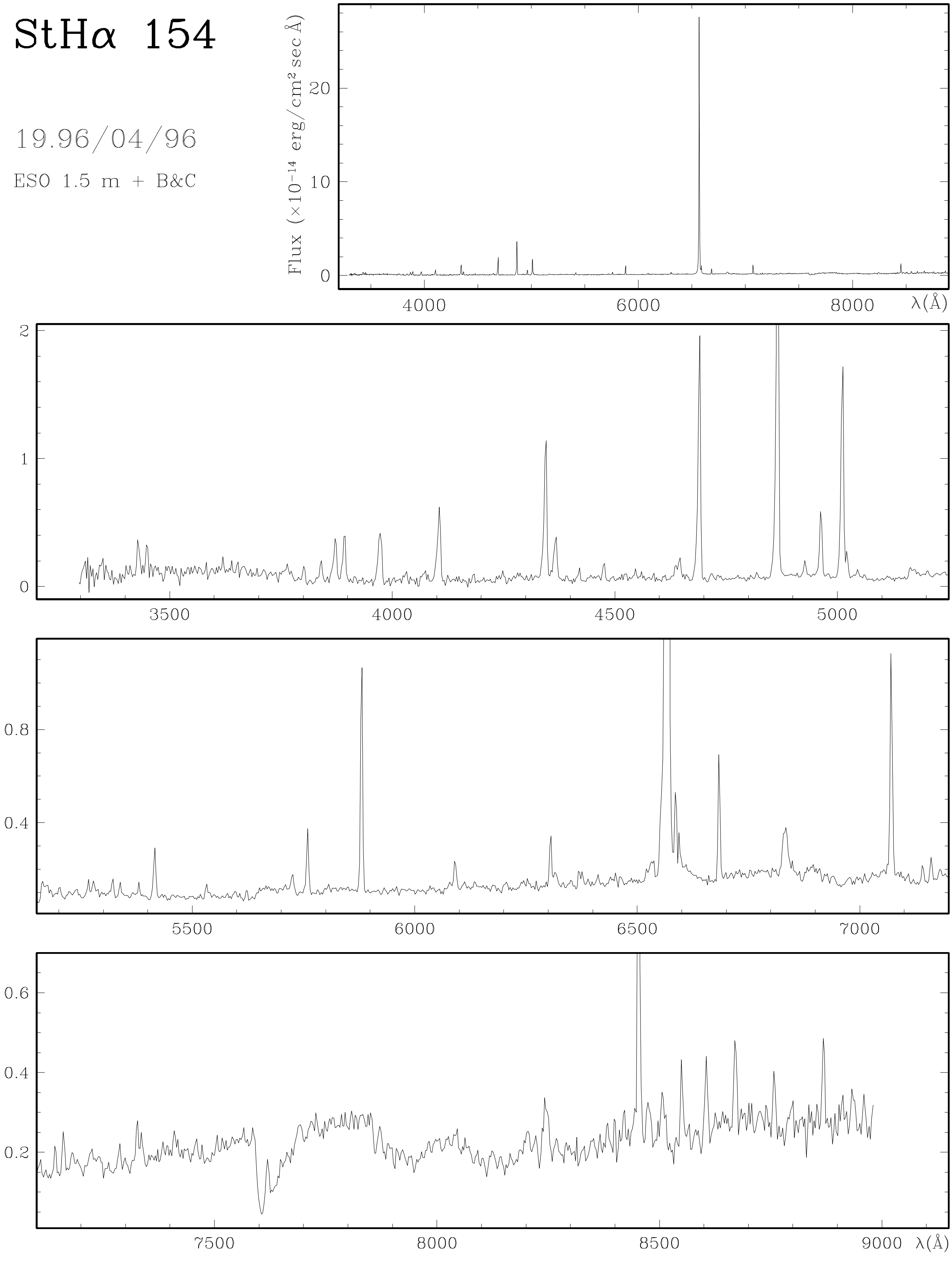


Fig. 80. ESO 1.5m + B&C spectrum of StHA 154

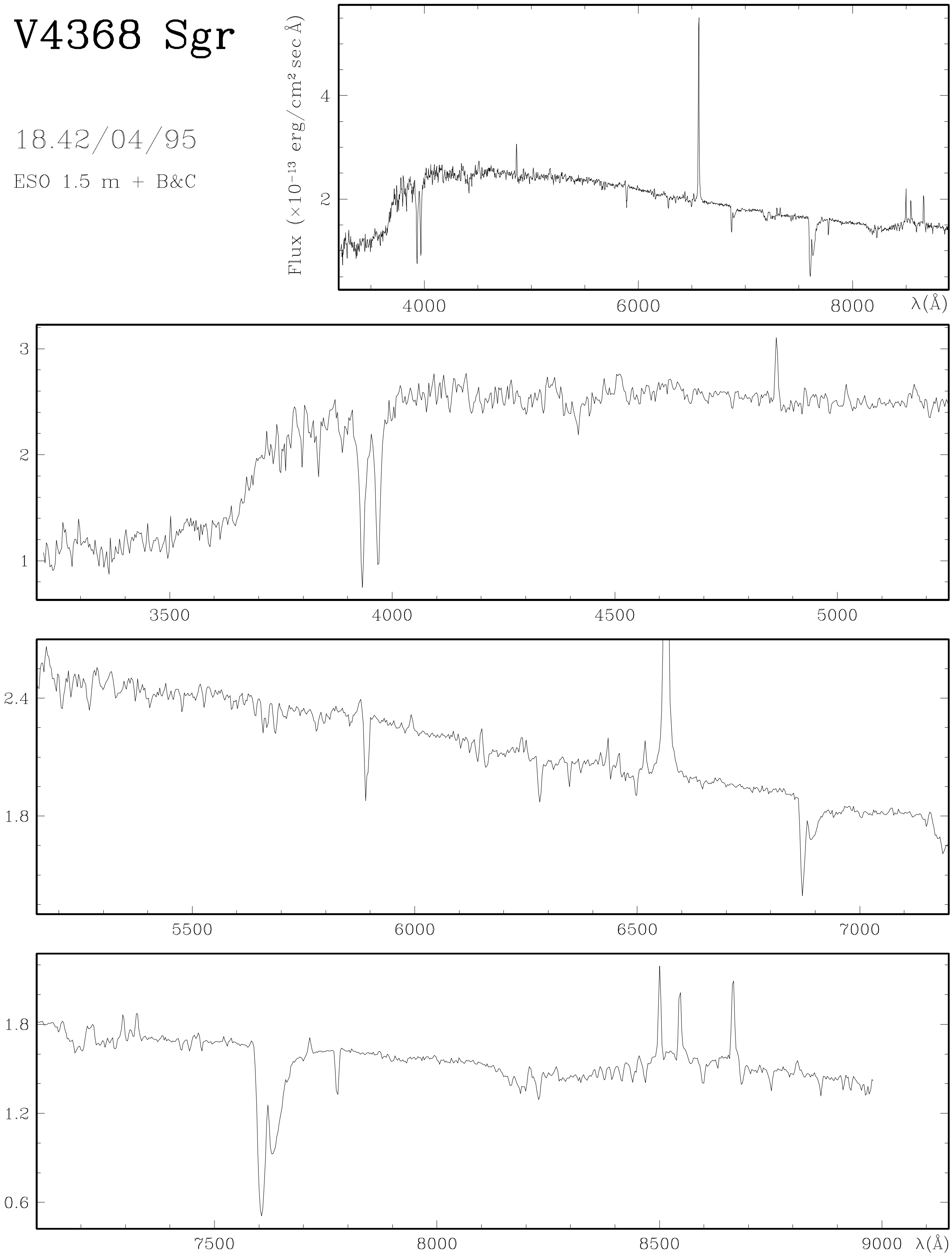


Fig. 81. ESO 1.5m + B&C spectrum of V4368 Sgr

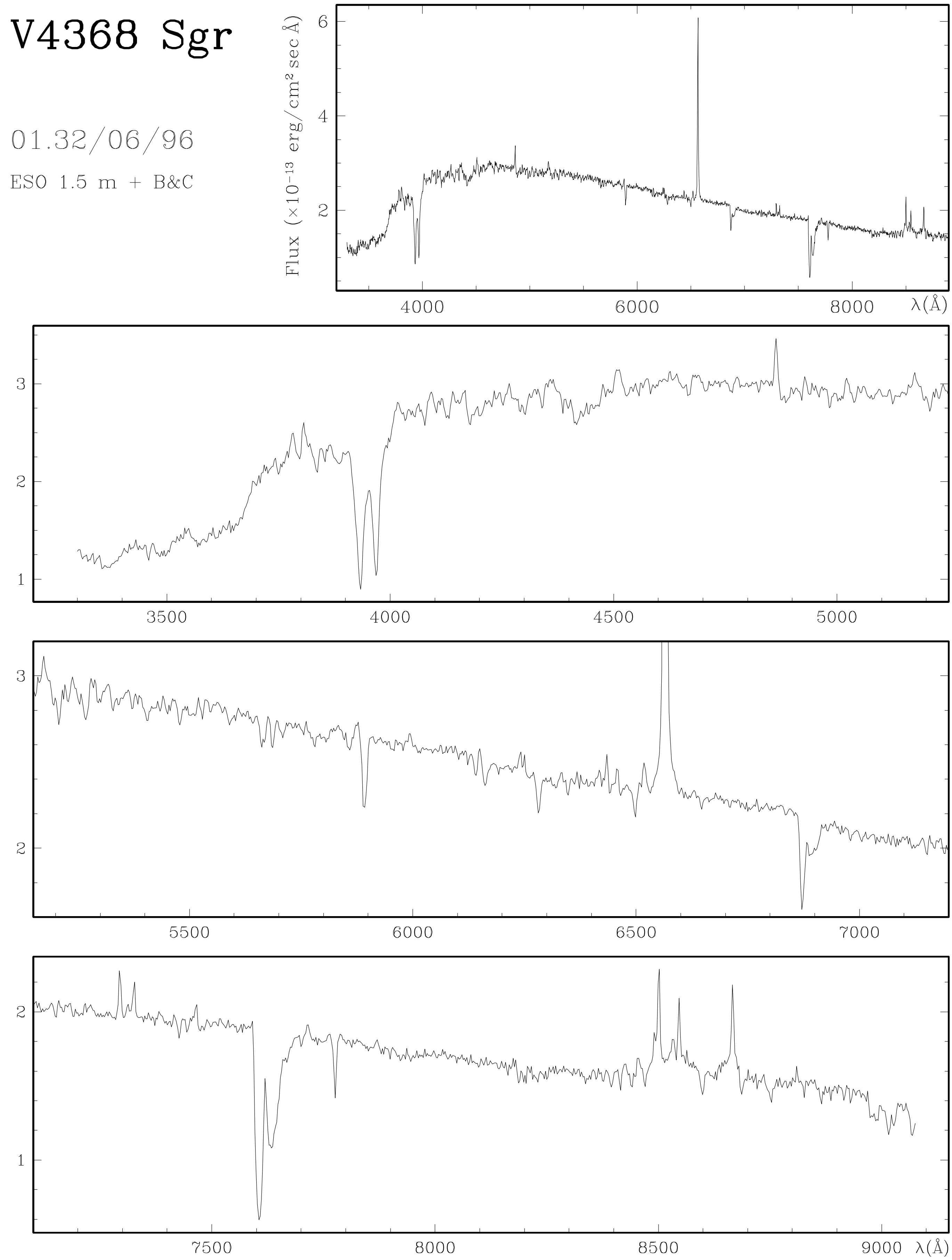


Fig. 82. ESO 1.5m + B&C spectrum of V4368 Sgr

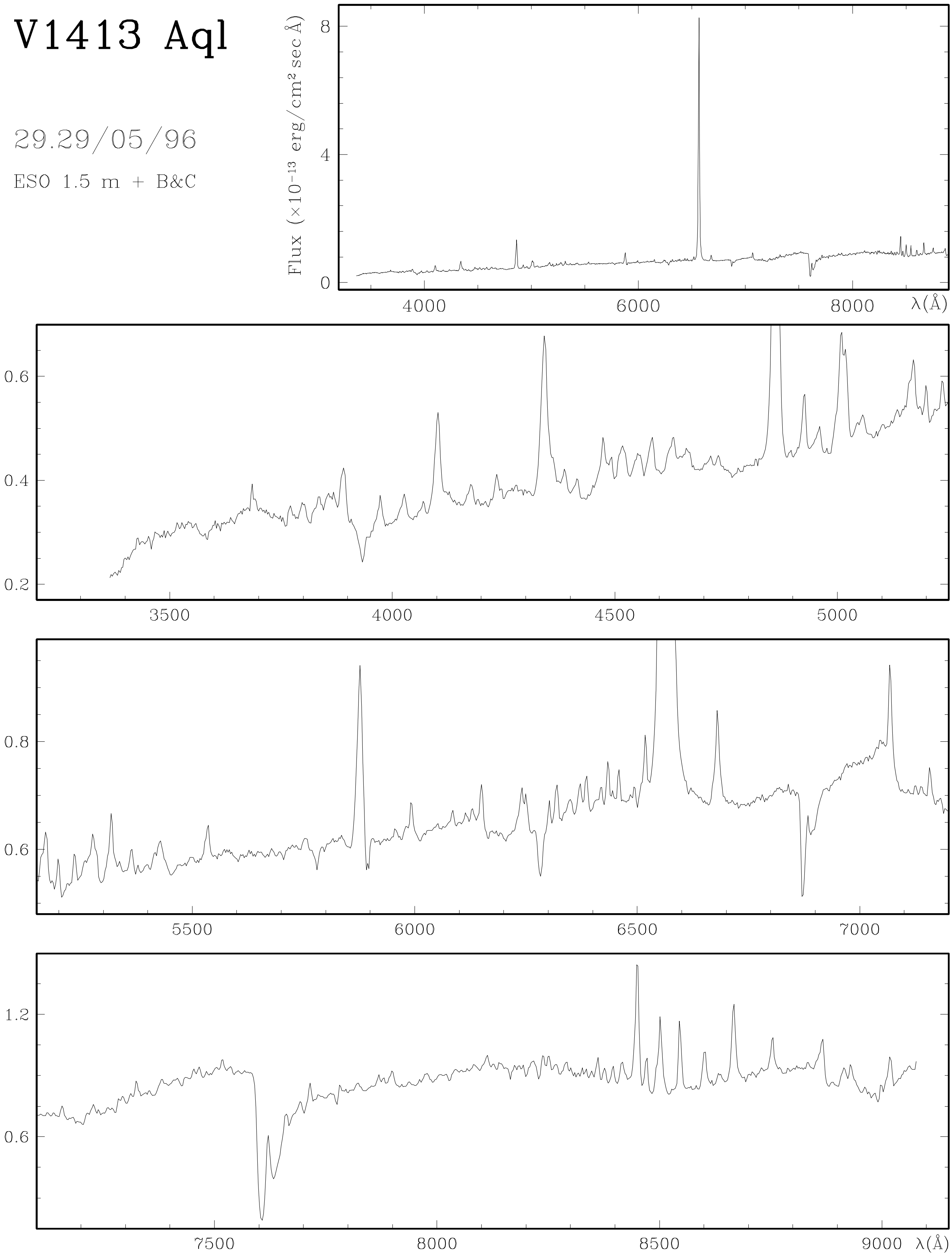


Fig. 83. ESO 1.5m + B&C spectrum of V1413 Aql

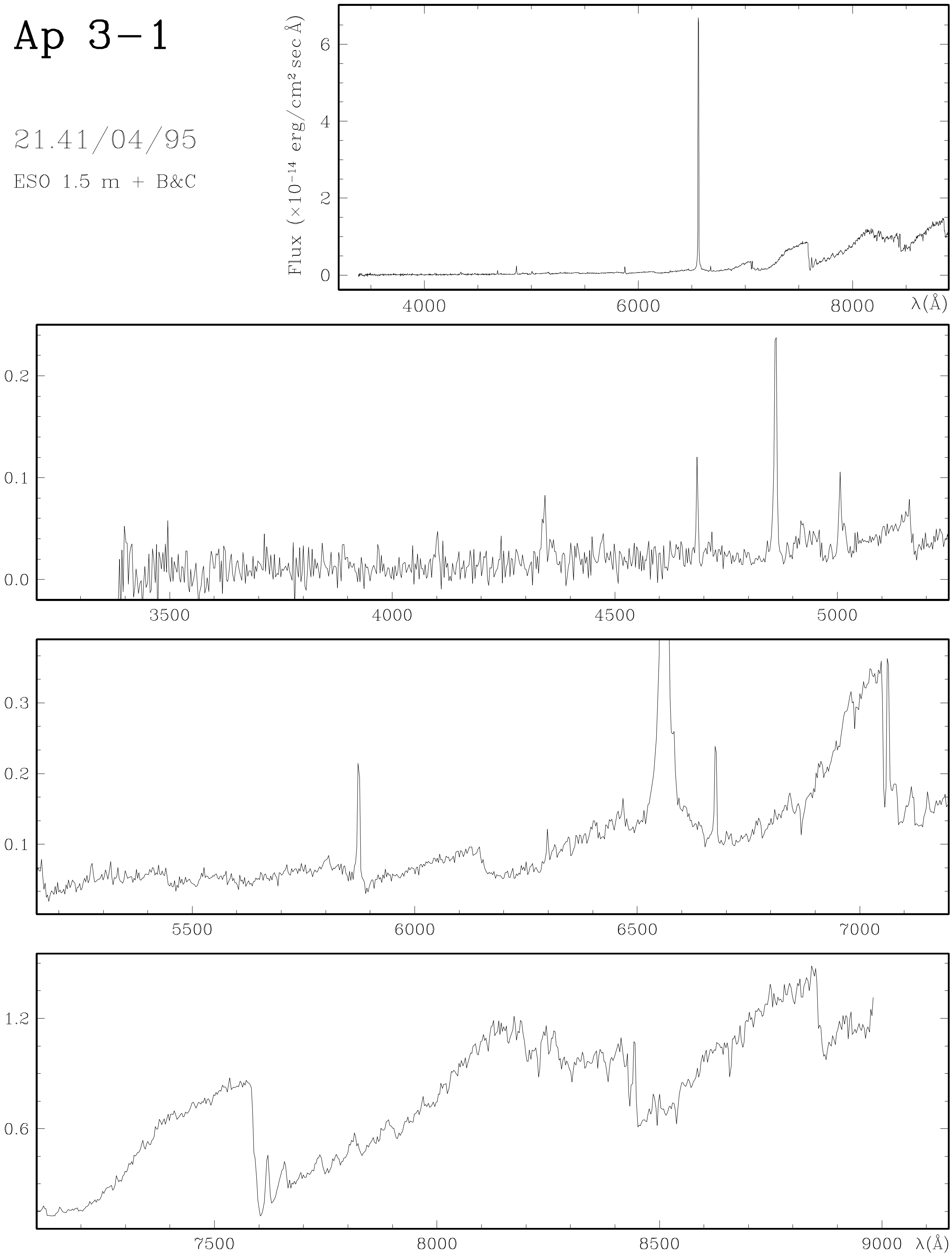


Fig. 84. ESO 1.5m + B&C spectrum of Ap 3-1

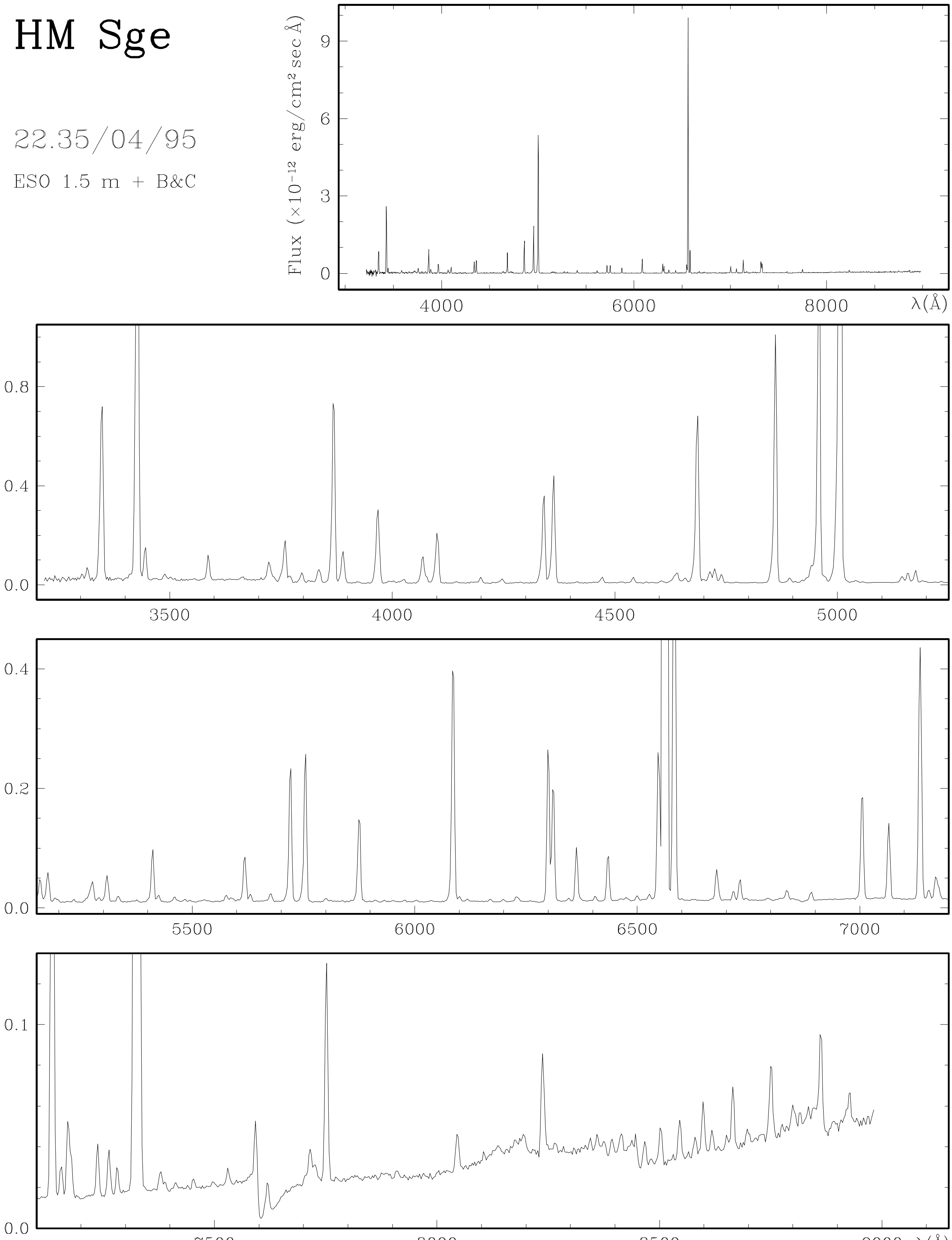


Fig. 85. ESO 1.5m + B&C spectrum of HM Sge

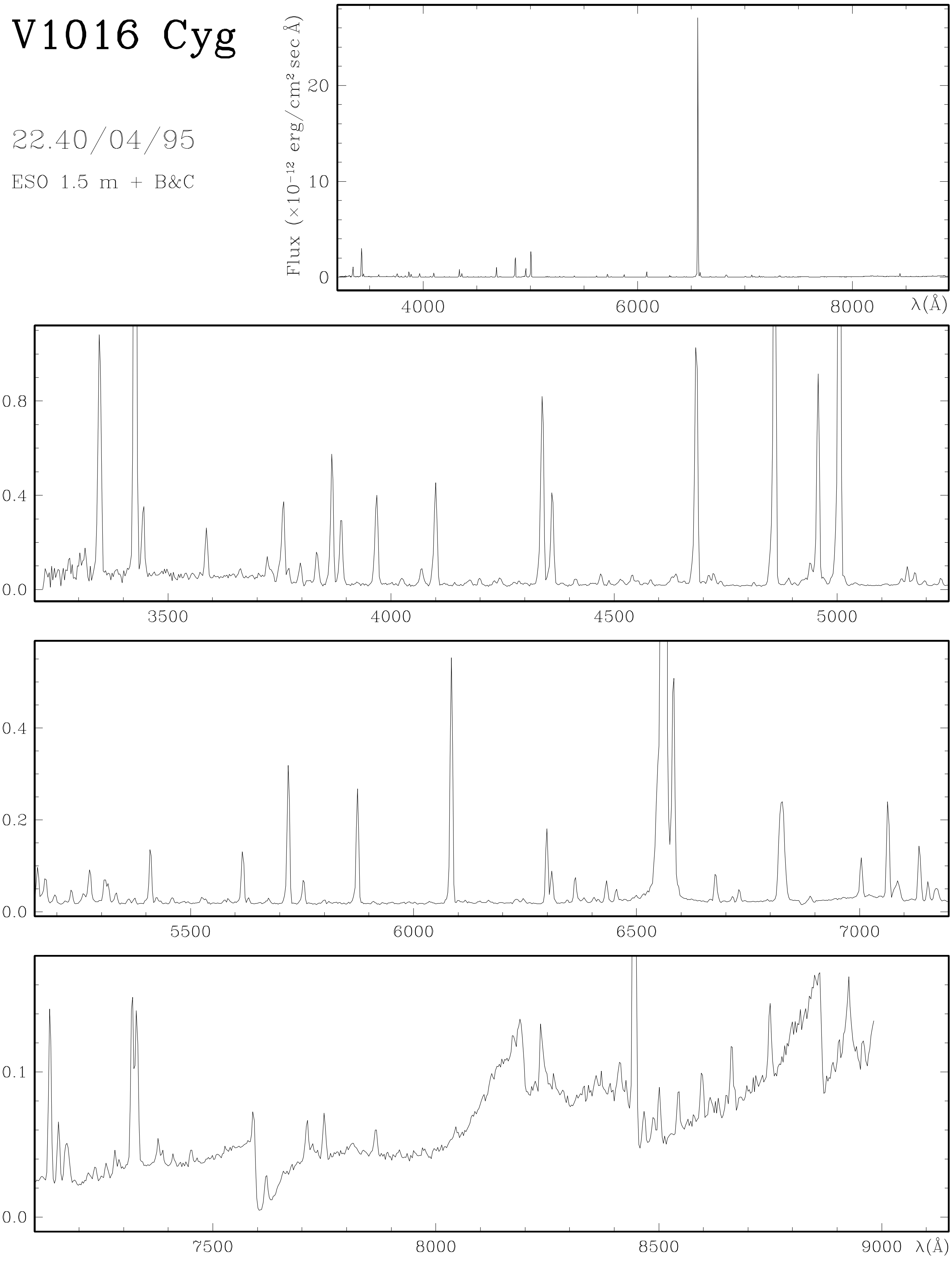


Fig. 86. ESO 1.5m + B&C spectrum of V1016 Cyg

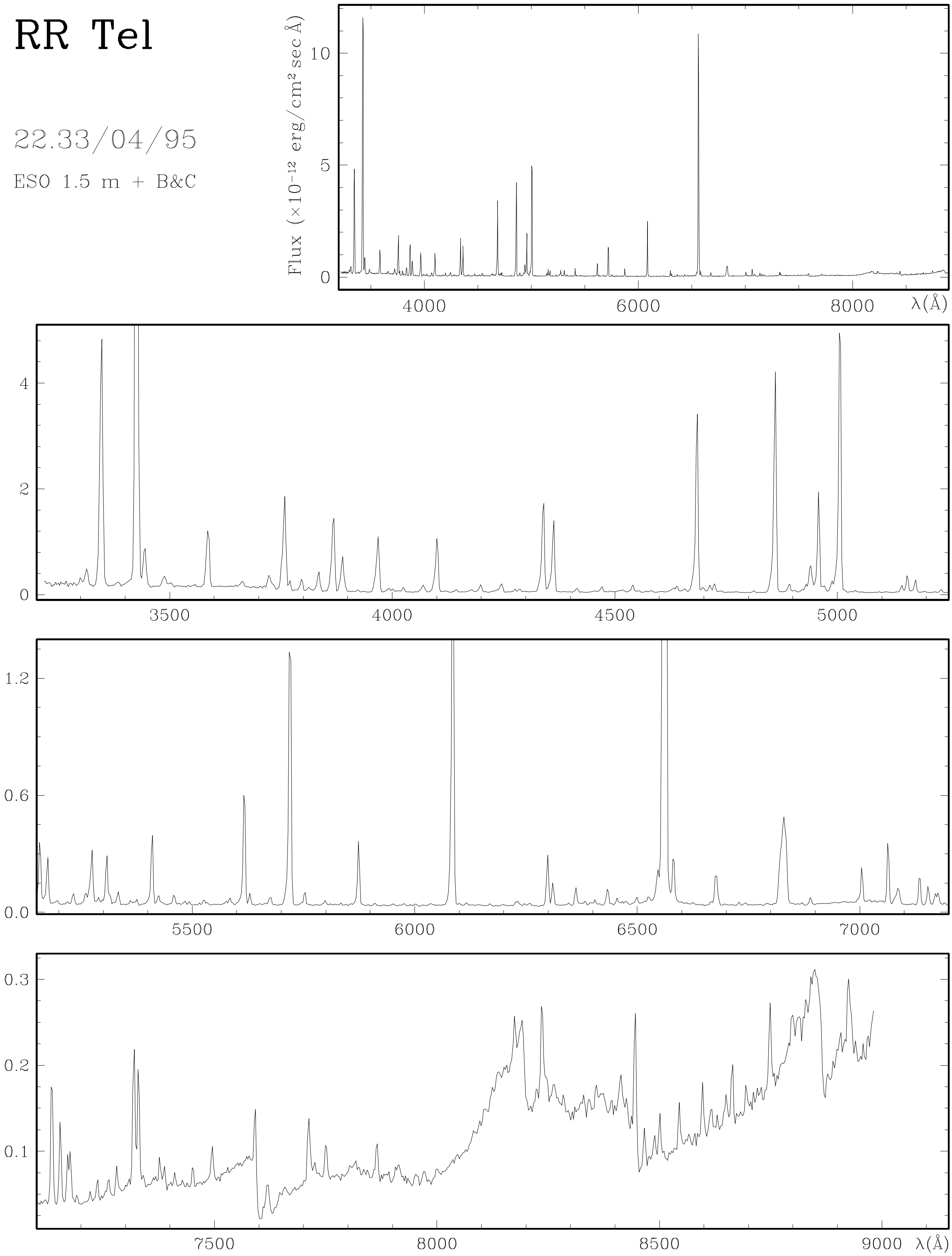


Fig. 87. ESO 1.5m + B&C spectrum of RR Tel

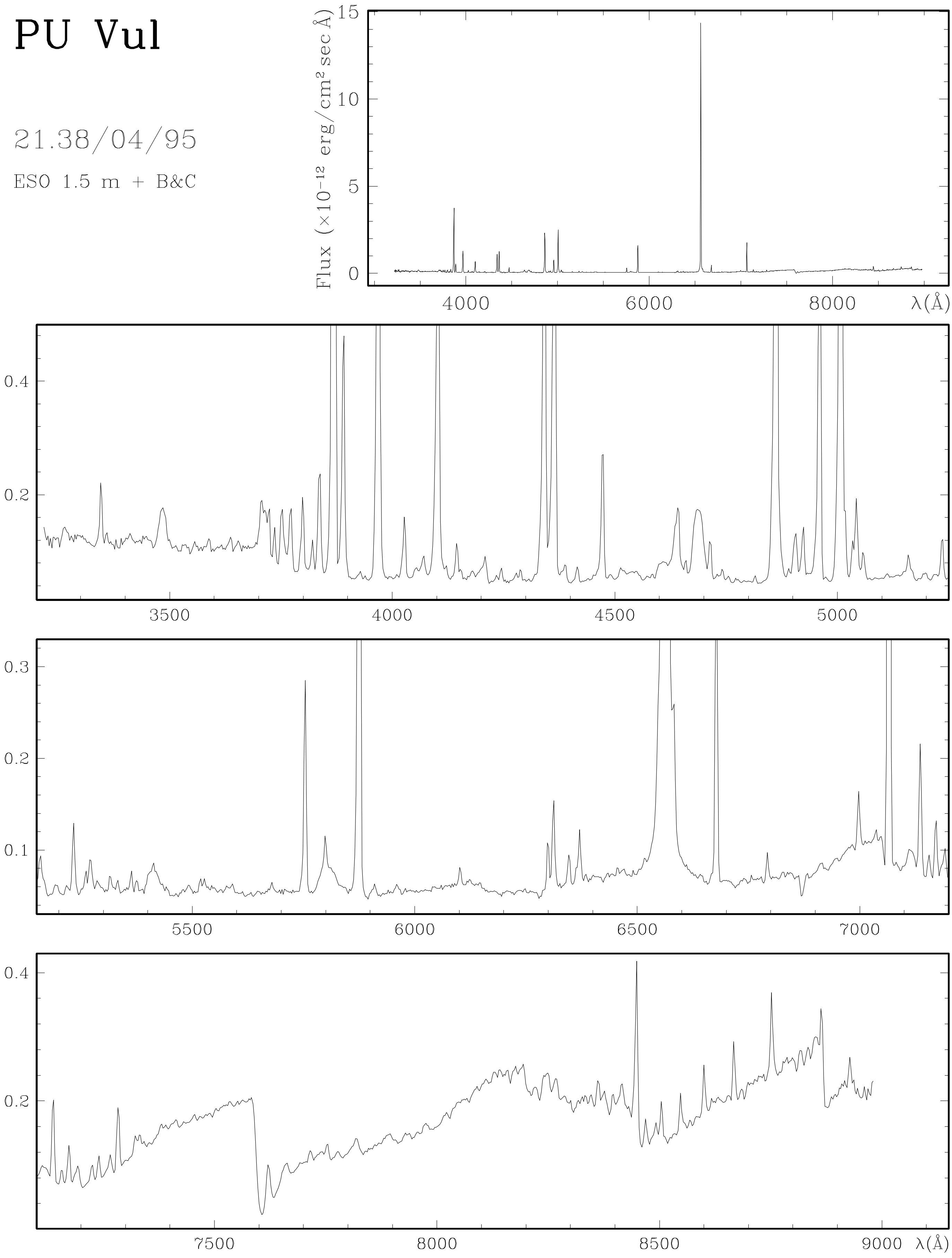


Fig. 88. ESO 1.5m + B&C spectrum of PU Vul

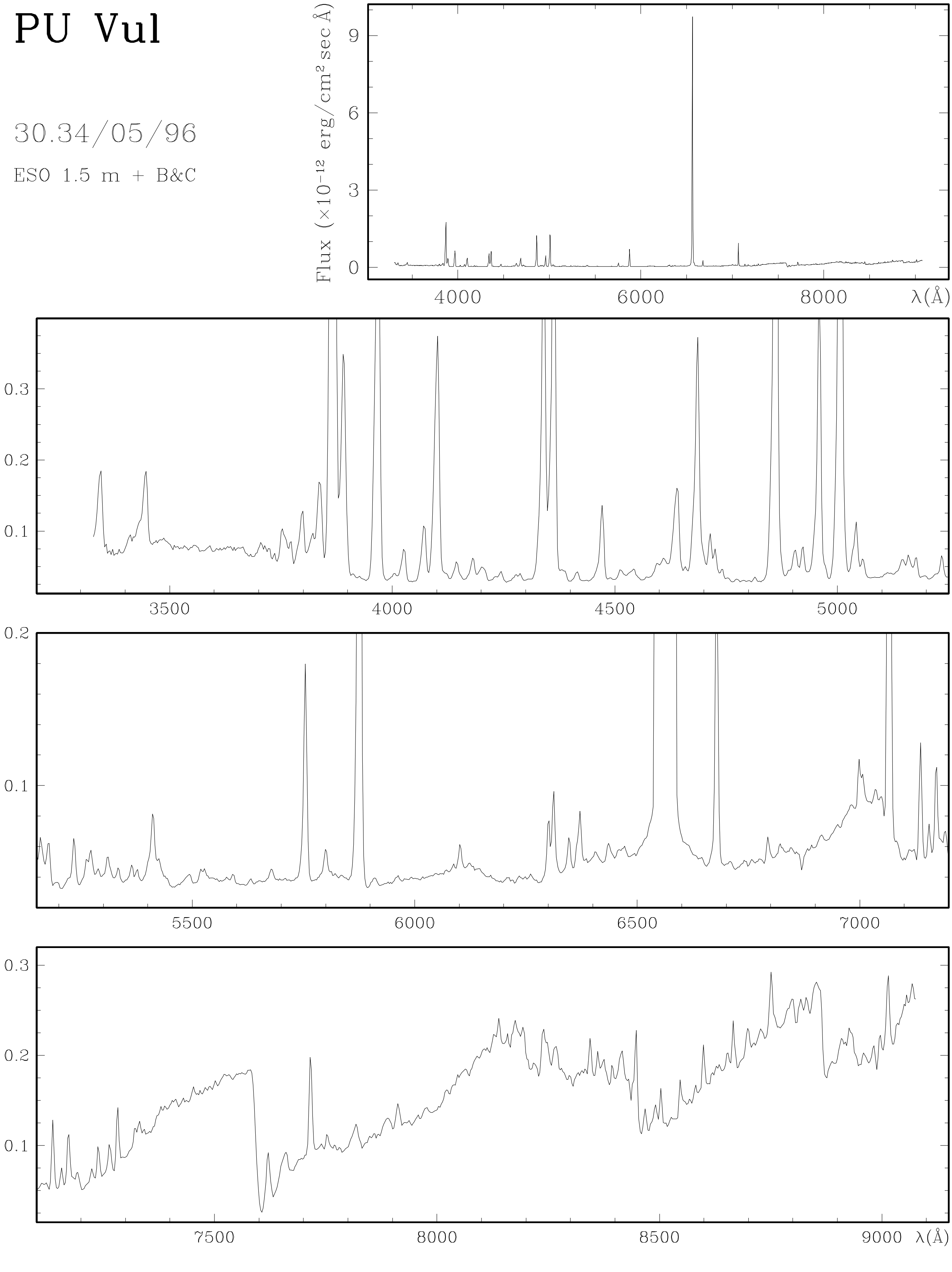


Fig. 89. ESO 1.5m + B&C spectrum of PU Vul

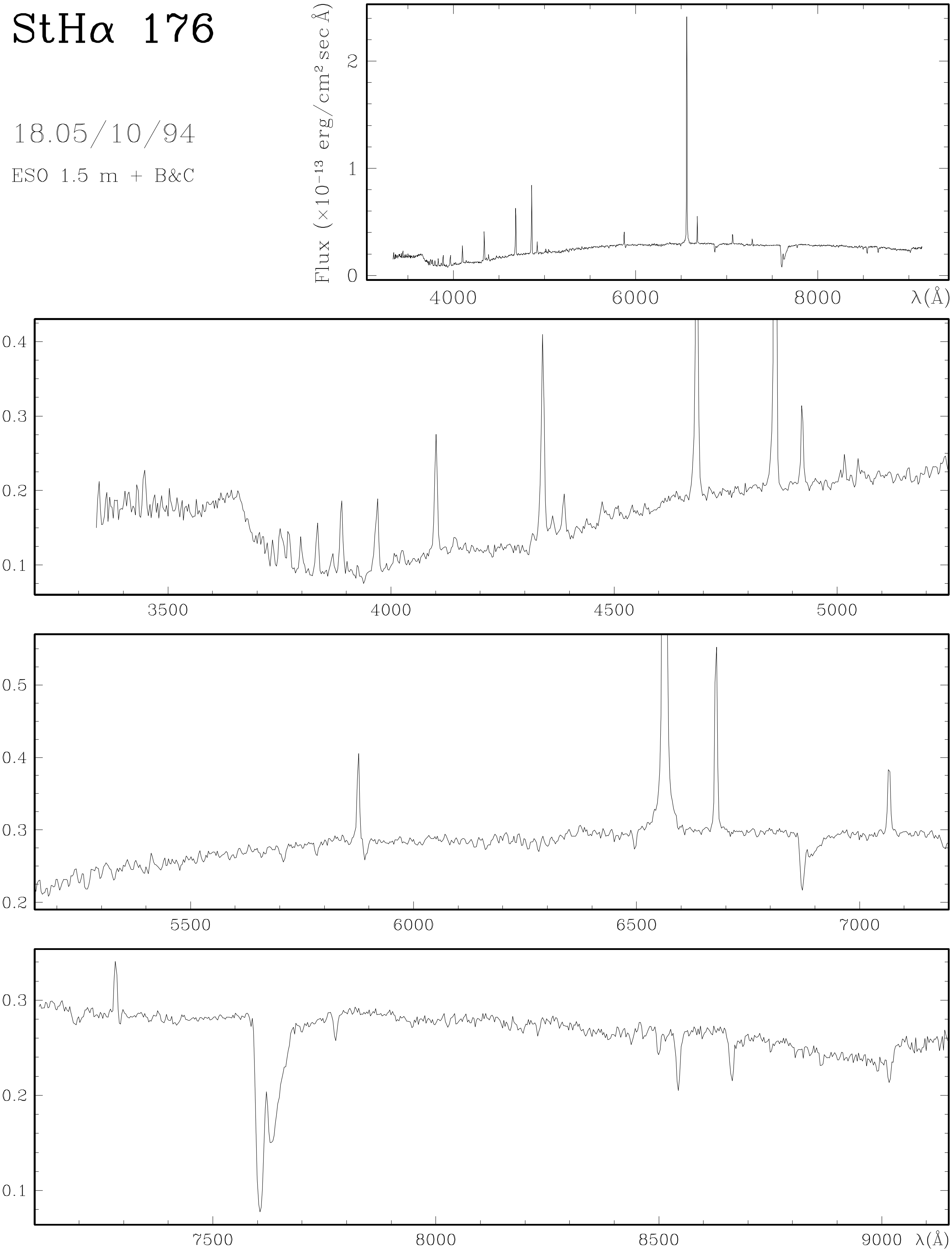


Fig. 90. ESO 1.5m + B&C spectrum of StHA 176

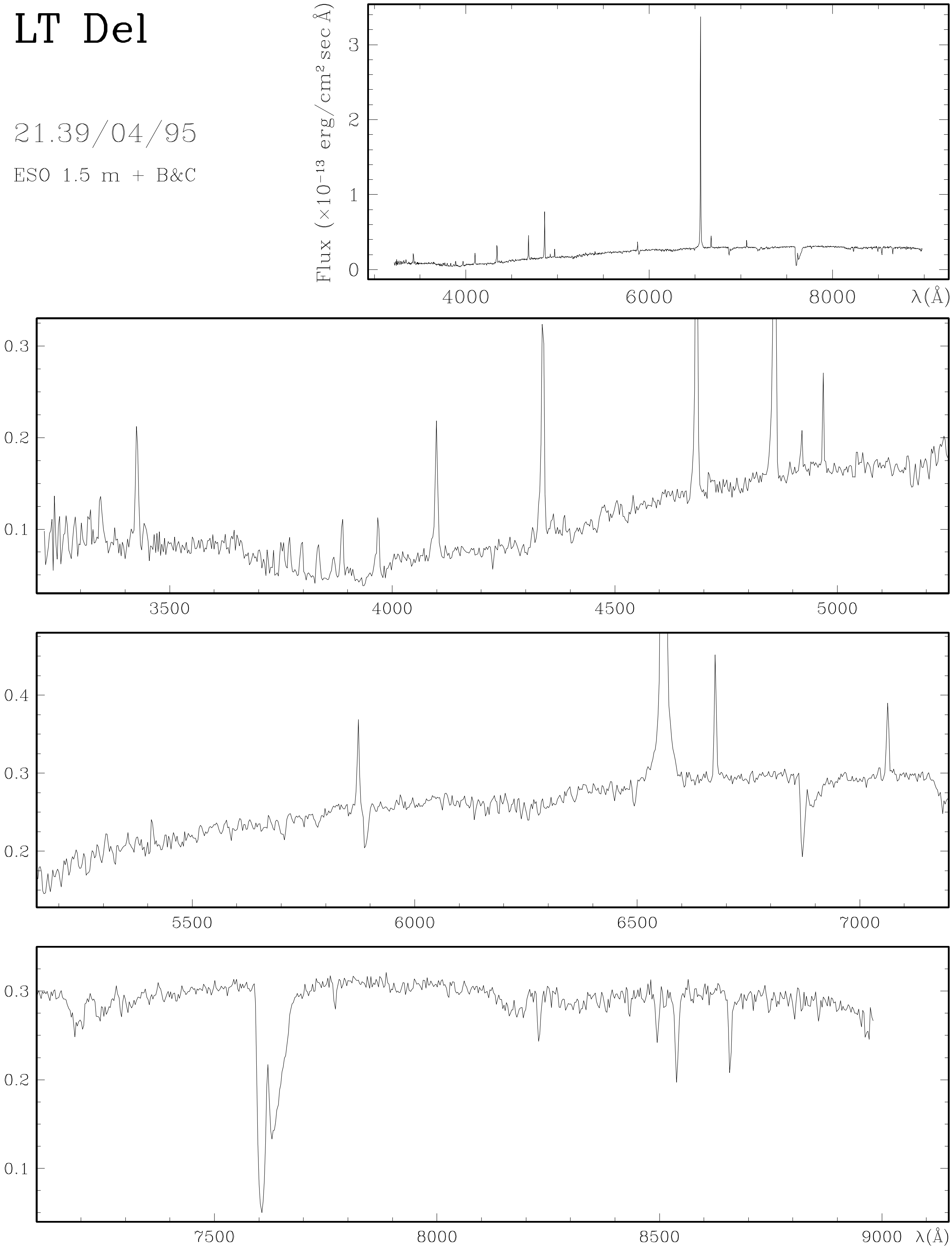


Fig. 91. ESO 1.5m + B&C spectrum of LT Del

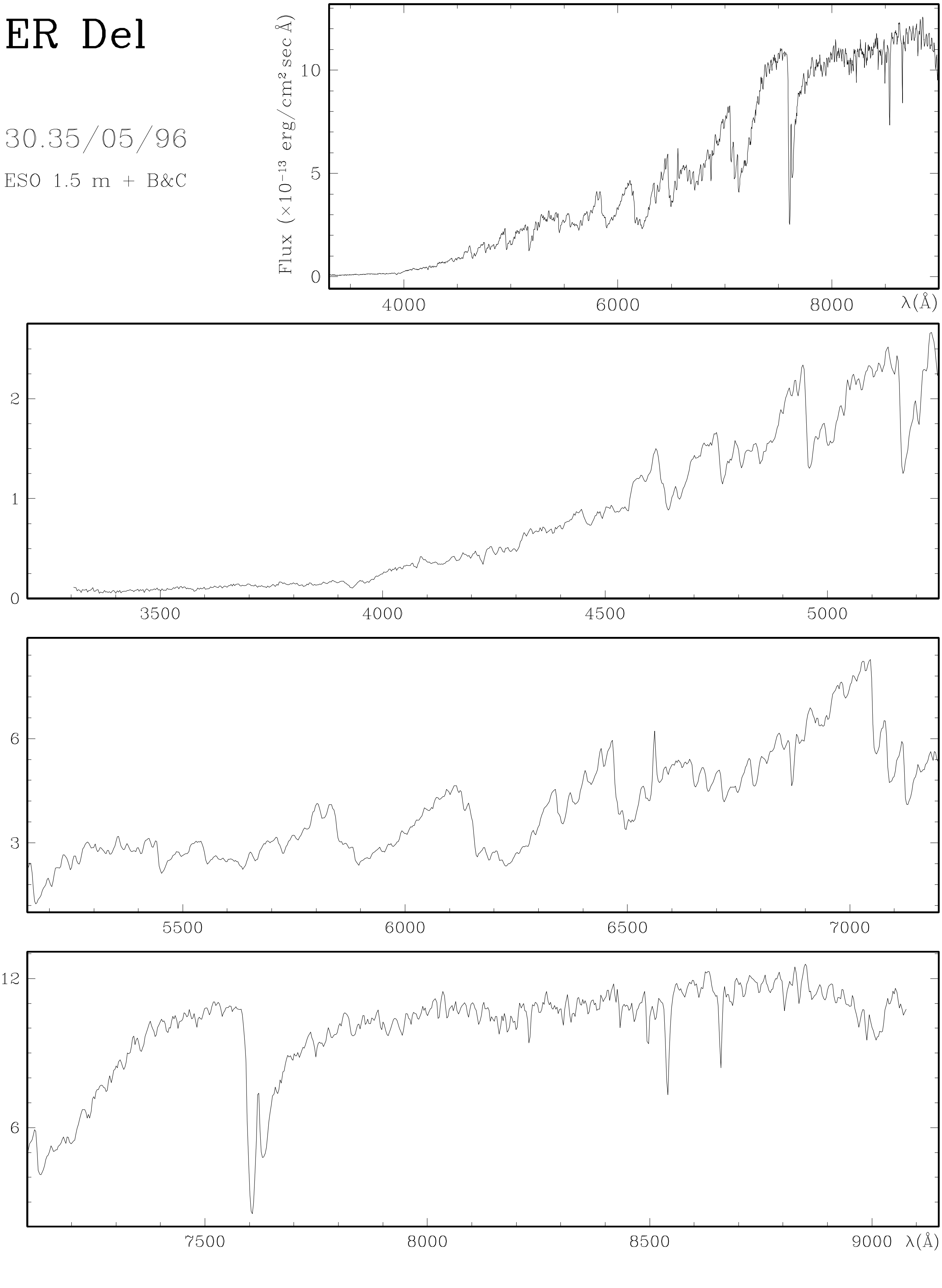


Fig. 92. ESO 1.5m + B&C spectrum of ER Del

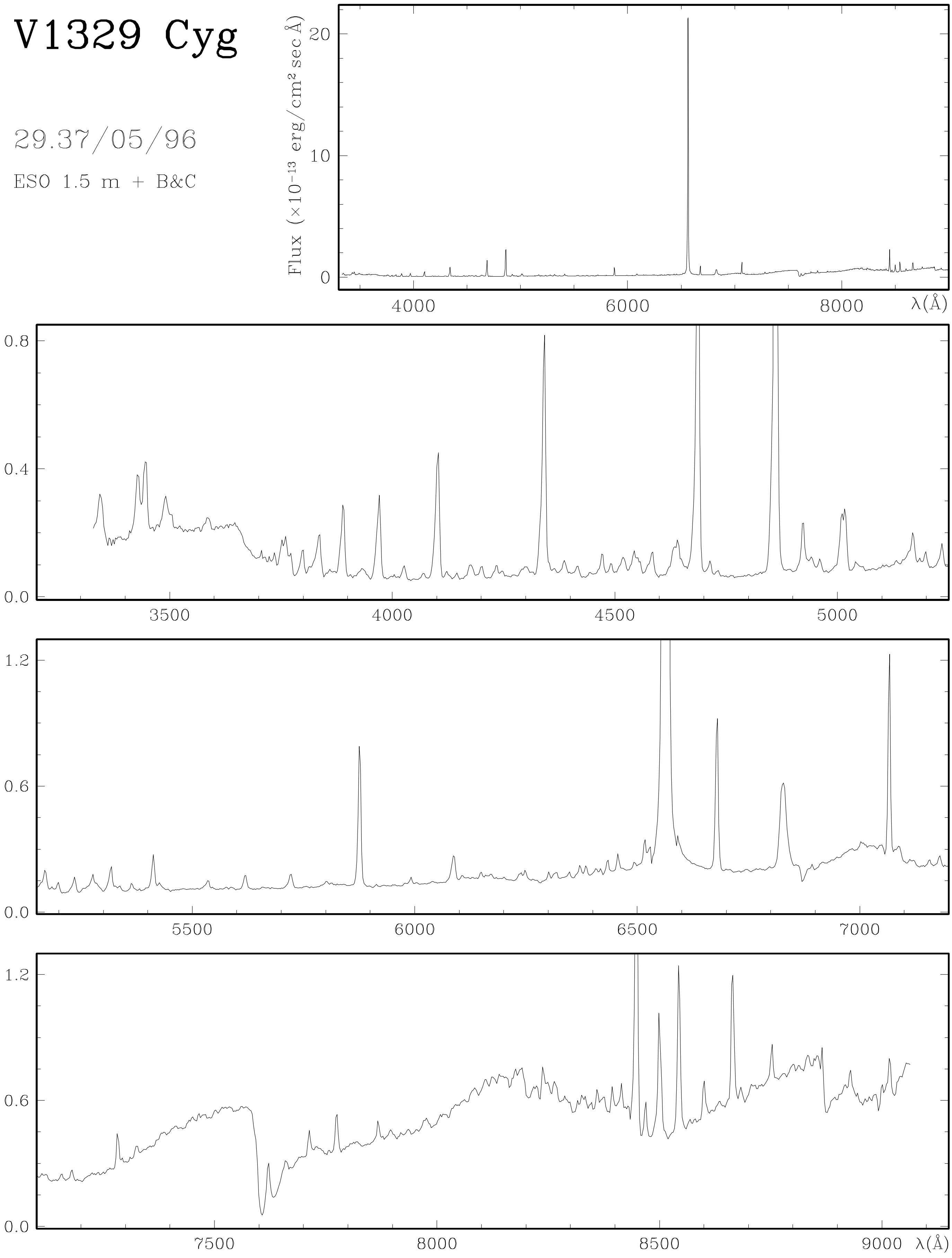


Fig. 93. ESO 1.5m + B&C spectrum of V1329 Cyg

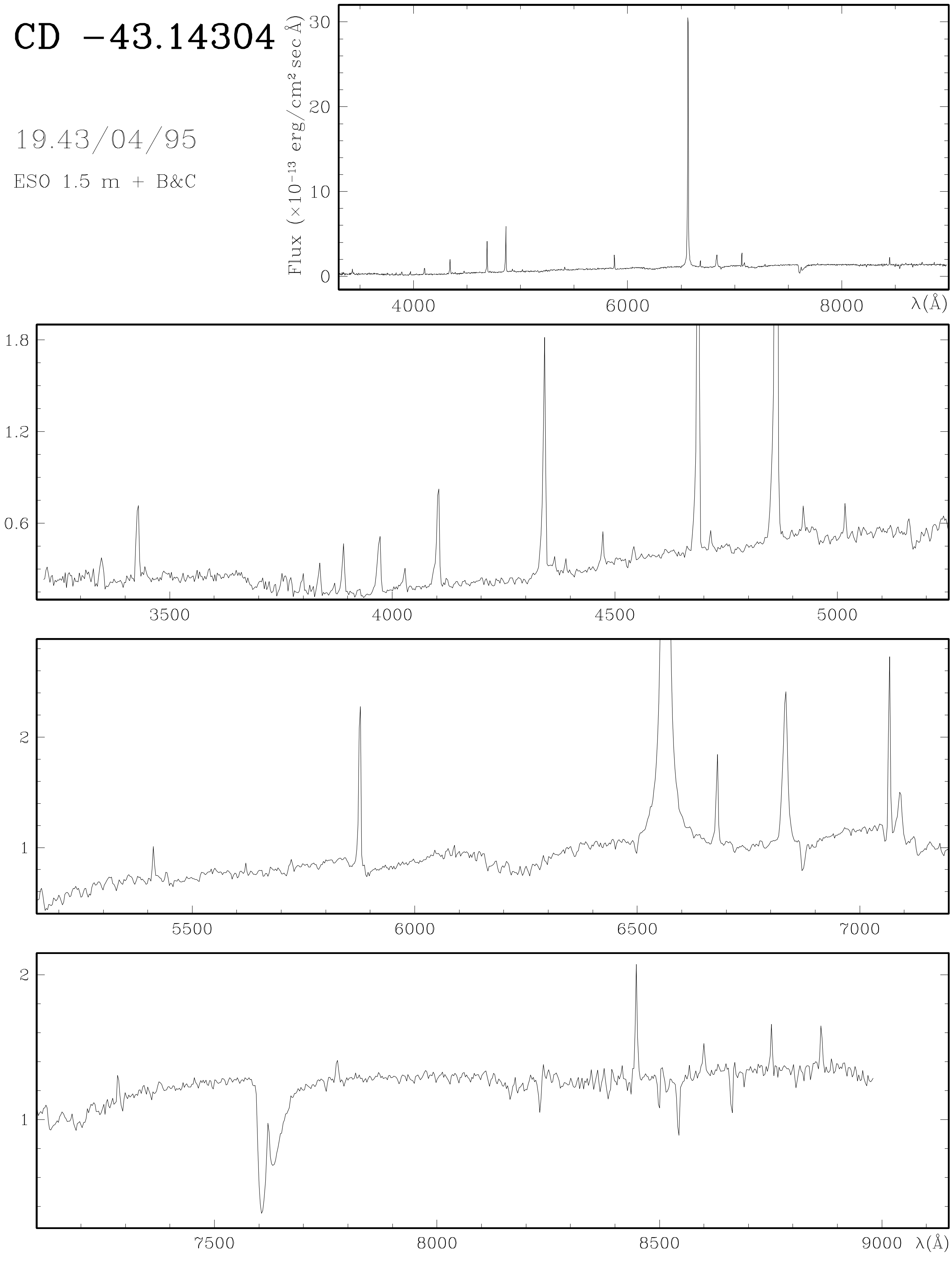


Fig. 94. ESO 1.5m + B&C spectrum of CD –43.14304

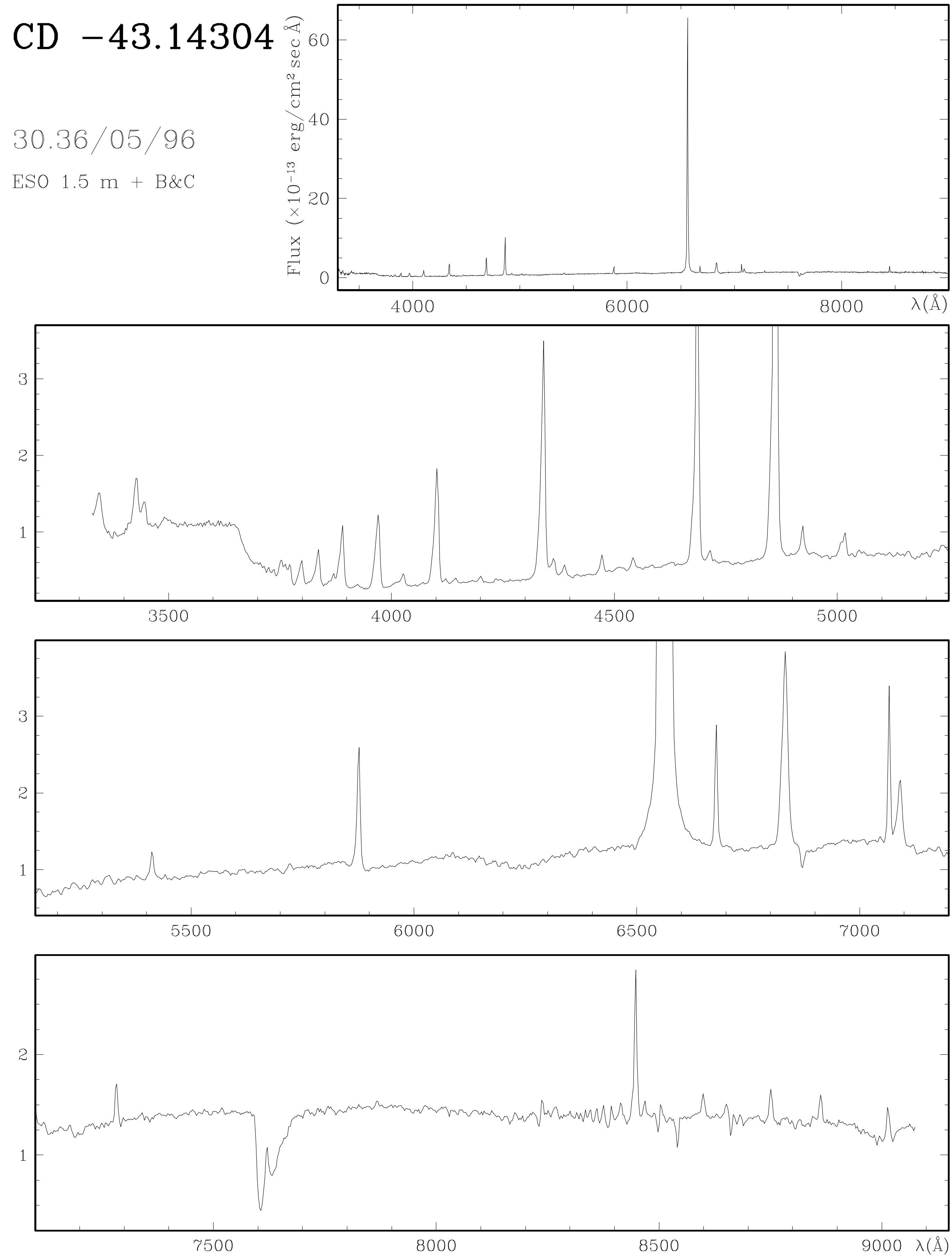


Fig. 95. ESO 1.5m + B&C spectrum of CD –43.14304

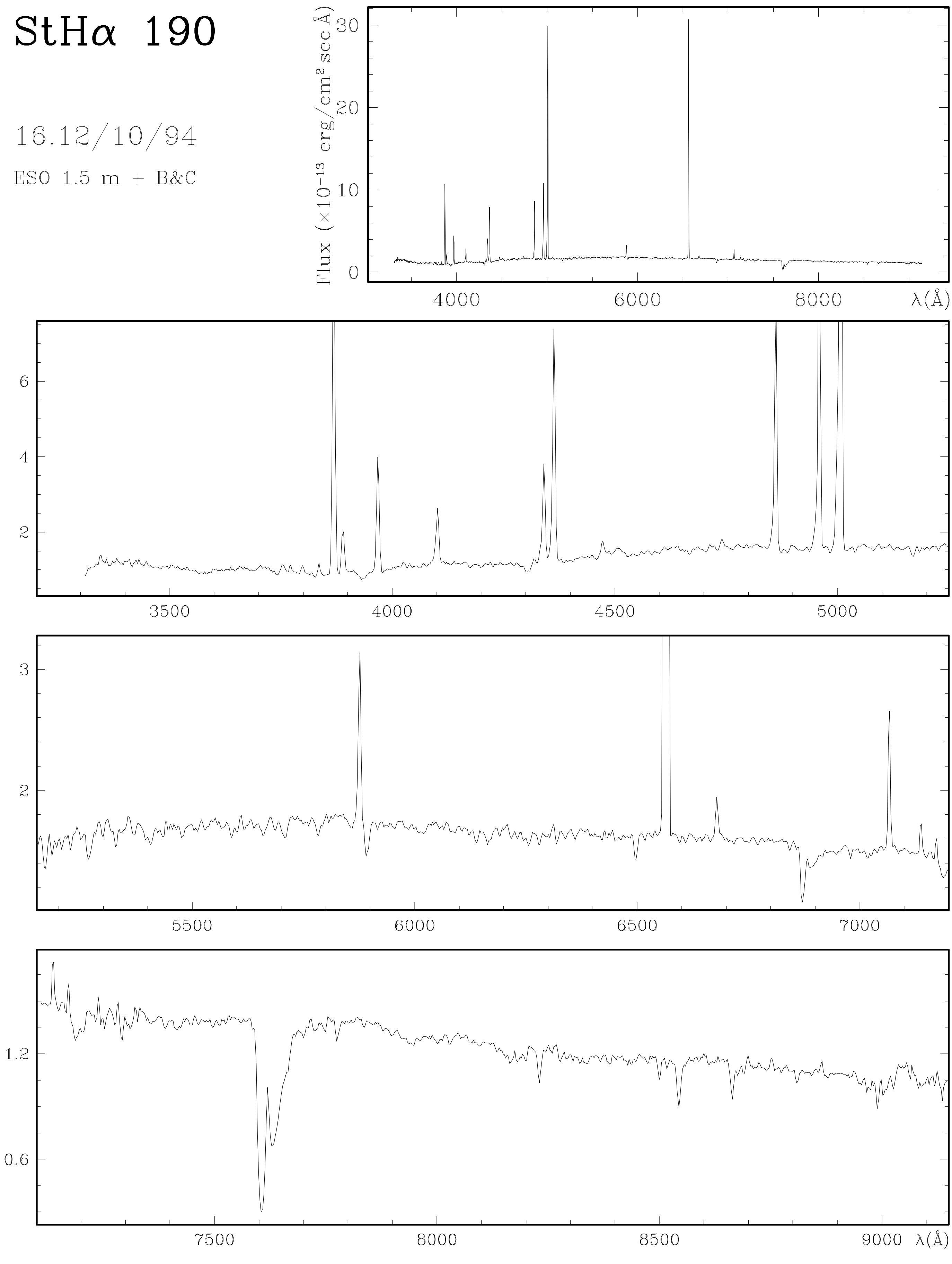


Fig. 96. ESO 1.5m + B&C spectrum of StHA 190

AG Peg

29.39/05/96

ESO 1.5 m + B&C

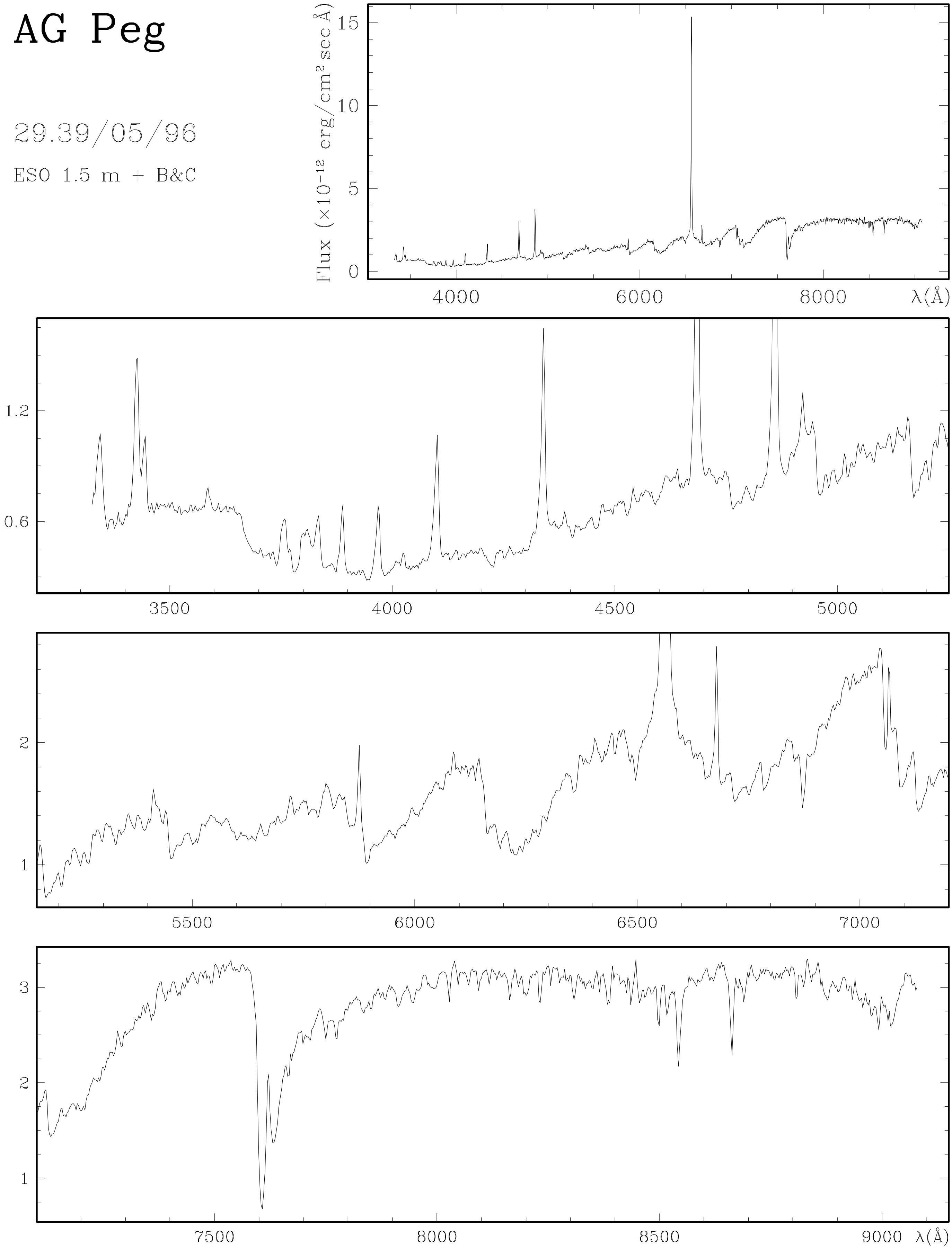


Fig. 97. ESO 1.5m + B&C spectrum of AG Peg

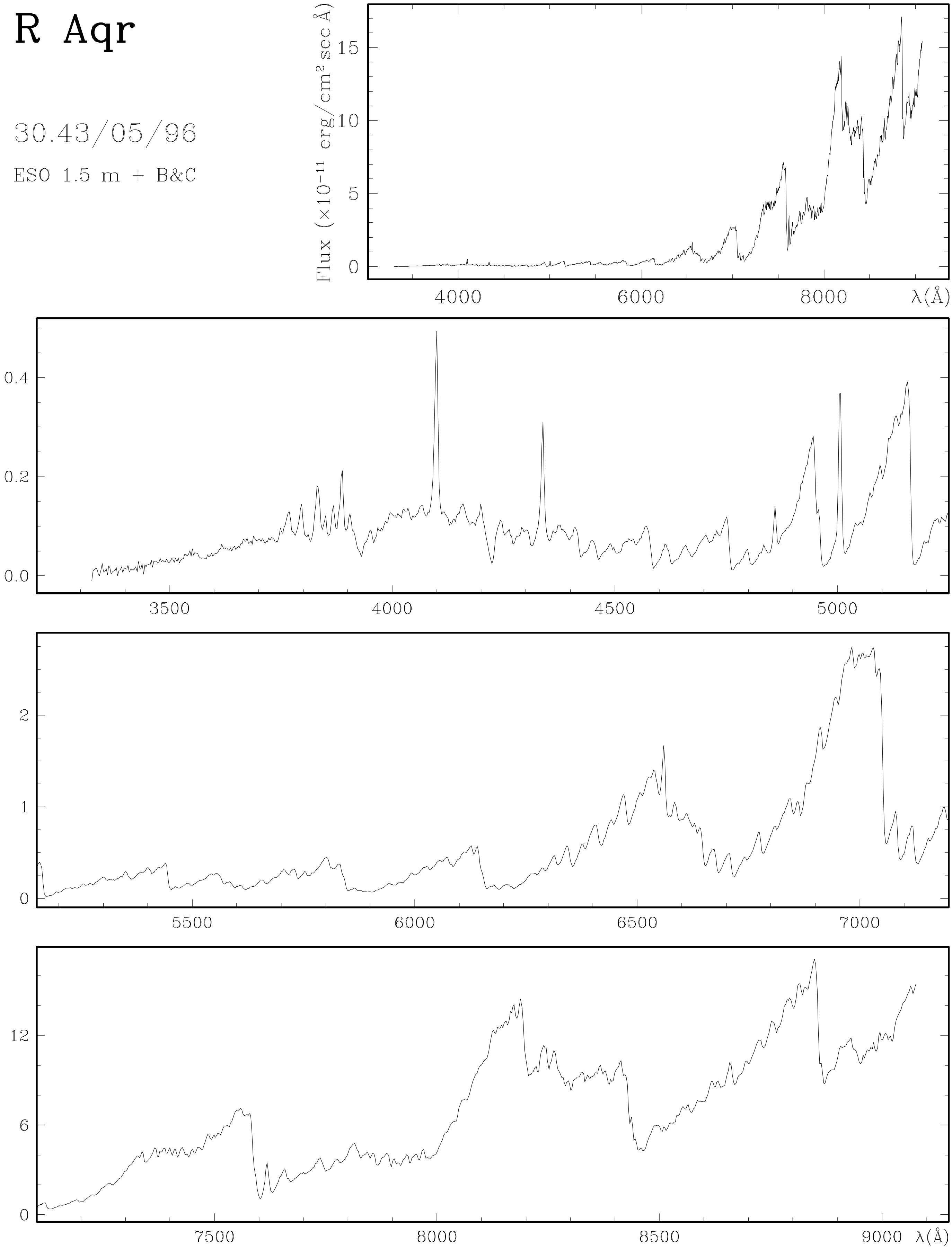


Fig. 98. ESO 1.5m + B&C spectrum of R Aqr

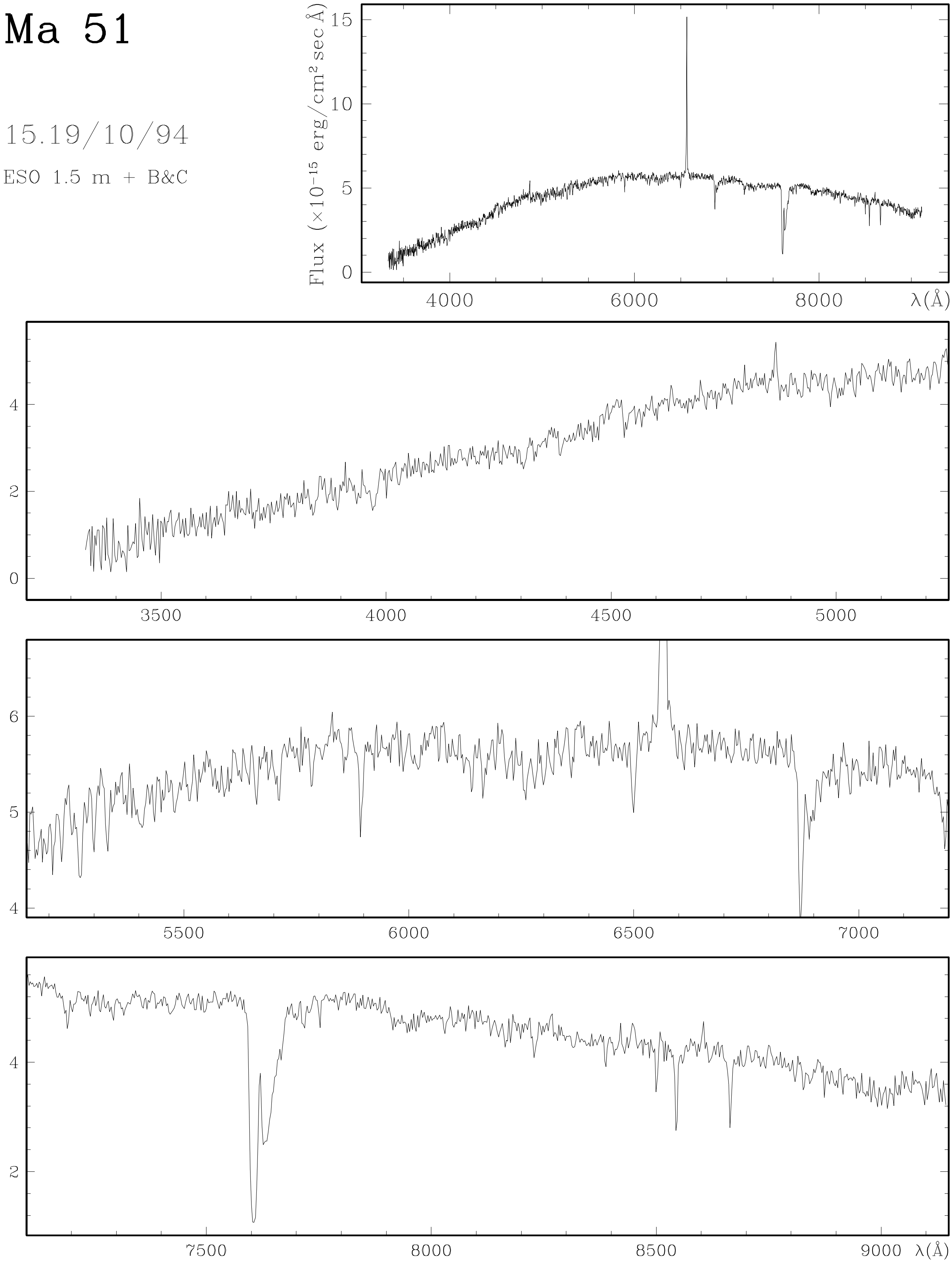


Fig. 99. ESO 1.5m + B&C spectrum of Ma 51

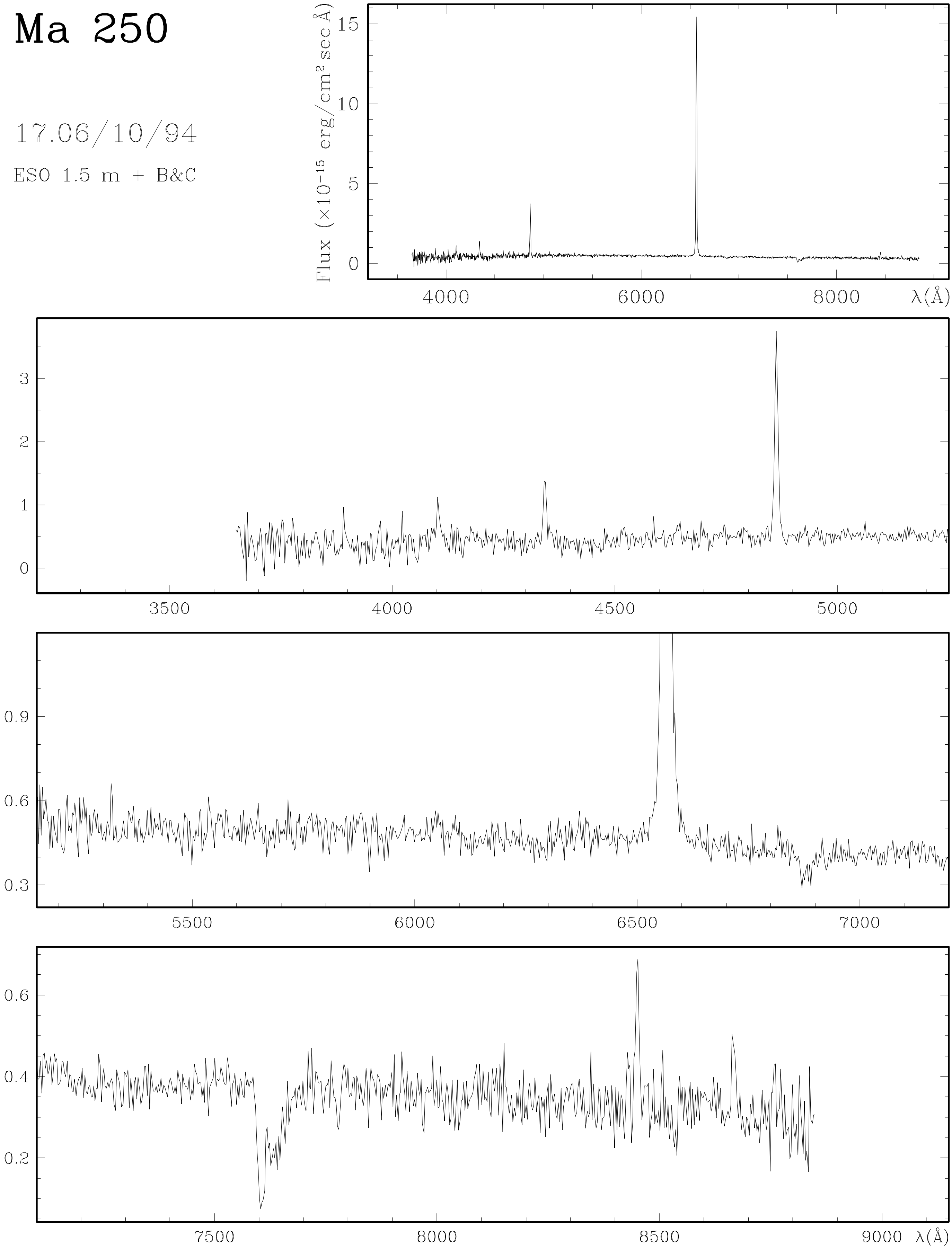


Fig. 100. ESO 1.5m + B&C spectrum of Ma 250

Ma 285

18.08/10/94

ESO 1.5 m + B&C

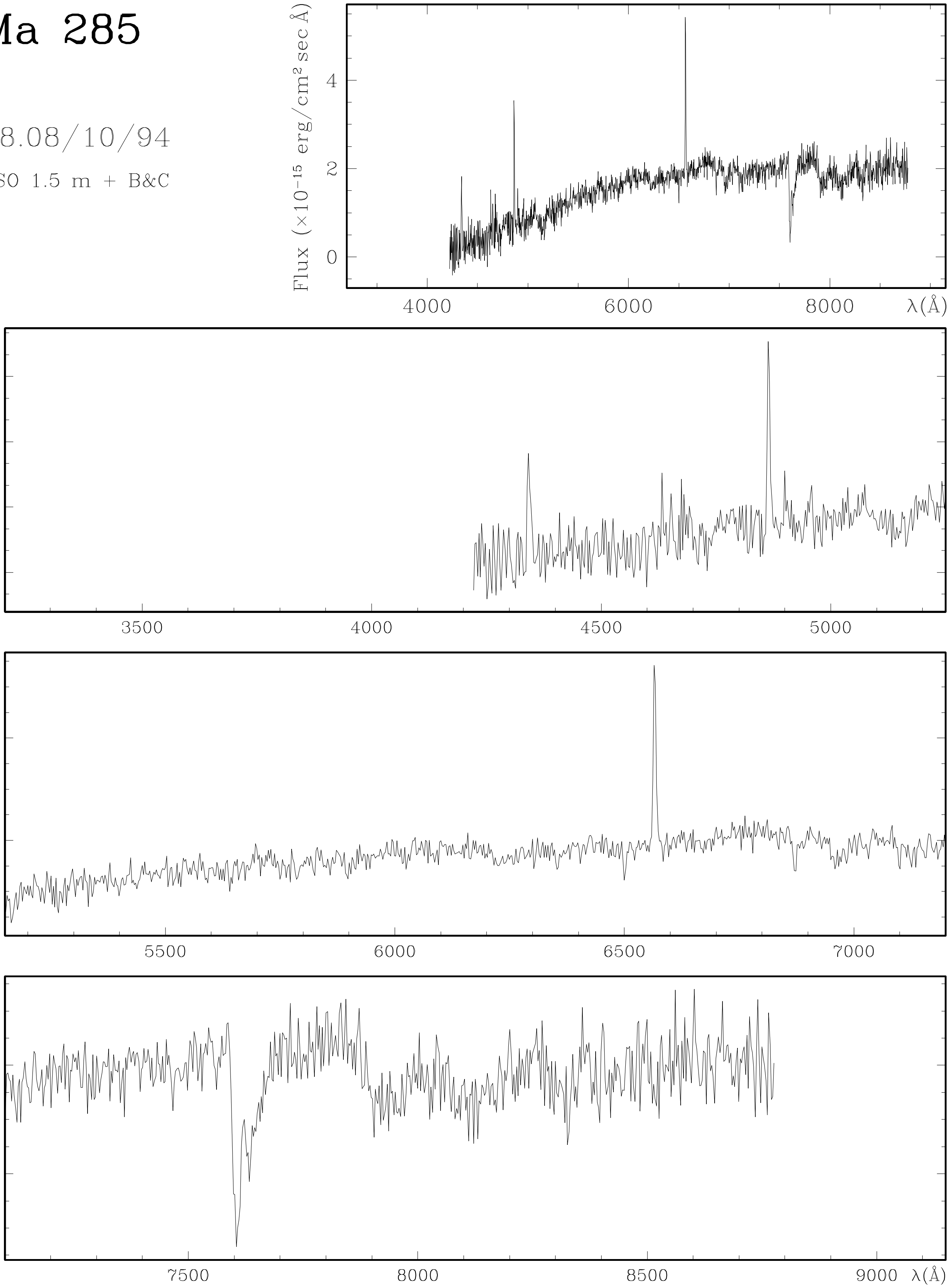


Fig. 101. ESO 1.5m + B&C spectrum of Ma 285

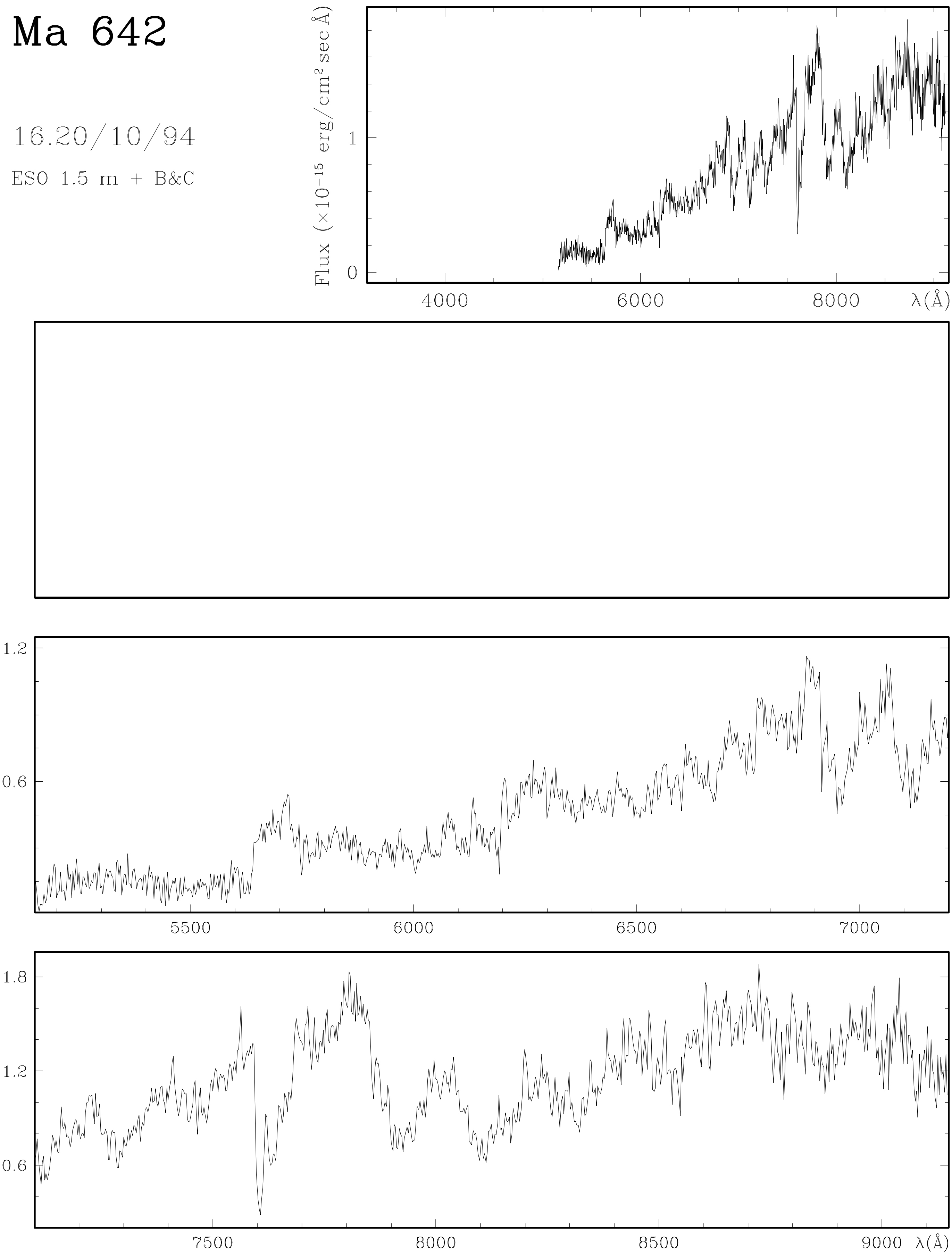


Fig. 102. ESO 1.5m + B&C spectrum of Ma 642

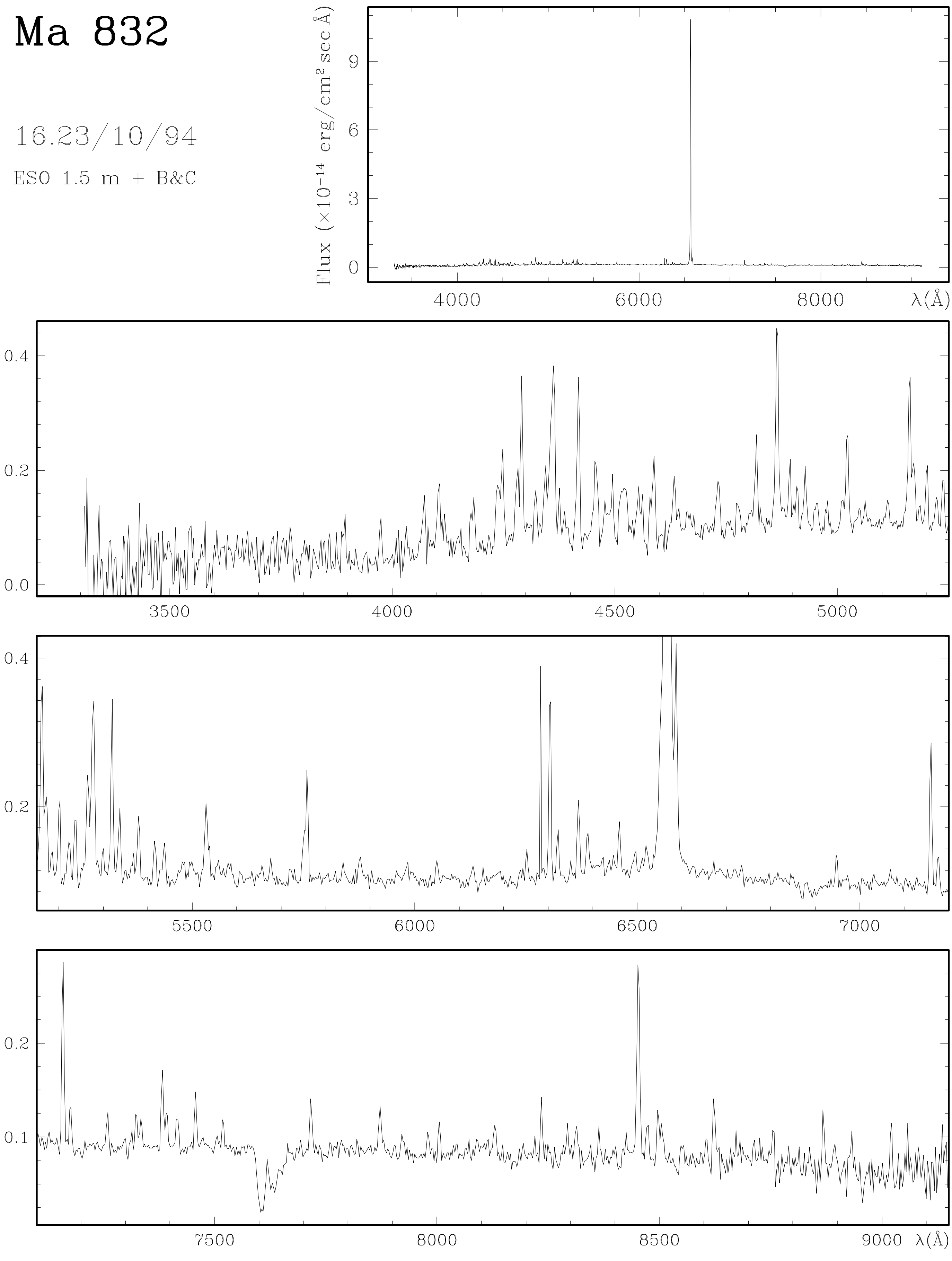


Fig. 103. ESO 1.5m + B&C spectrum of Ma 832

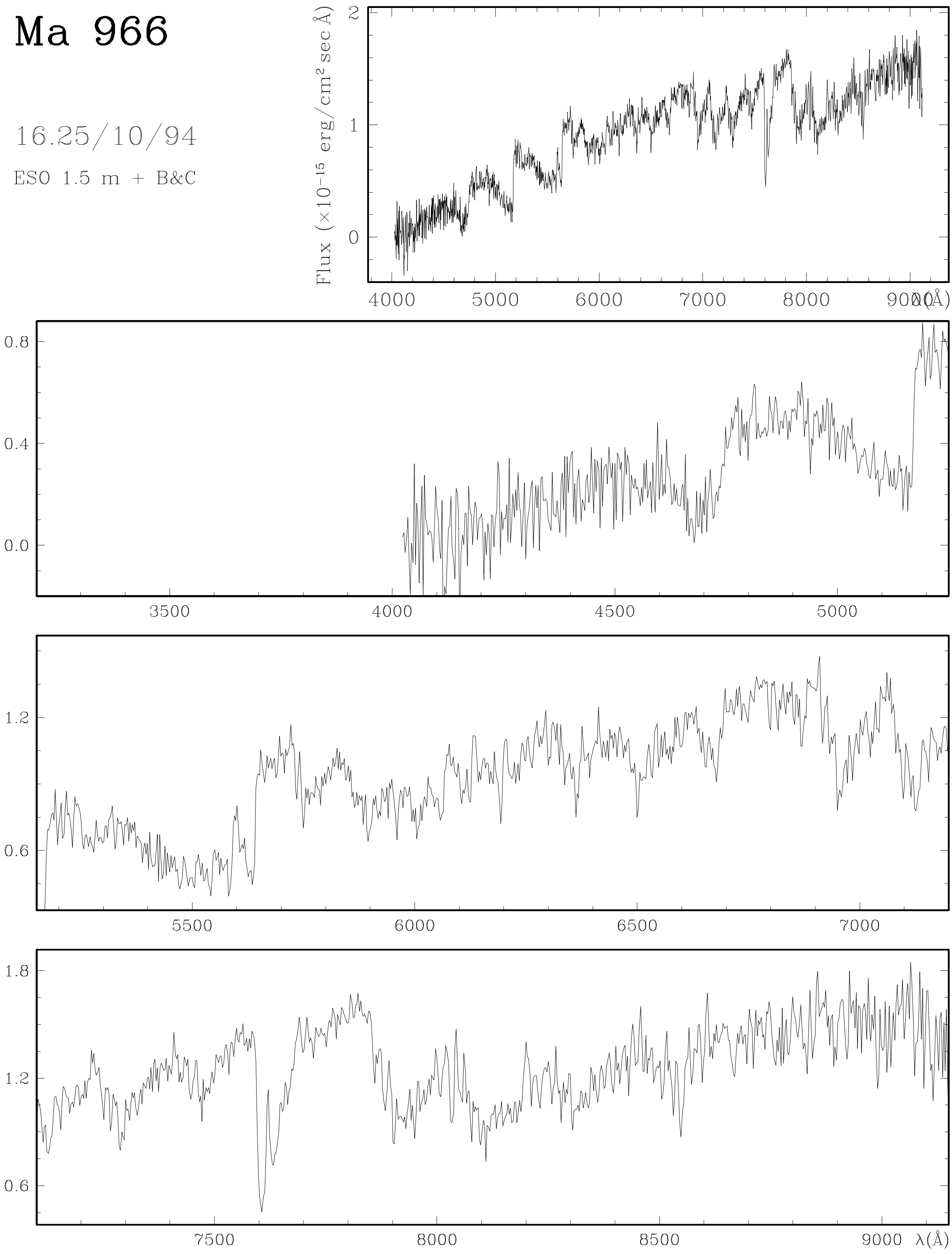


Fig. 104. ESO 1.5m + B&C spectrum of Ma 966

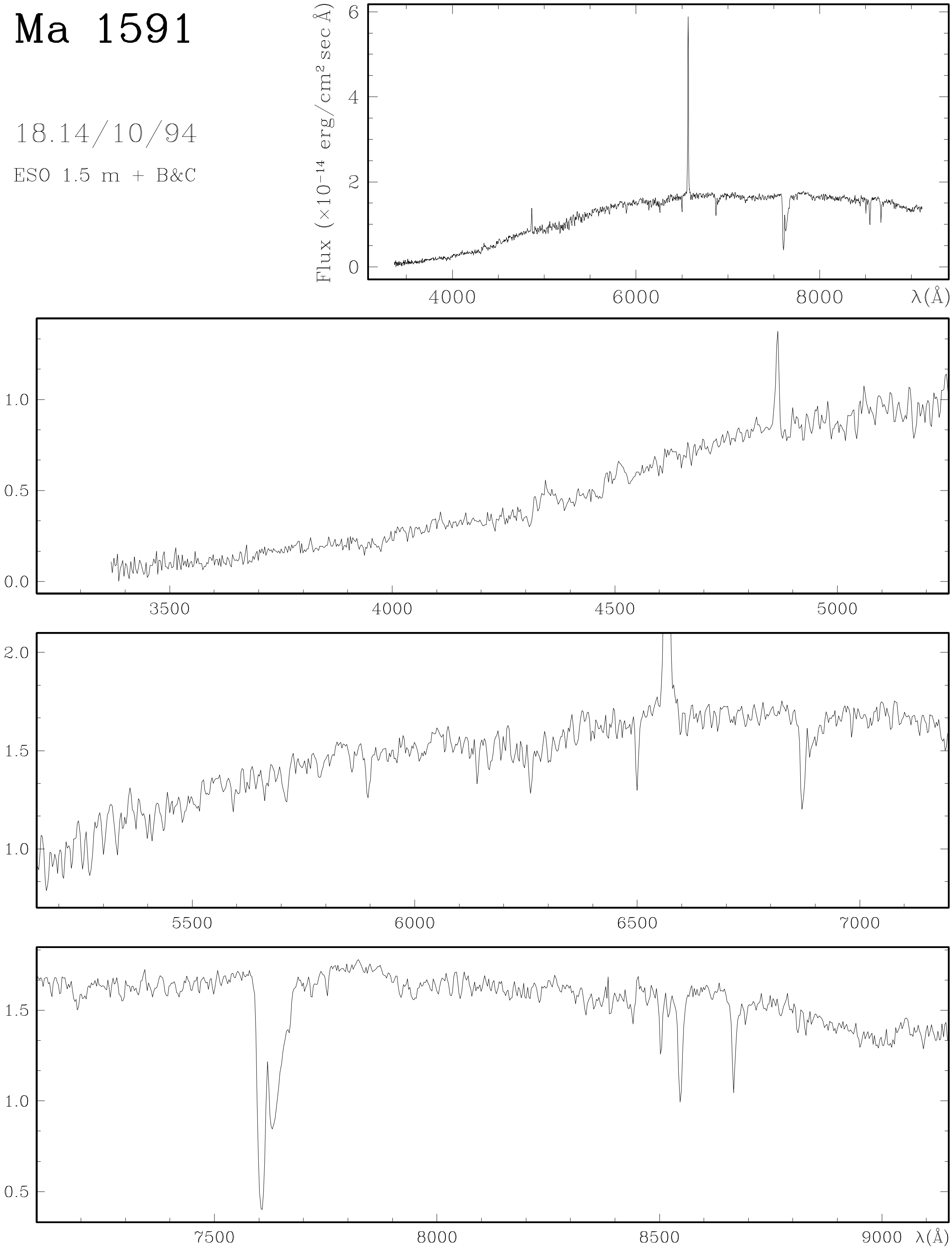


Fig. 105. ESO 1.5m + B&C spectrum of Ma 1591

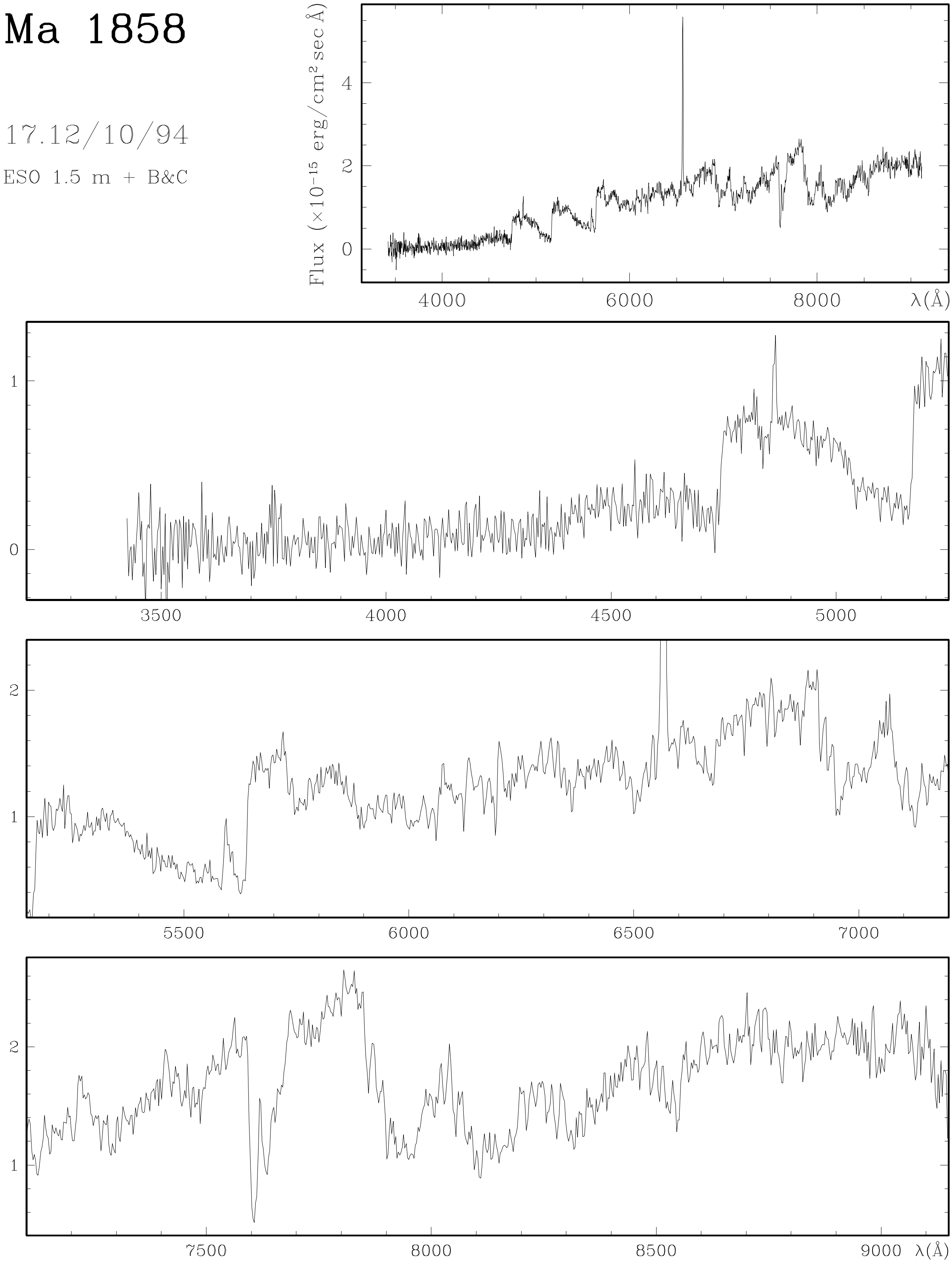


Fig. 106. ESO 1.5m + B&C spectrum of Ma 1858

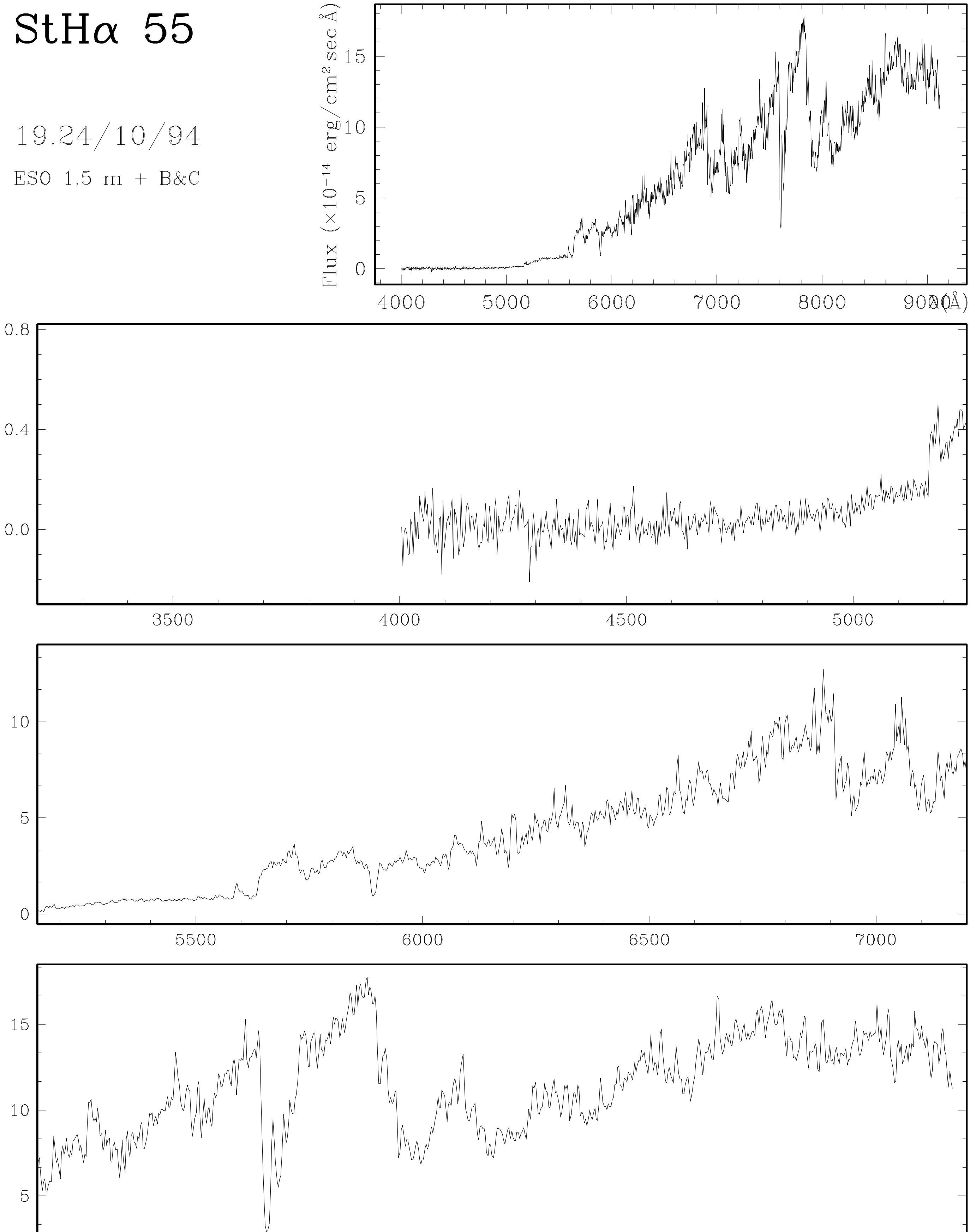


Fig. 107. ESO 1.5m + B&C spectrum of StHA 55

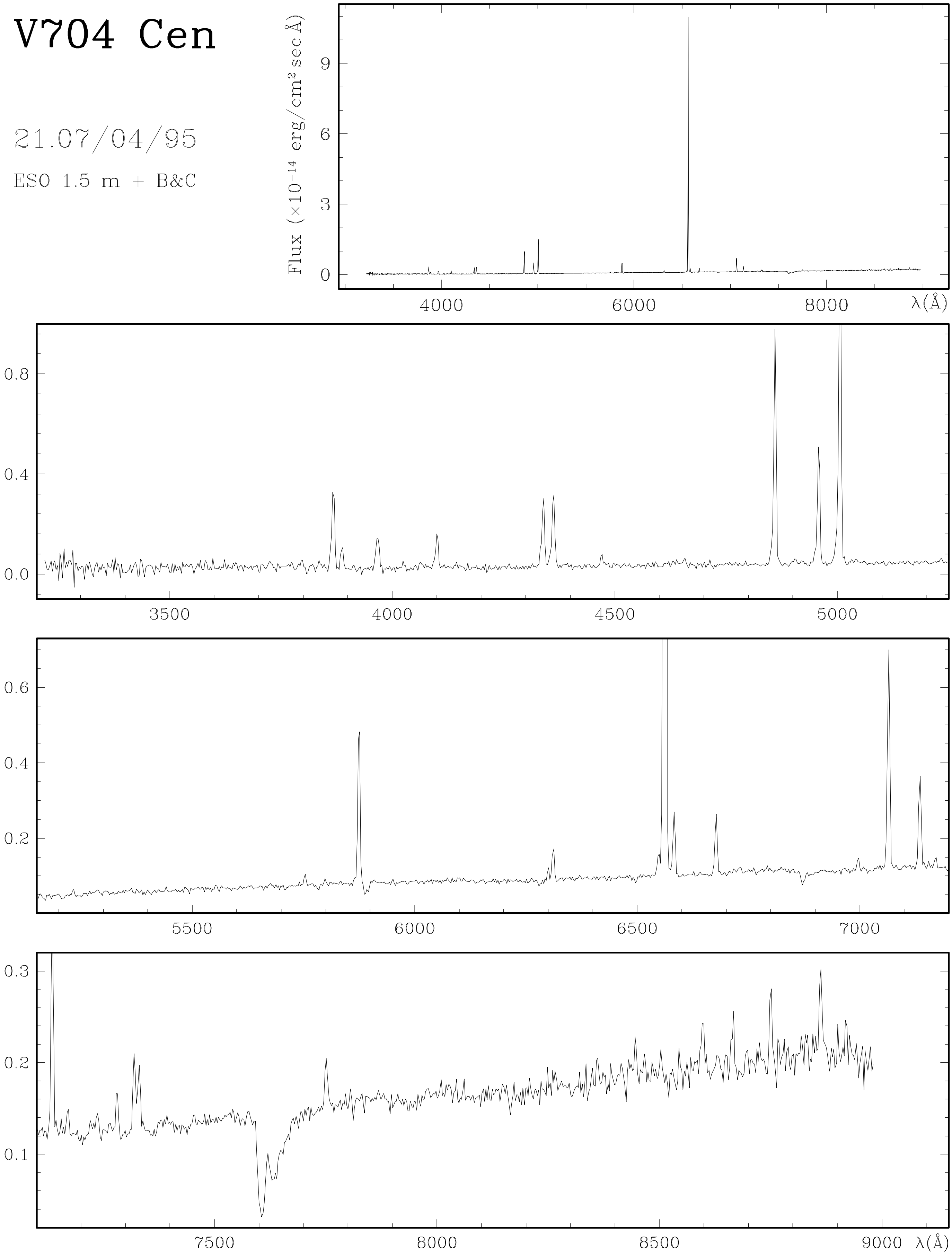


Fig. 108. ESO 1.5m + B&C spectrum of V704 Cen

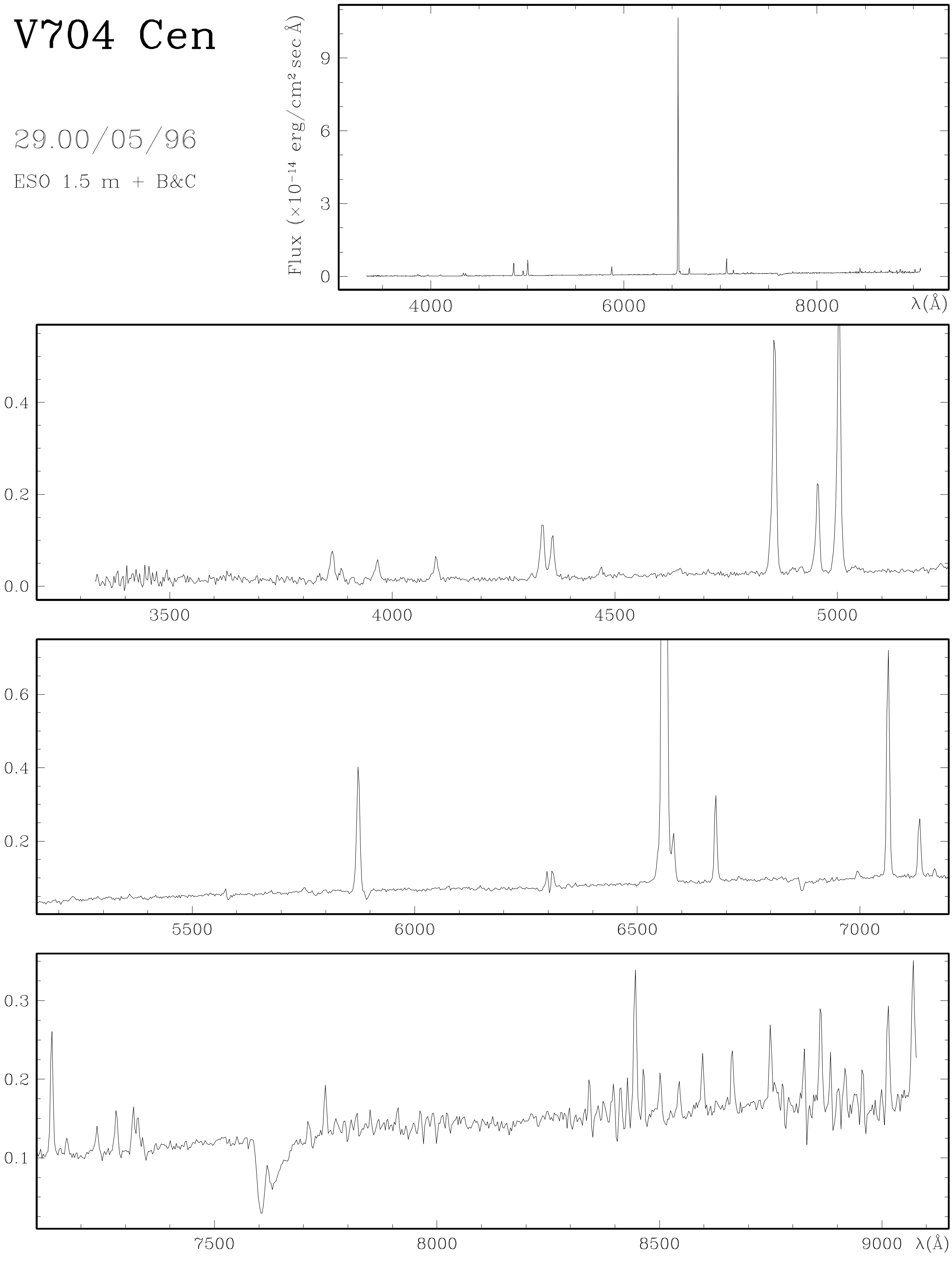


Fig. 109. ESO 1.5m + B&C spectrum of V704 Cen

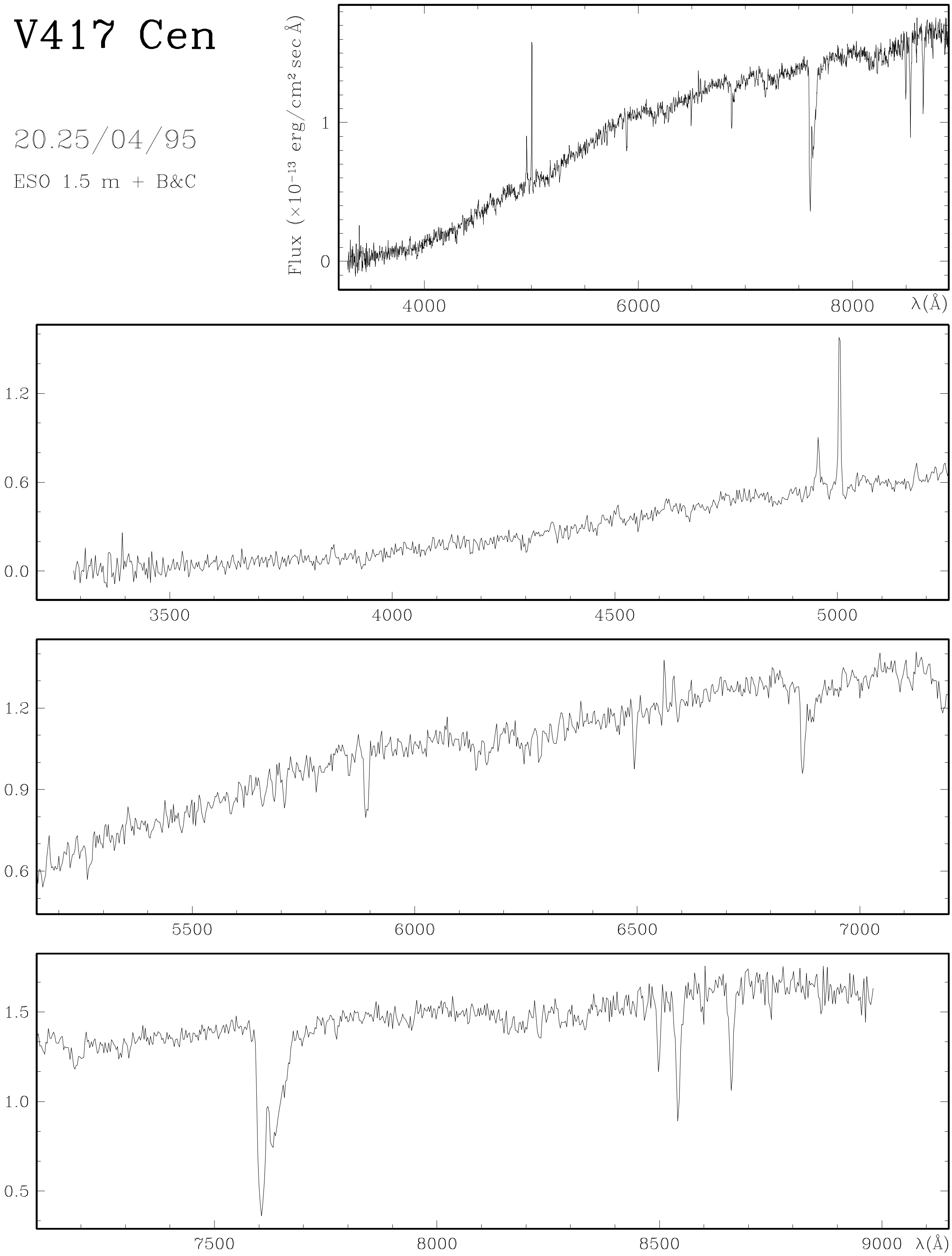


Fig. 110. ESO 1.5m + B&C spectrum of V417 Cen

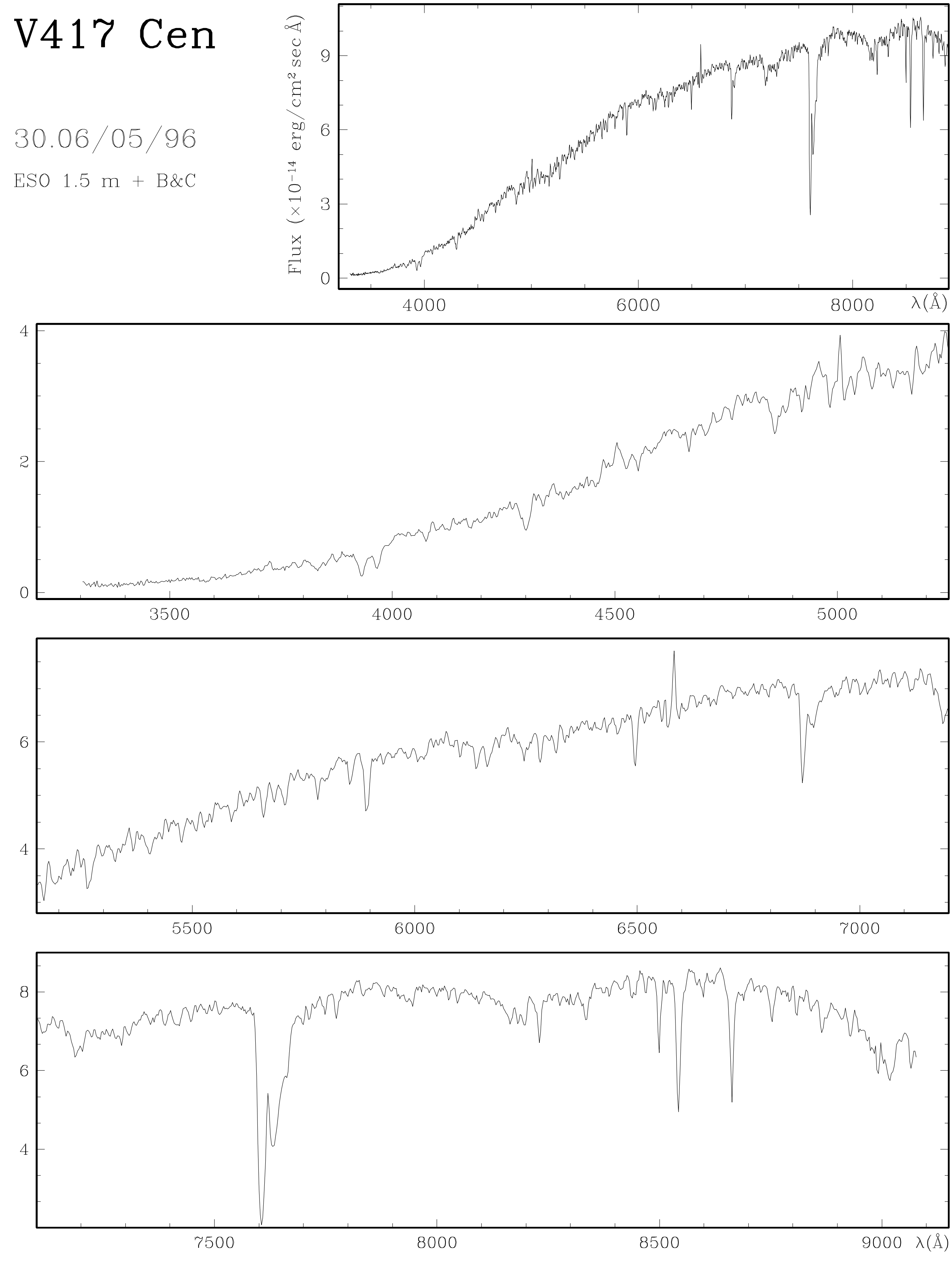


Fig. 111. ESO 1.5m + B&C spectrum of V417 Cen

V748 Cen

30.09/05/96

ESO 1.5 m + B&C

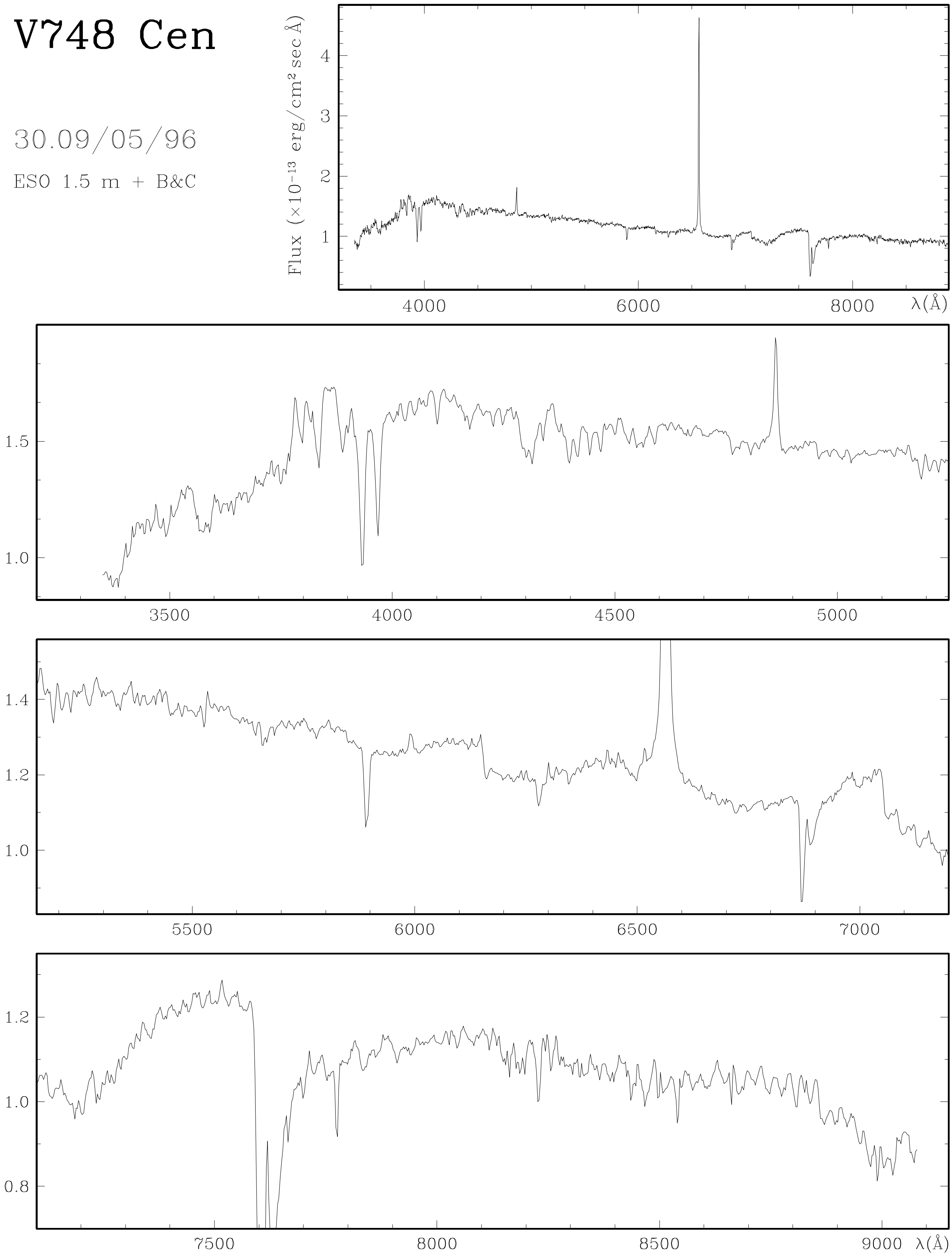


Fig. 112. ESO 1.5m + B&C spectrum of V748 Cen

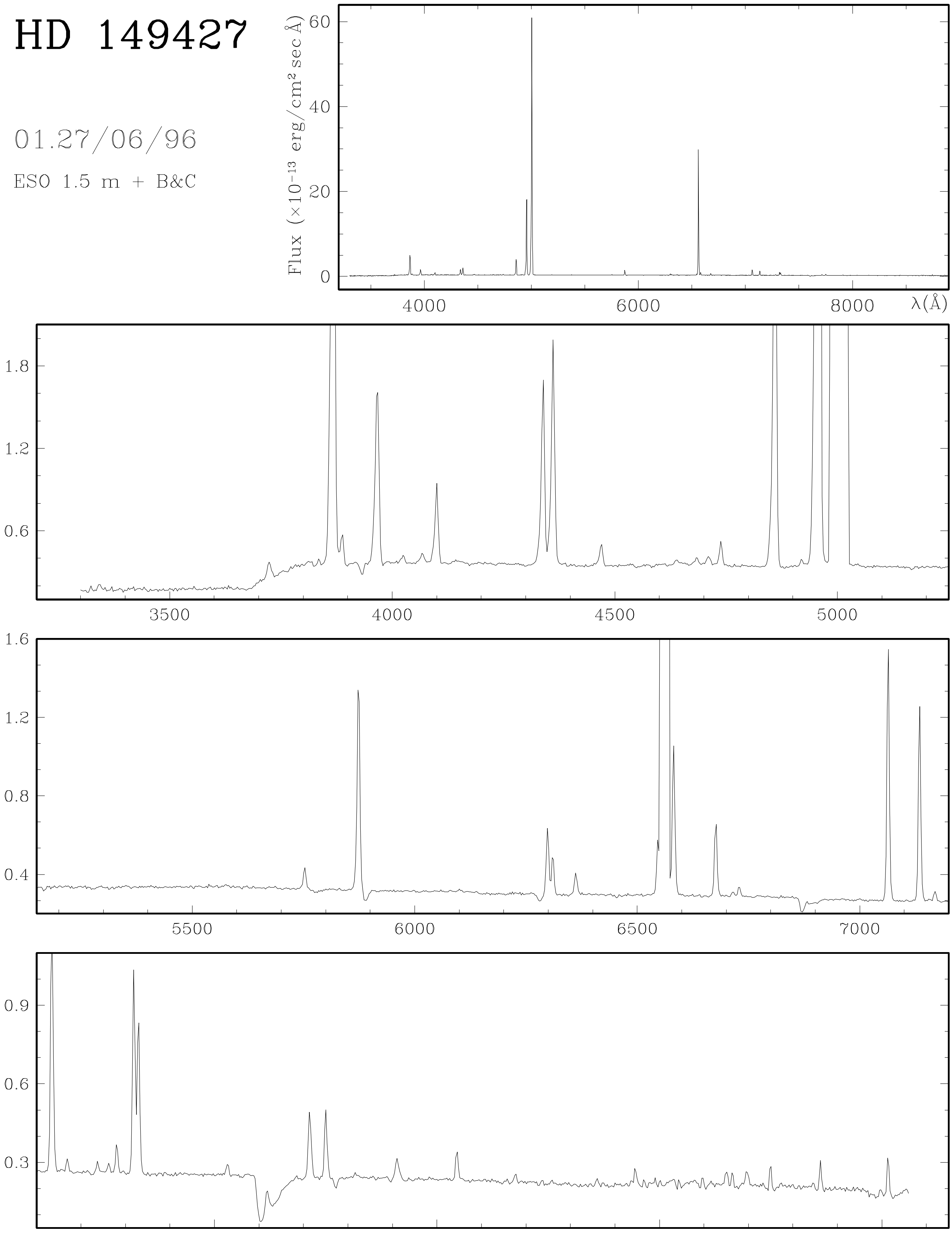


Fig. 113. ESO 1.5m + B&C spectrum of HD 149427

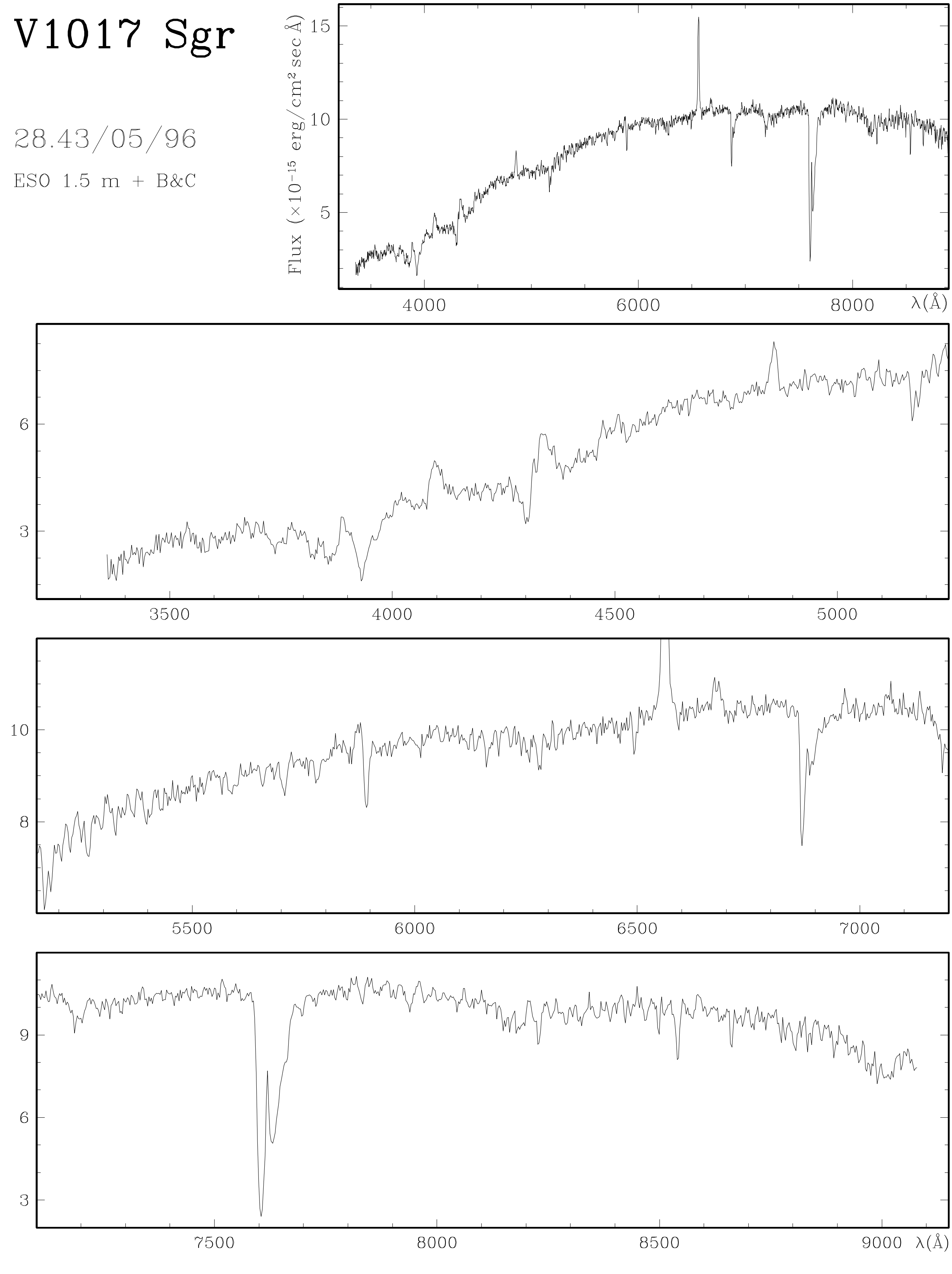


Fig. 114. ESO 1.5m + B&C spectrum of V1017 Sgr

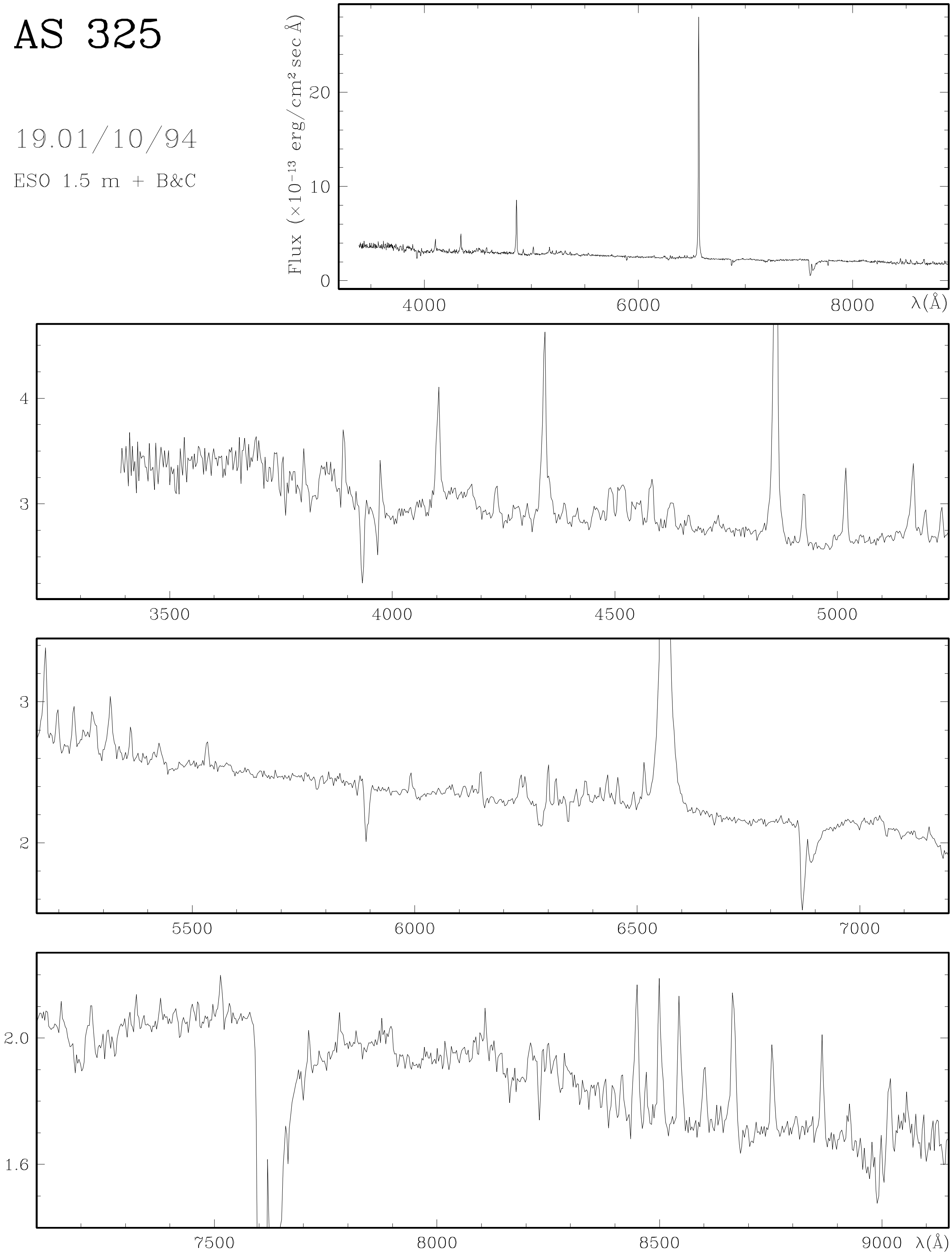


Fig. 115. ESO 1.5m + B&C spectrum of AS 325

EG And

15.02/10/95

Asiago 1.82 m + B&C

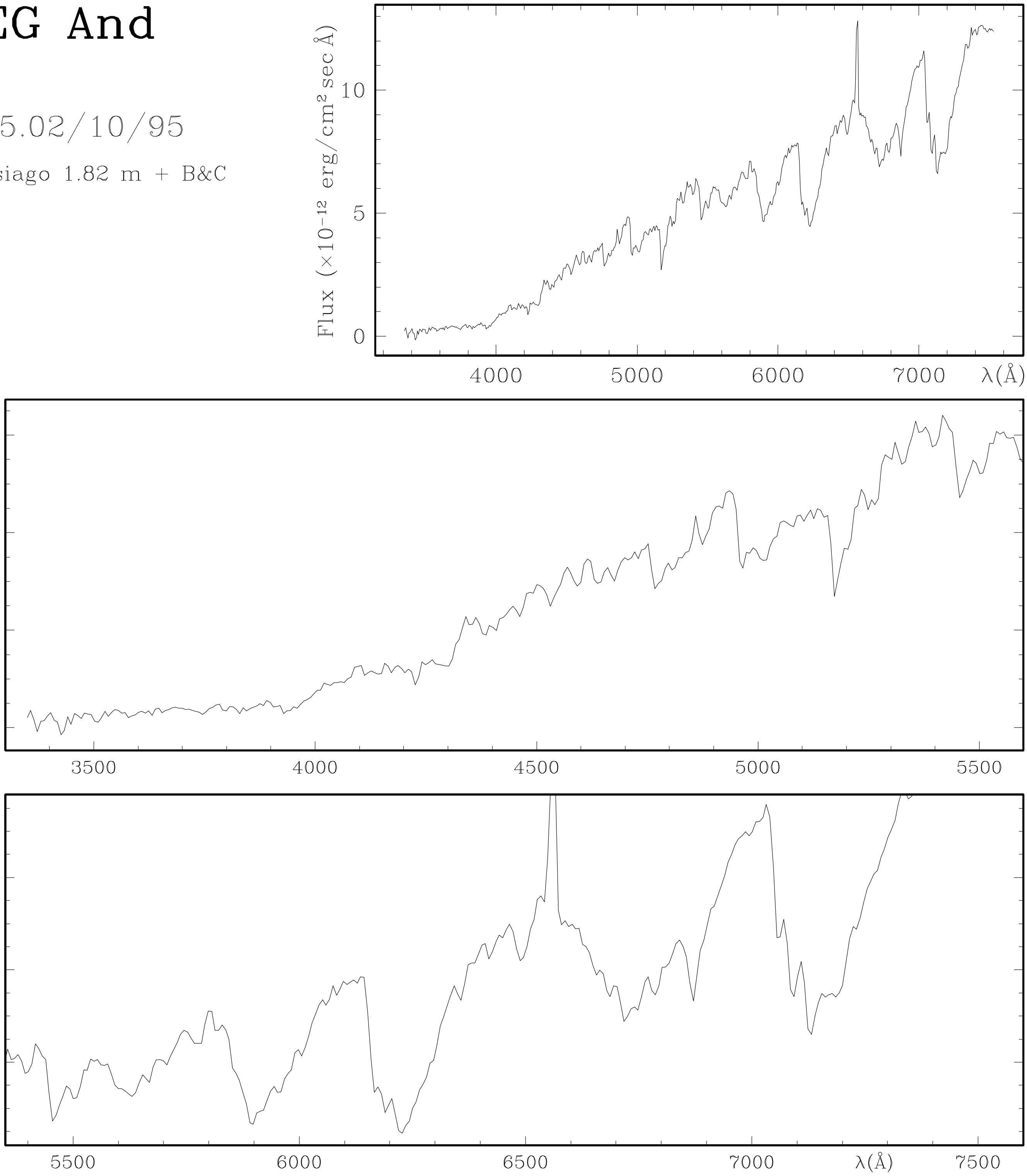


Fig. 116. Asiago 1.82m + B&C spectrum of EG And

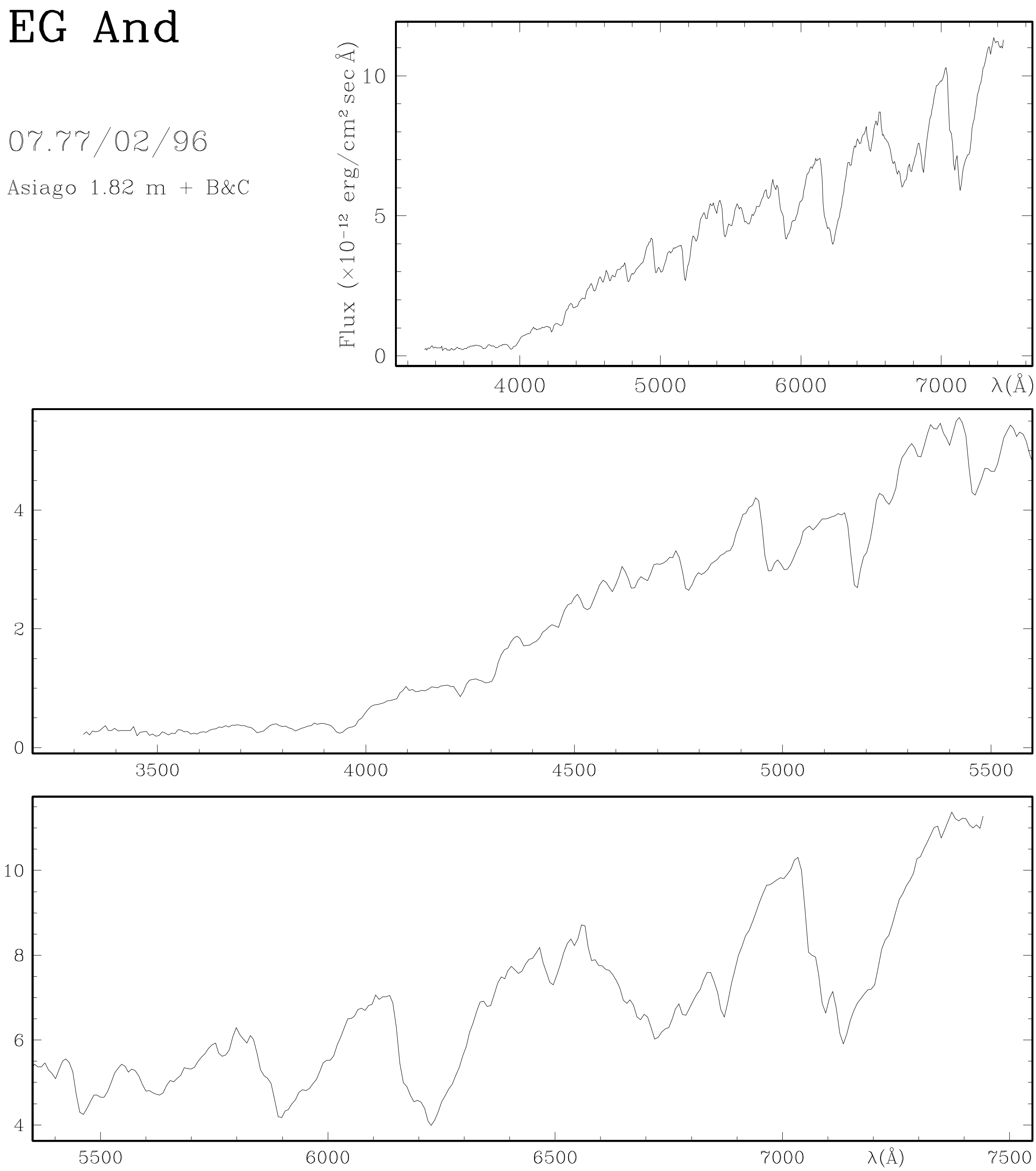


Fig. 117. Asiago 1.82m + B&C spectrum of EG And

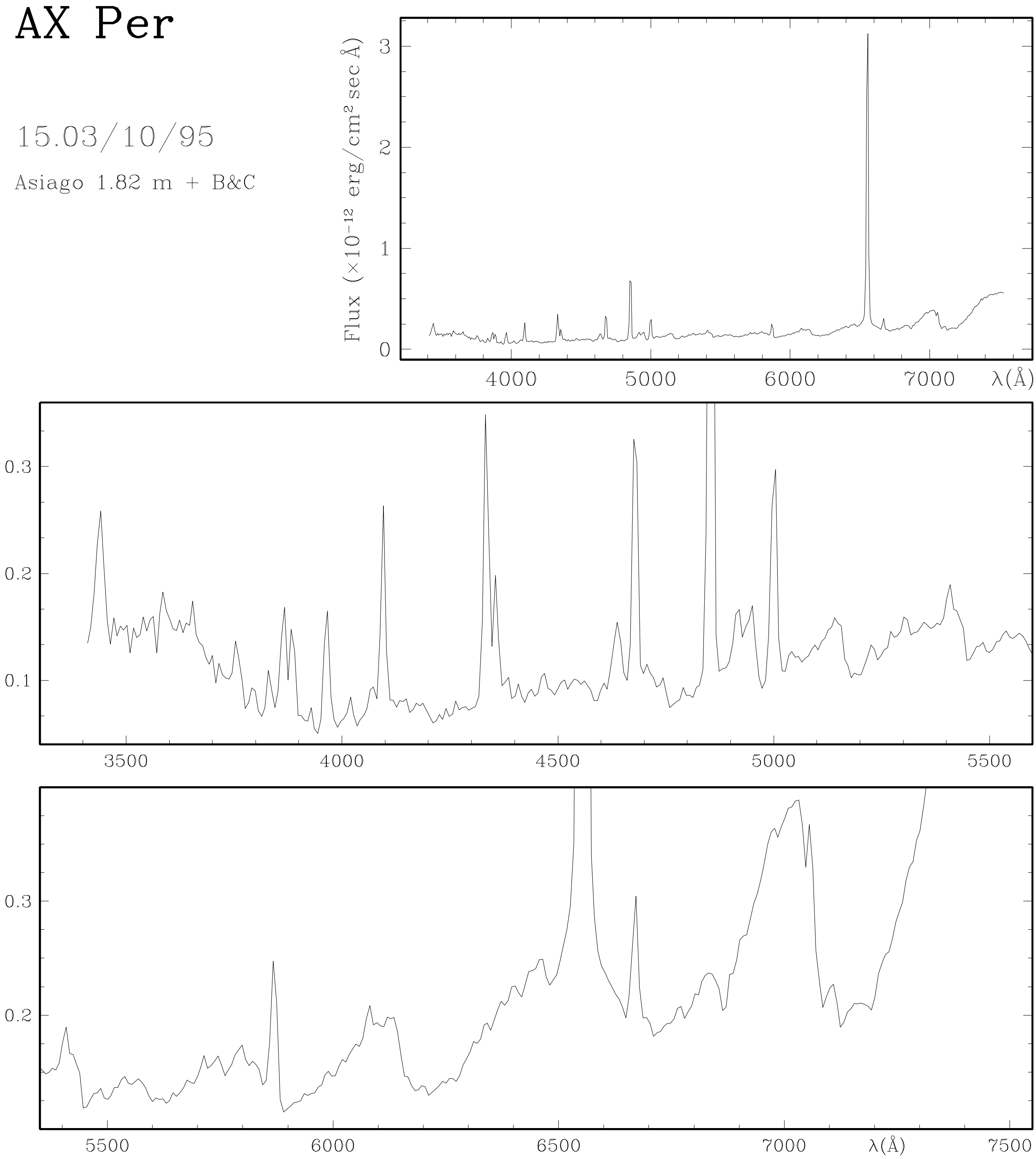


Fig. 118. Asiago 1.82m + B&C spectrum of AX Per

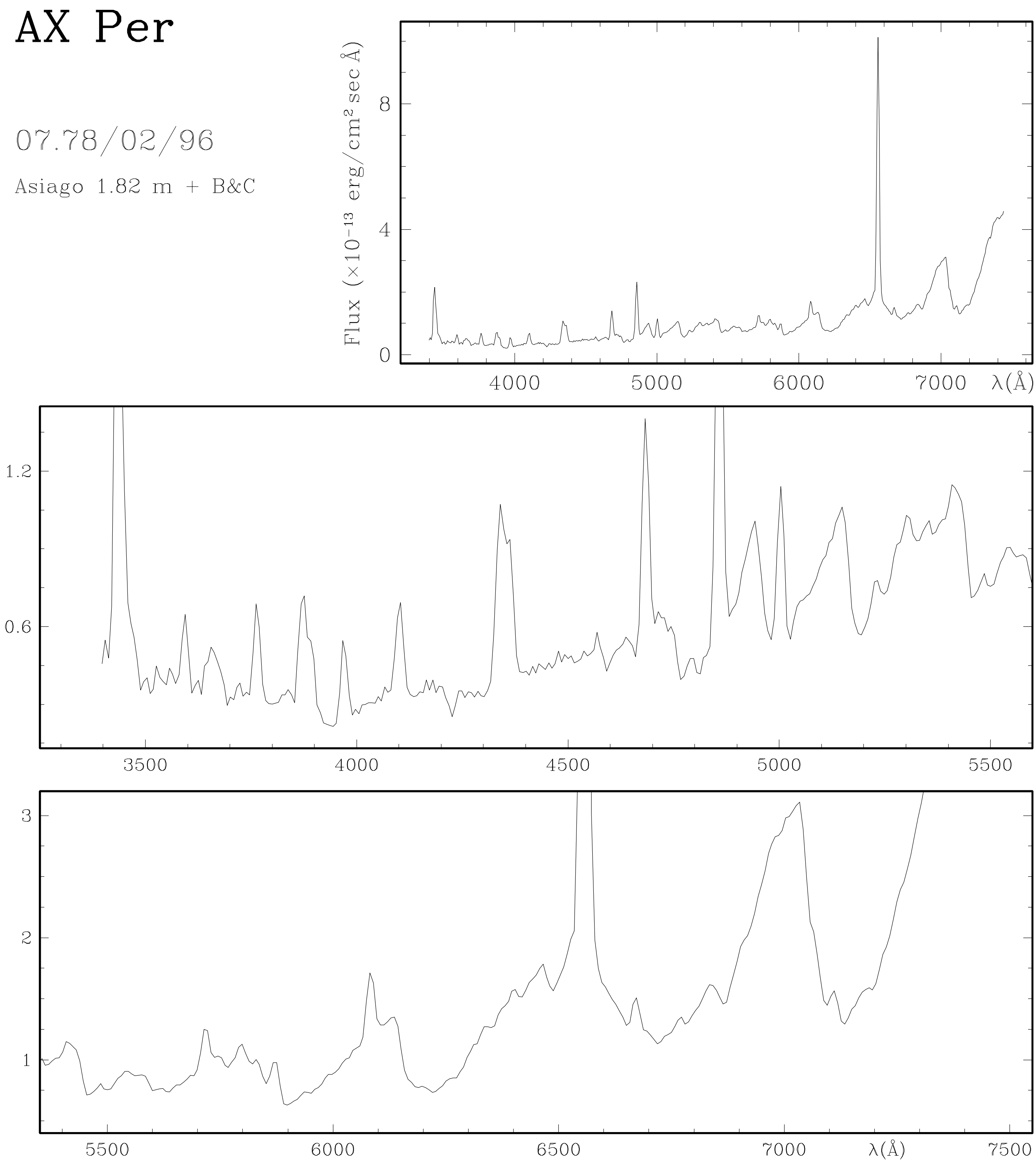


Fig. 119. Asiago 1.82m + B&C spectrum of AX Per

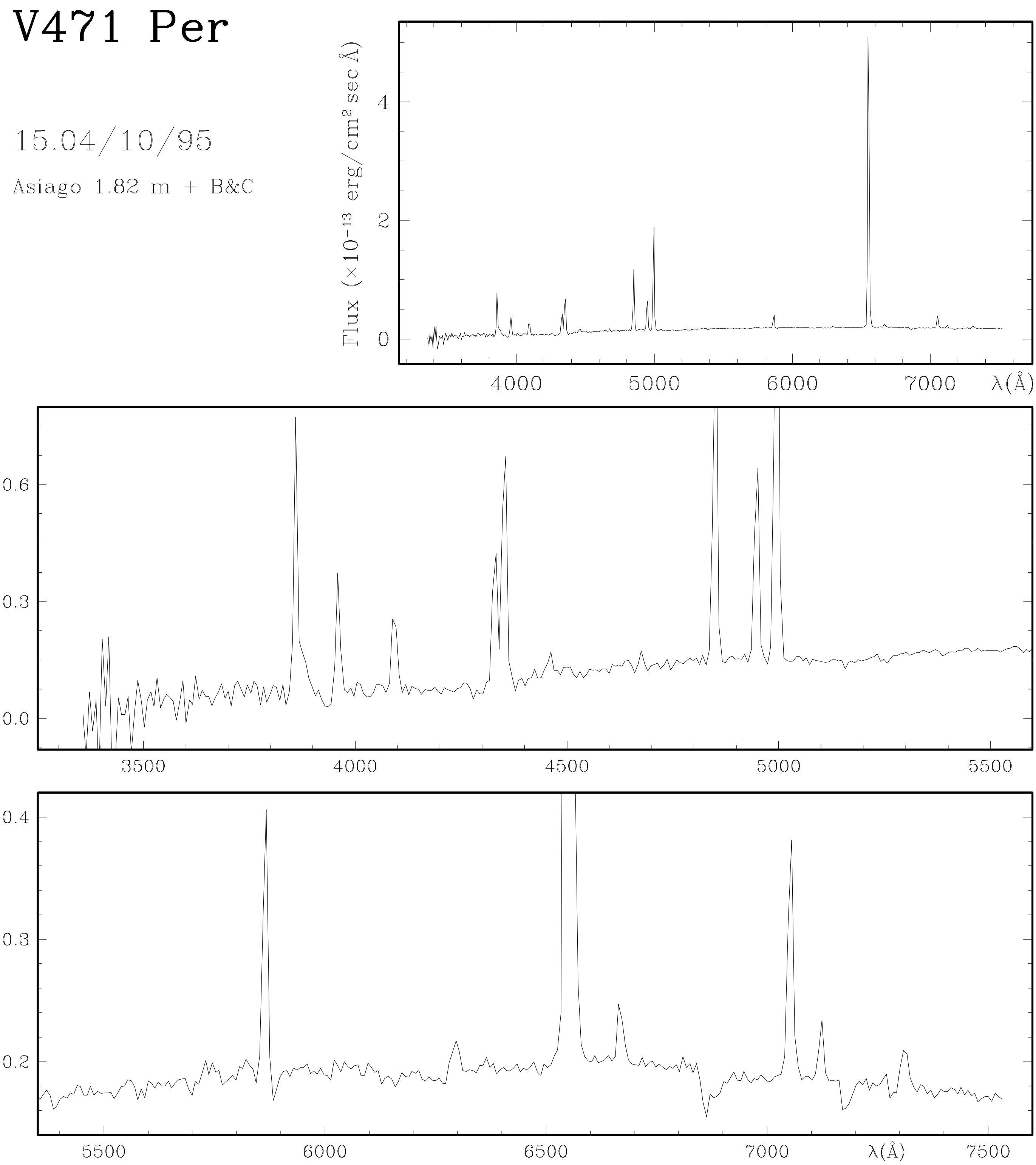


Fig. 120. Asiago 1.82m + B&C spectrum of V471 Per

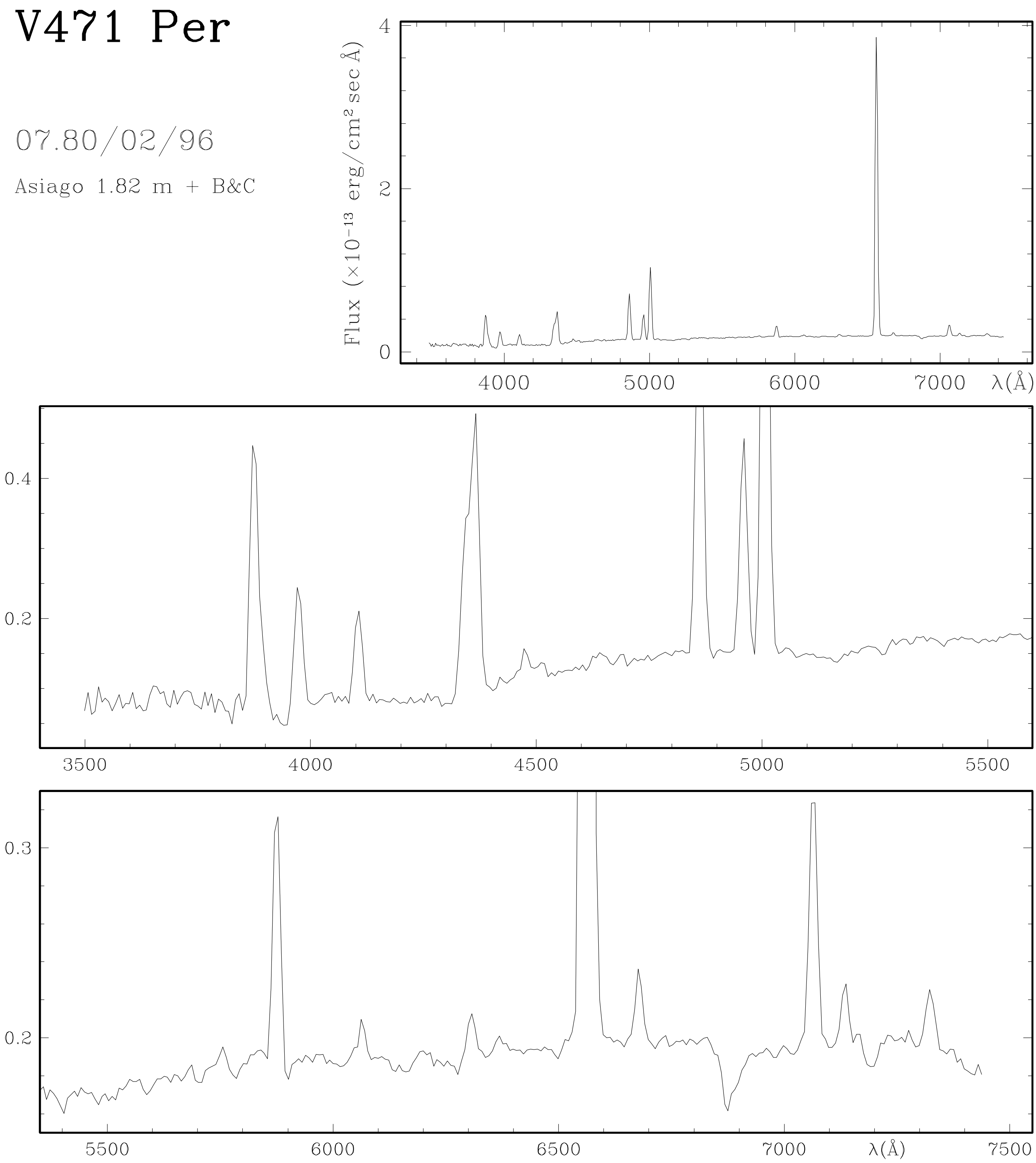


Fig. 121. Asiago 1.82m + B&C spectrum of V471 Per

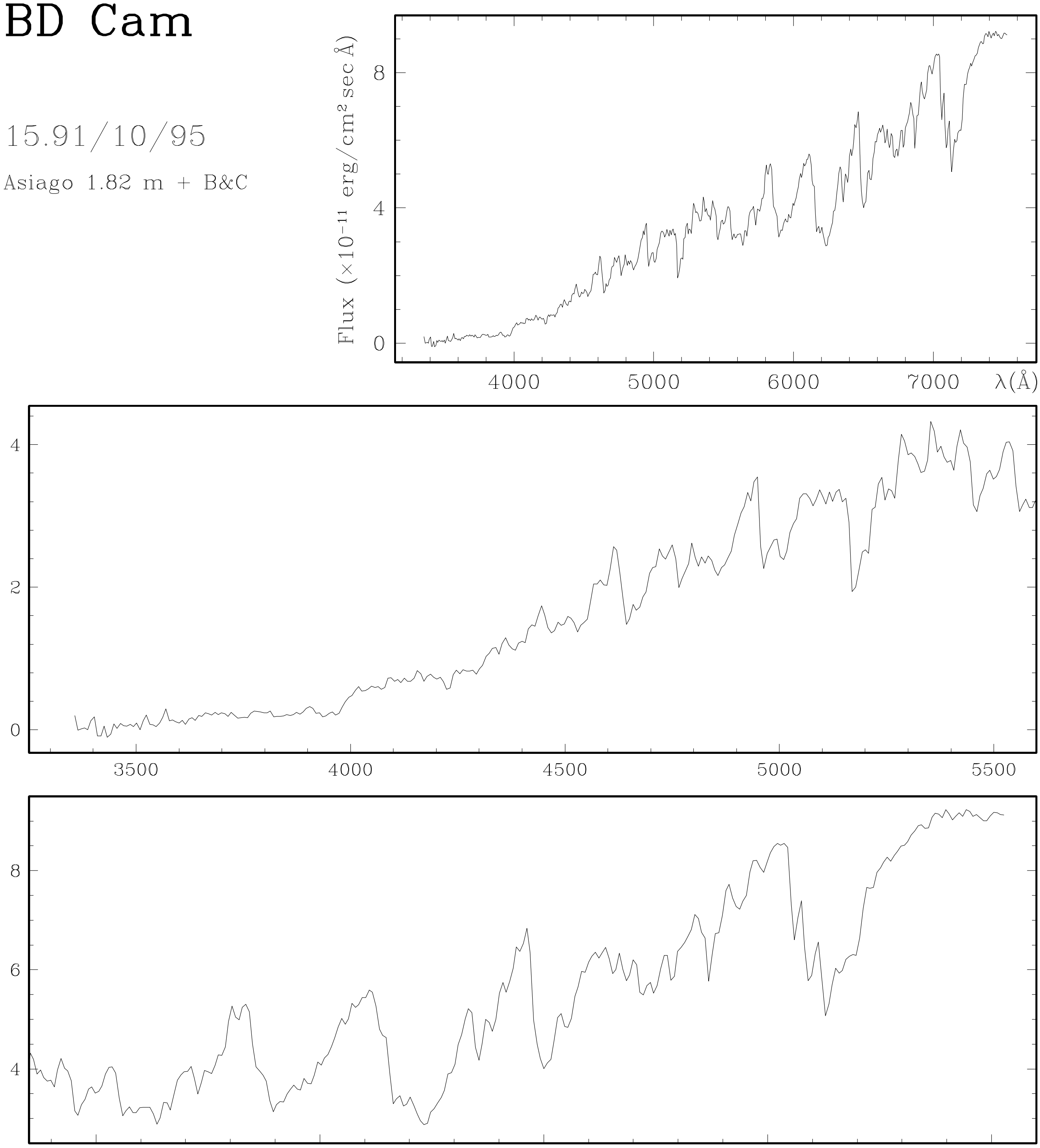


Fig. 122. Asiago 1.82m + B&C spectrum of BD Cam

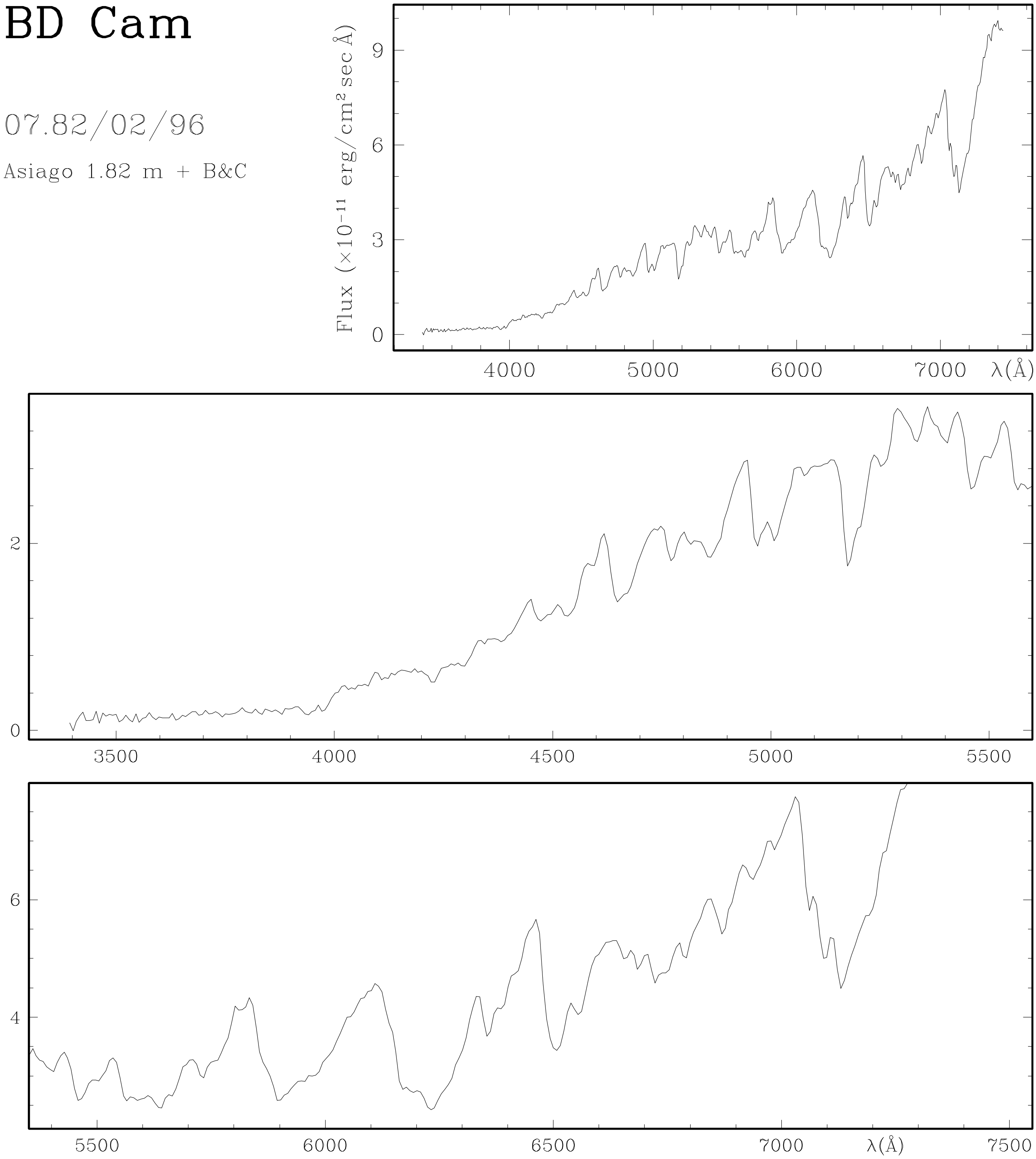


Fig. 123. Asiago 1.82m + B&C spectrum of BD Cam

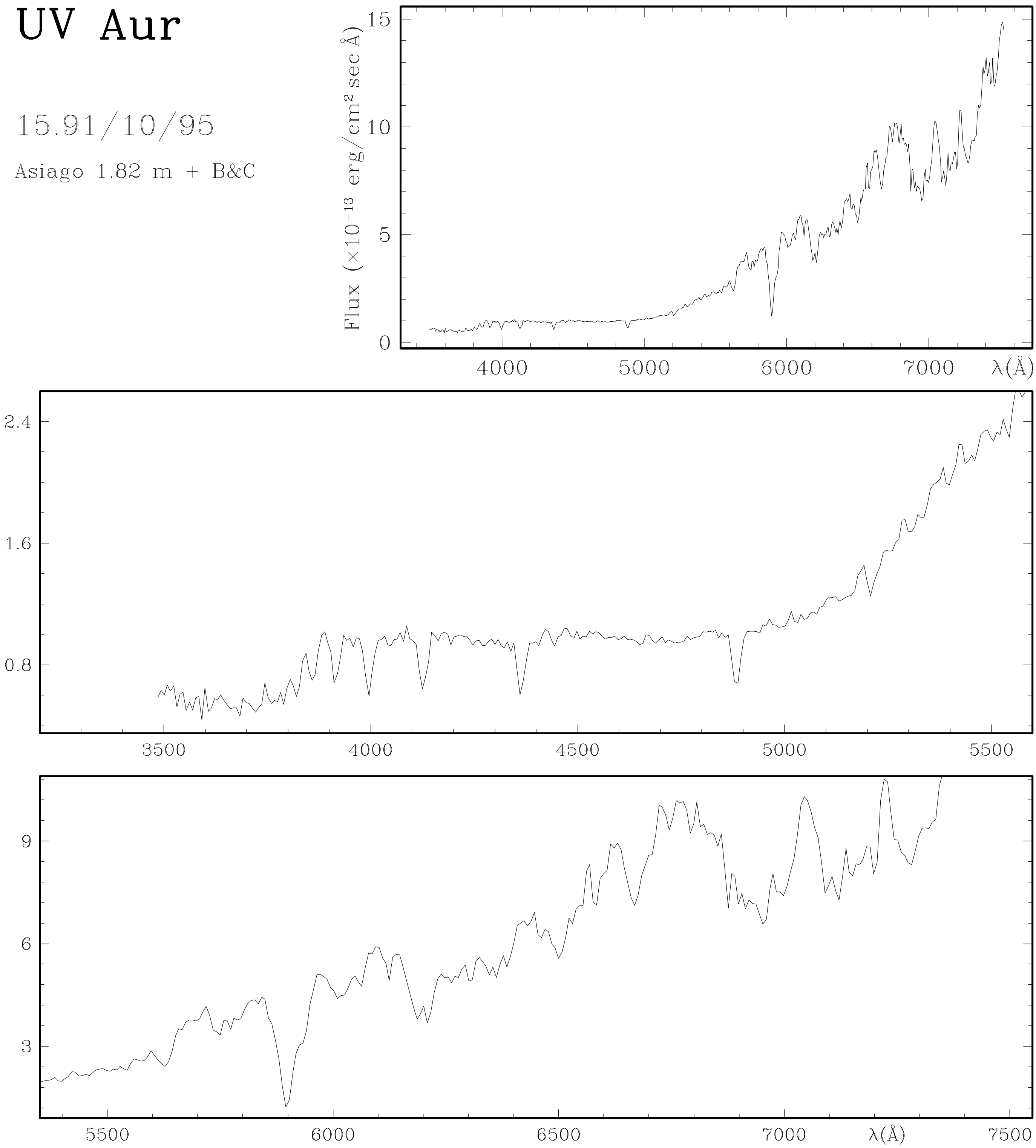


Fig. 124. Asiago 1.82m + B&C spectrum of UV Aur

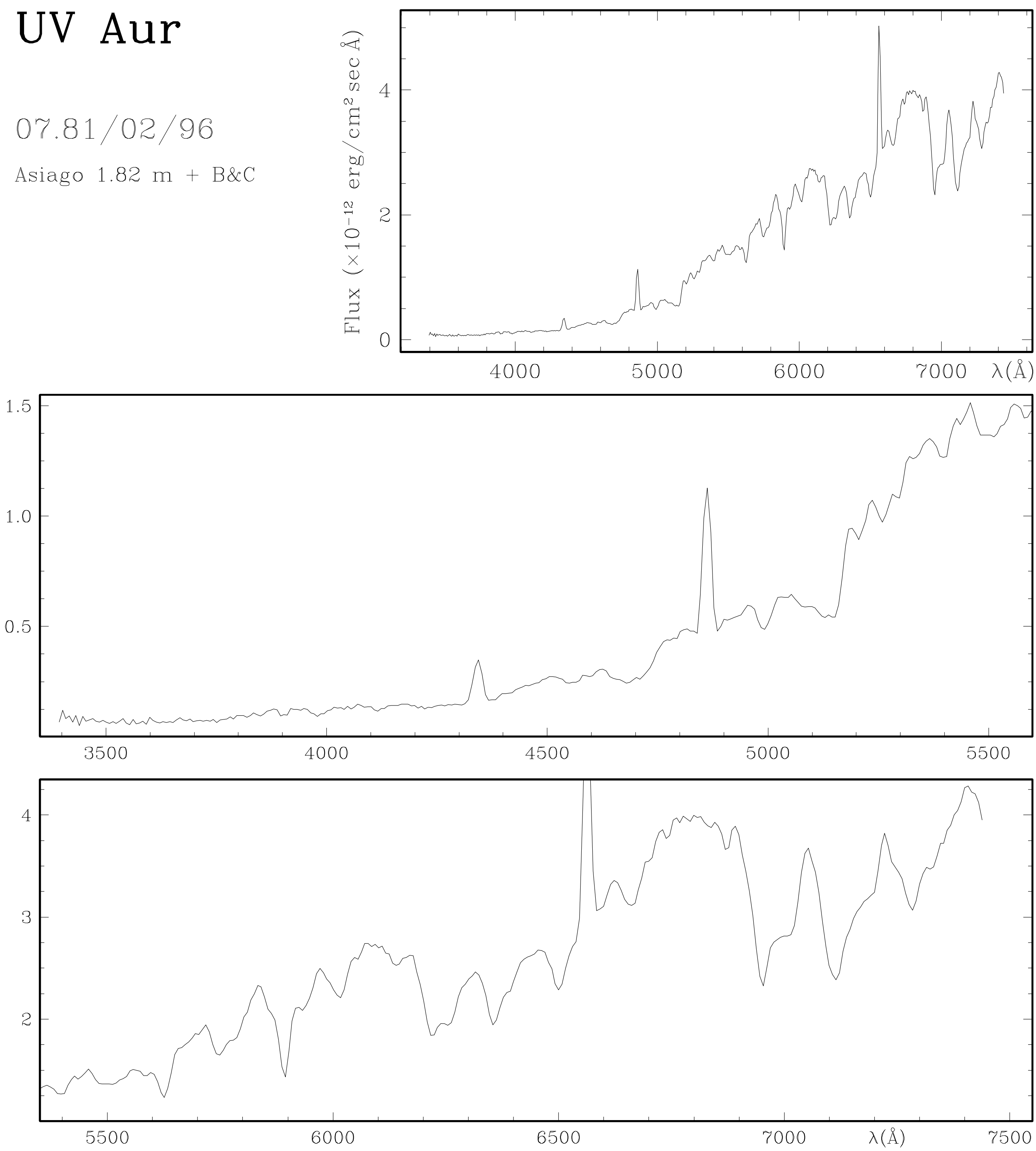


Fig. 125. Asiago 1.82m + B&C spectrum of UV Aur

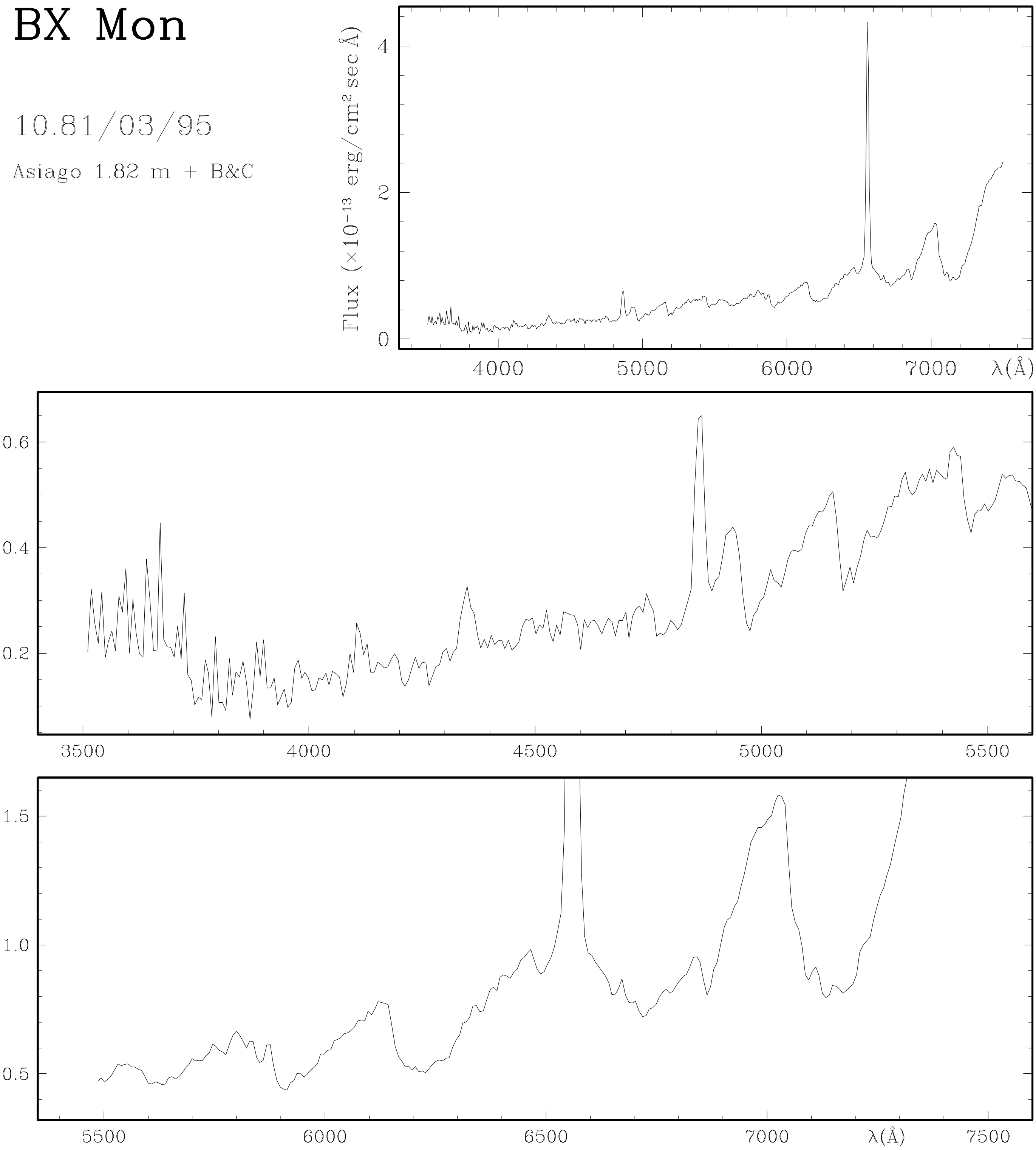


Fig. 126. Asiago 1.82m + B&C spectrum of BX Mon

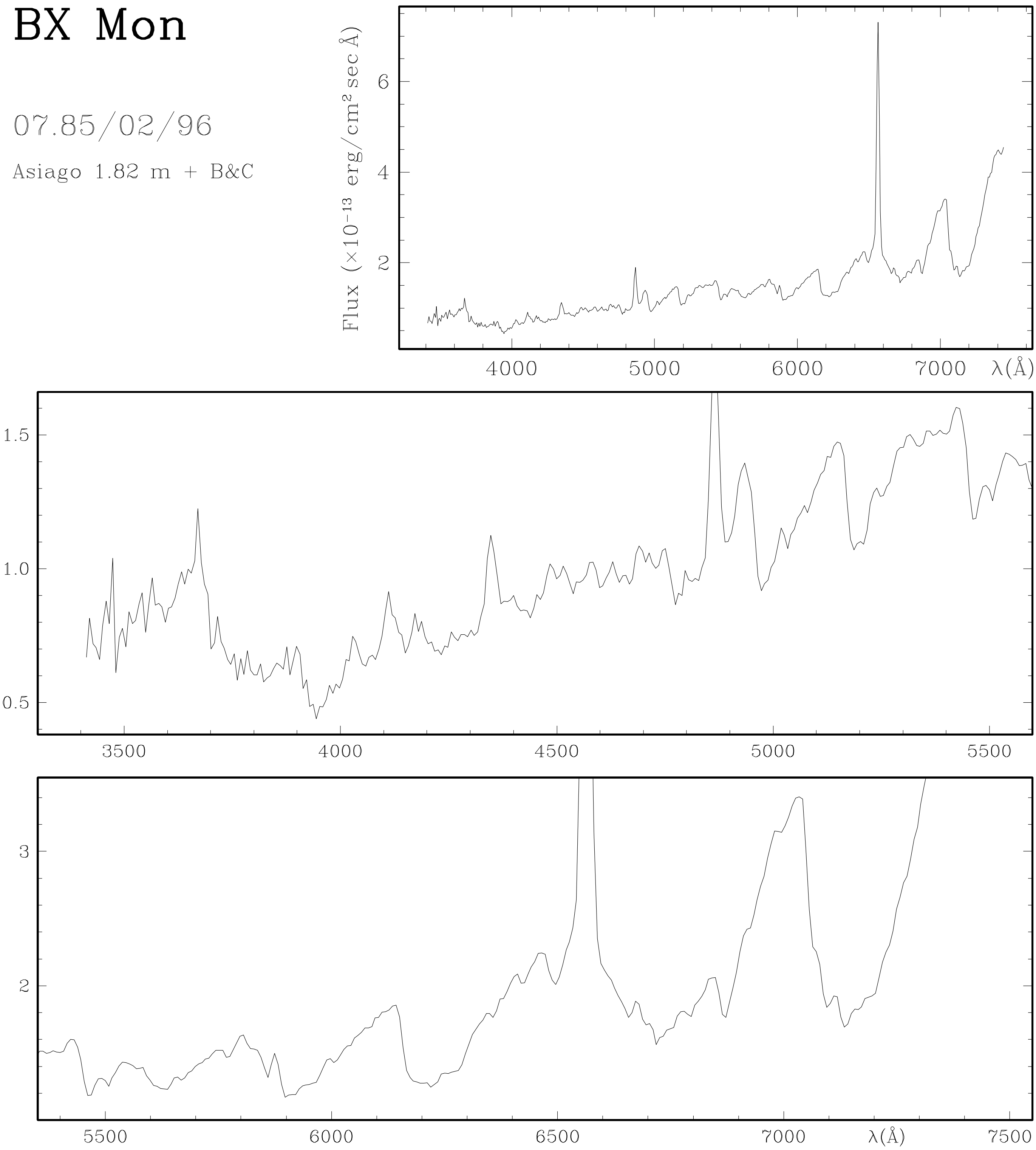


Fig. 127. Asiago 1.82m + B&C spectrum of BX Mon

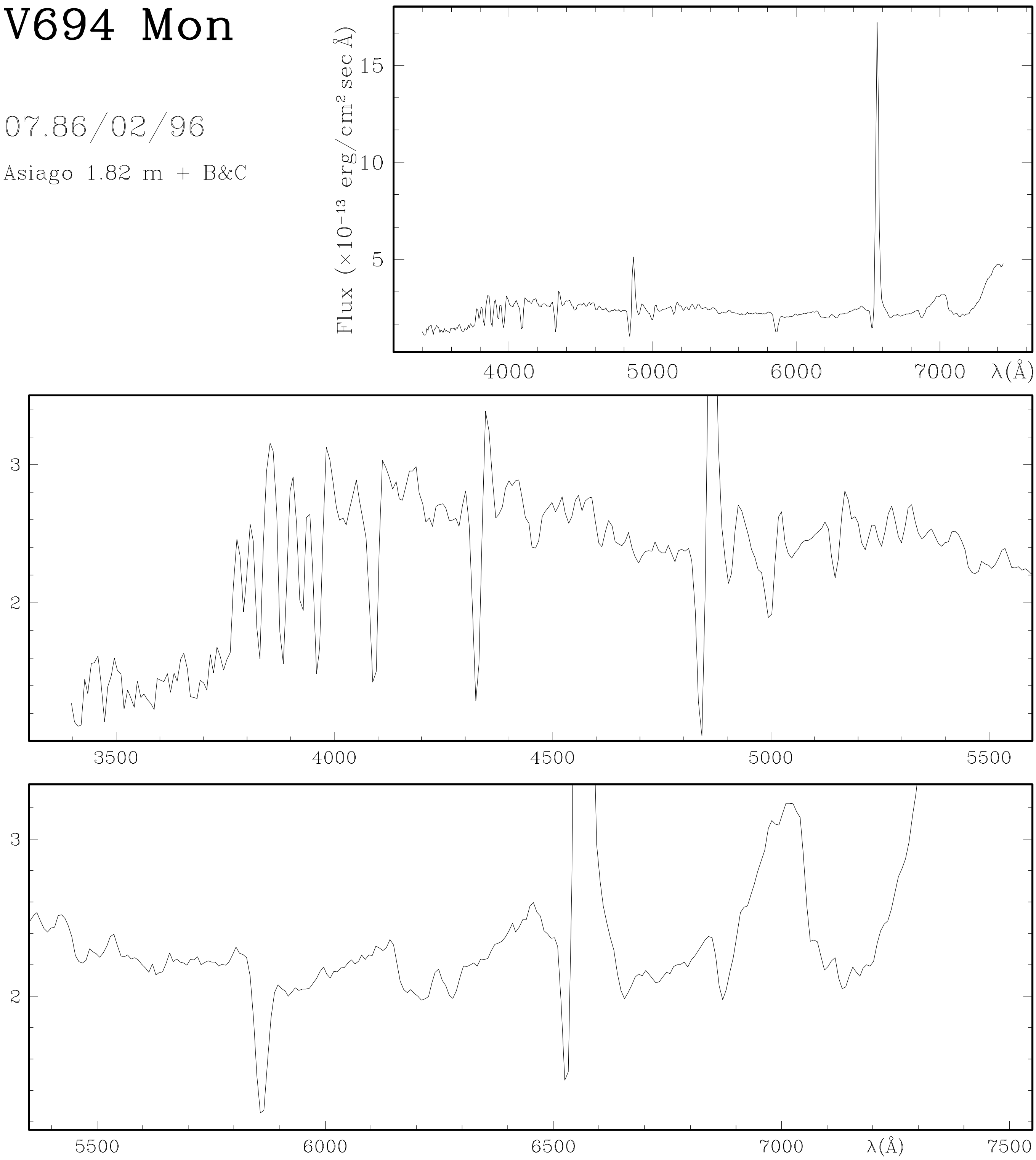


Fig. 128. Asiago 1.82m + B&C spectrum of MWC 560

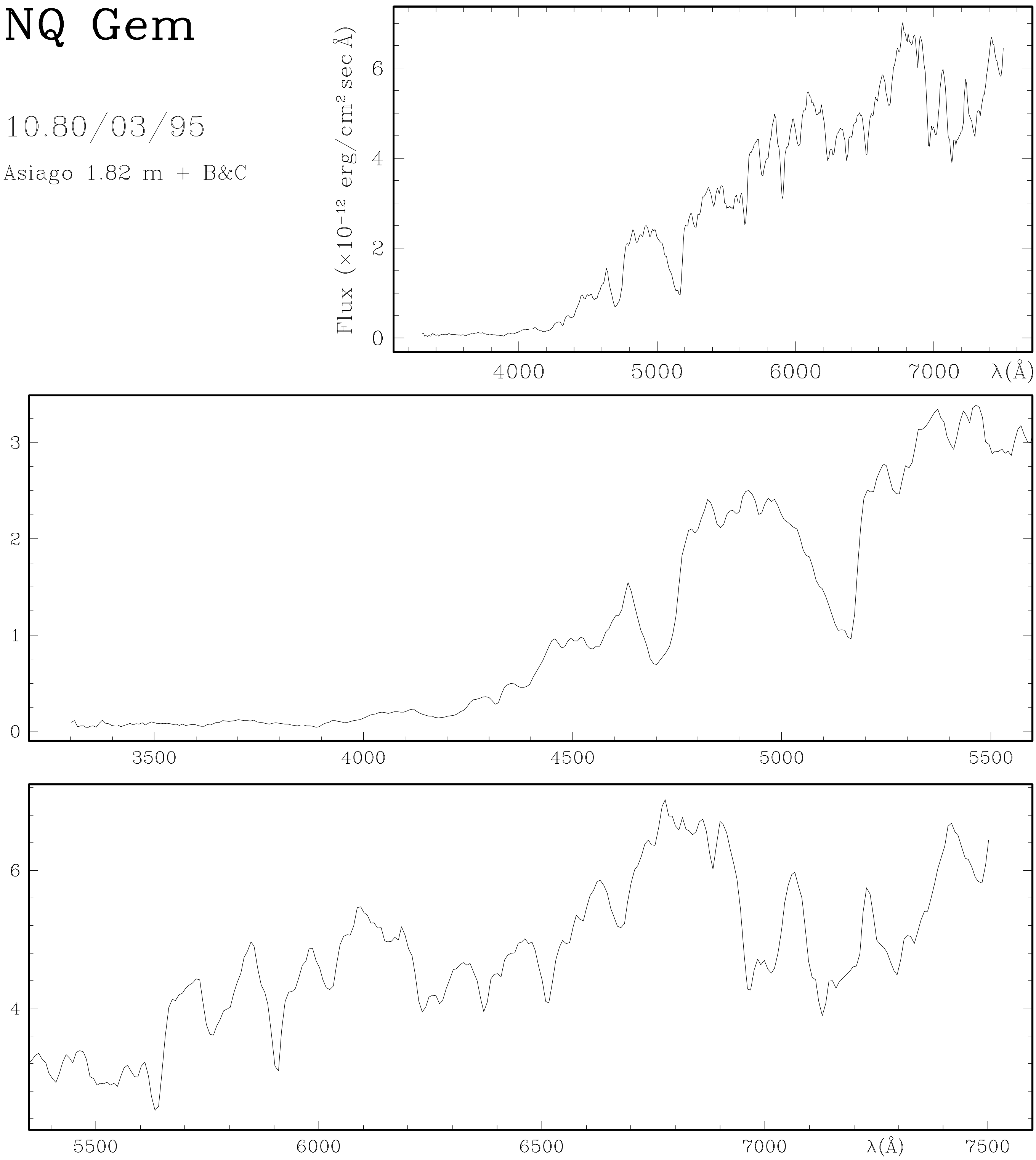
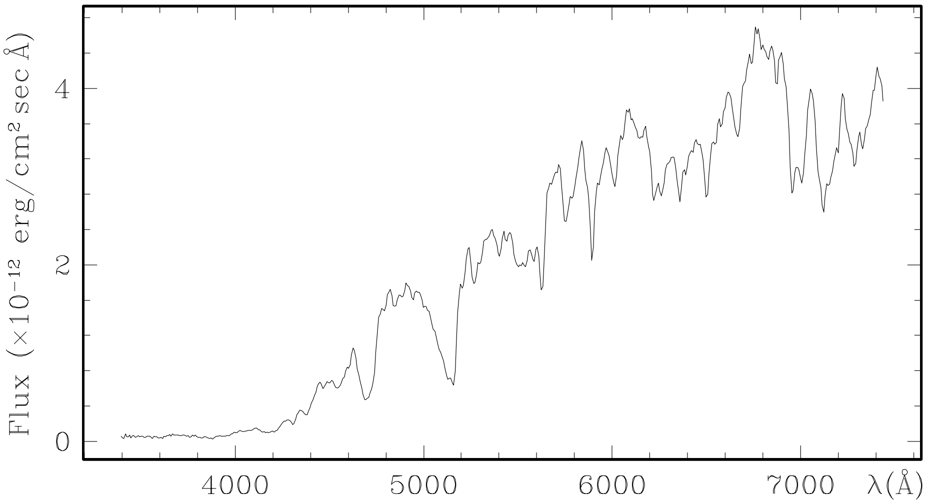


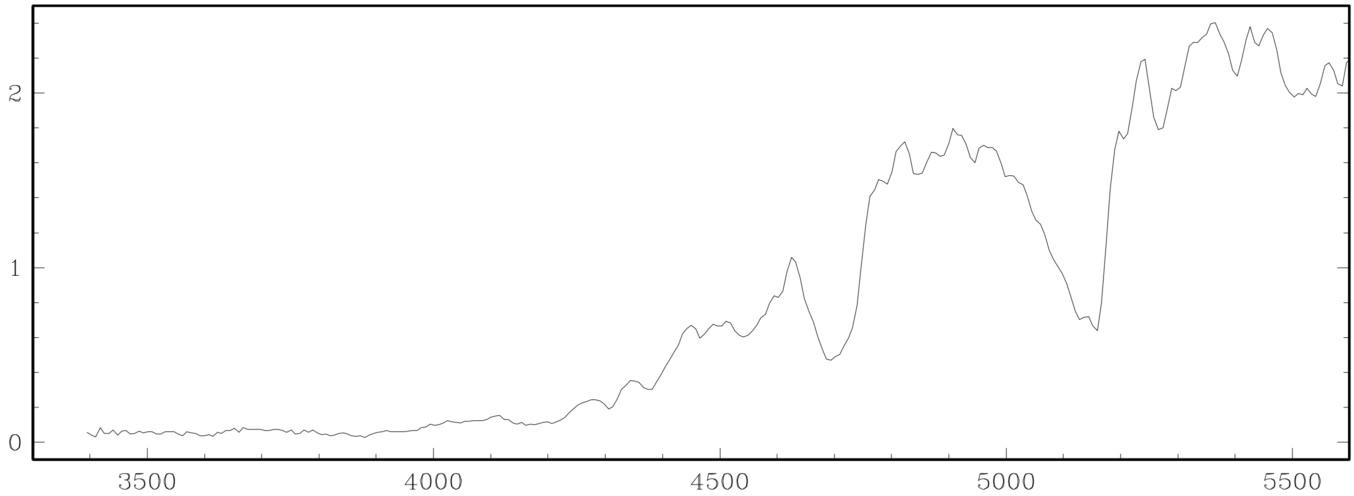
Fig. 129. Asiago 1.82m + B&C spectrum of NQ Gem

NQ Gem

07.84/02/96

Asiago 1.82 m + B&C





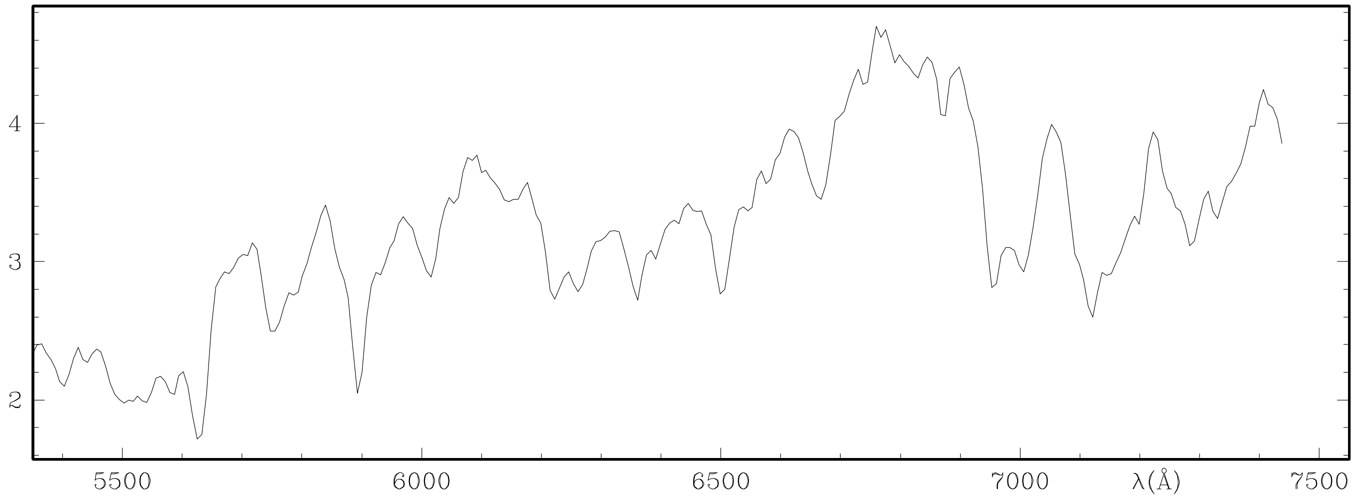


Fig. 130. Asiago 1.82m + B&C spectrum of NQ Gem

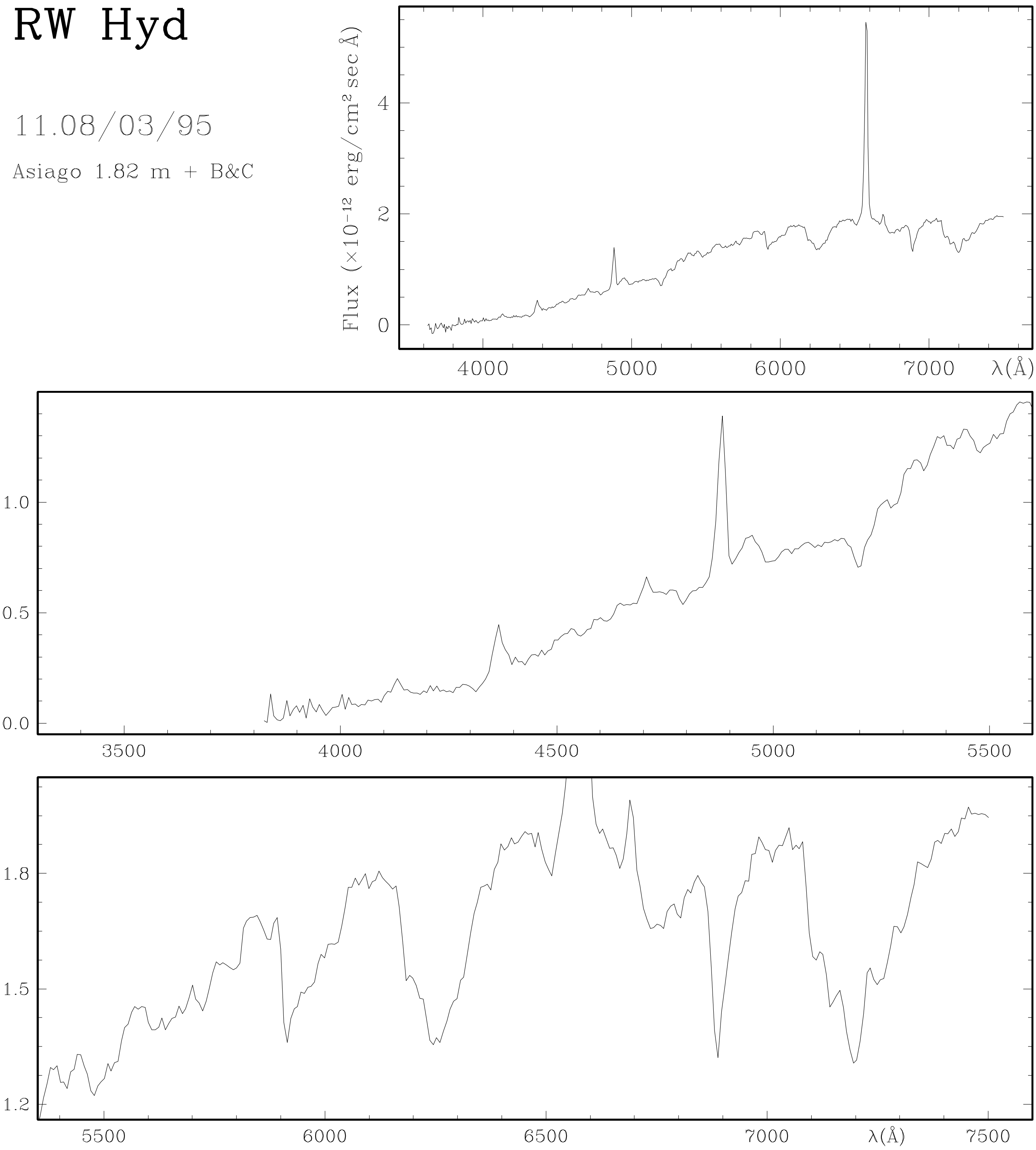


Fig. 131. Asiago 1.82m + B&C spectrum of RW Hya

IV Vir

11.09/03/95

Asiago 1.82 m + B&C

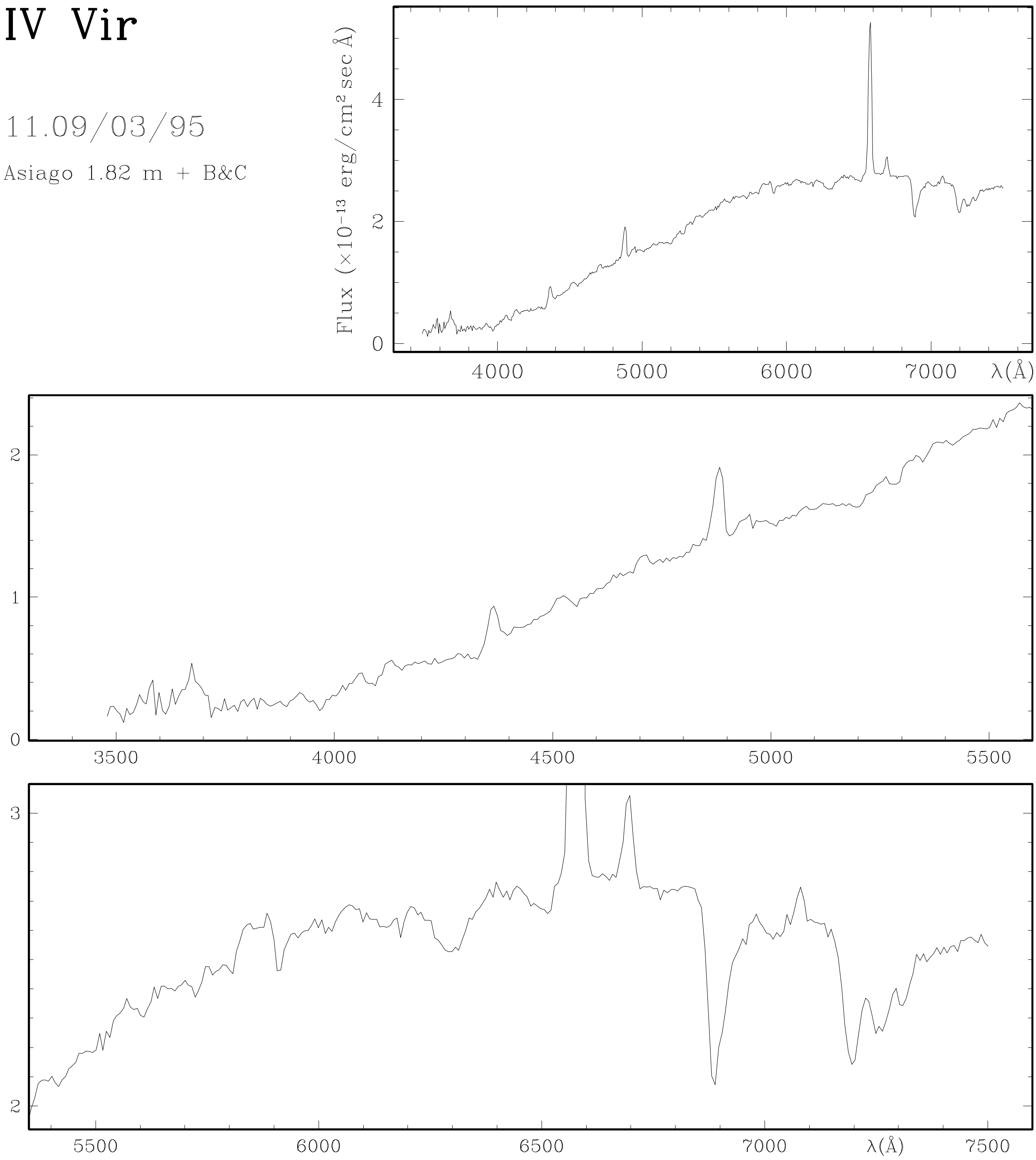


Fig. 132. Asiago 1.82m + B&C spectrum of IV Vir

T CrB

27.82/07/93

Asiago 1.82 m + B&C

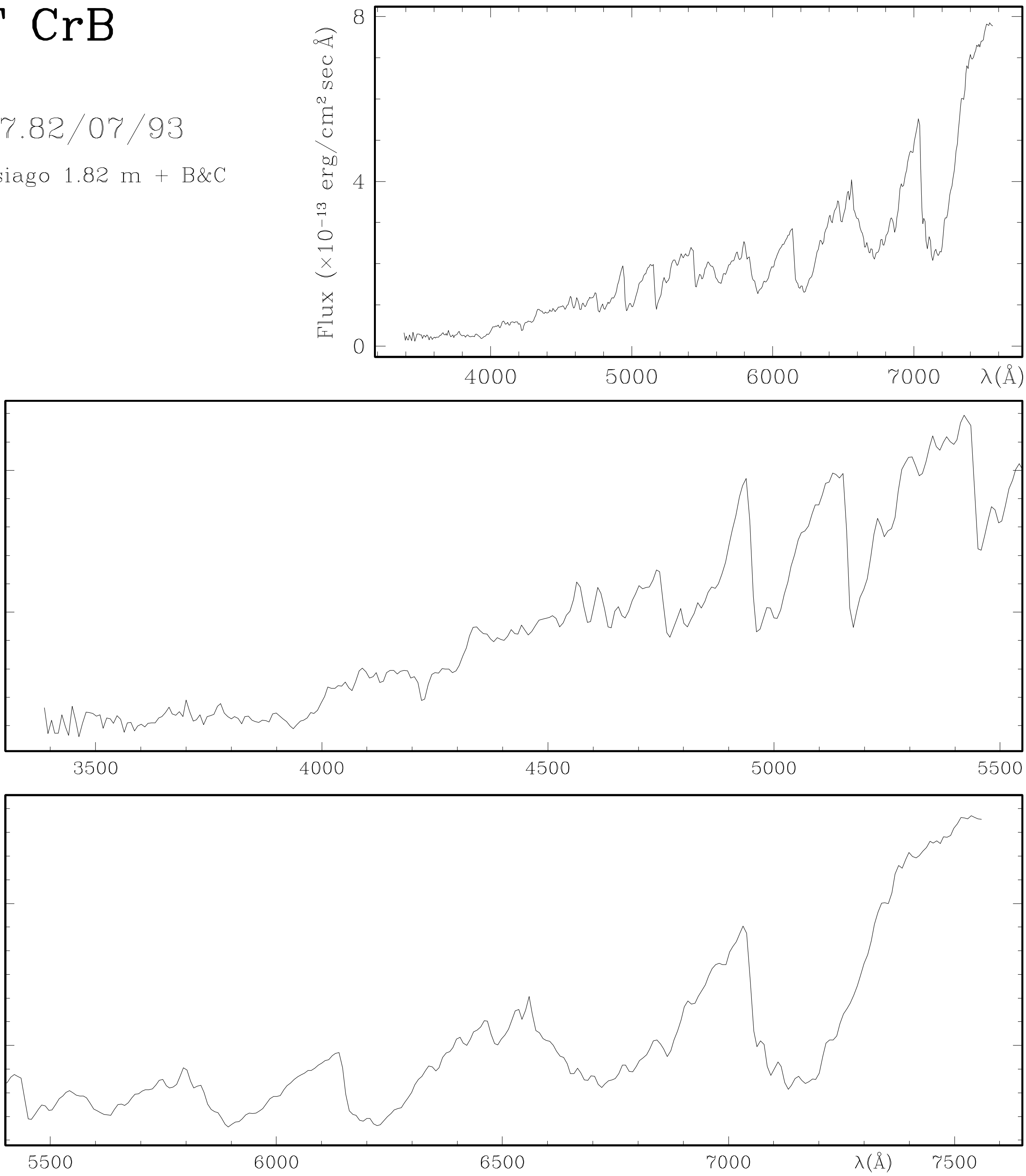


Fig. 133. Asiago 1.82m + B&C spectrum of T CrB

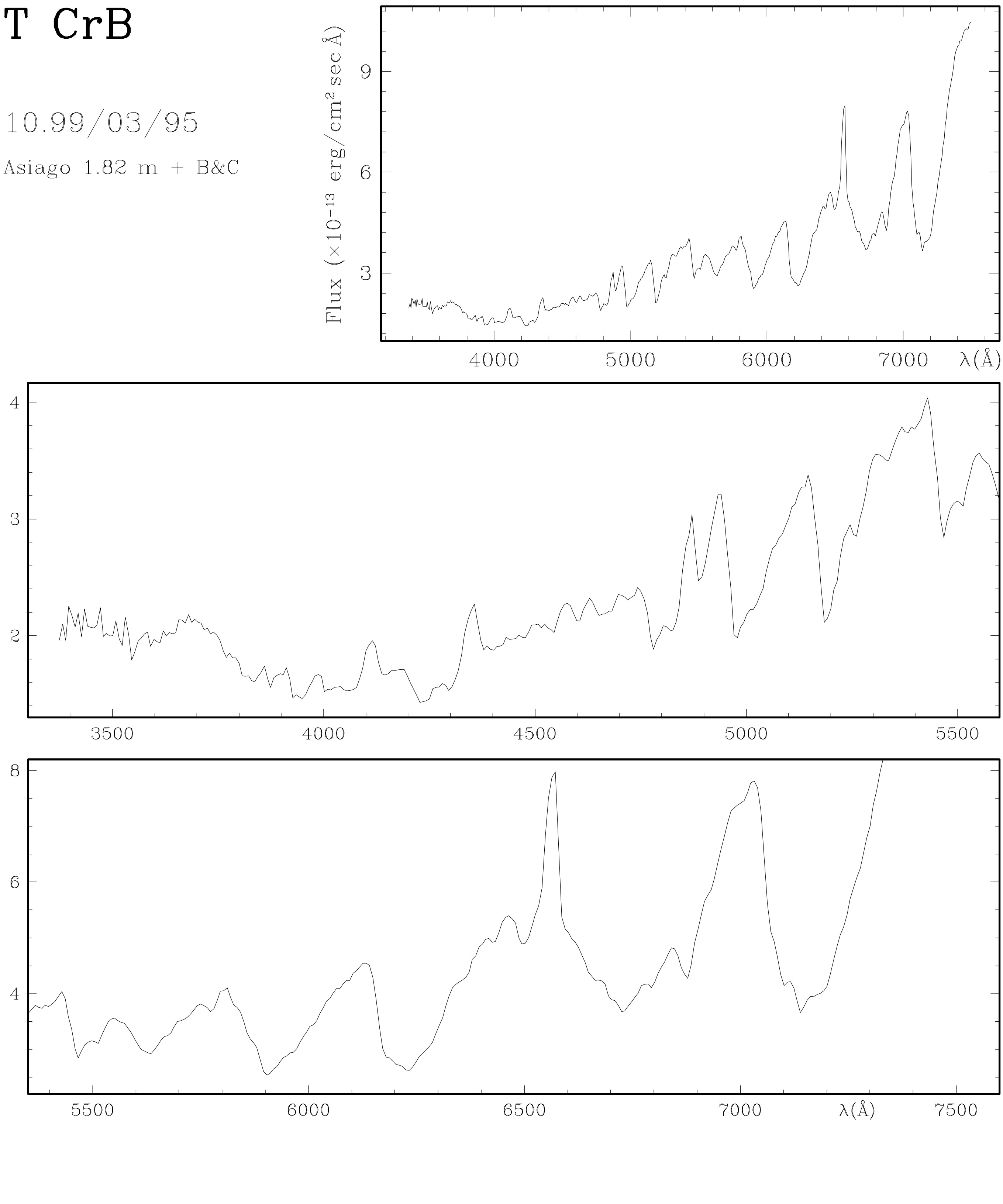


Fig. 134. Asiago 1.82m + B&C spectrum of T CrB

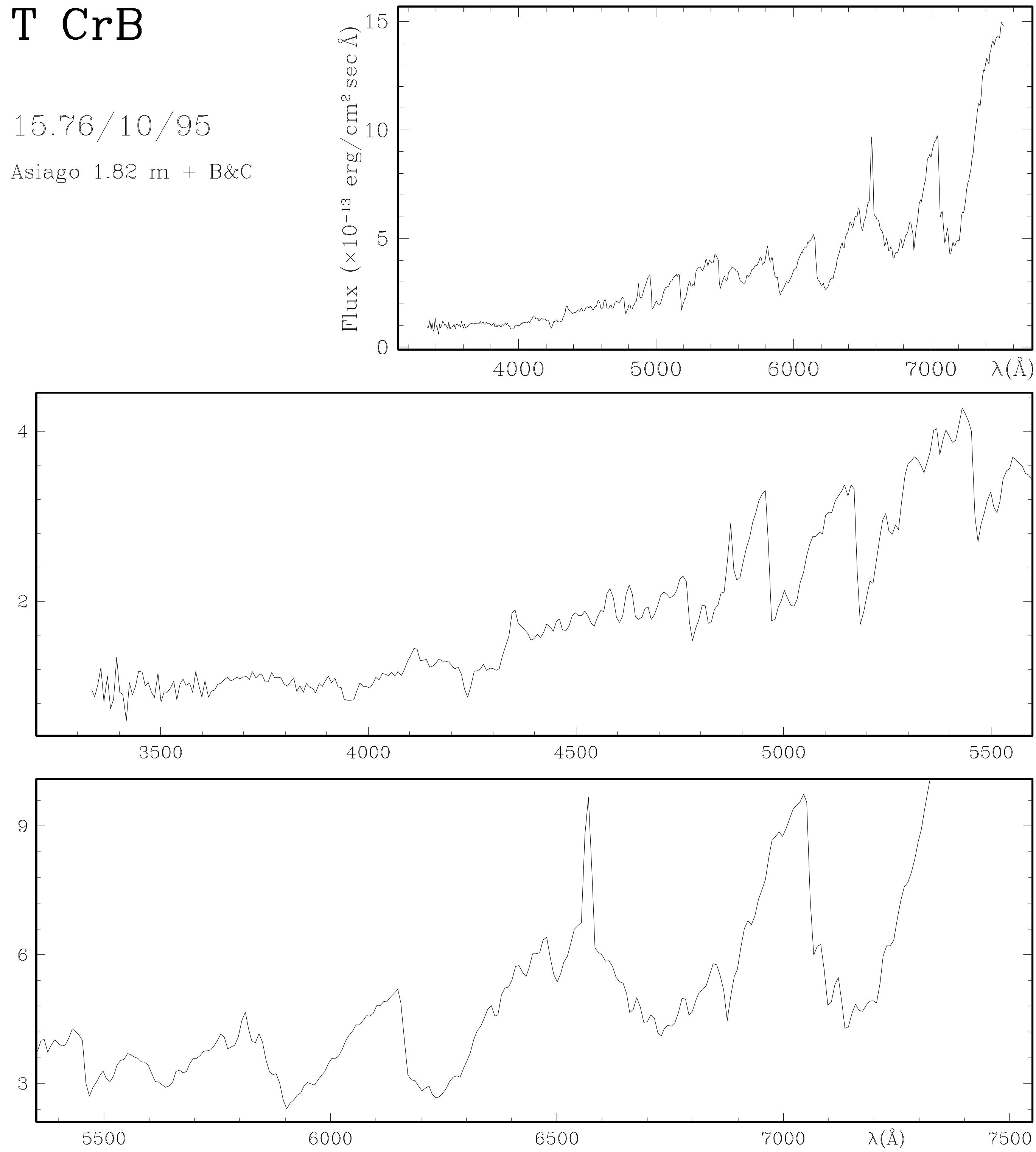


Fig. 135. Asiago 1.82m + B&C spectrum of T CrB

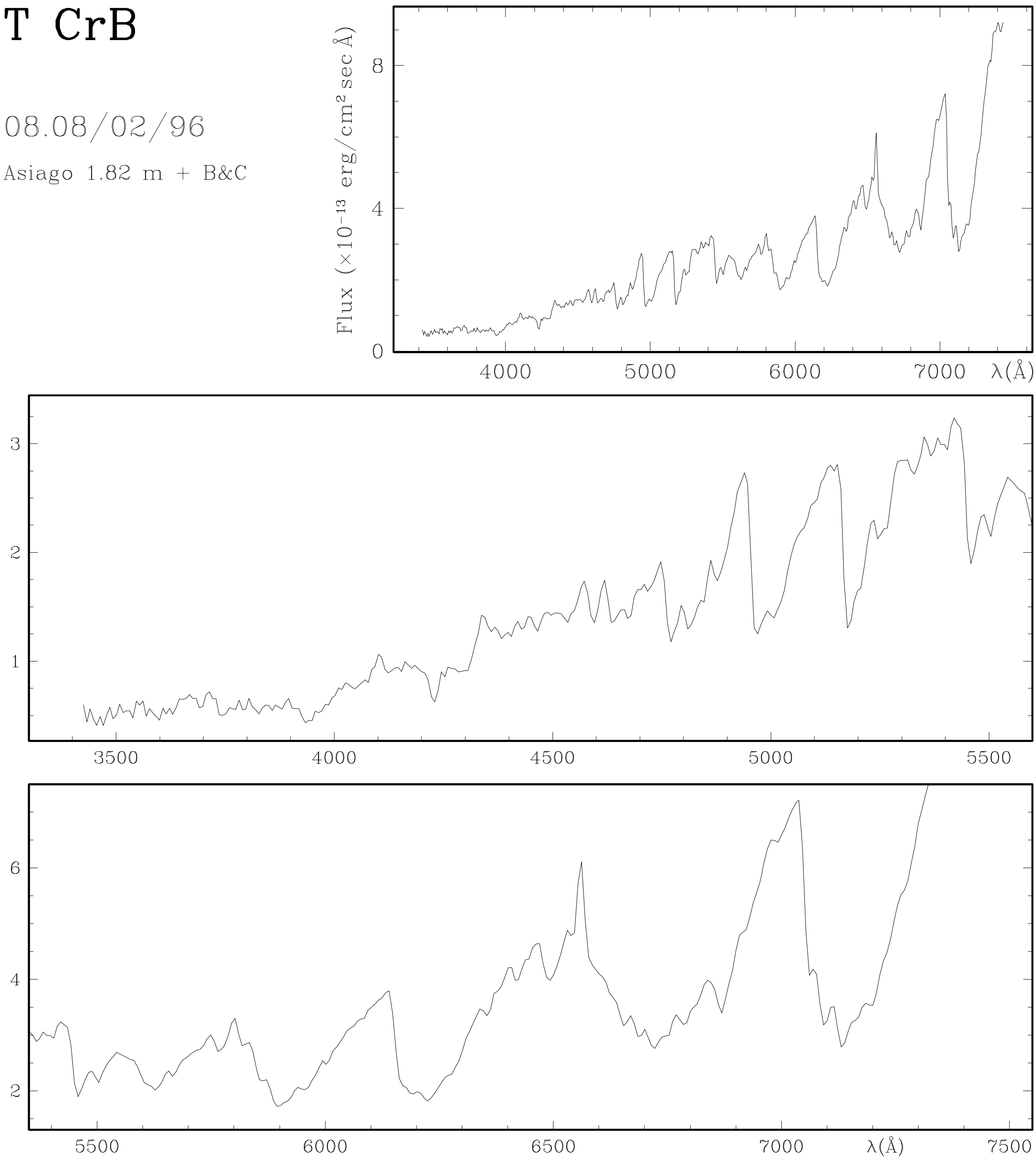


Fig. 136. Asiago 1.82m + B&C spectrum of T CrB

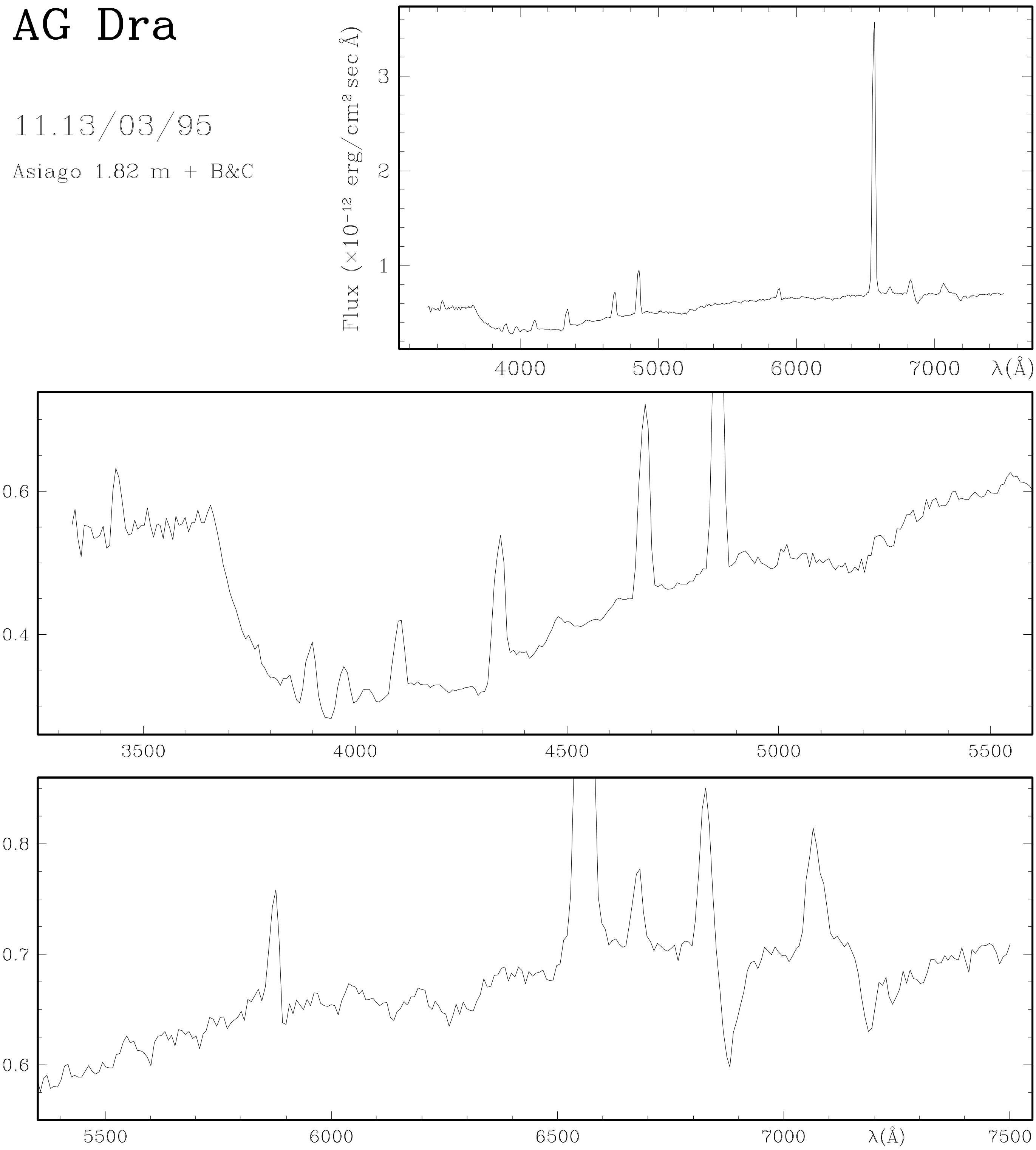


Fig. 137. Asiago 1.82m + B&C spectrum of AG Dra

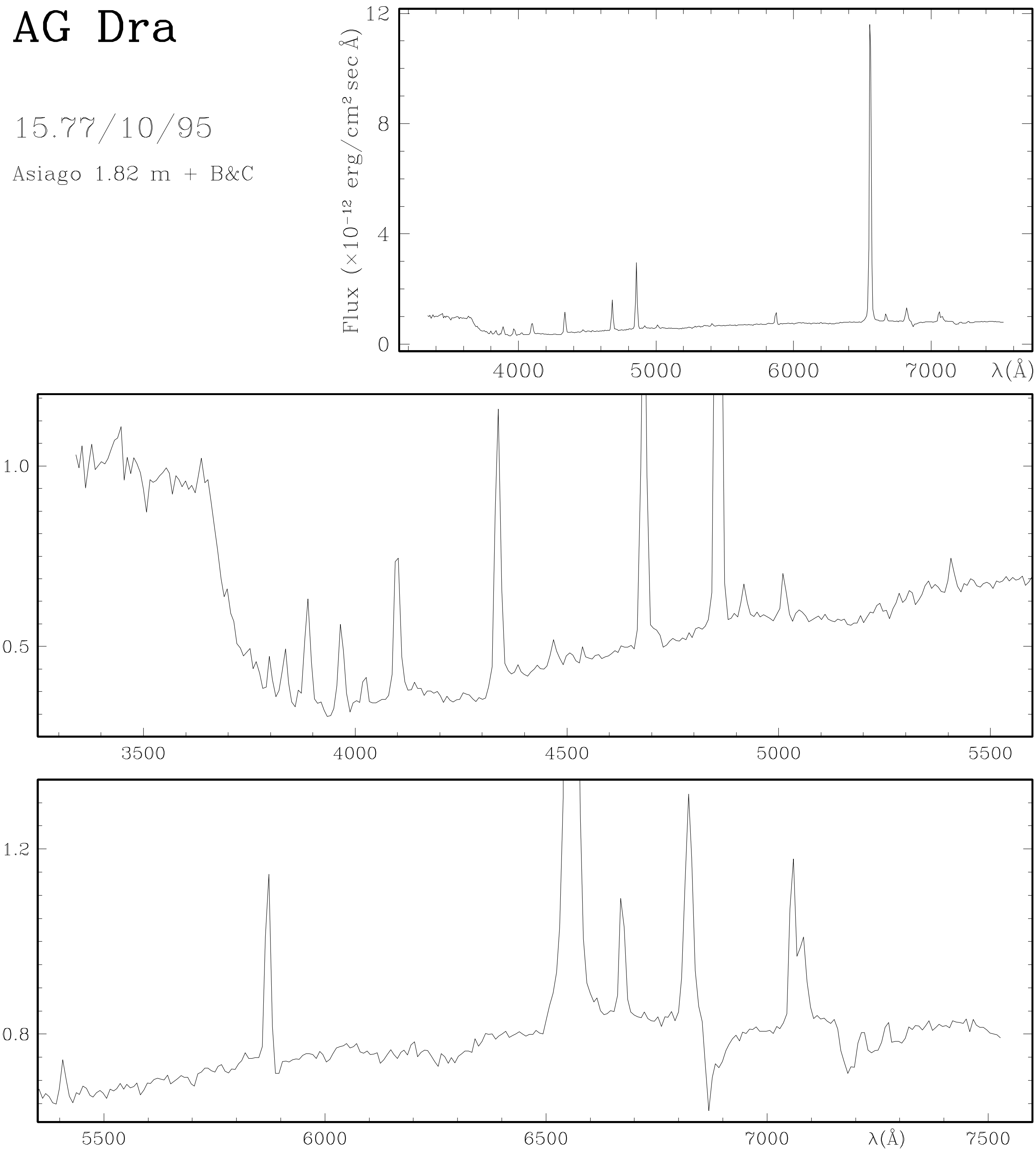


Fig. 138. Asiago 1.82m + B&C spectrum of AG Dra

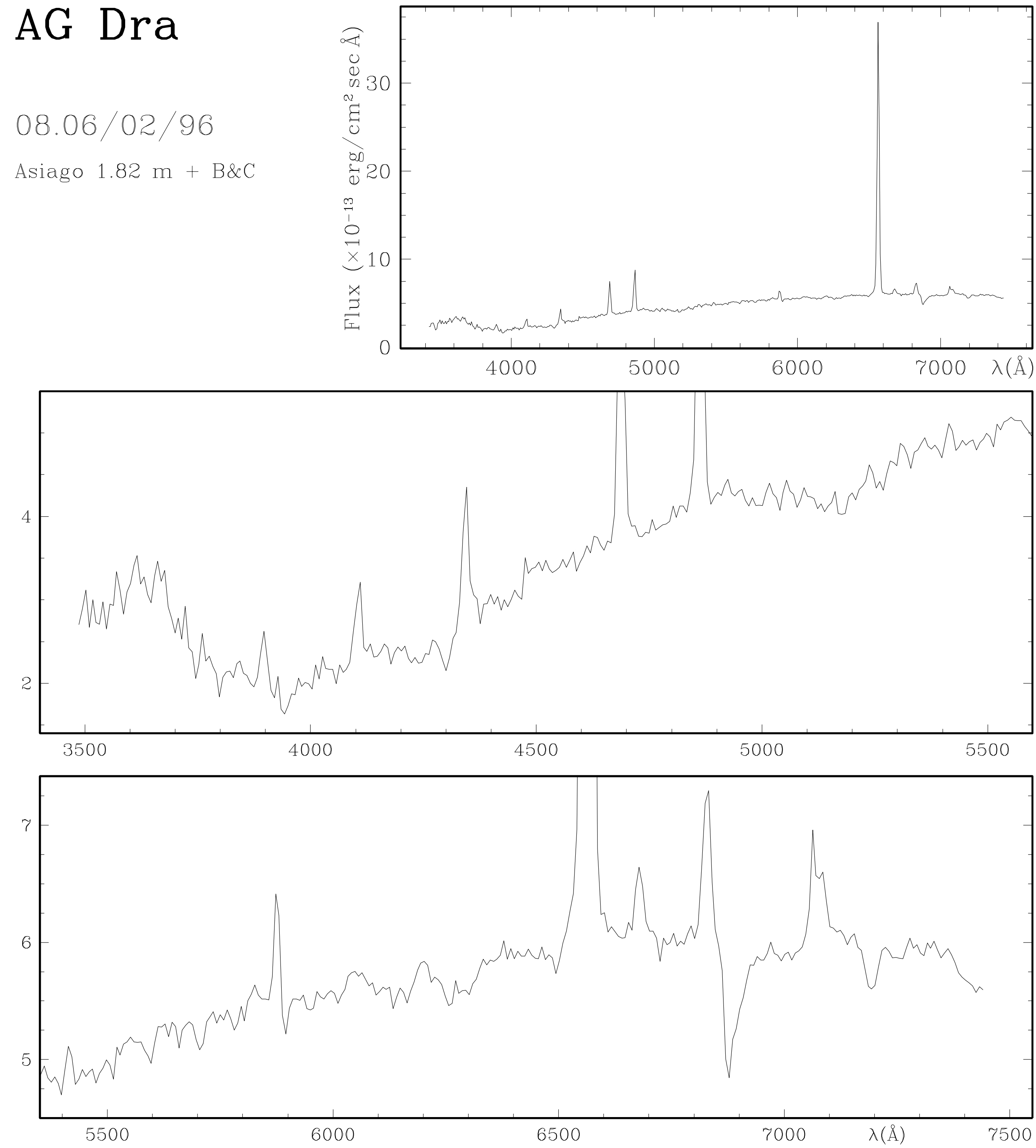


Fig. 139. Asiago 1.82m + B&C spectrum of AG Dra

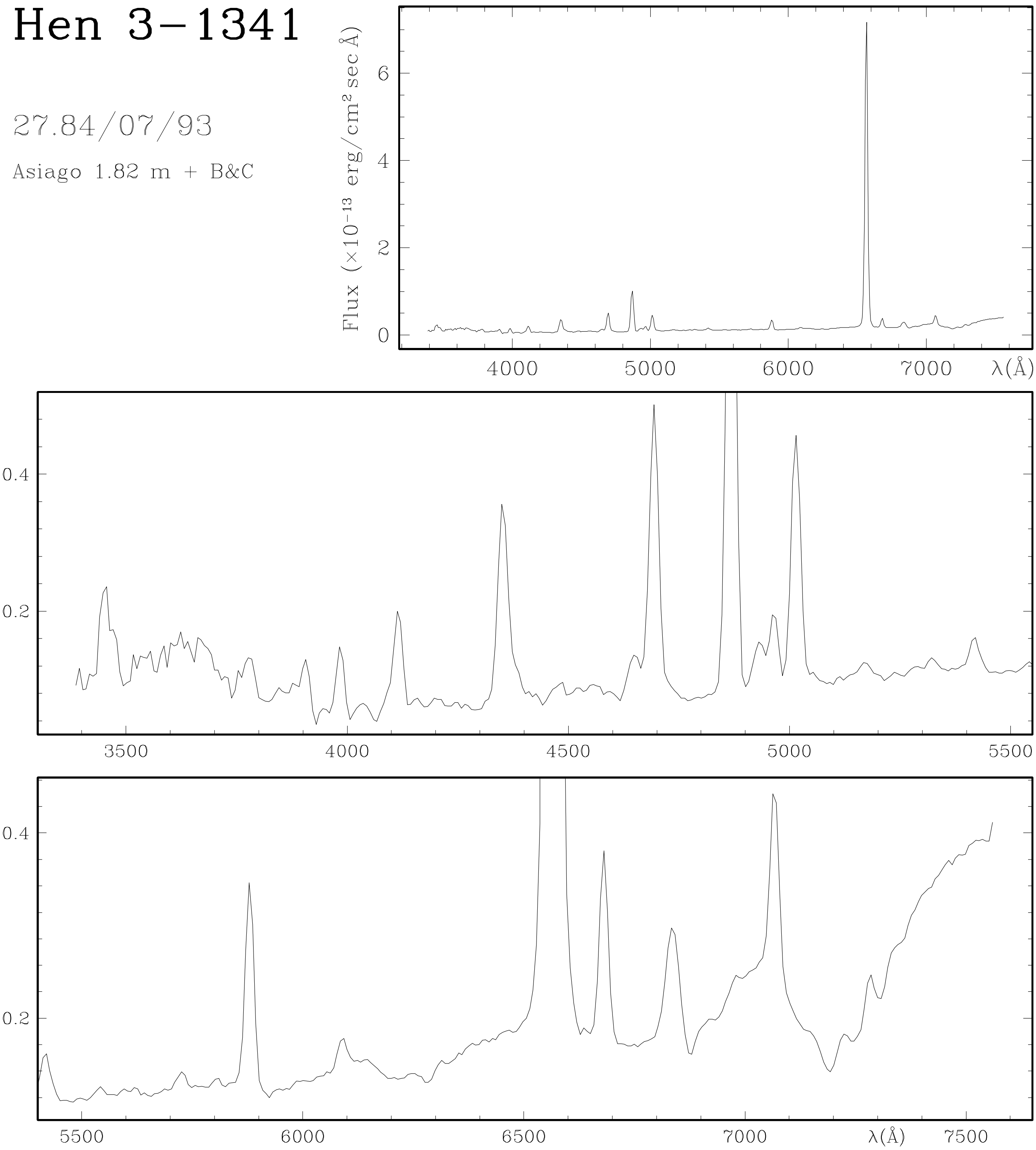


Fig. 140. Asiago 1.82m + B&C spectrum of Hen 3-1341

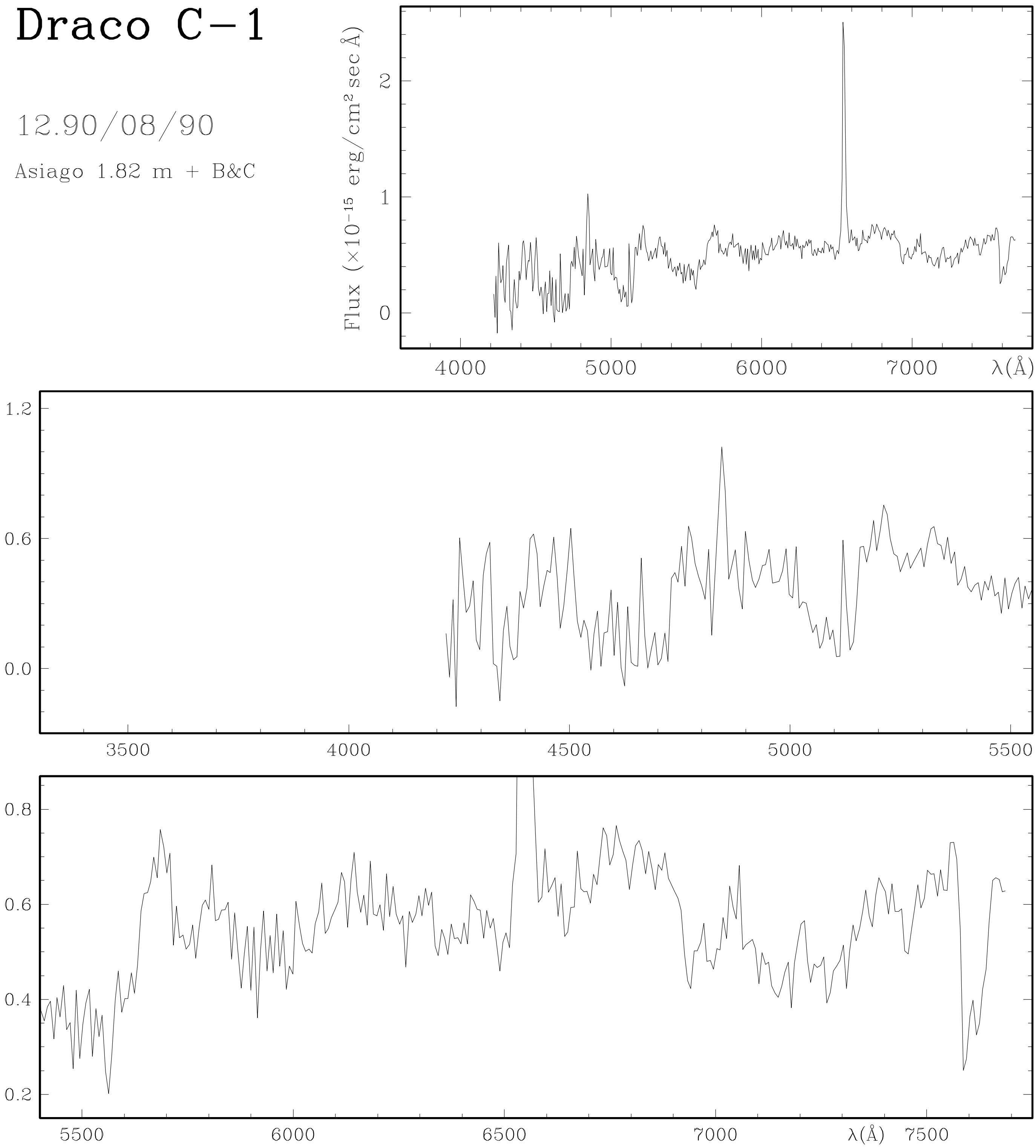
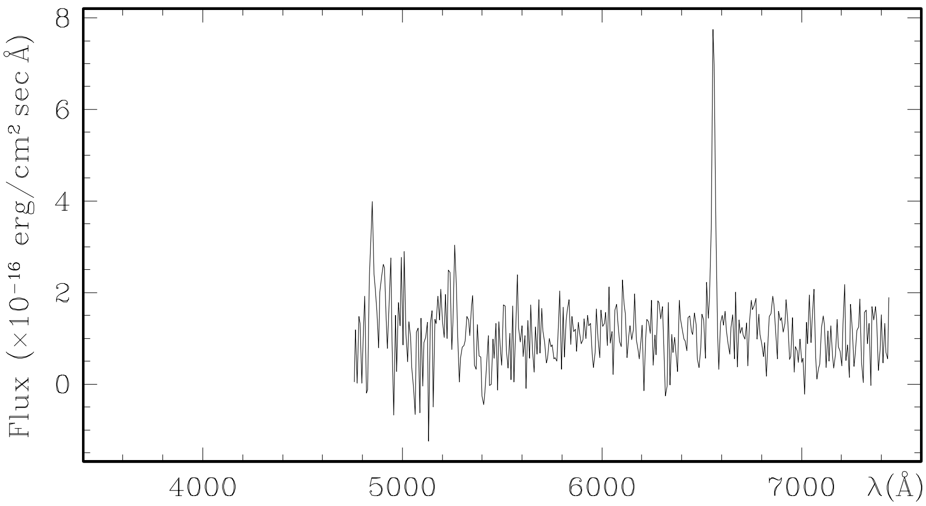


Fig. 141. Asiago 1.82m + B&C spectrum of Draco C-1

Draco C−1

10.86/07/96

Asiago 1.82 m + B&C



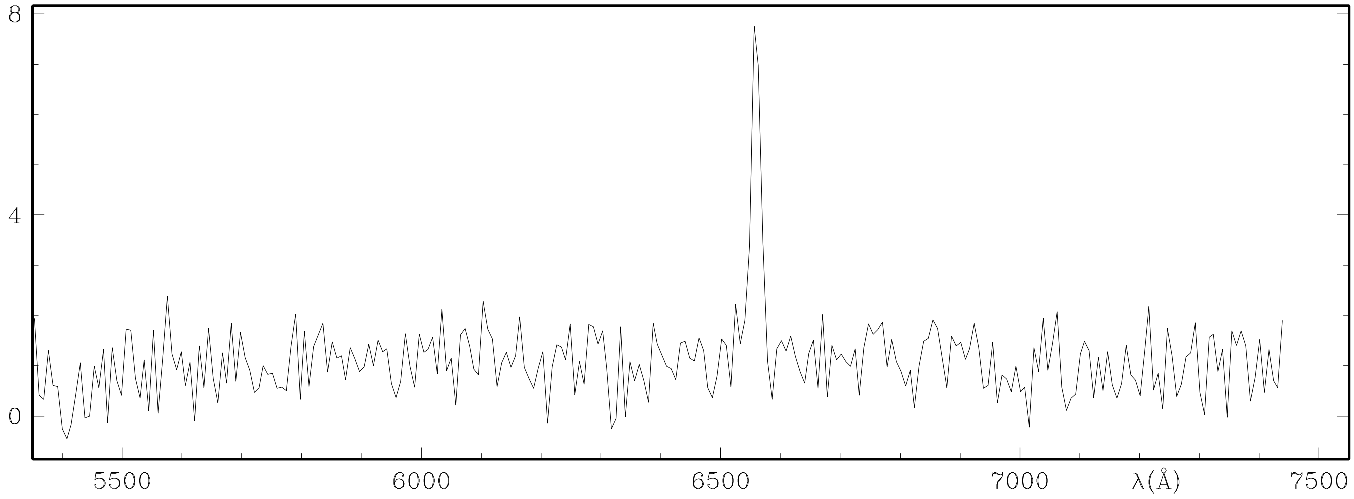


Fig. 142. Asiago 1.82m + B&C spectrum of Draco C-1

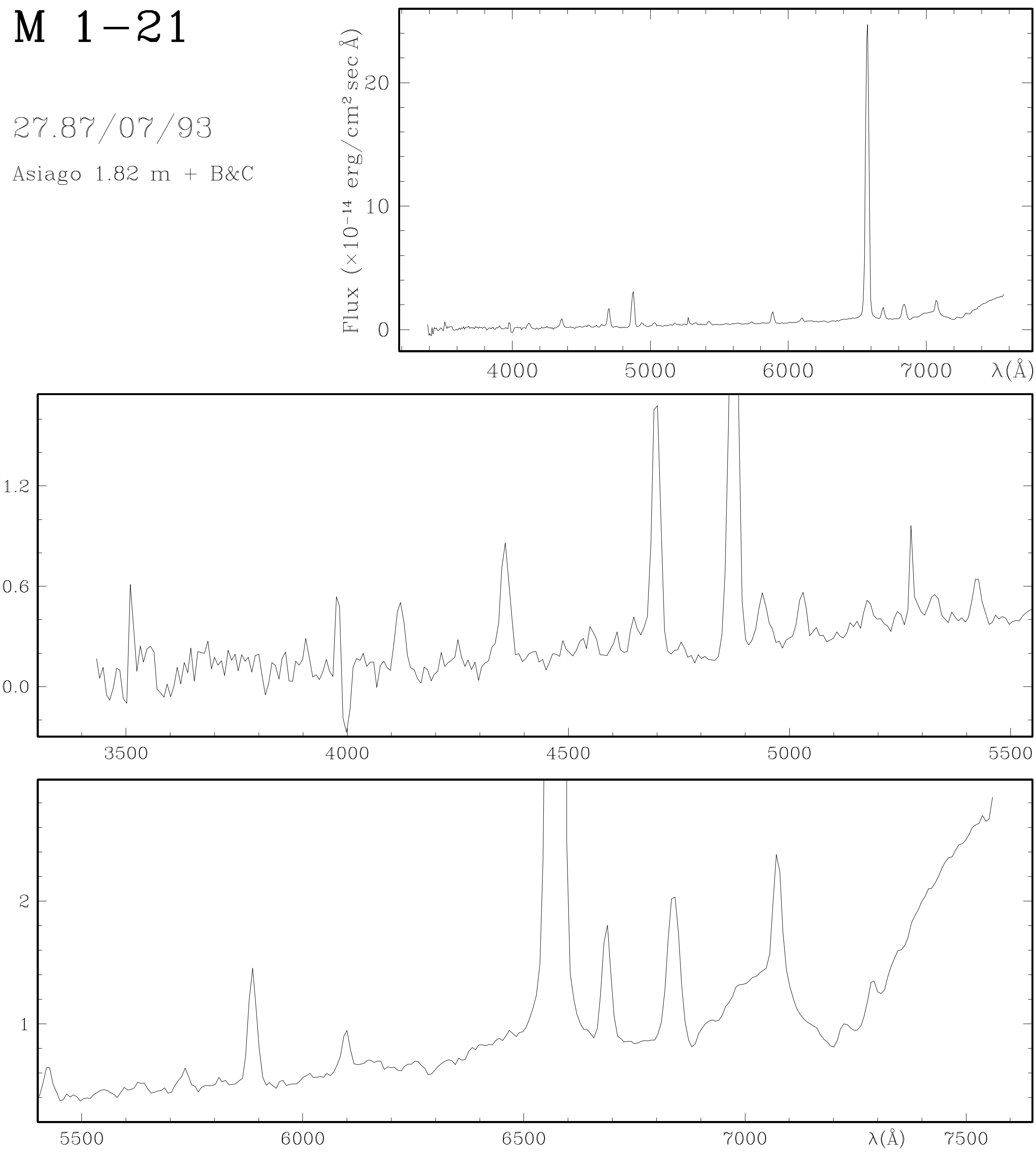


Fig. 143. Asiago 1.82m + B&C spectrum of M 1-21

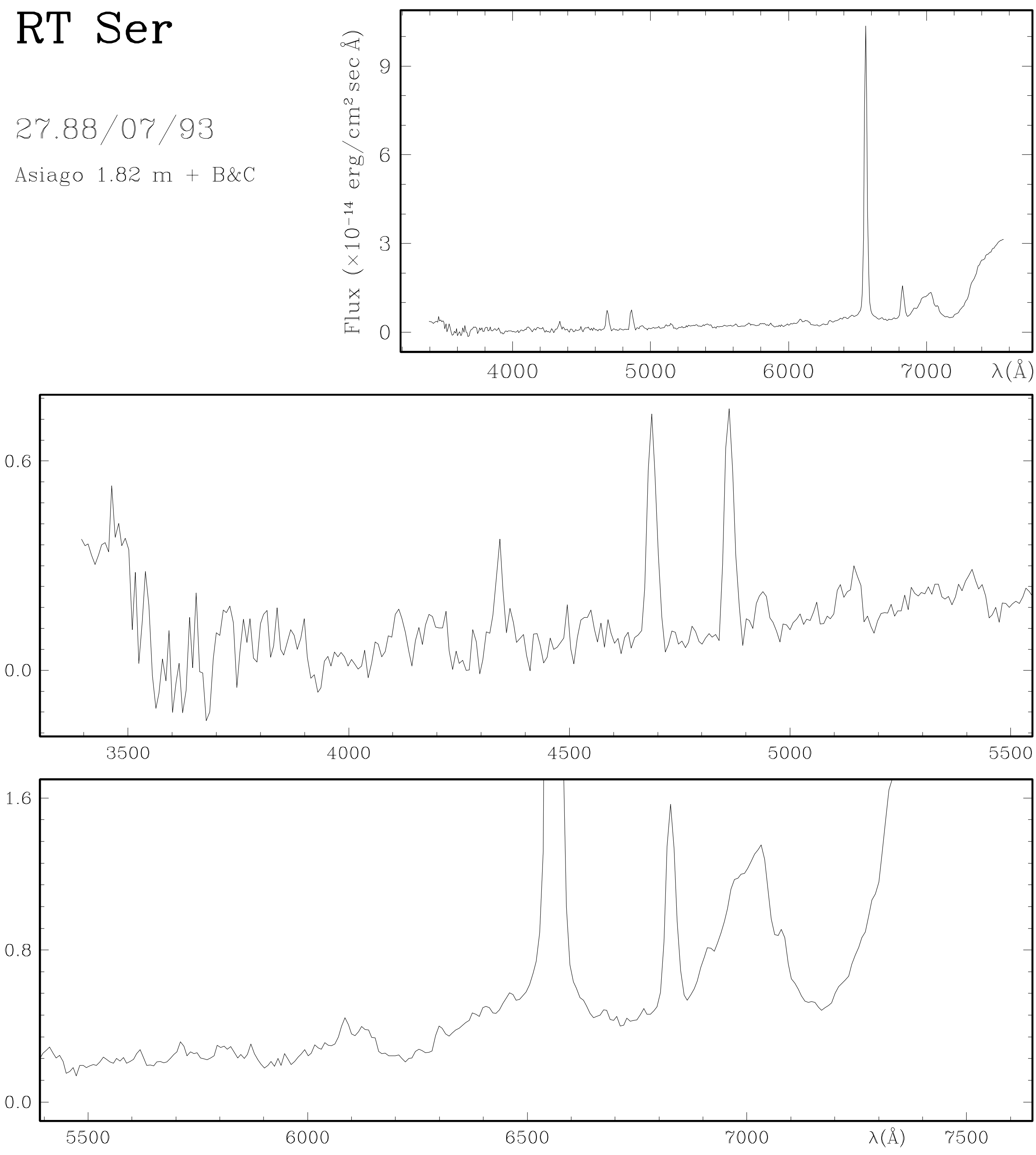


Fig. 144. Asiago 1.82m + B&C spectrum of RT Ser

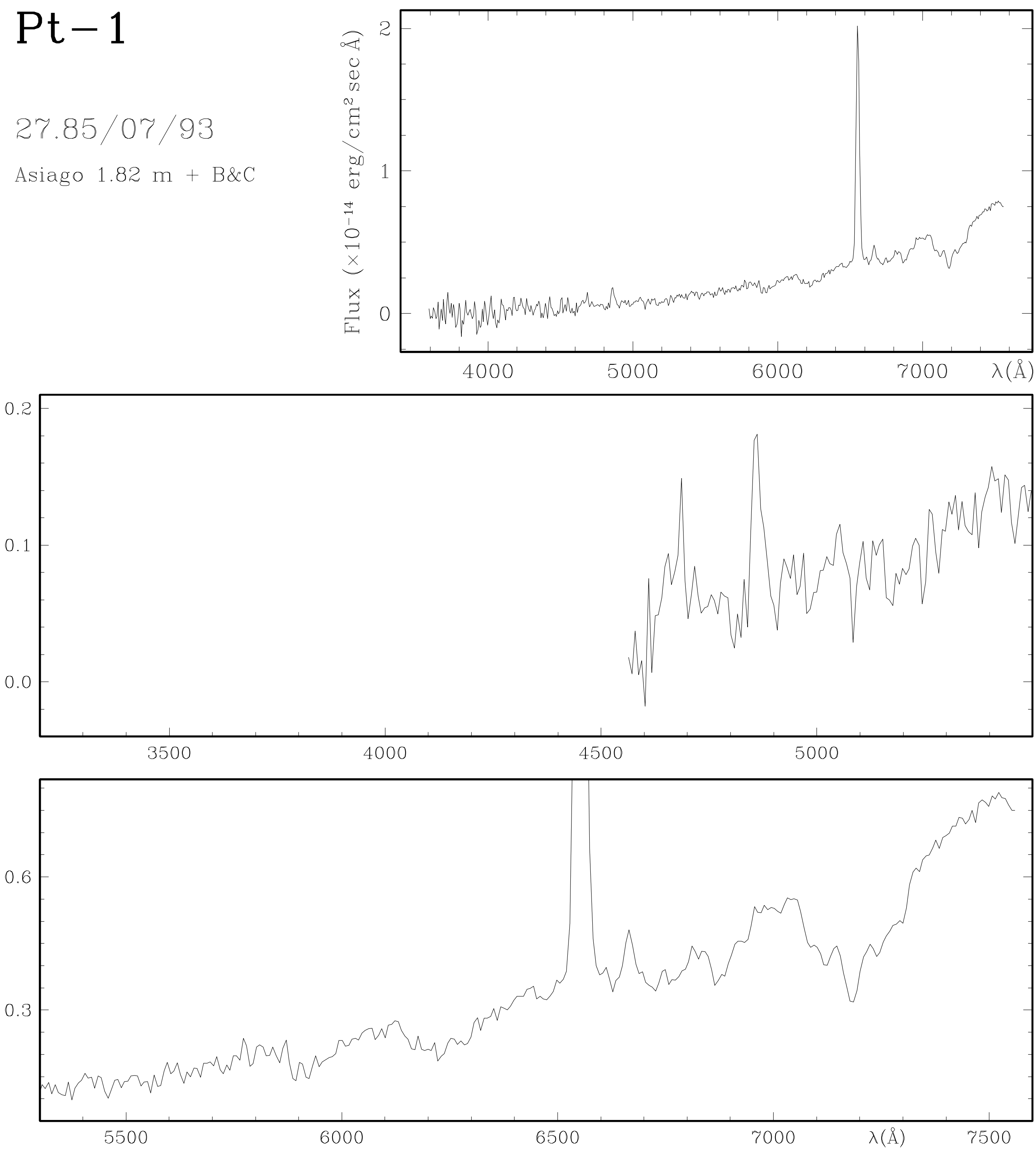


Fig. 145. Asiago 1.82m + B&C spectrum of Pt 1

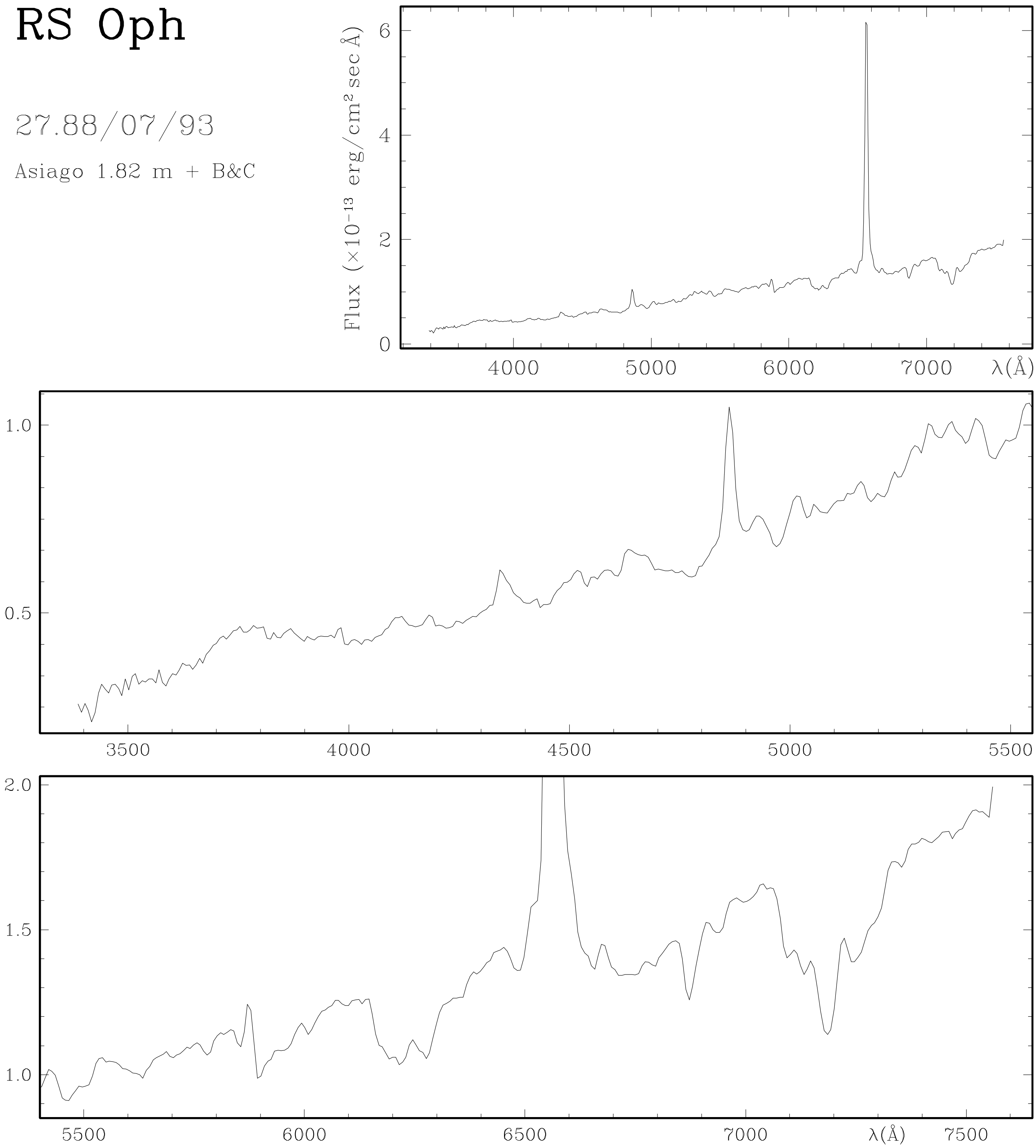


Fig. 146. Asiago 1.82m + B&C spectrum of RS Oph

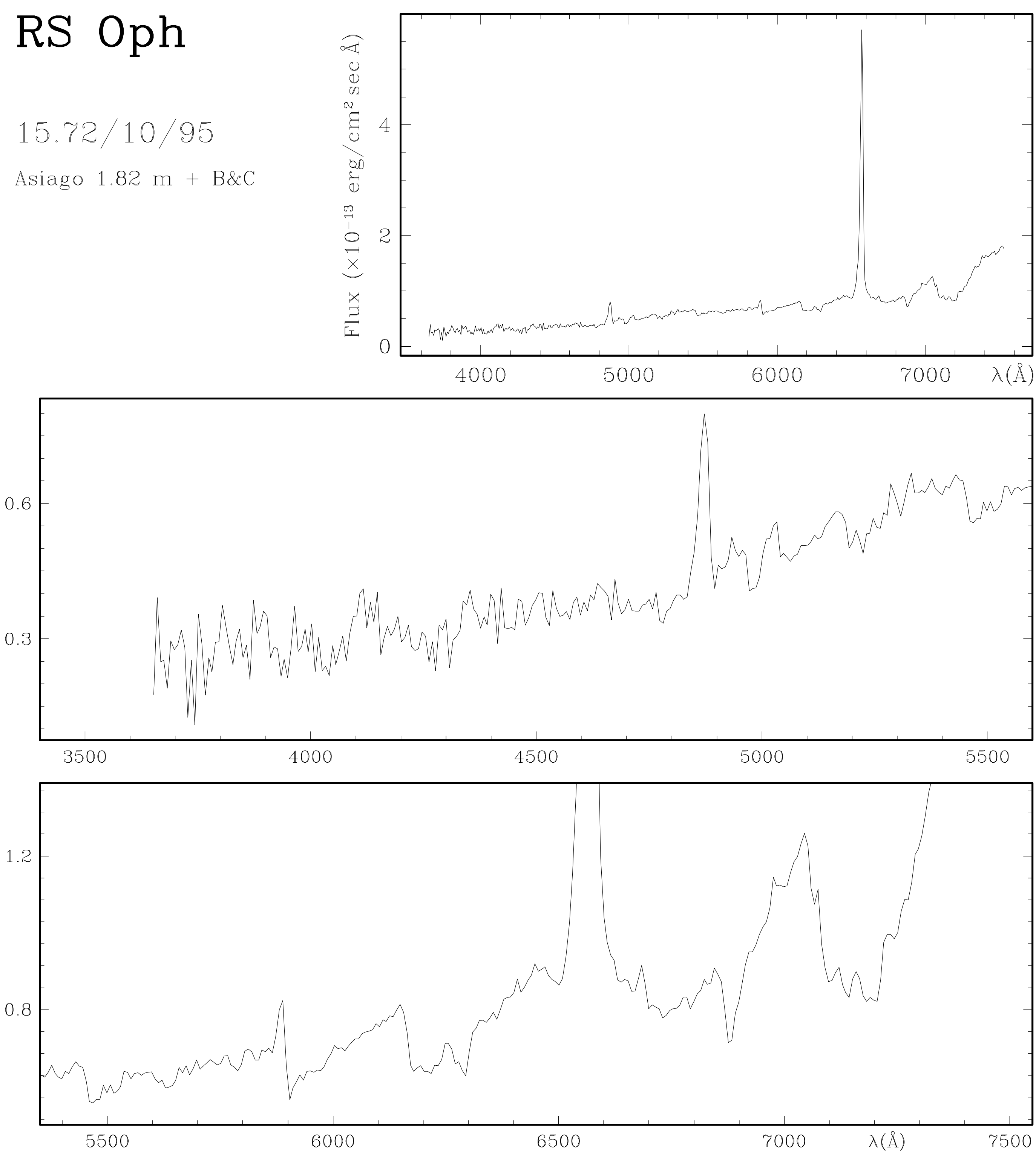


Fig. 147. Asiago 1.82m + B&C spectrum of RS Oph

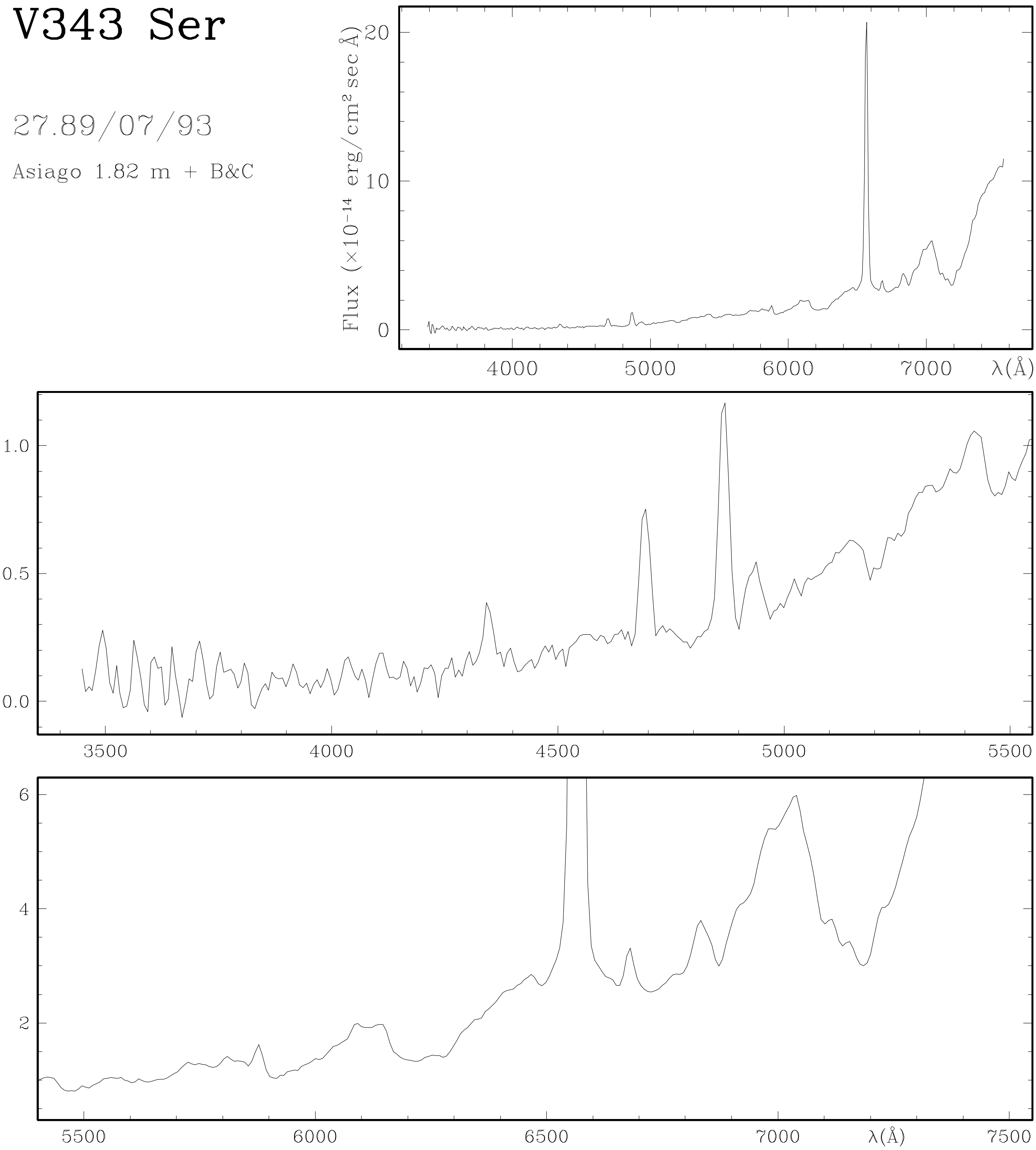


Fig. 148. Asiago 1.82m + B&C spectrum of V343 Ser

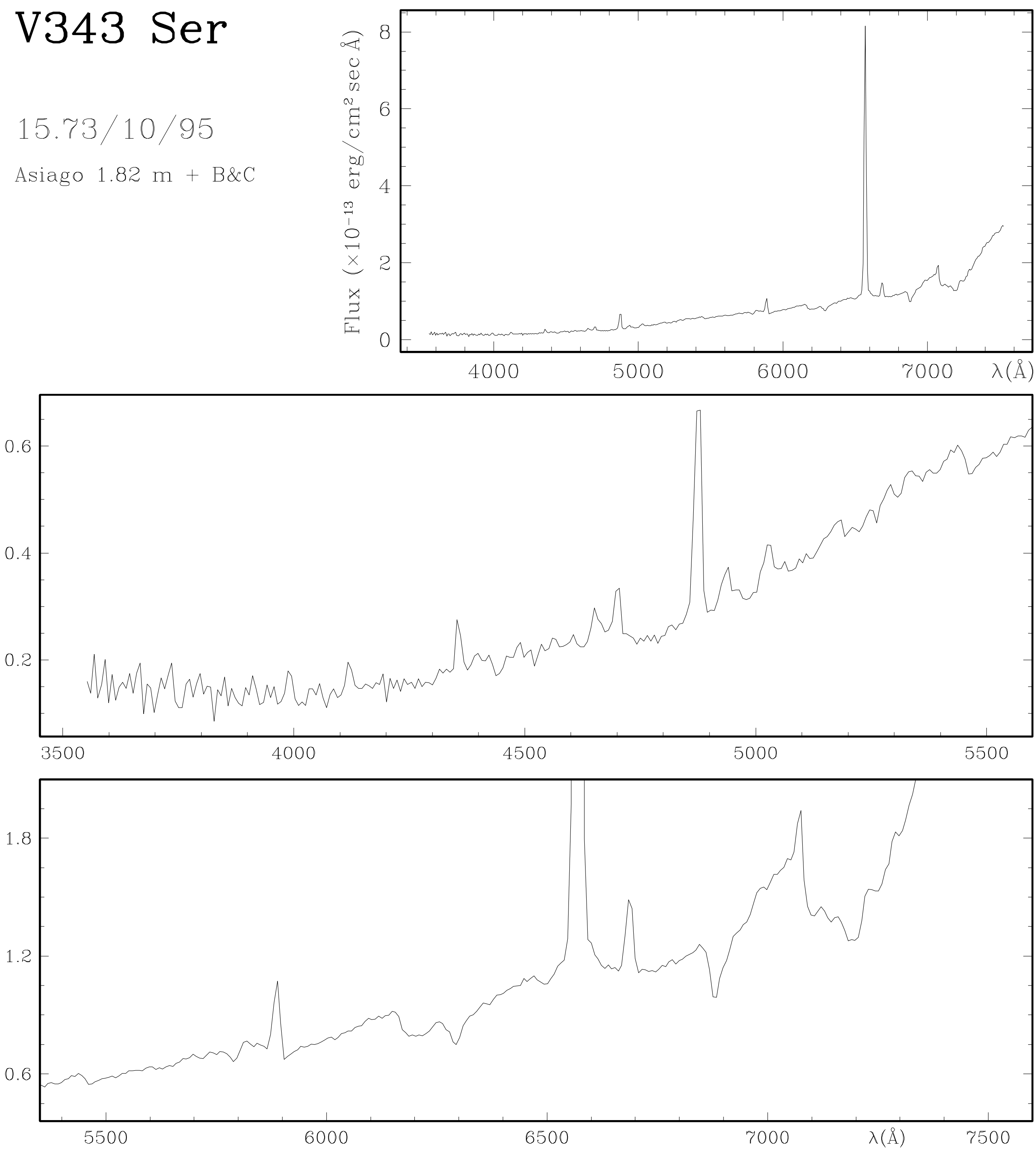


Fig. 149. Asiago 1.82m + B&C spectrum of V343 Ser

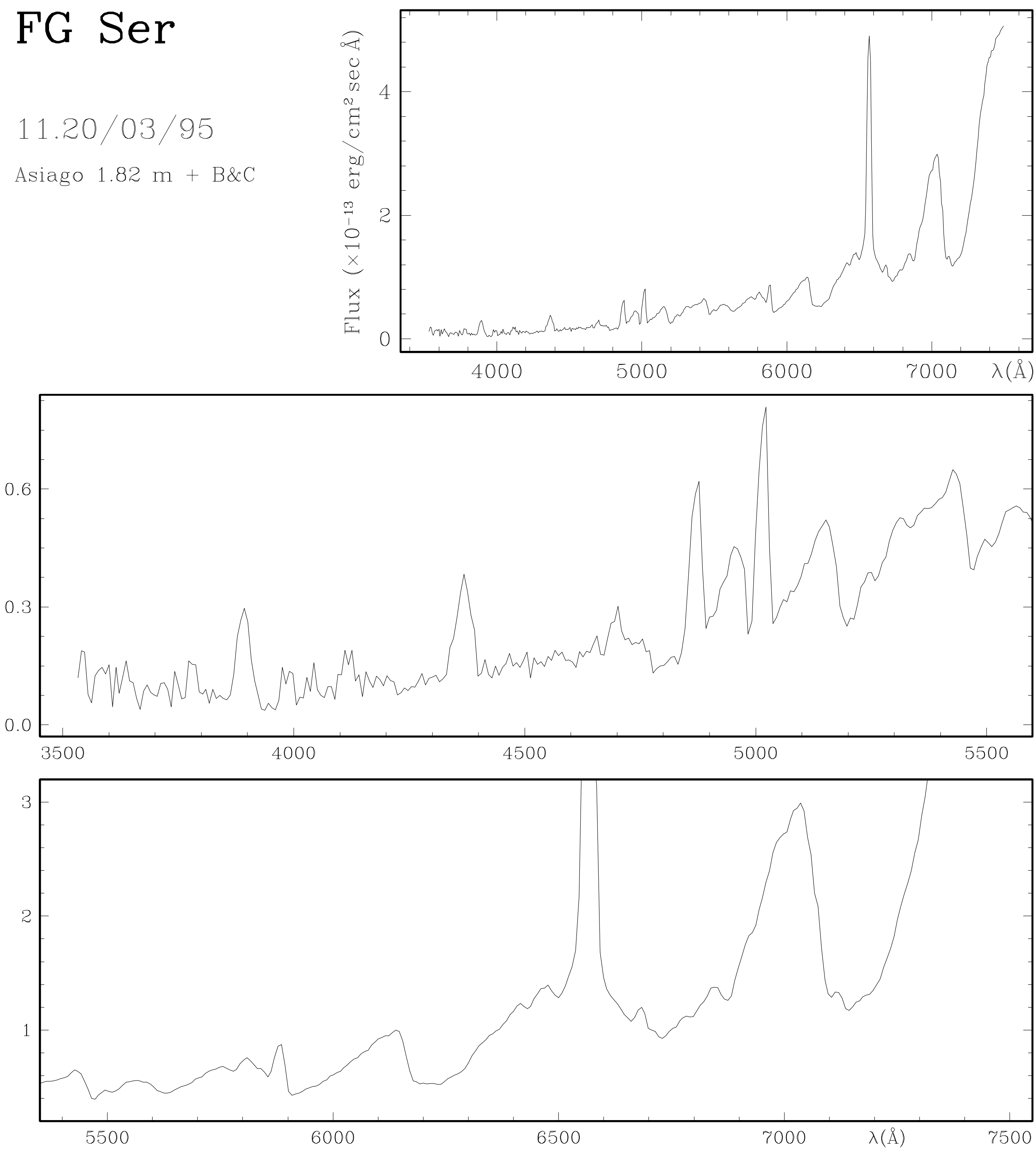


Fig. 150. Asiago 1.82m + B&C spectrum of FG Ser

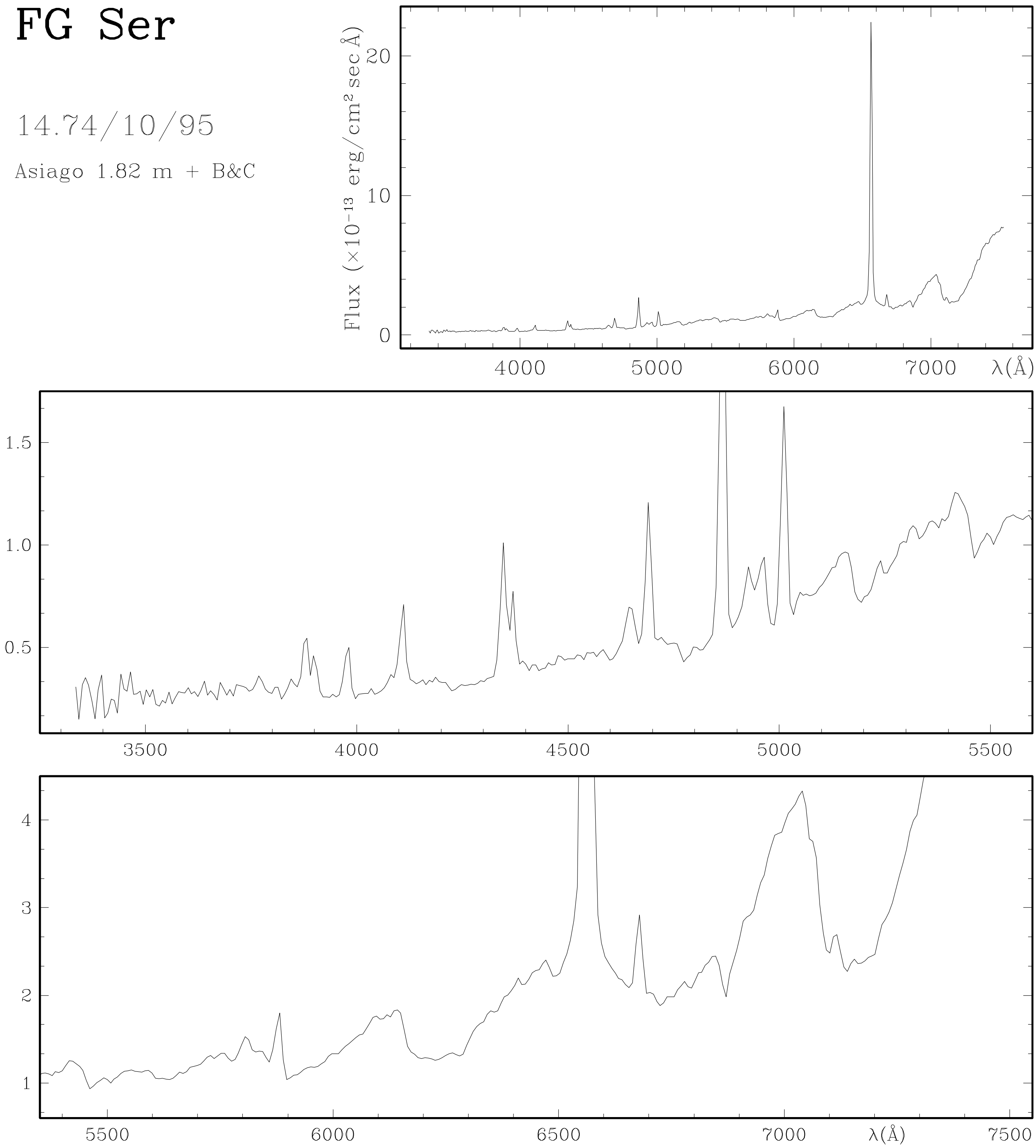


Fig. 151. Asiago 1.82m + B&C spectrum of FG Ser

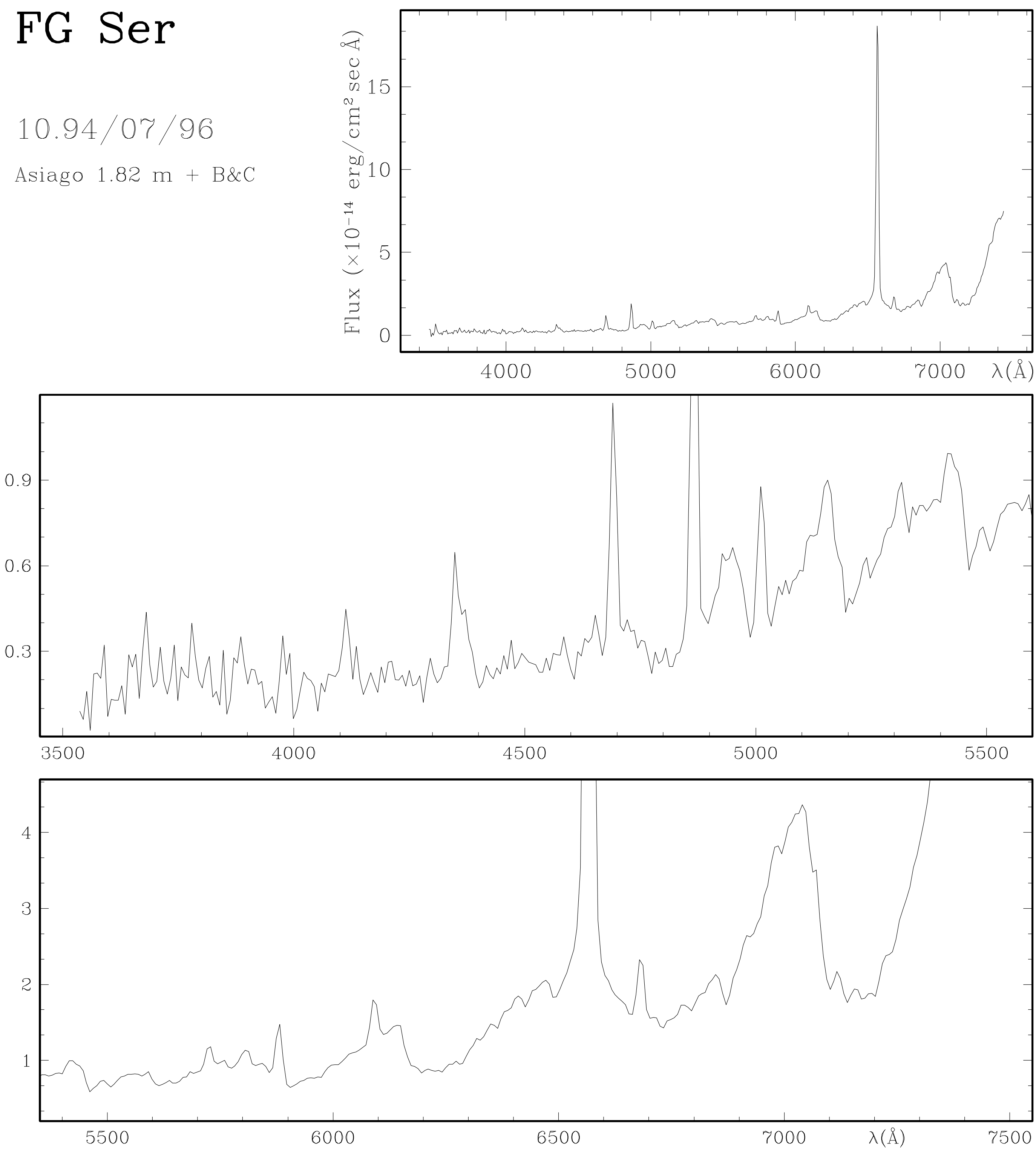


Fig. 152. Asiago 1.82m + B&C spectrum of FG Ser

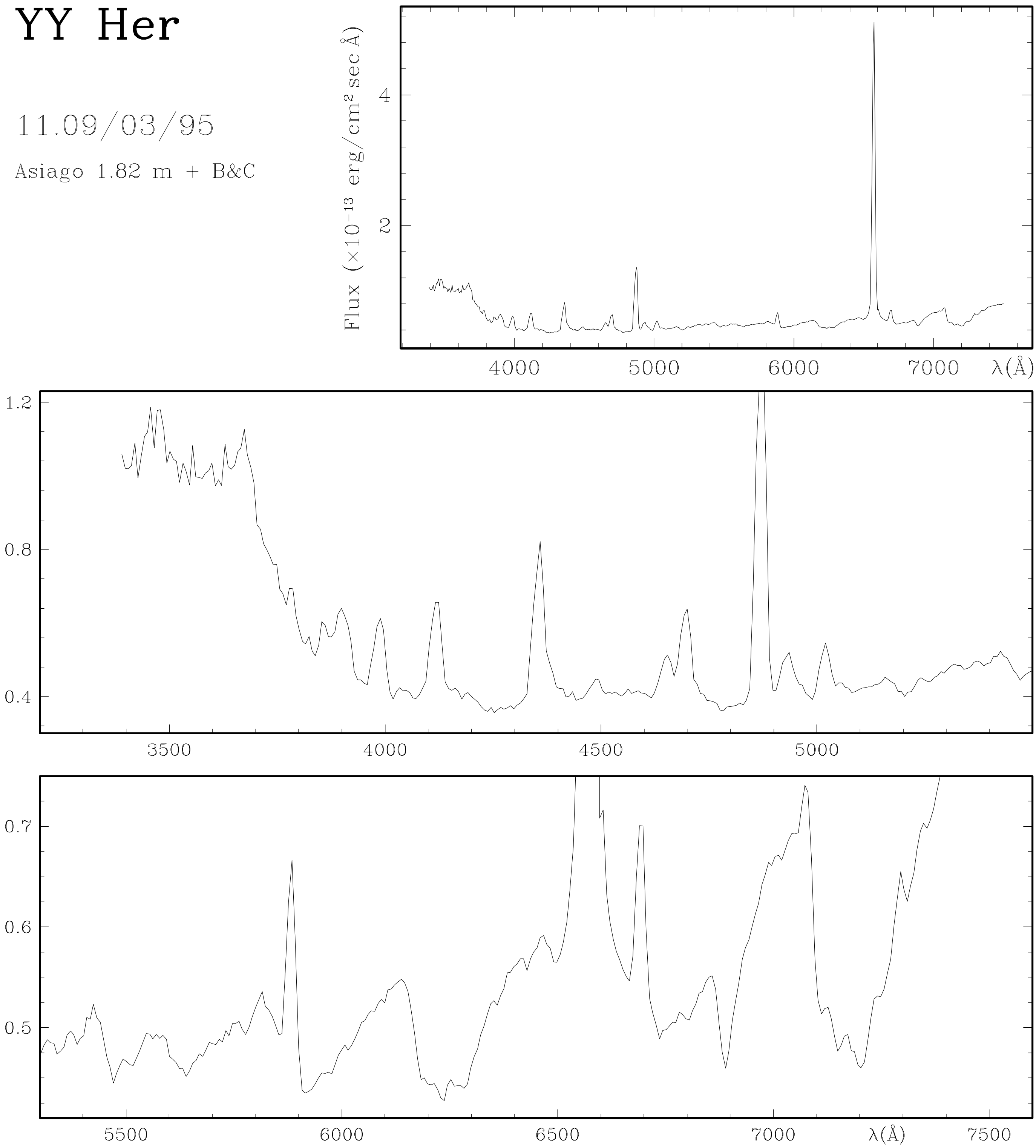


Fig. 153. Asiago 1.82m + B&C spectrum of YY Her

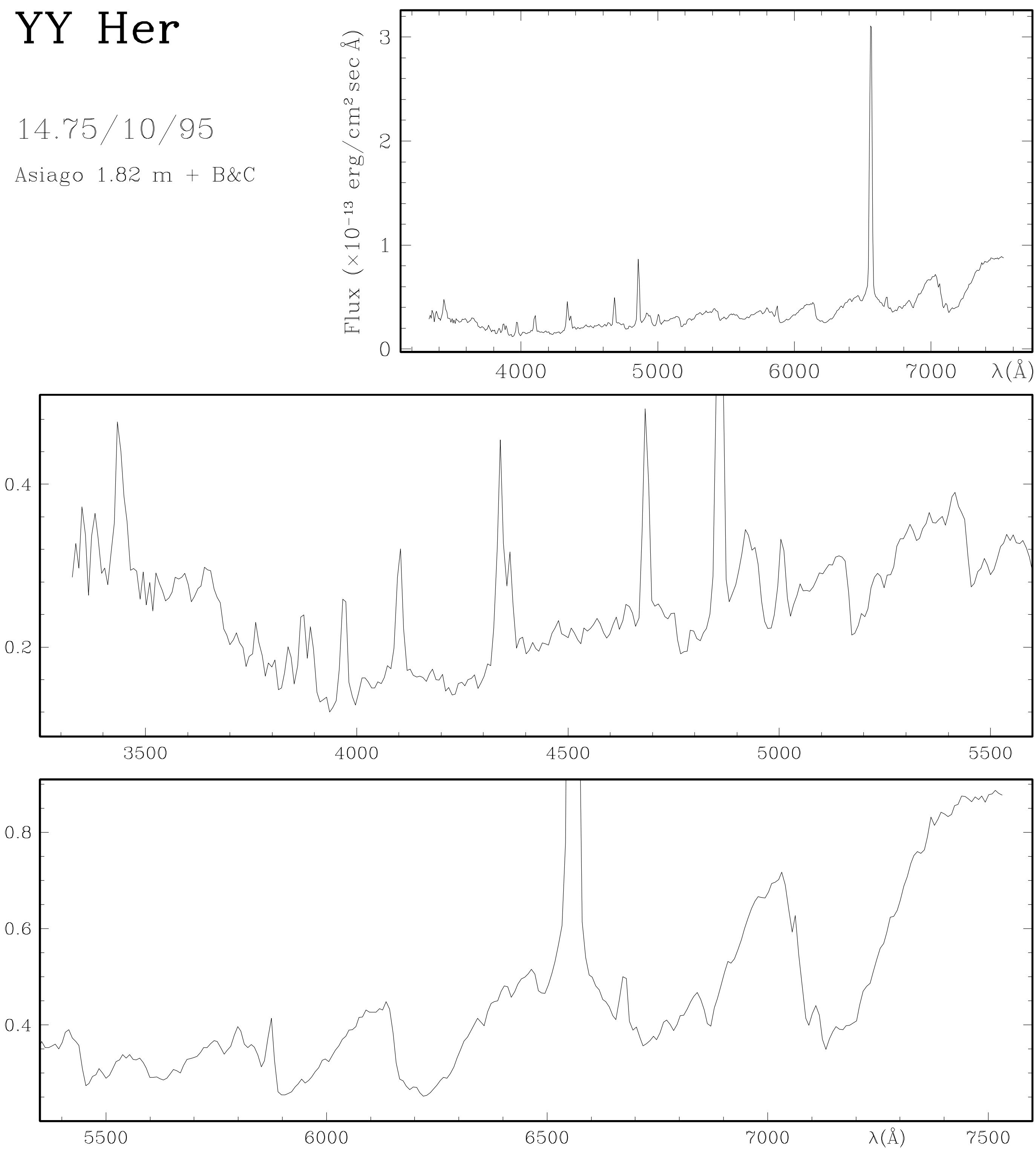


Fig. 154. Asiago 1.82m + B&C spectrum of YY Her

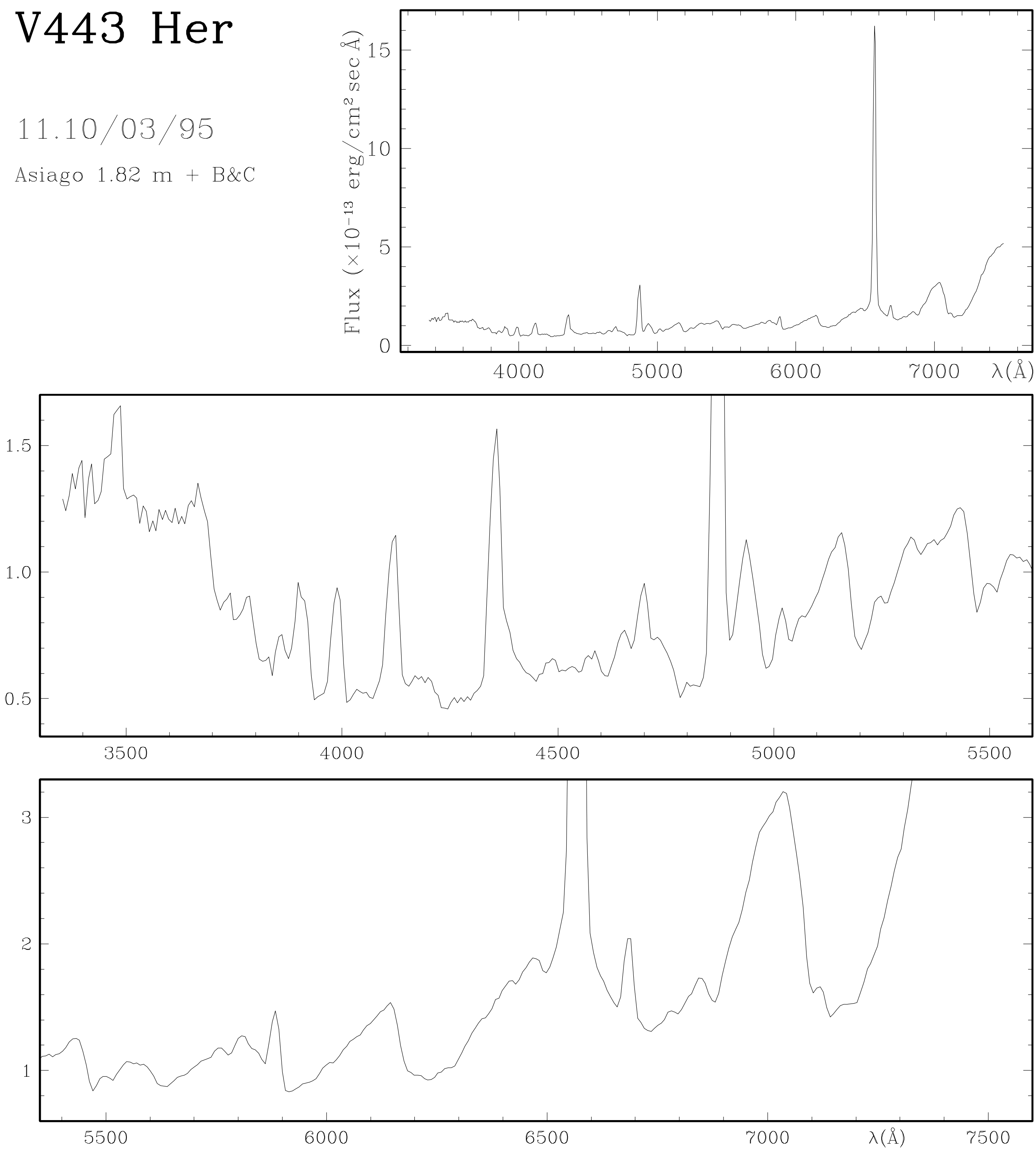


Fig. 155. Asiago 1.82m + B&C spectrum of V443 Her

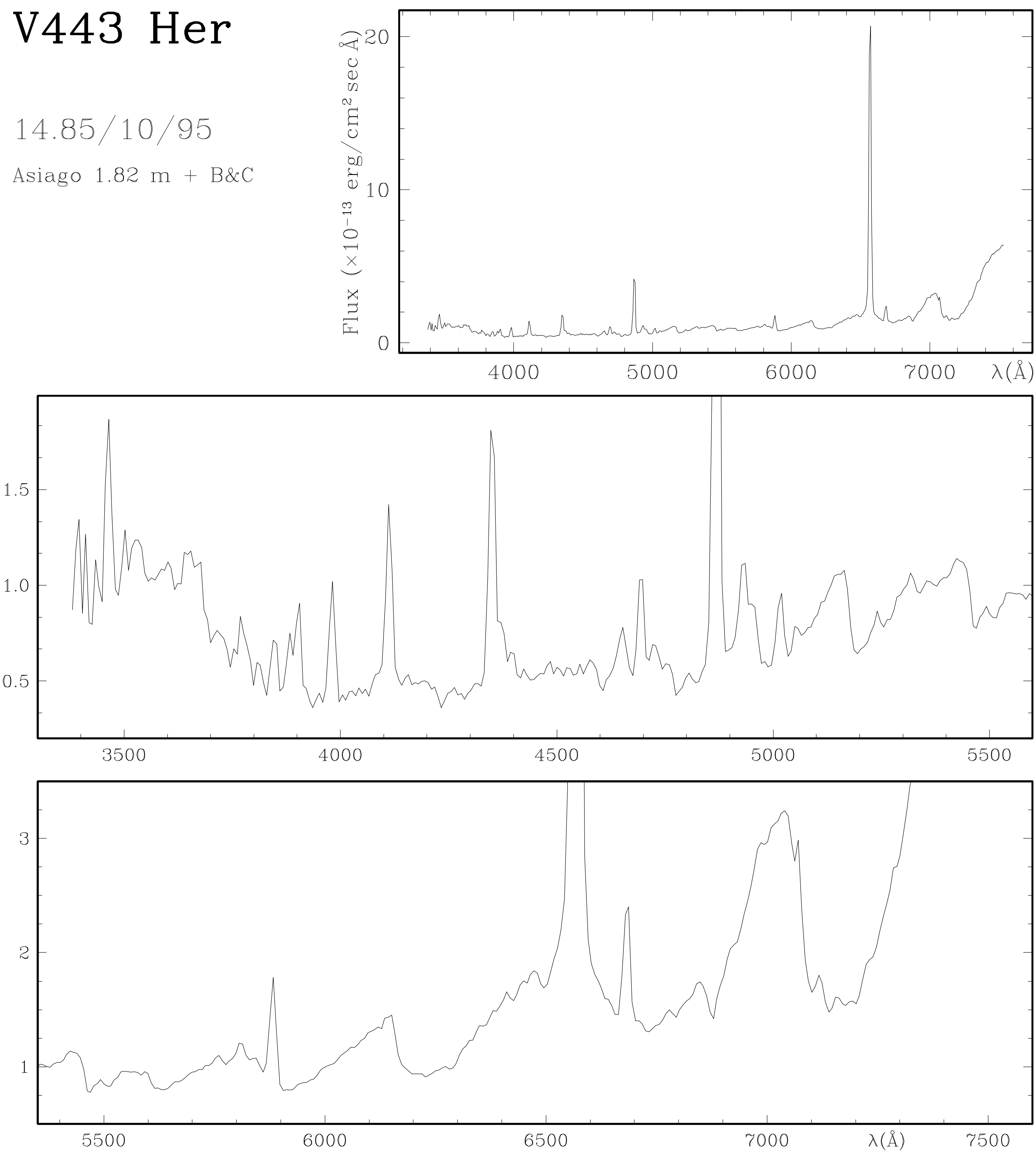


Fig. 156. Asiago 1.82m + B&C spectrum of V443 Her

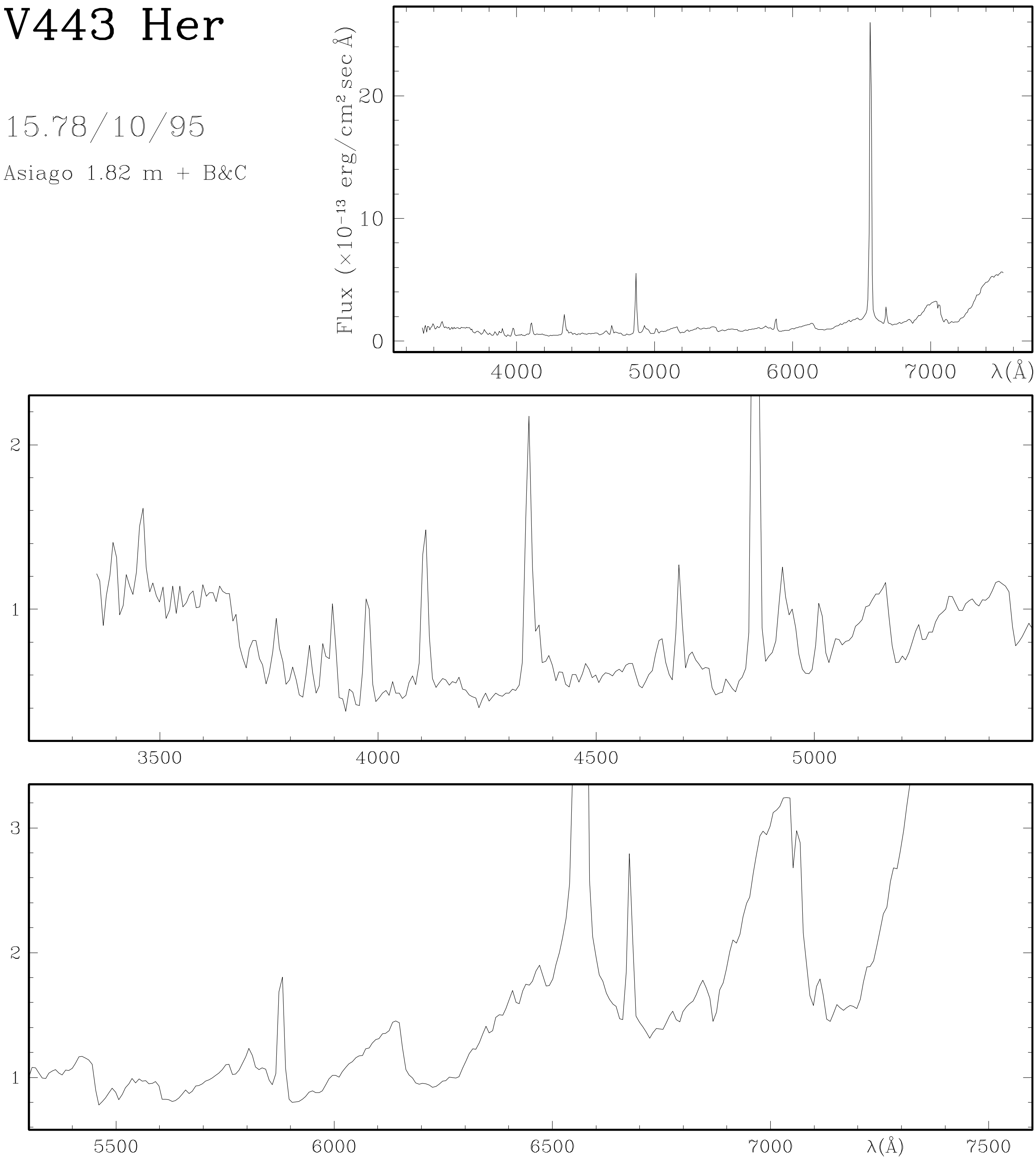


Fig. 157. Asiago 1.82m + B&C spectrum of V443 Her

MWC 960

27.90/07/93

Asiago 1.82 m + B&C

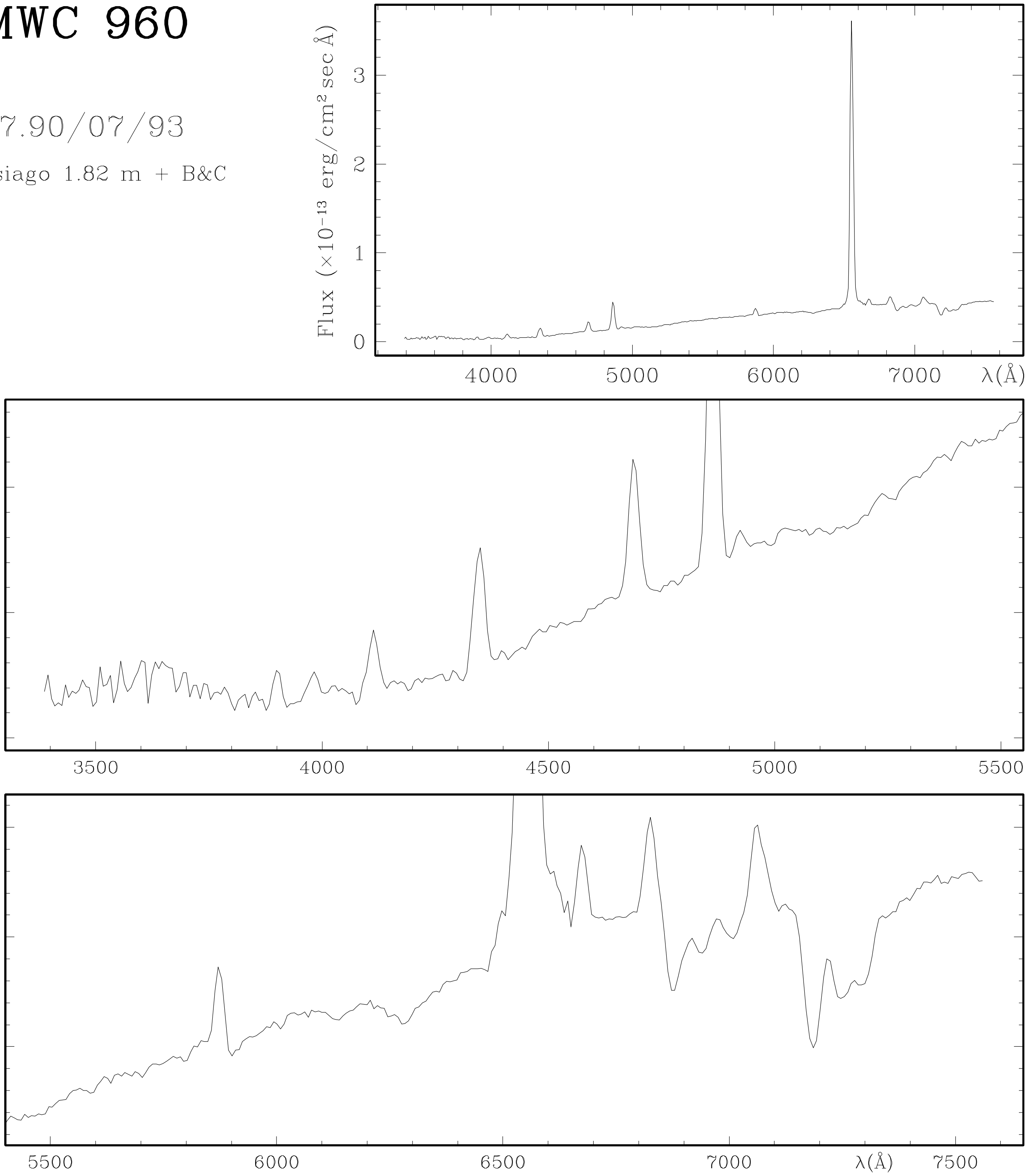


Fig. 158. Asiago 1.82m + B&C spectrum of MWC 960

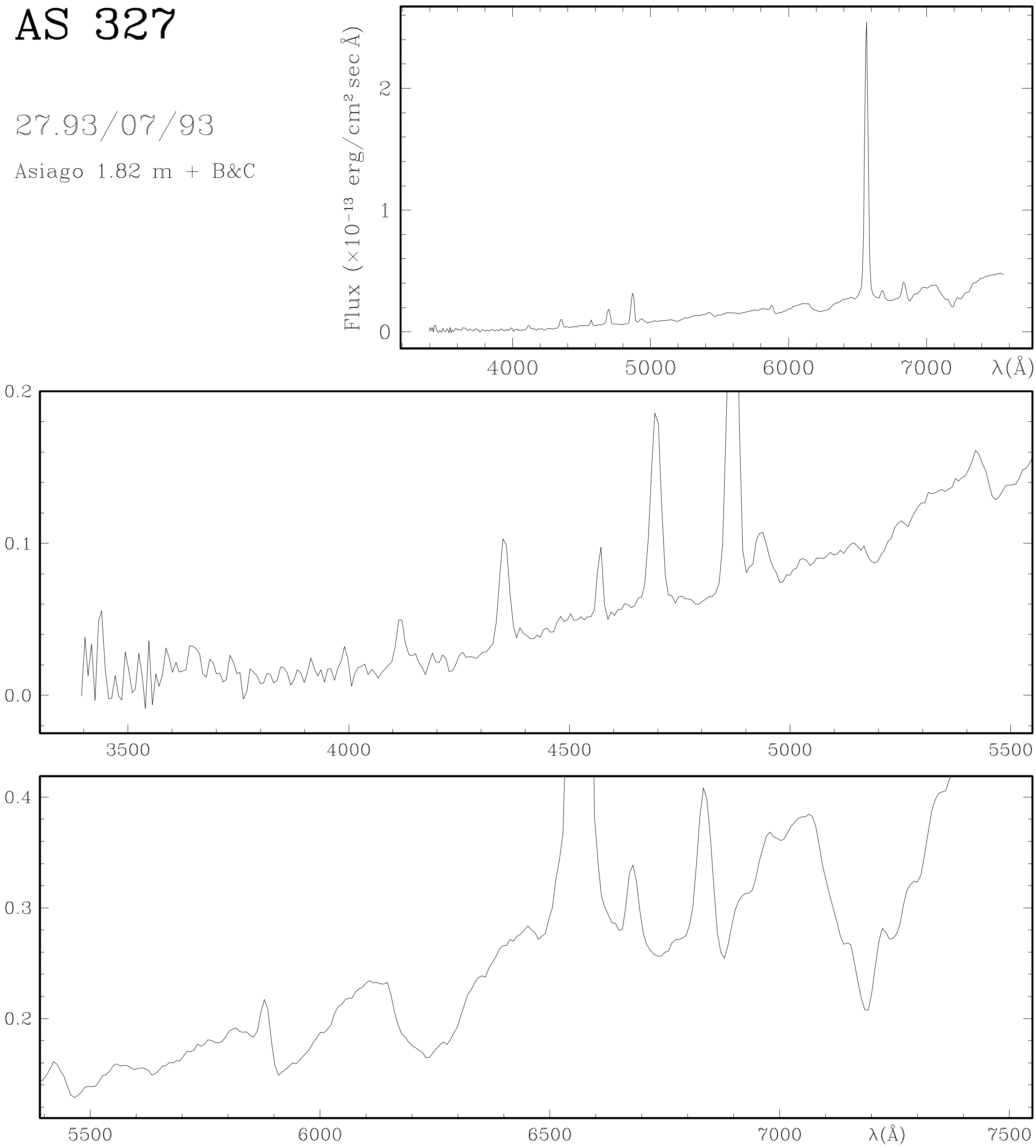


Fig. 159. Asiago 1.82m + B&C spectrum of AS 327

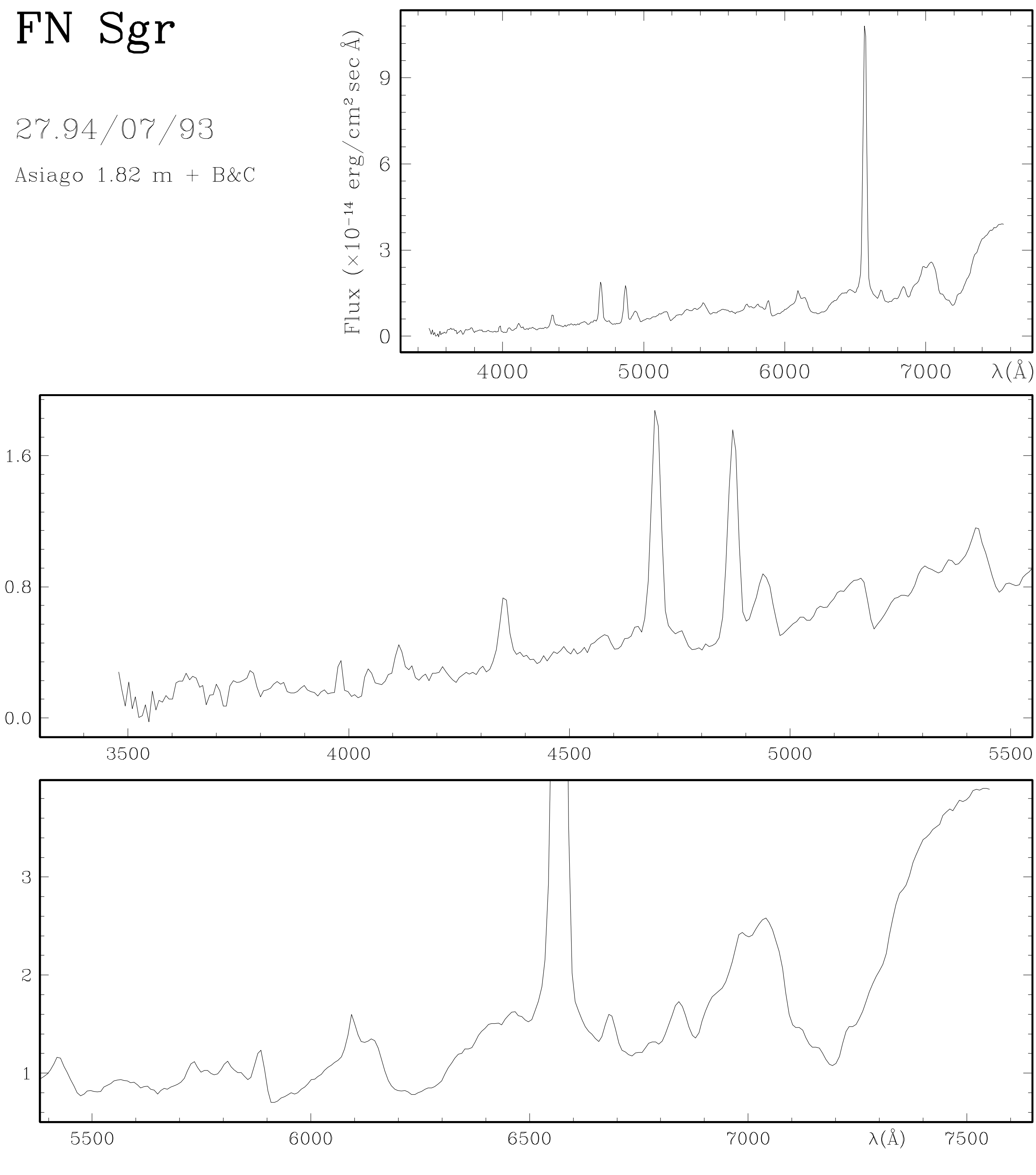


Fig. 160. Asiago 1.82m + B&C spectrum of FN Sgr

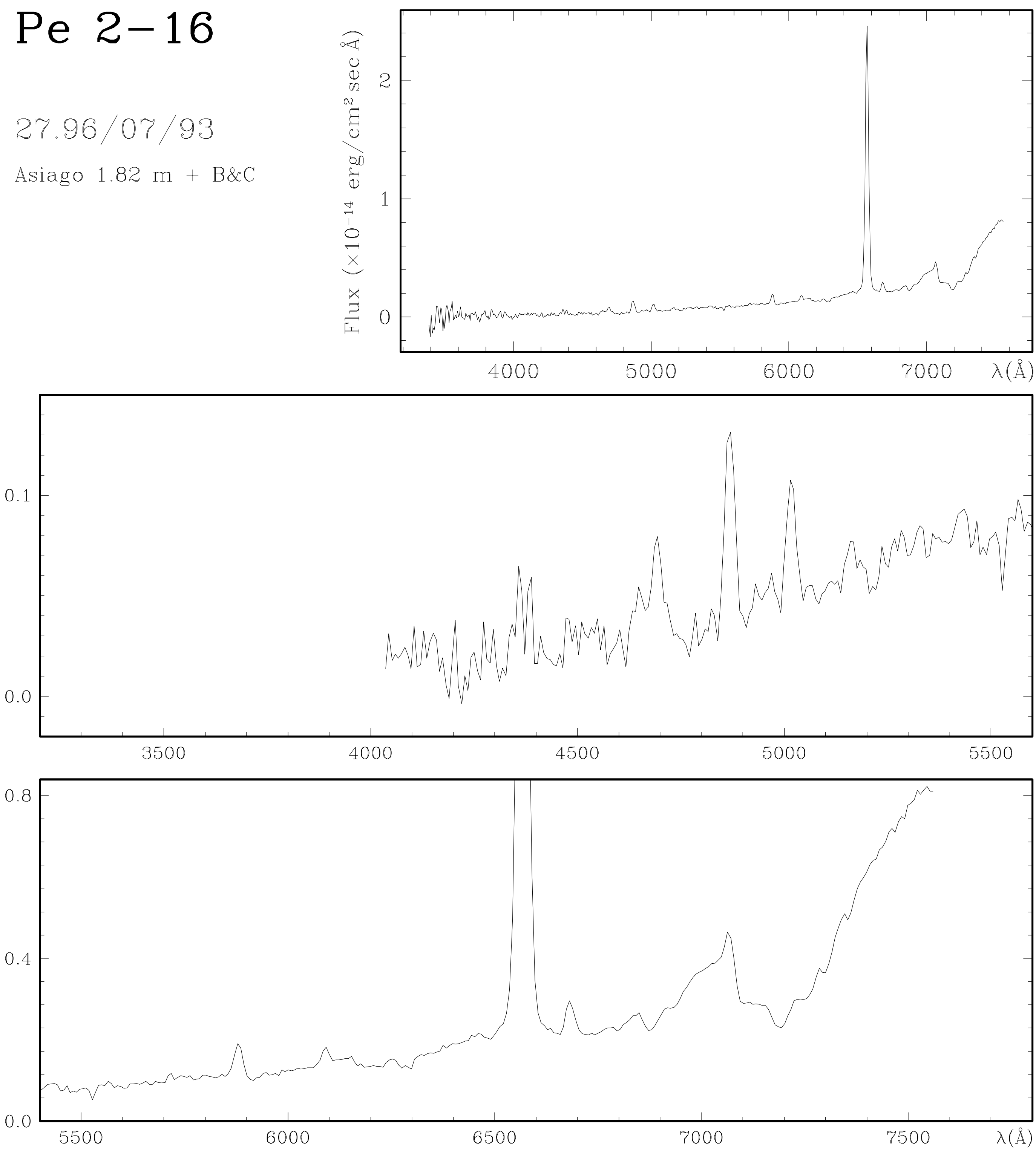


Fig. 161. Asiago 1.82m + B&C spectrum of Pe 2-16

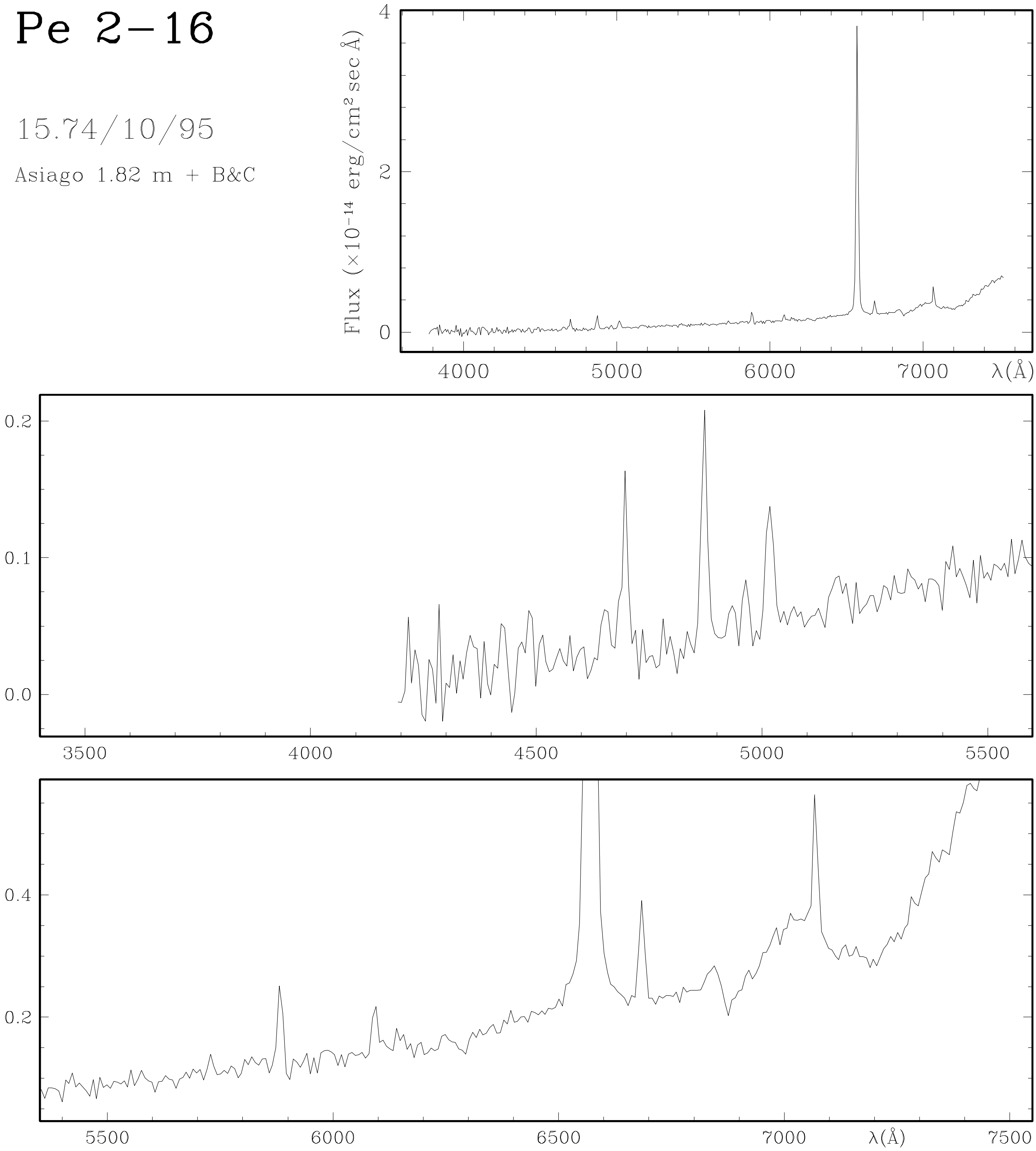


Fig. 162. Asiago 1.82m + B&C spectrum of Pe 2-16

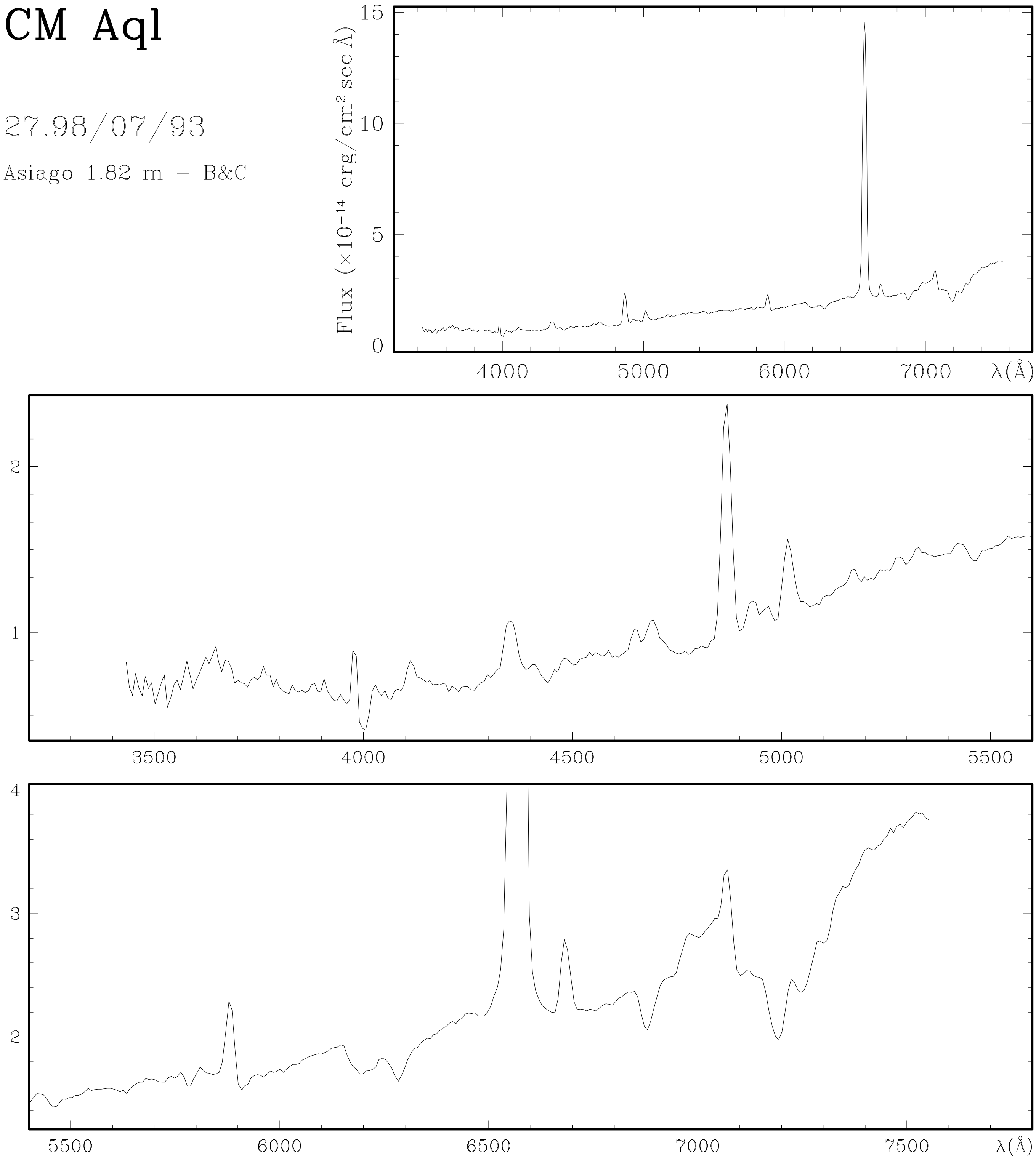


Fig. 163. Asiago 1.82m + B&C spectrum of CM Aql

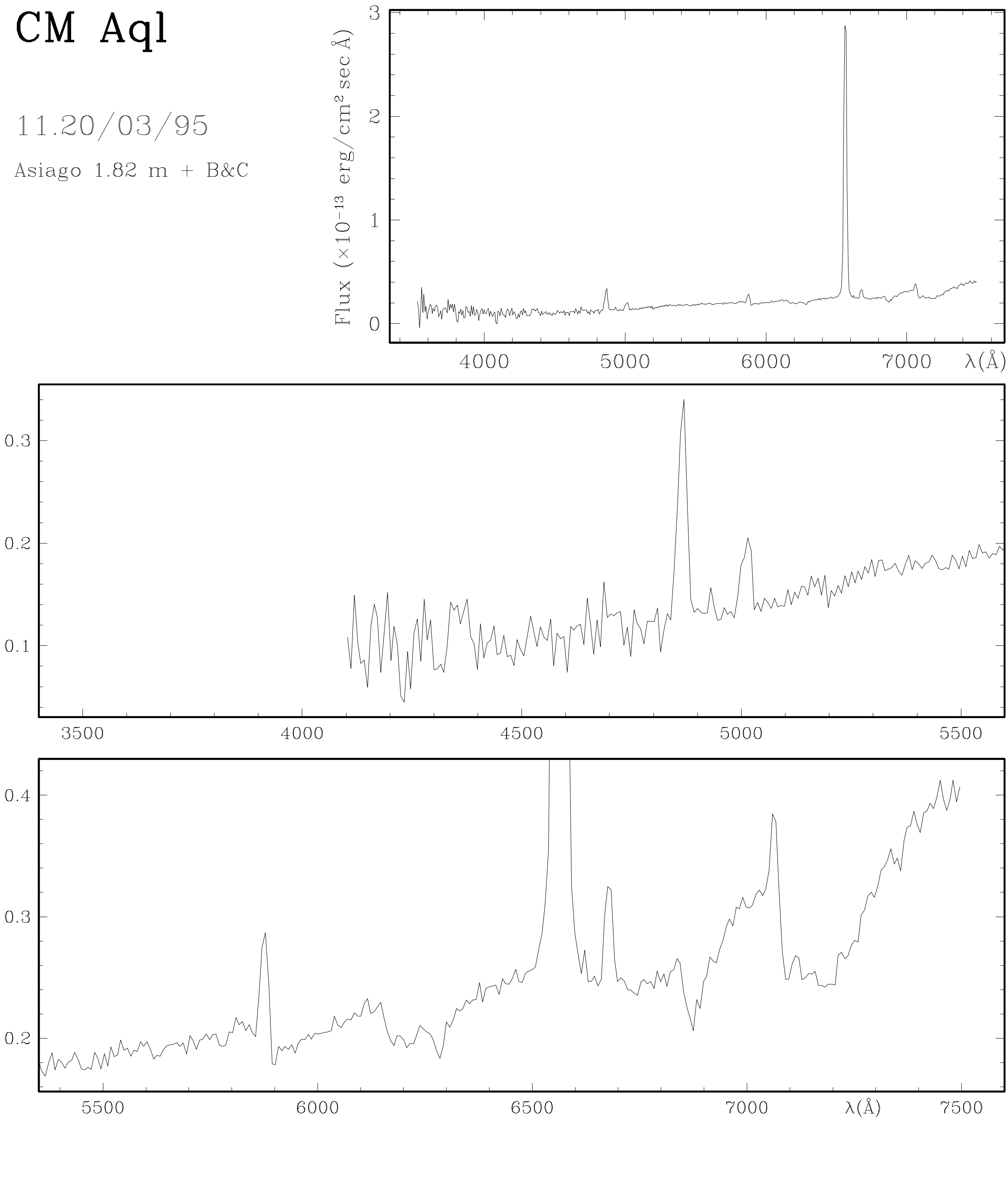


Fig. 164. Asiago 1.82m + B&C spectrum of CM Aql

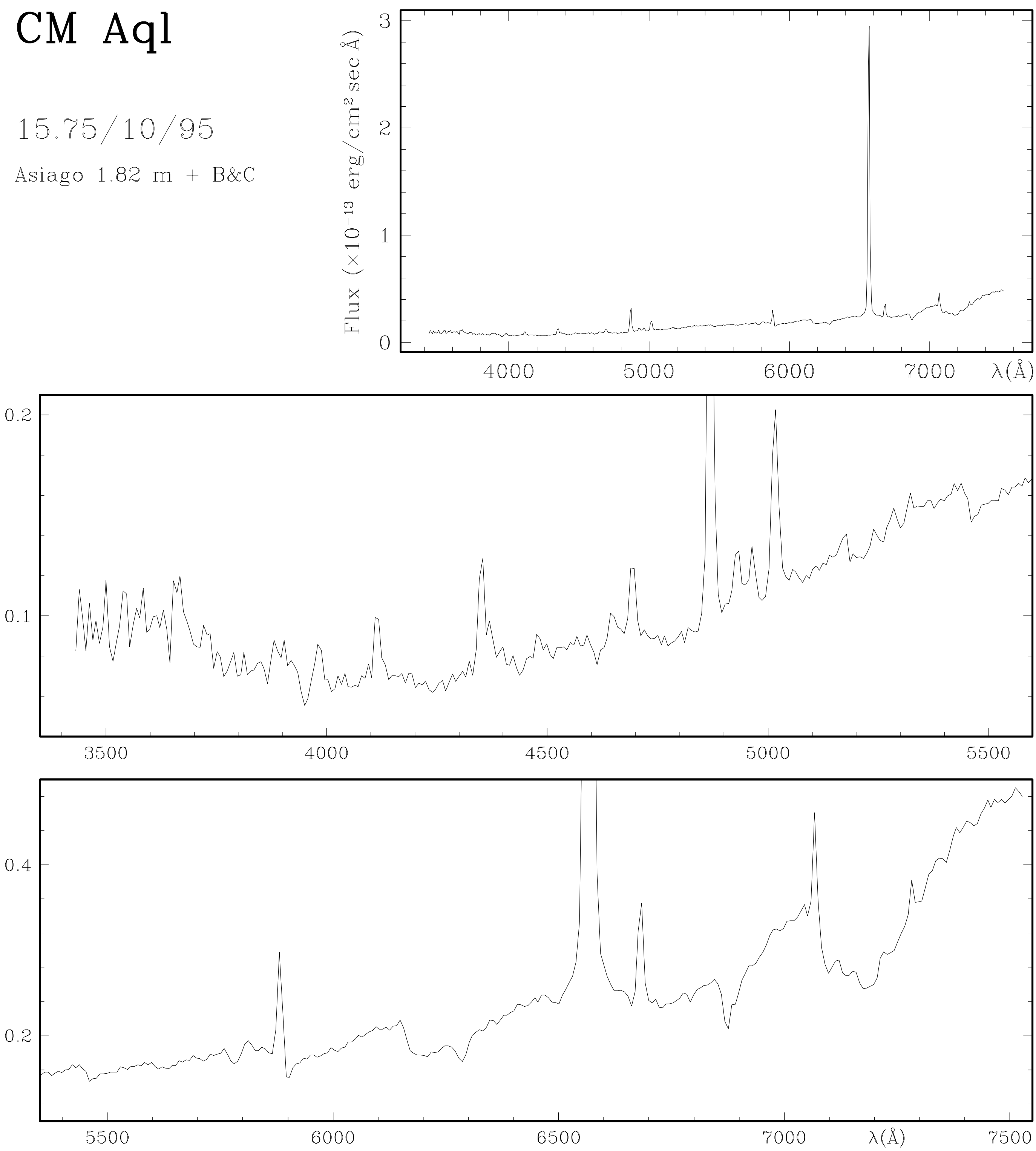


Fig. 165. Asiago 1.82m + B&C spectrum of CM Aql

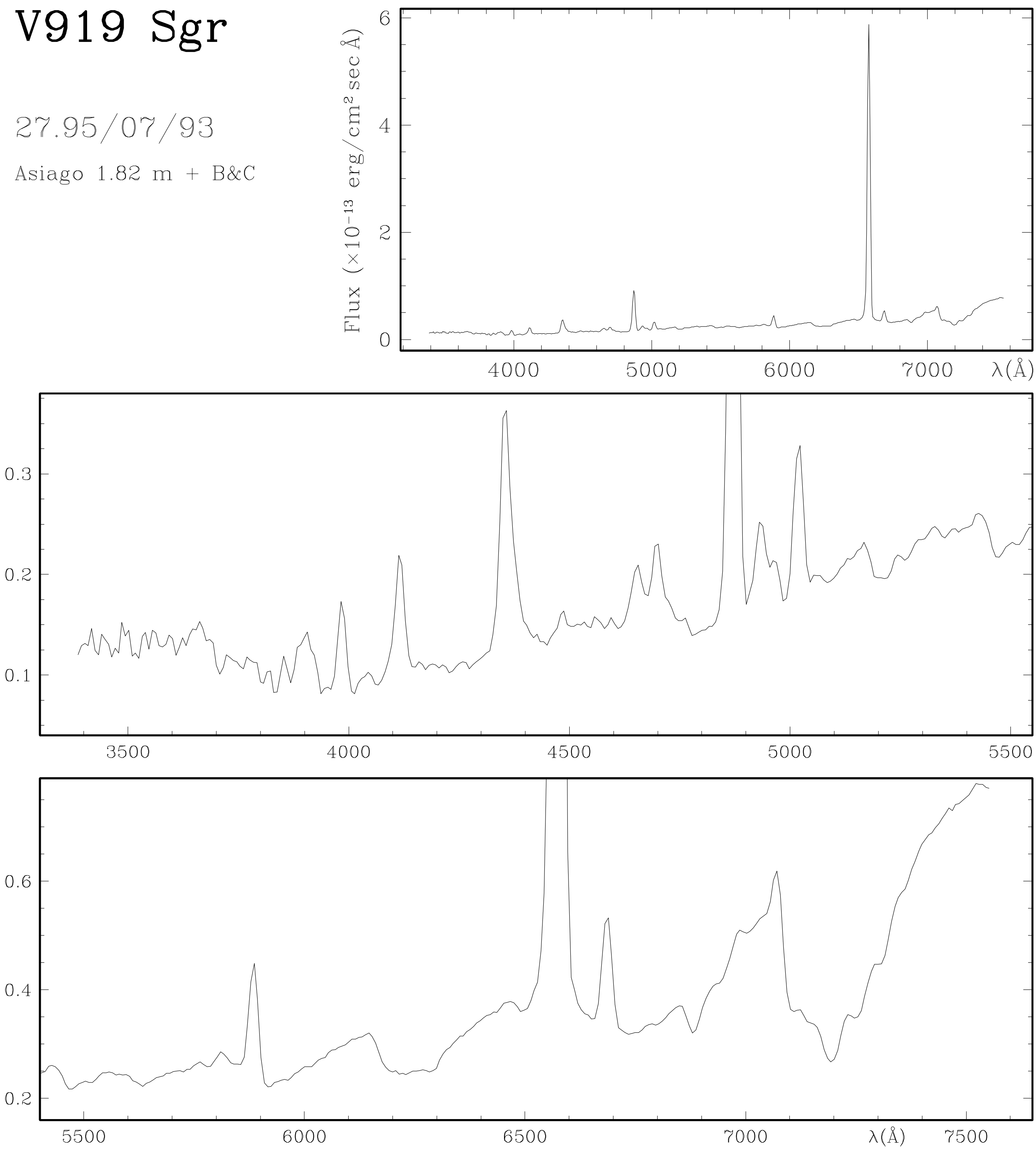


Fig. 166. Asiago 1.82m + B&C spectrum of V919 Sgr

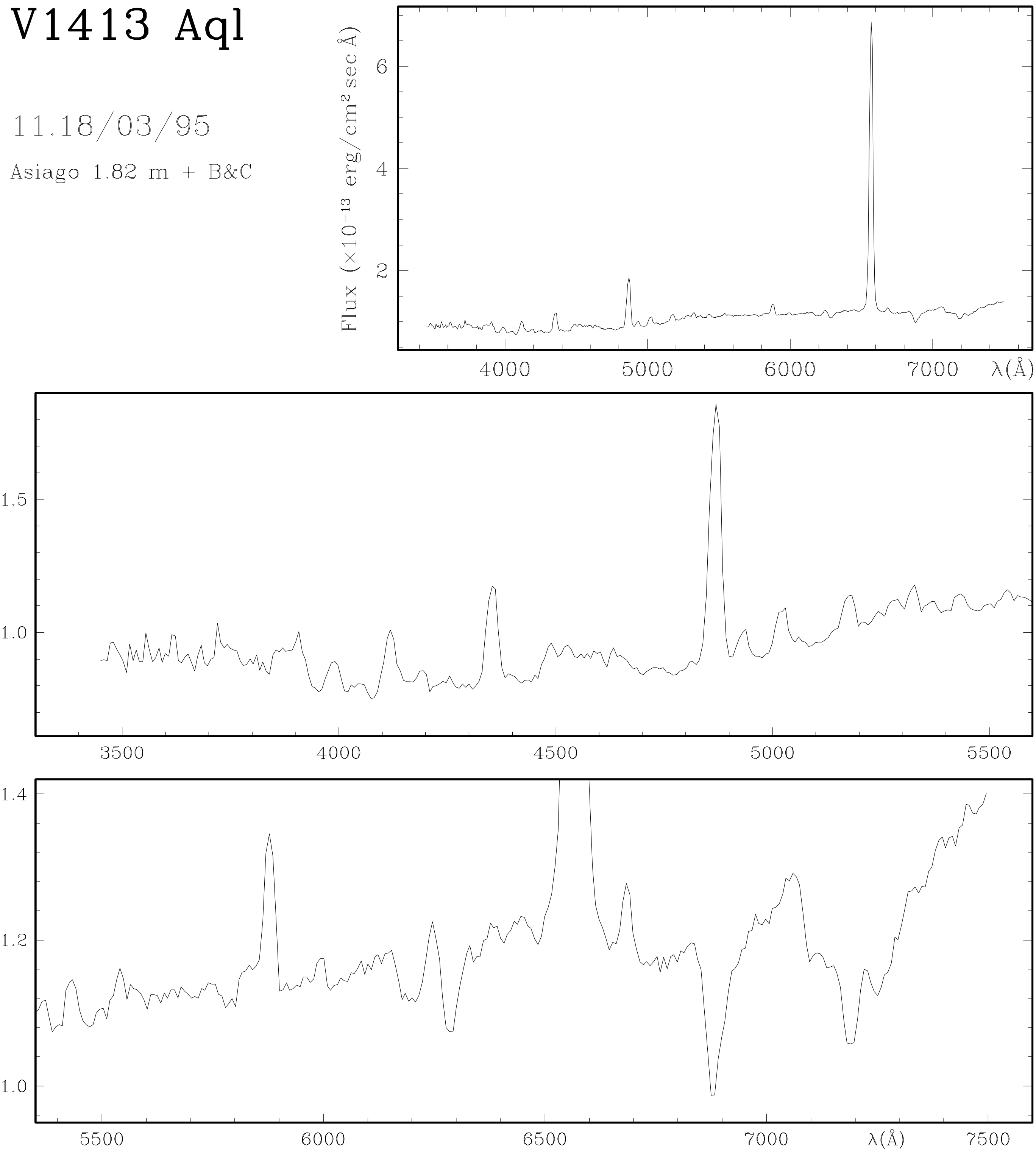


Fig. 167. Asiago 1.82m + B&C spectrum of V1413 Aql

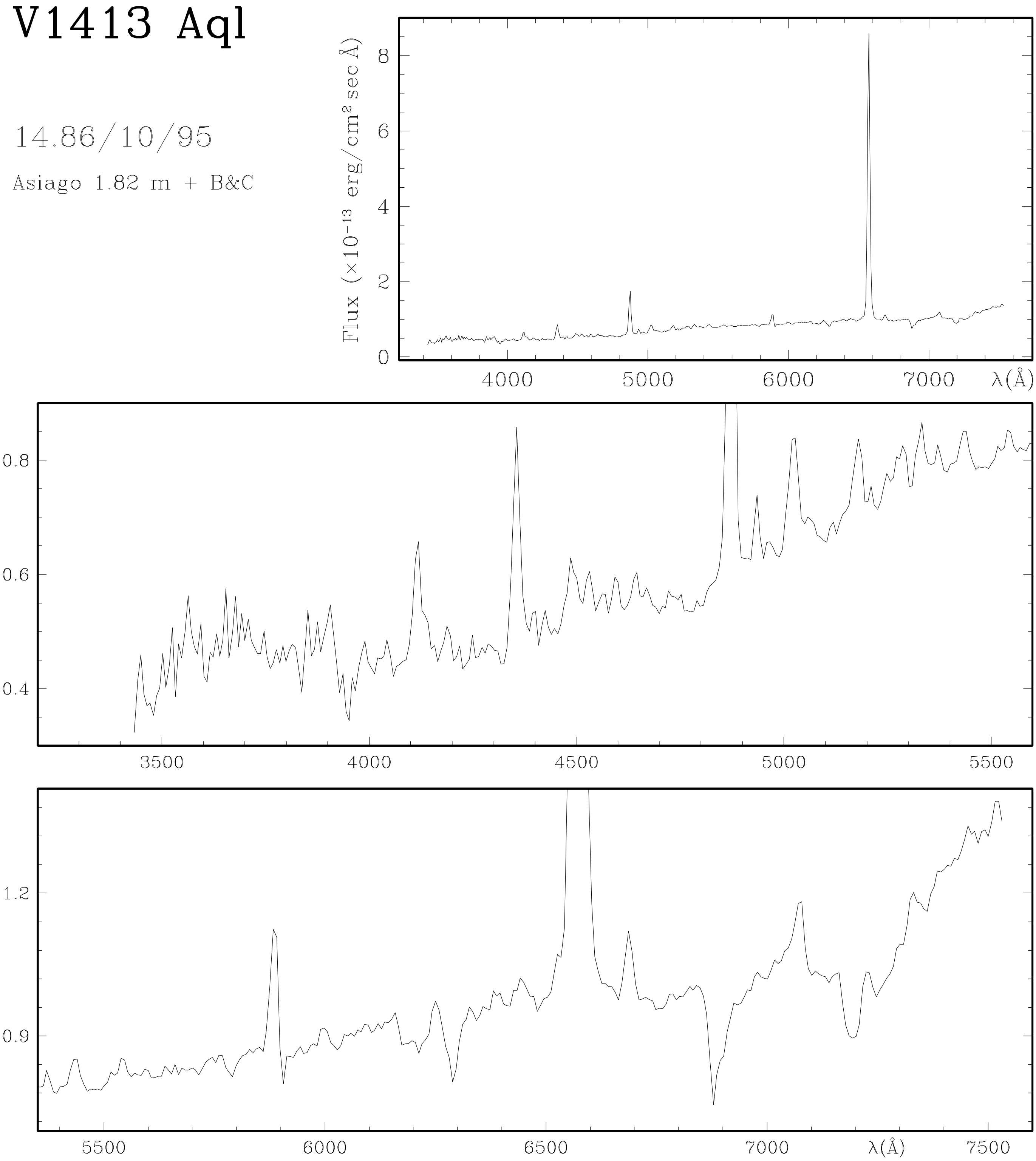


Fig. 168. Asiago 1.82m + B&C spectrum of V1413 Aql

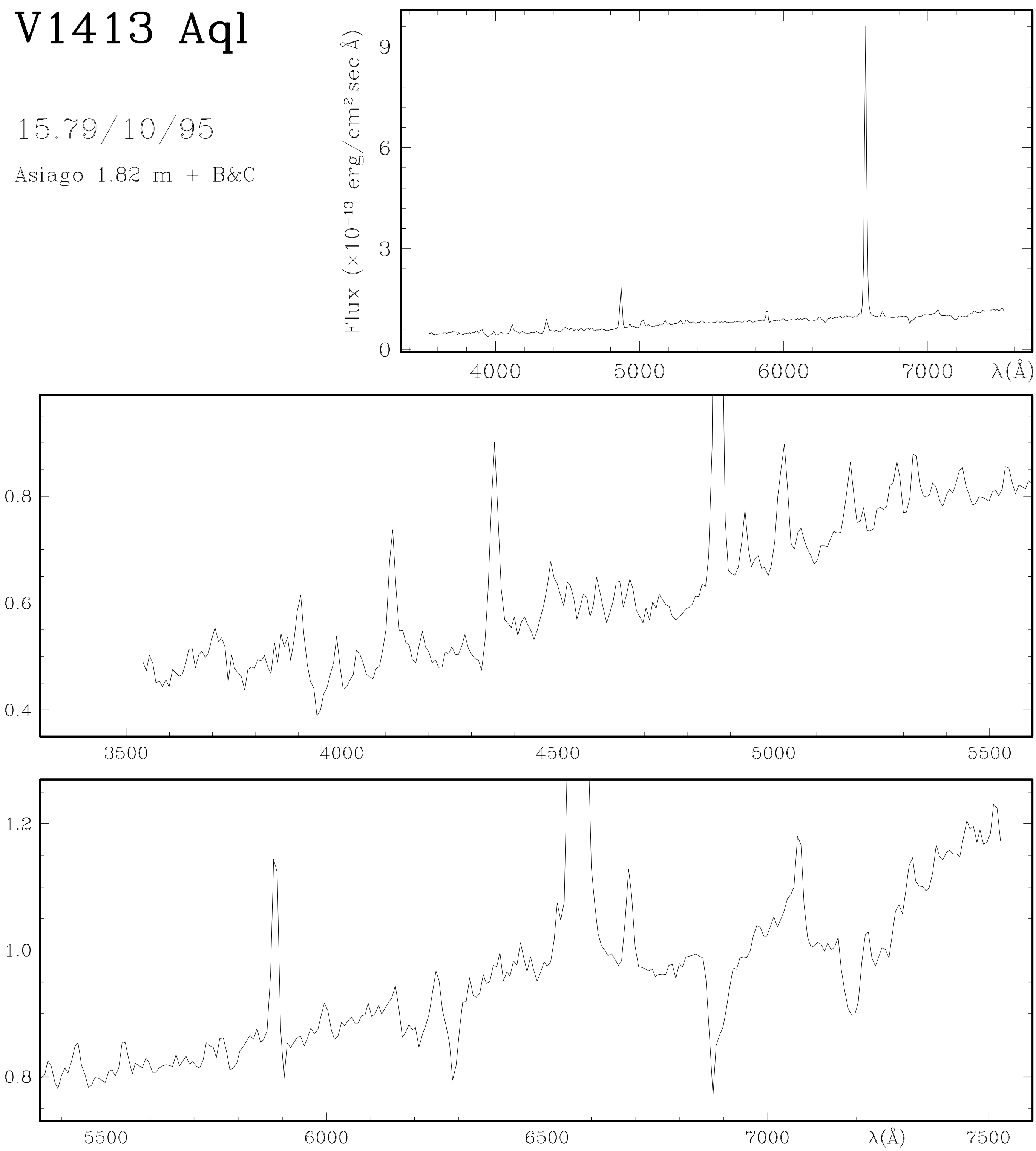


Fig. 169. Asiago 1.82m + B&C spectrum of V1413 Aql

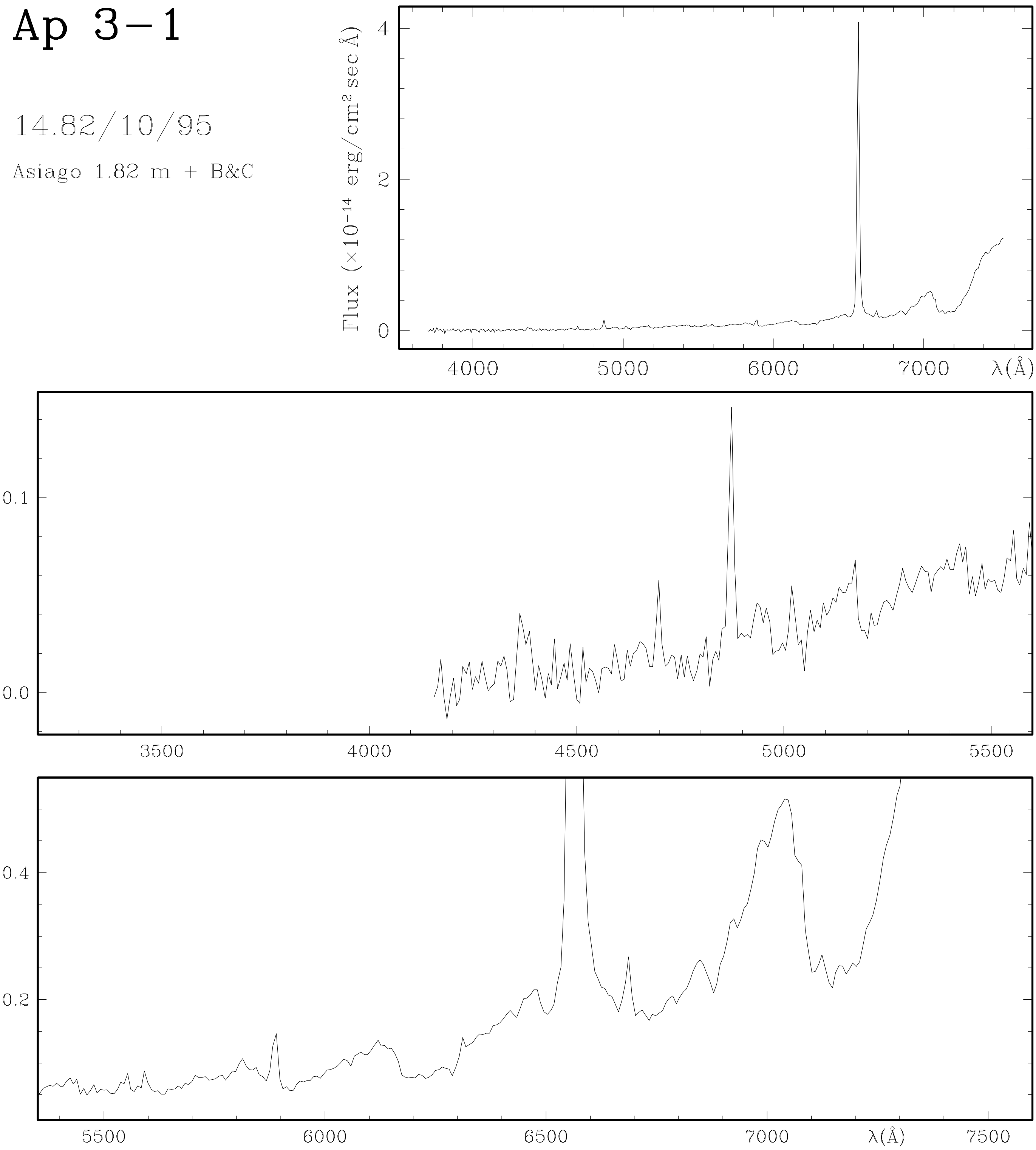


Fig. 170. Asiago 1.82m + B&C spectrum of Ap 3-1

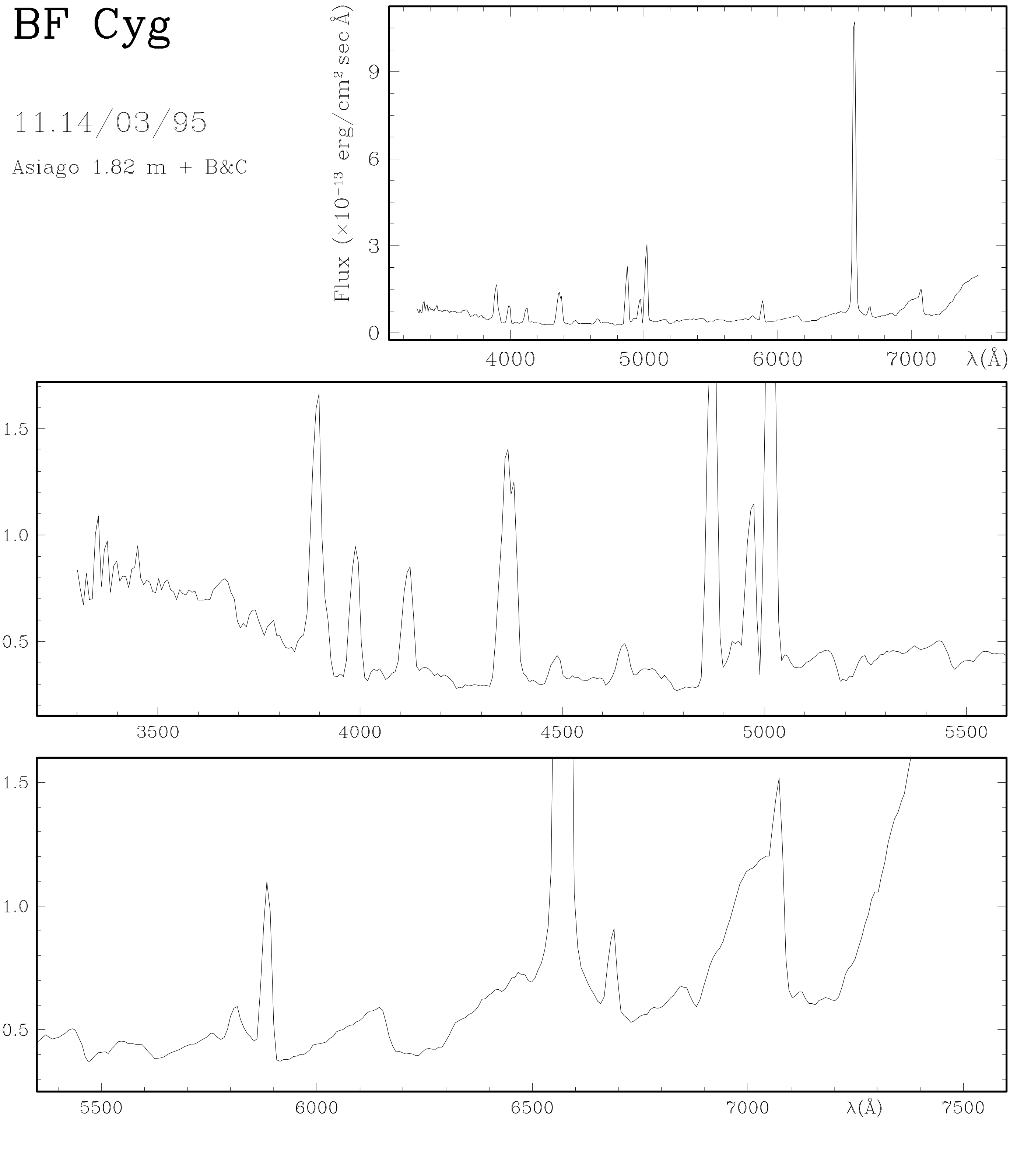


Fig. 171. Asiago 1.82m + B&C spectrum of BF Cyg

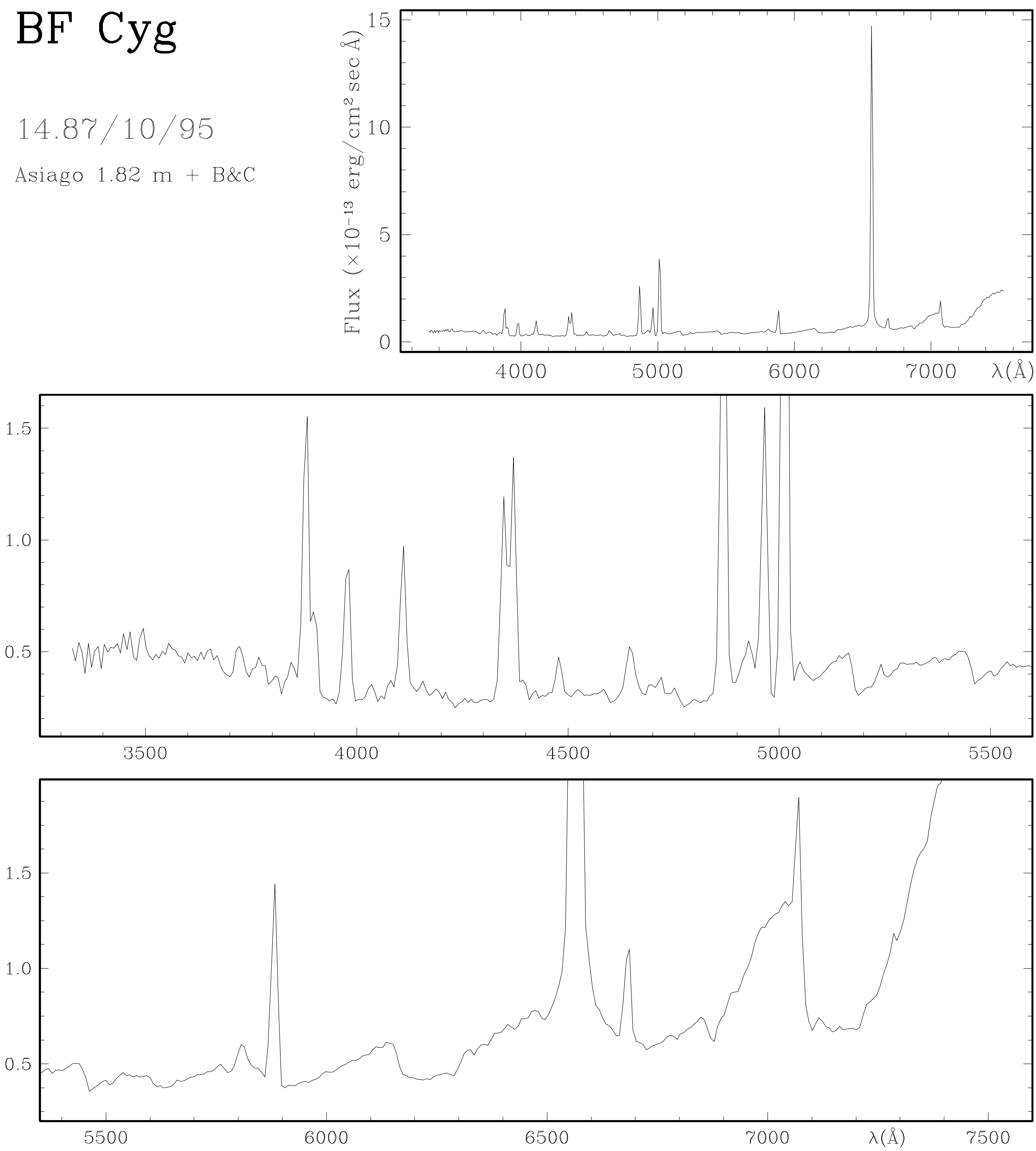


Fig. 172. Asiago 1.82m + B&C spectrum of BF Cyg

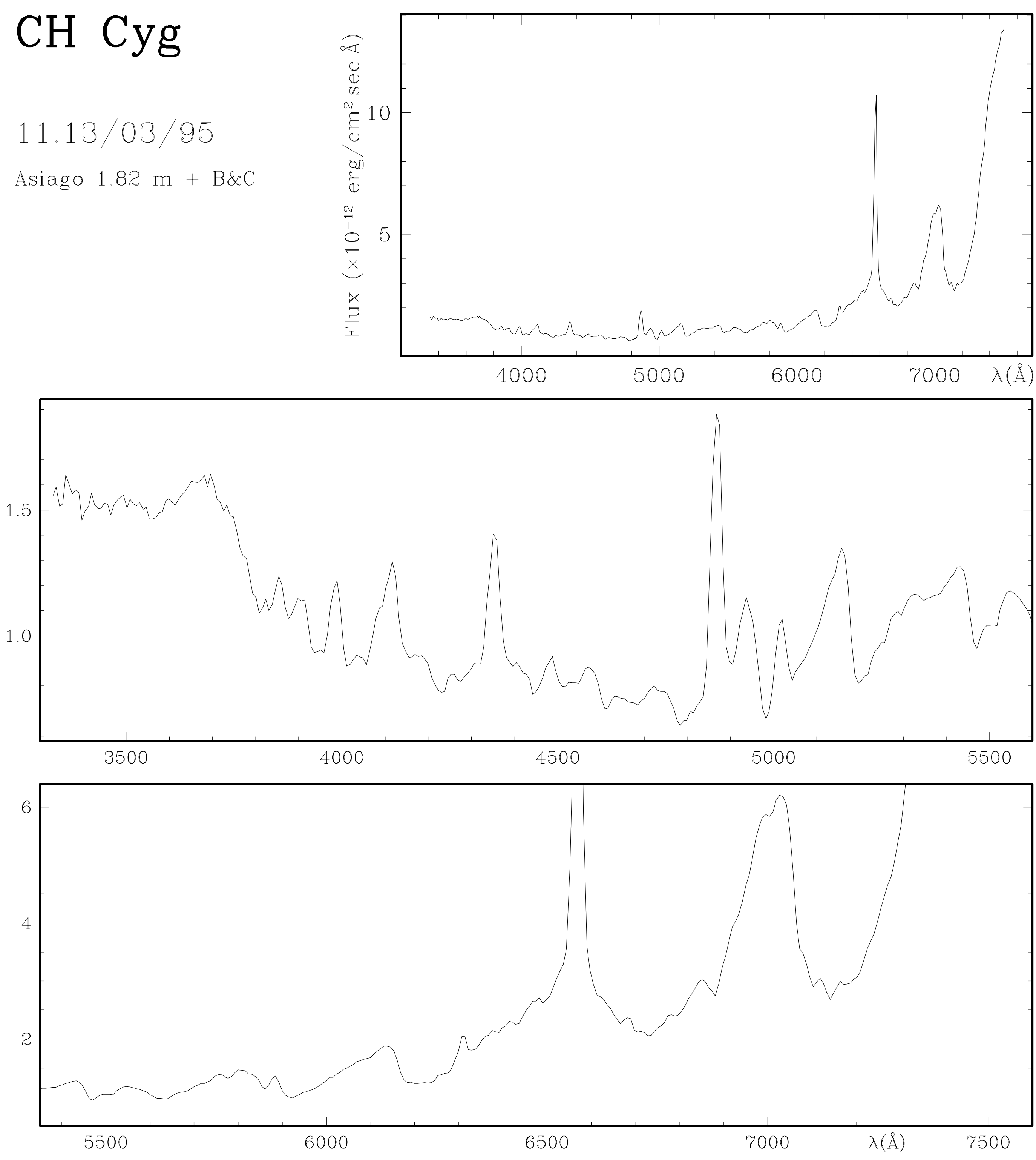


Fig. 173. Asiago 1.82m + B&C spectrum of CH Cyg

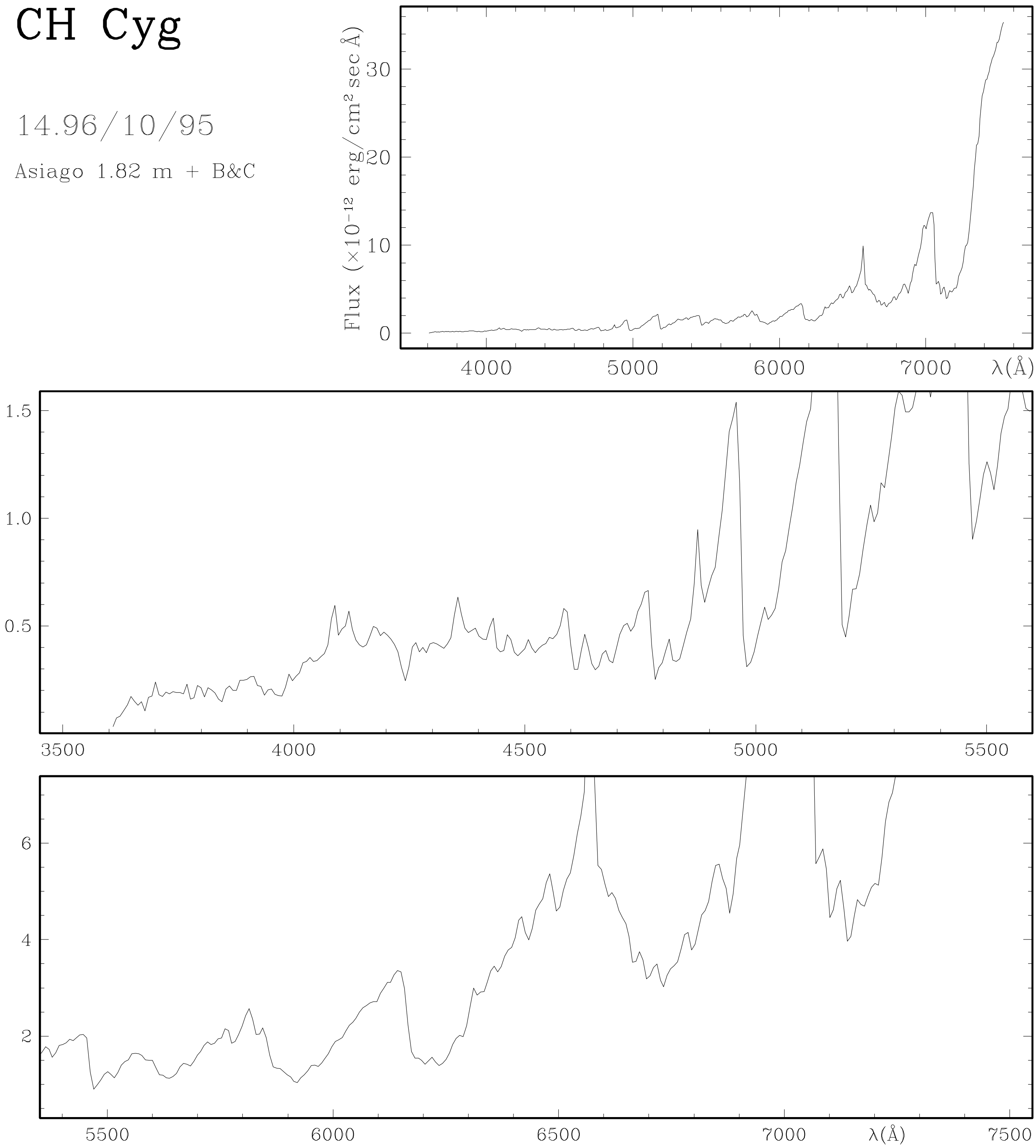


Fig. 174. Asiago 1.82m + B&C spectrum of CH Cyg

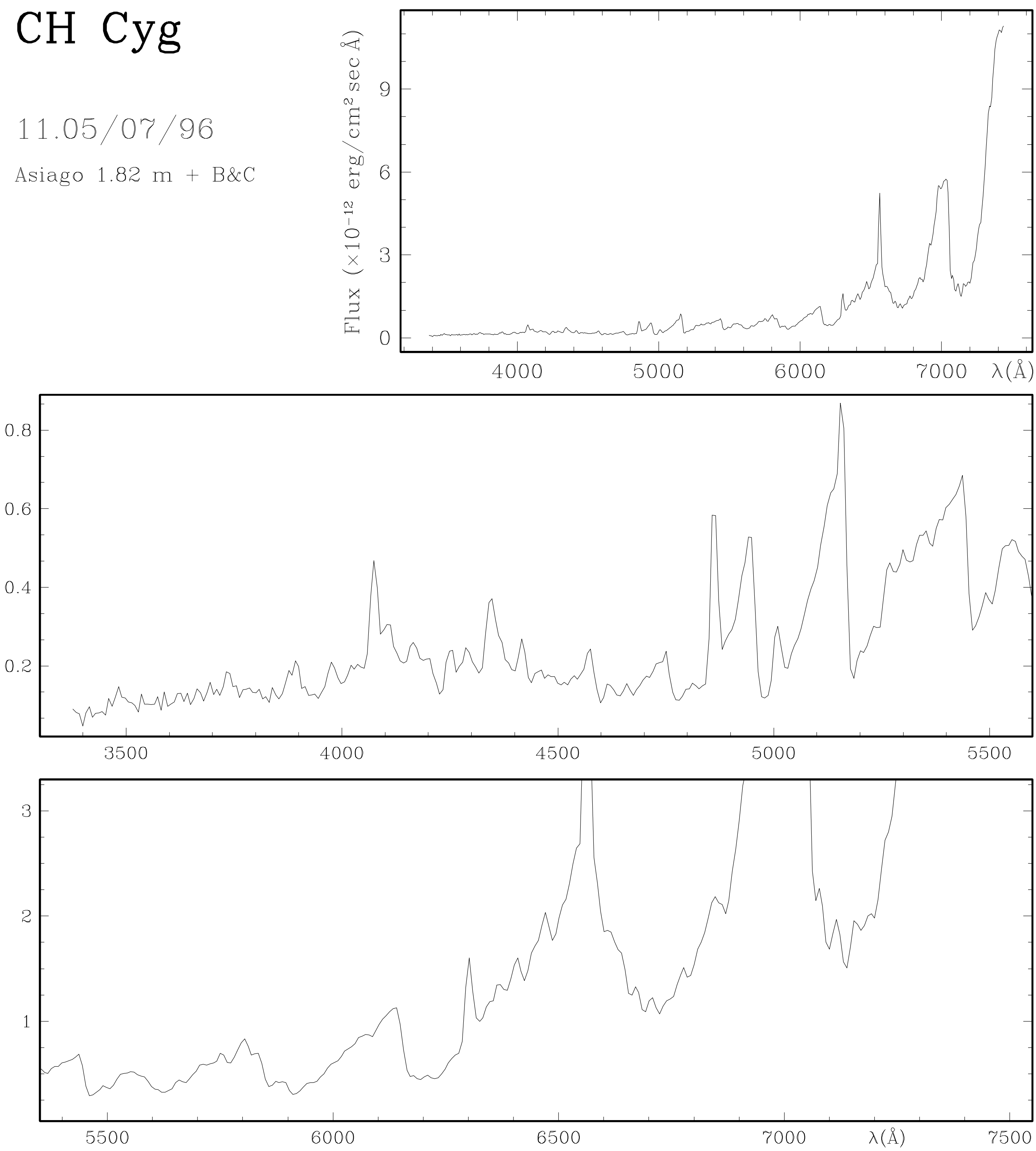


Fig. 175. Asiago 1.82m + B&C spectrum of CH Cyg

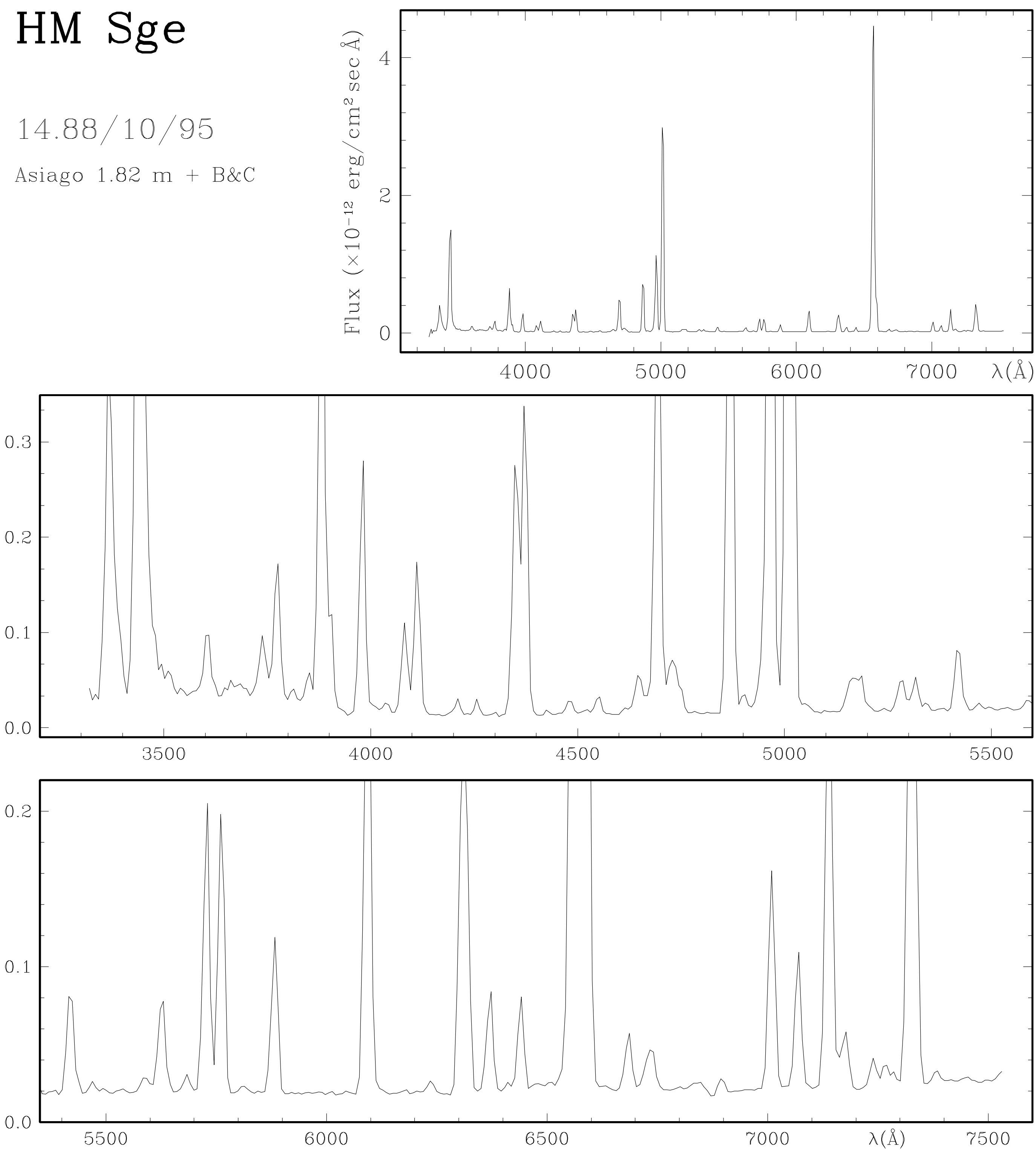


Fig. 176. Asiago 1.82m + B&C spectrum of HM Sge

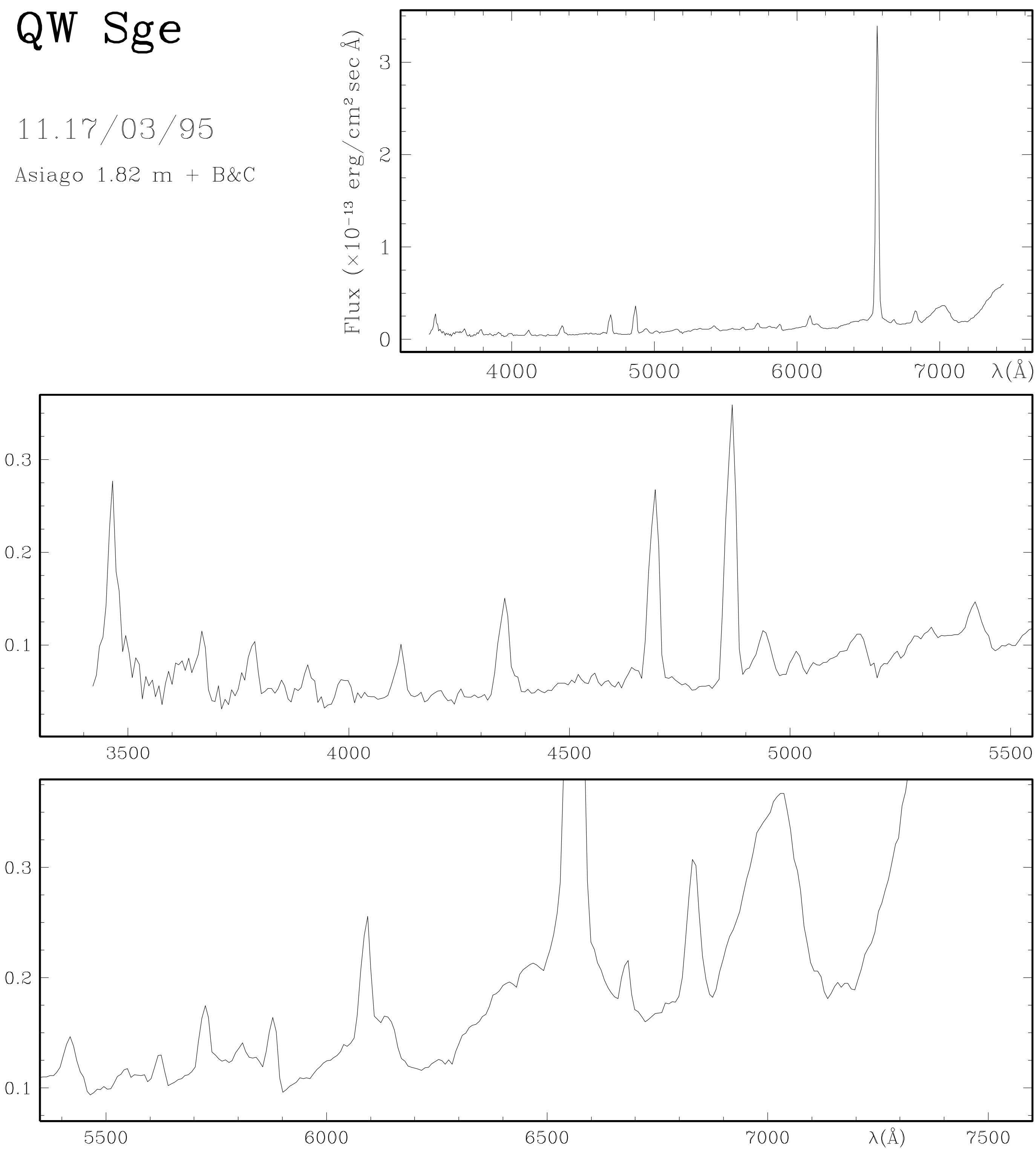


Fig. 177. Asiago 1.82m + B&C spectrum of QW Sge

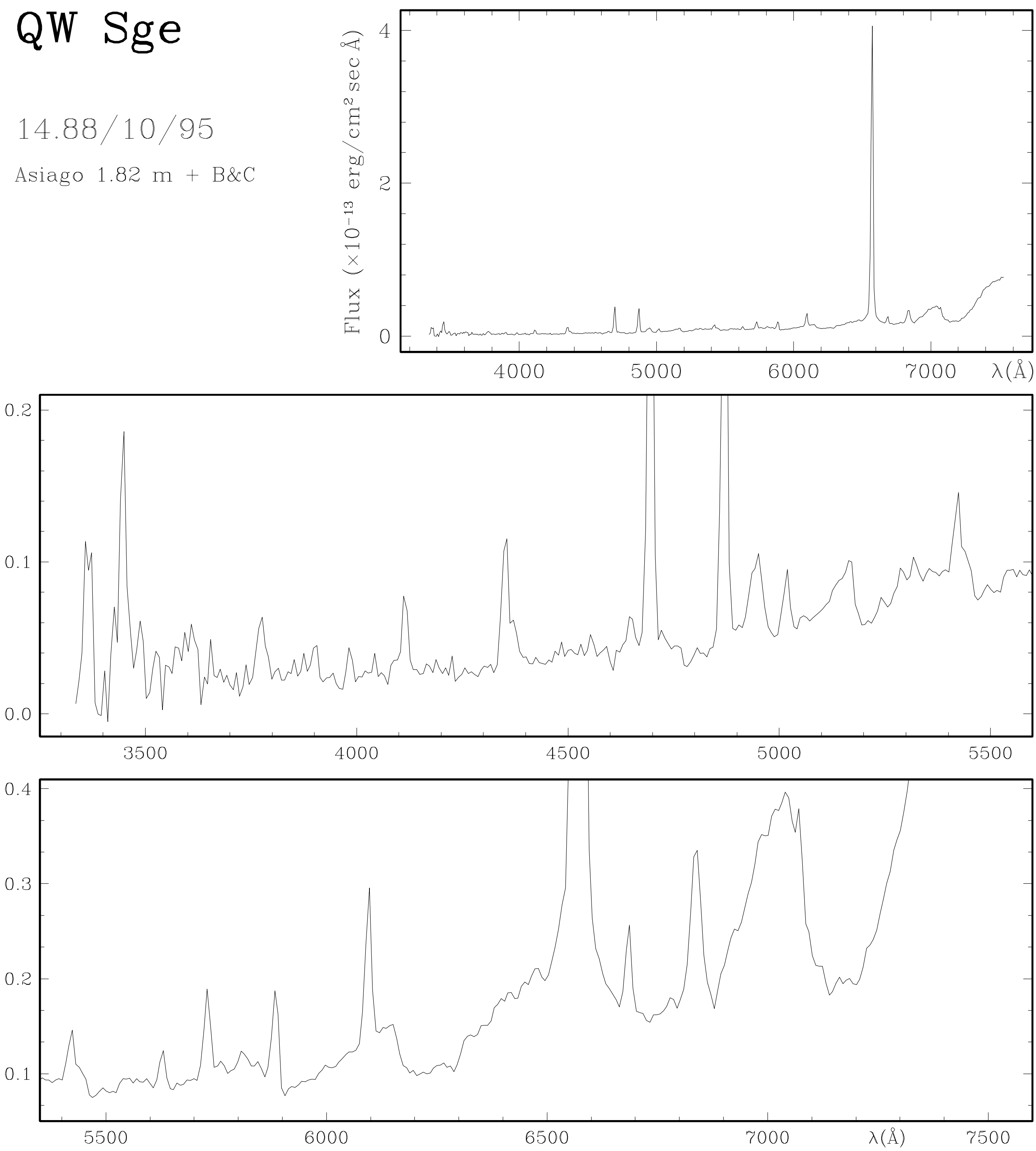


Fig. 178. Asiago 1.82m + B&C spectrum of QW Sge

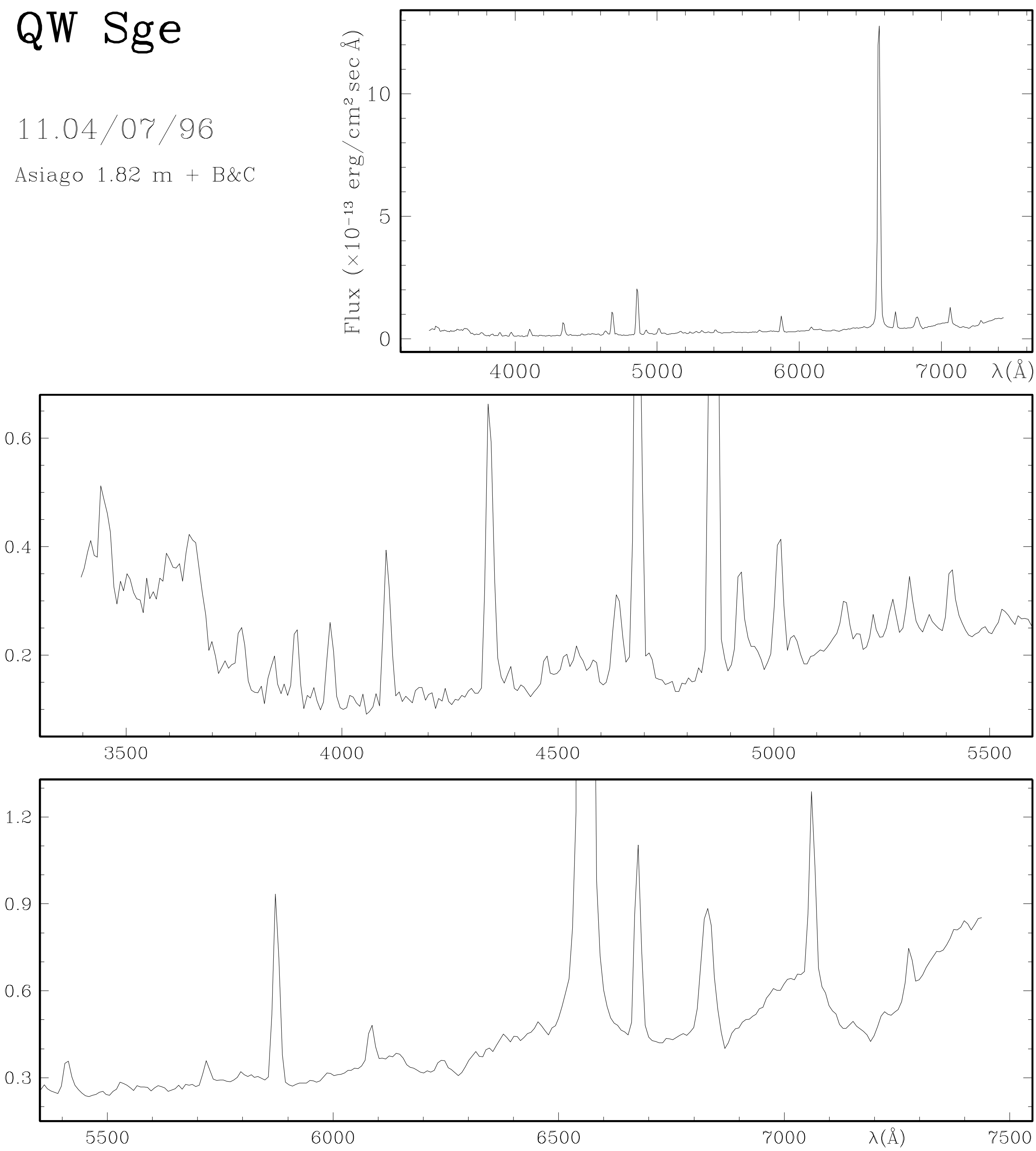


Fig. 179. Asiago 1.82m + B&C spectrum of QW Sge

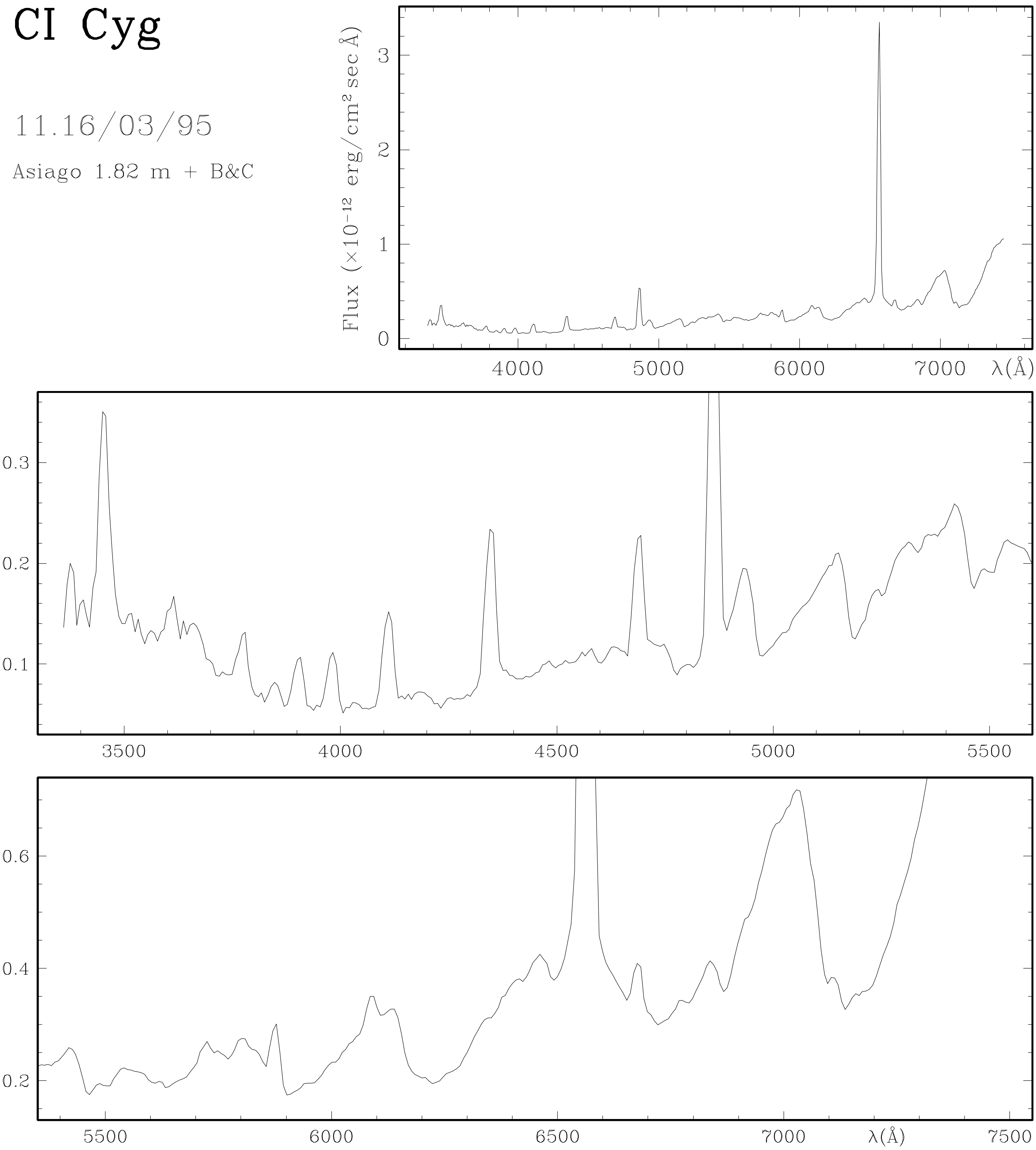


Fig. 180. Asiago 1.82m + B&C spectrum of CI Cyg

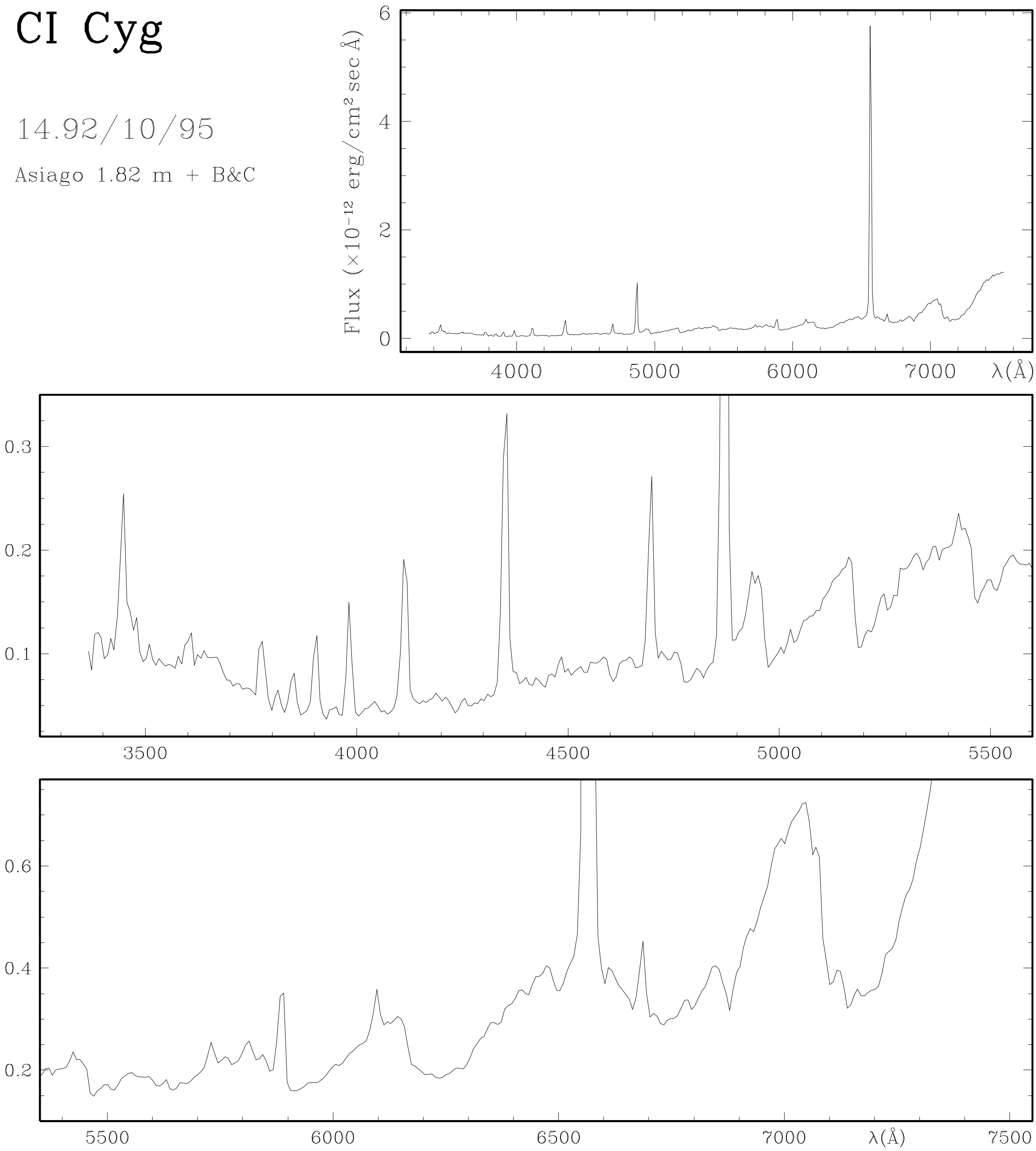


Fig. 181. Asiago 1.82m + B&C spectrum of CI Cyg

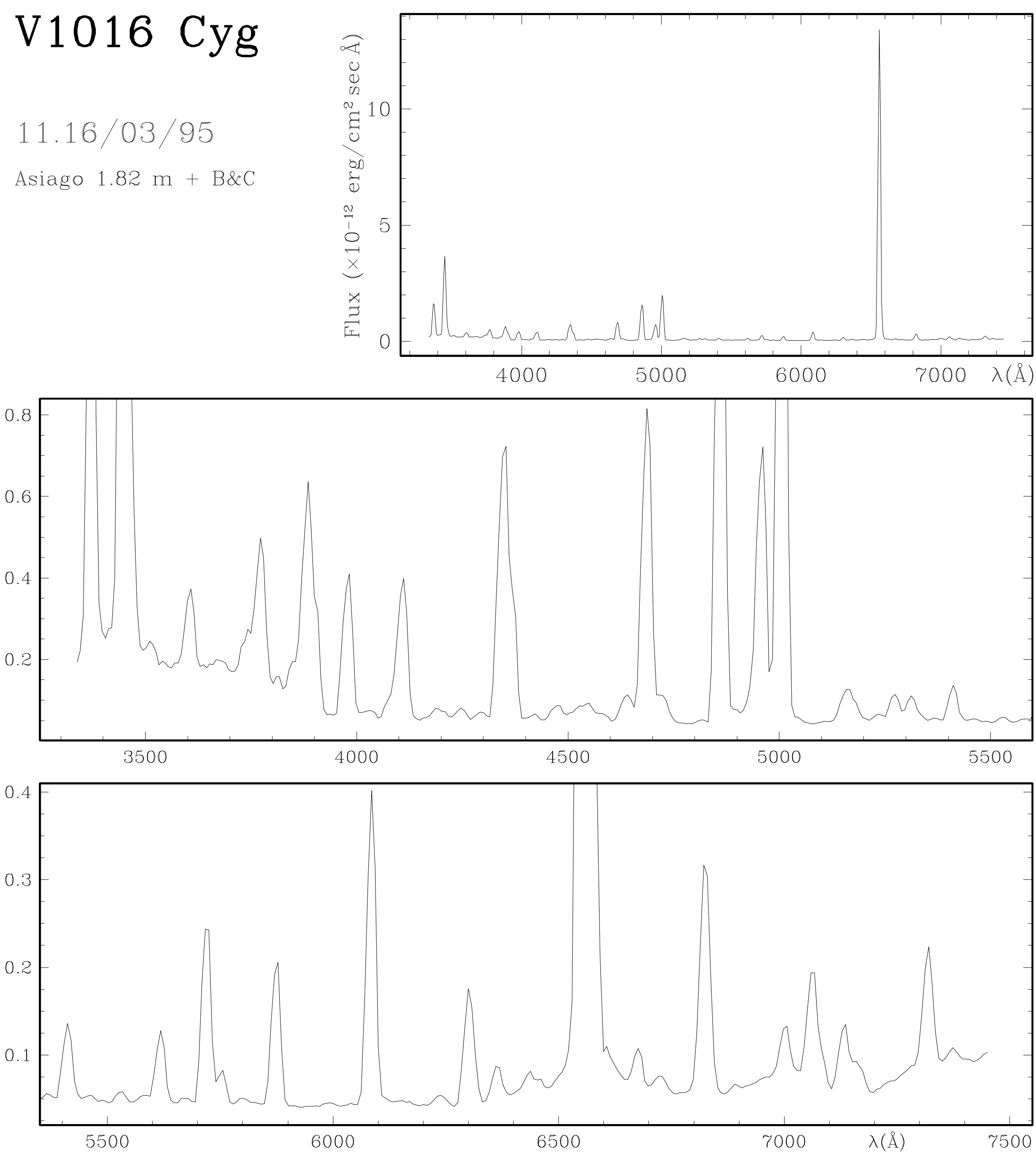


Fig. 182. Asiago 1.82m + B&C spectrum of V1016 Cyg

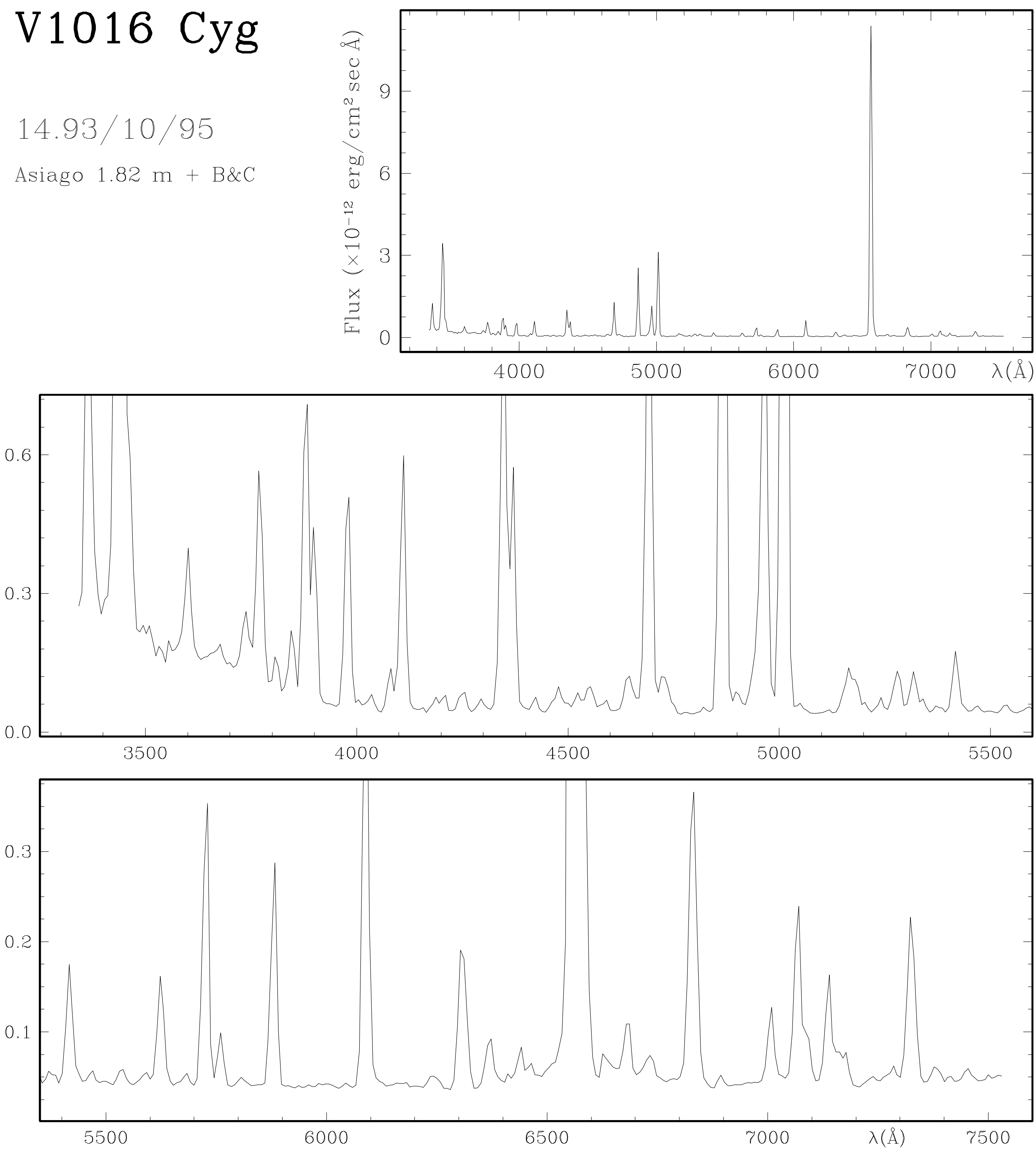


Fig. 183. Asiago 1.82m + B&C spectrum of V1016 Cyg

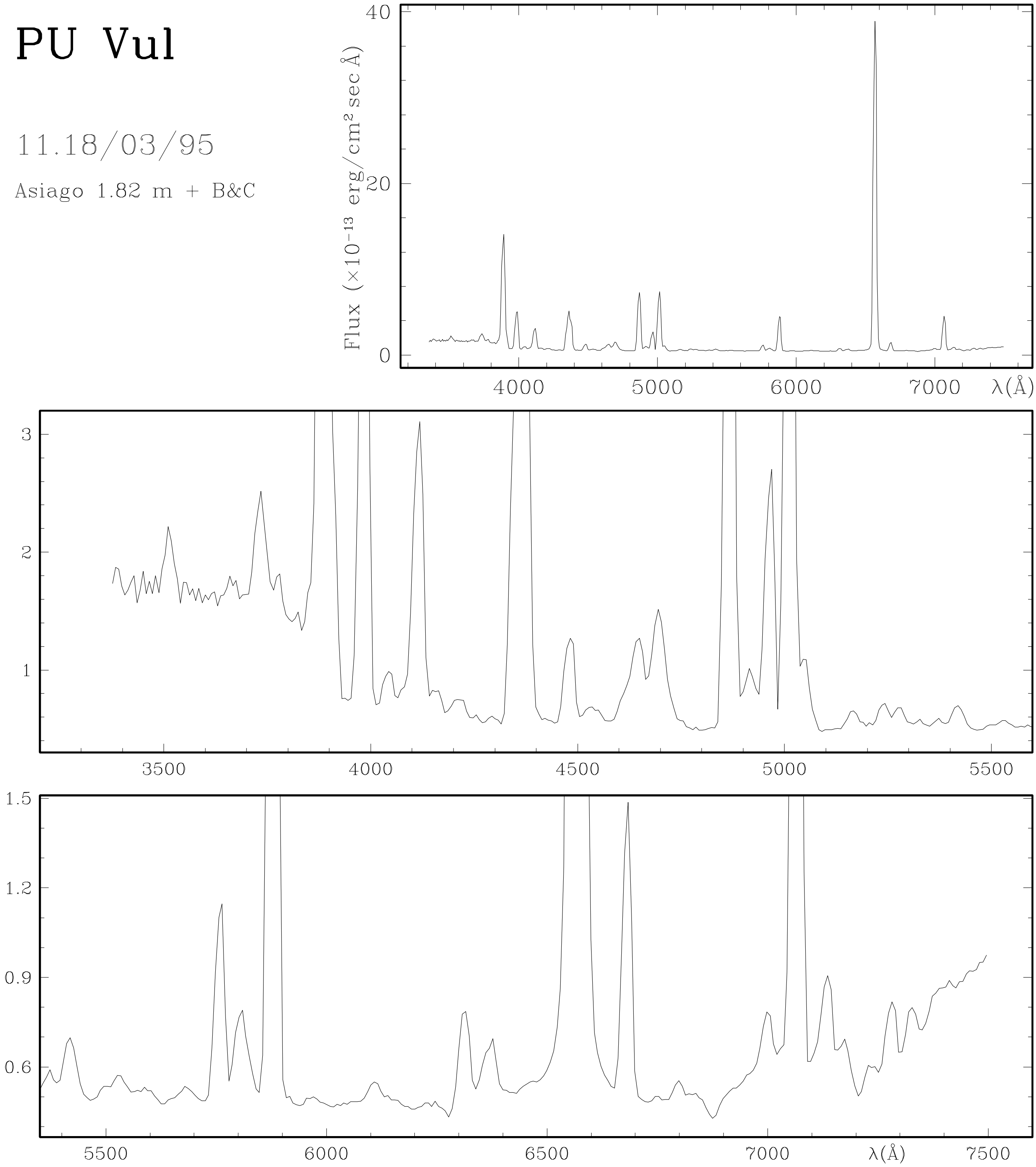


Fig. 184. Asiago 1.82m + B&C spectrum of PU Vul

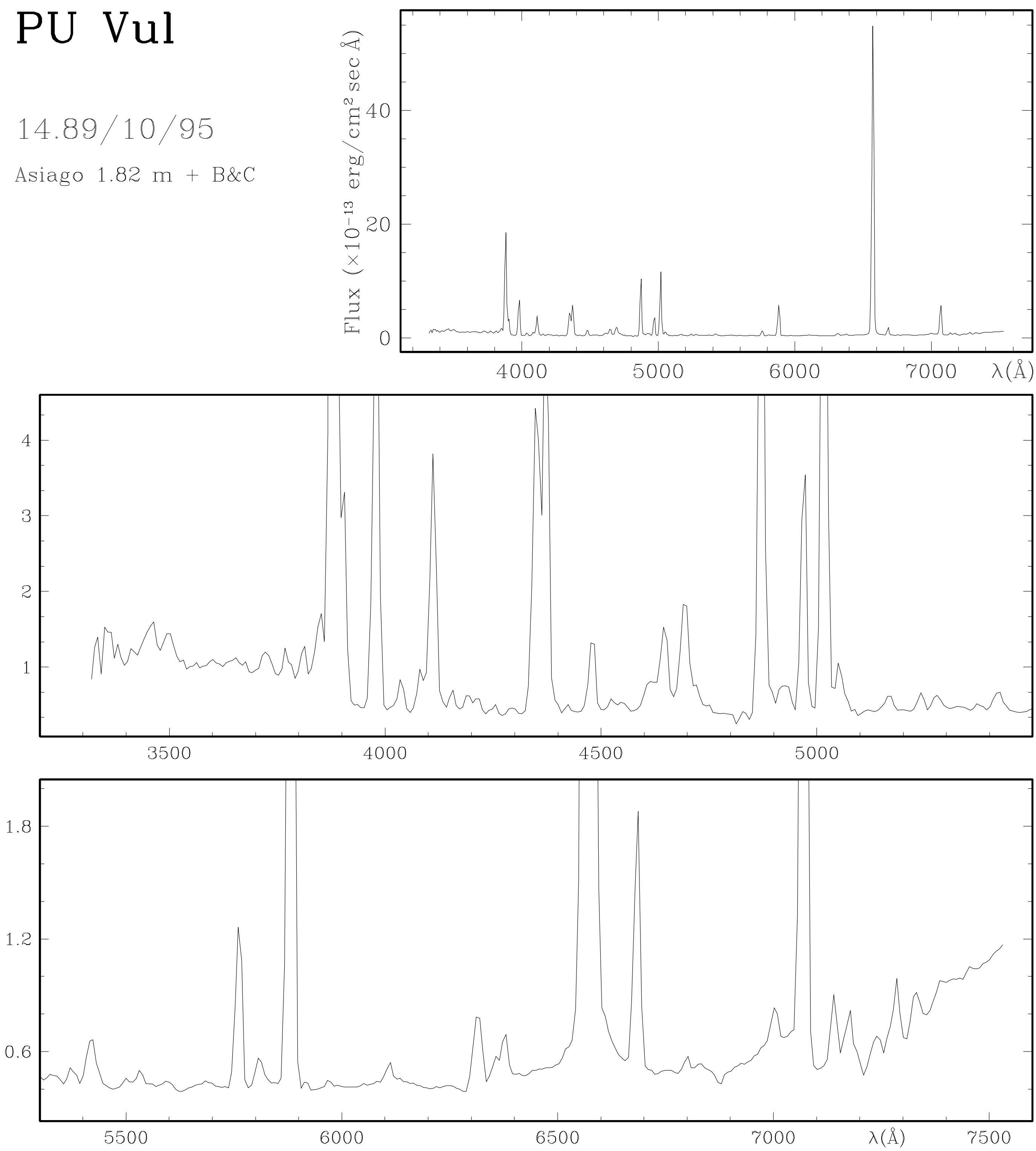


Fig. 185. Asiago 1.82m + B&C spectrum of PU Vul

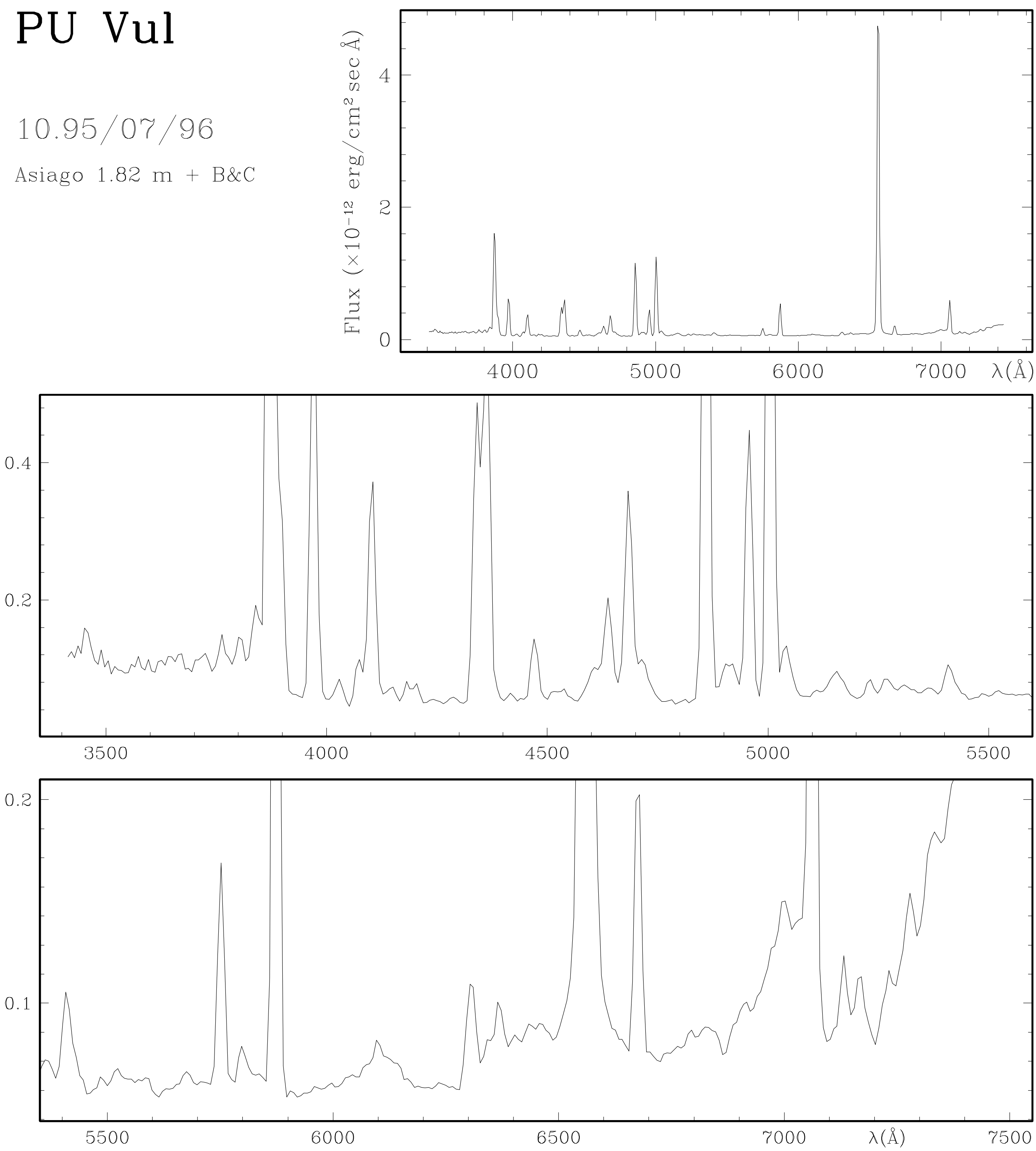


Fig. 186. Asiago 1.82m + B&C spectrum of PU Vul

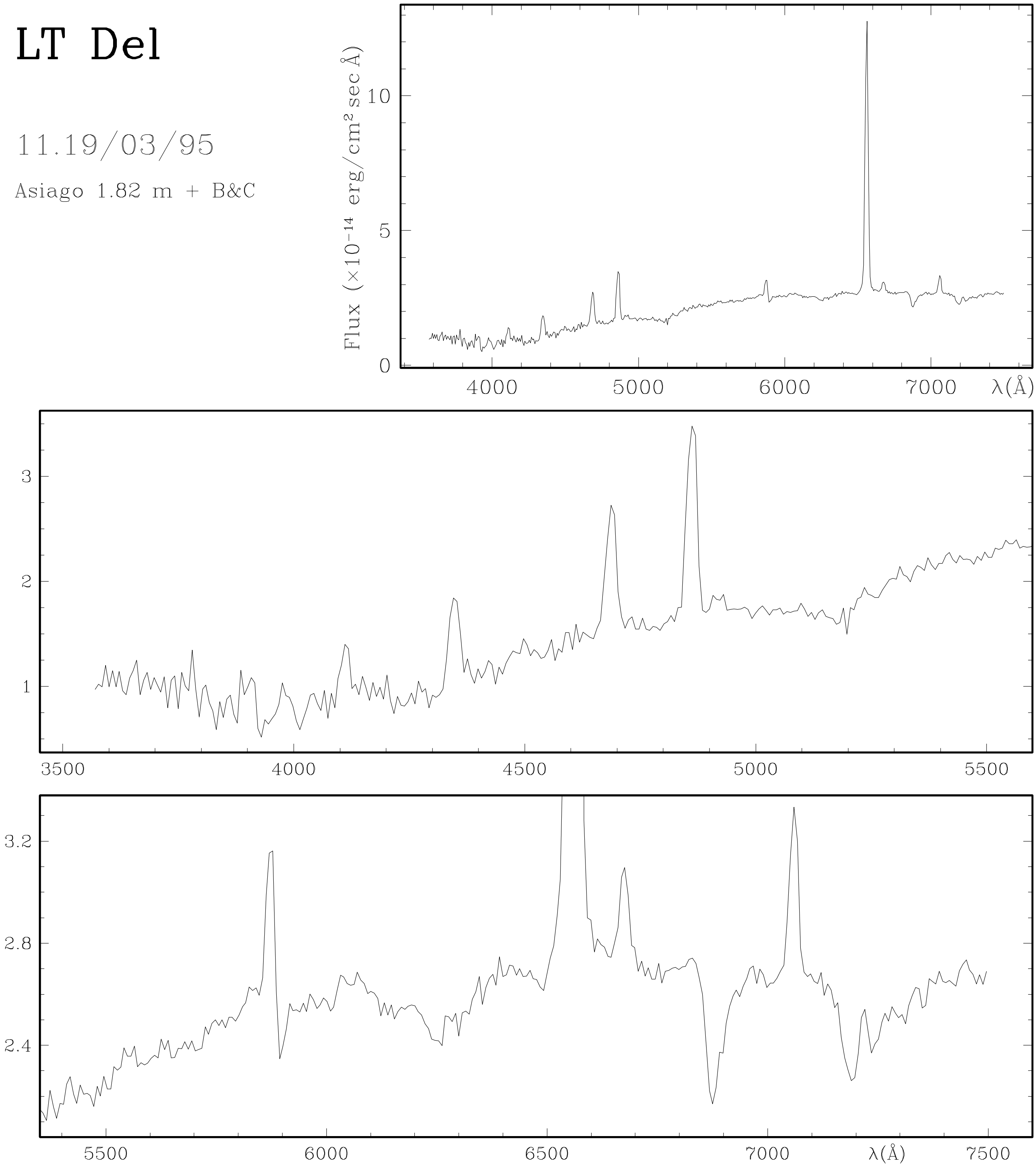


Fig. 187. Asiago 1.82m + B&C spectrum of LT Del

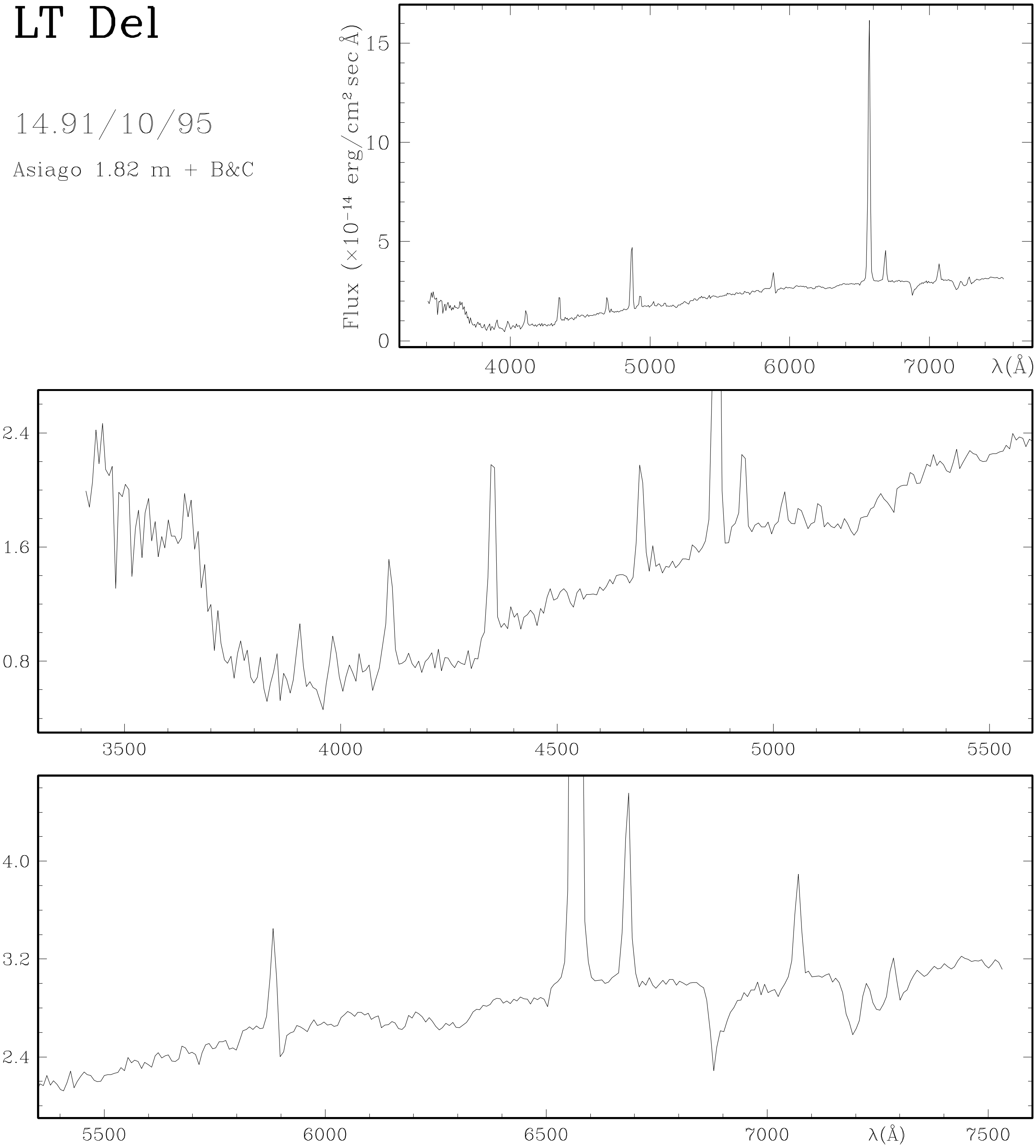


Fig. 188. Asiago 1.82m + B&C spectrum of LT Del

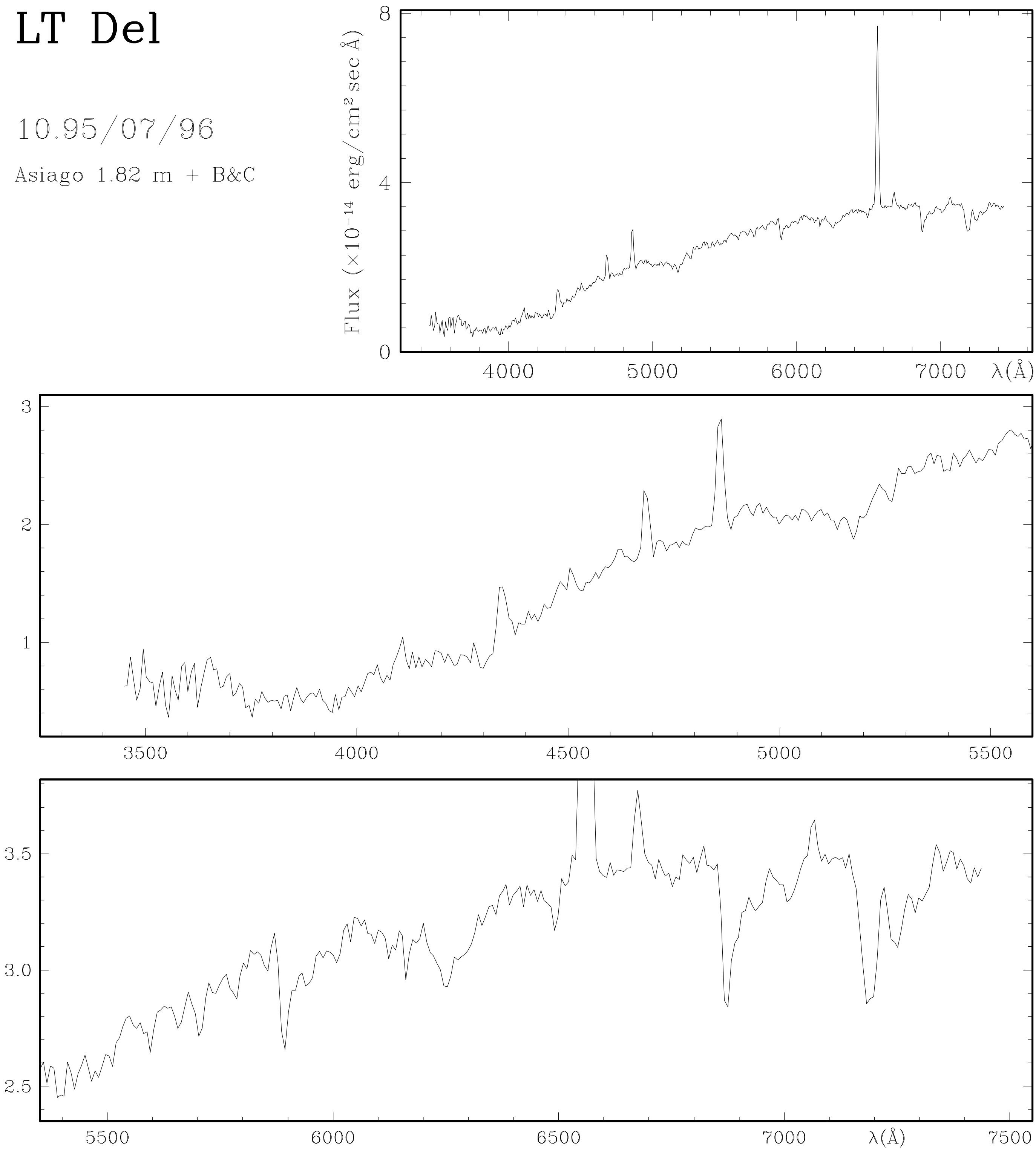


Fig. 189. Asiago 1.82m + B&C spectrum of LT Del

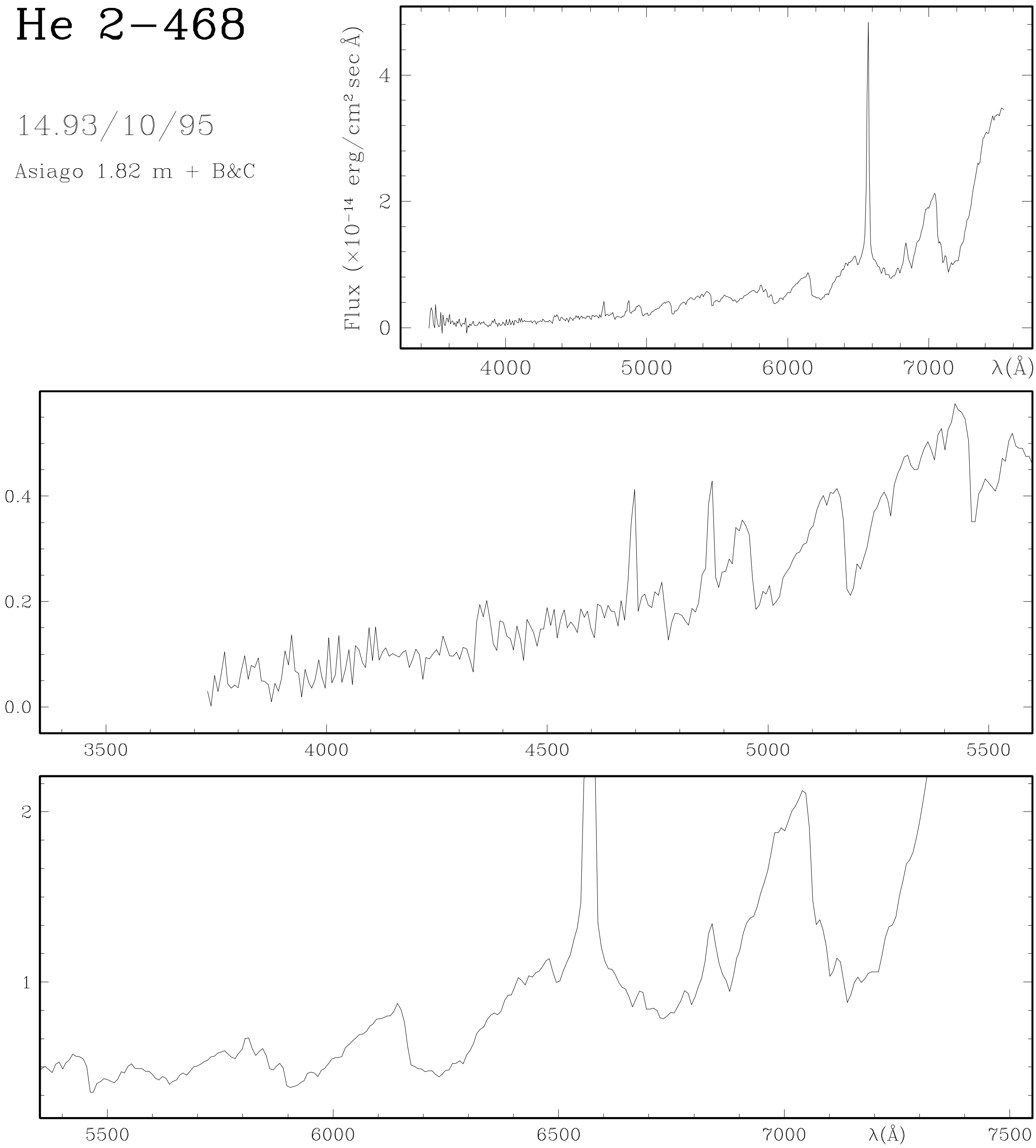


Fig. 190. Asiago 1.82m + B&C spectrum of Hen 2-468

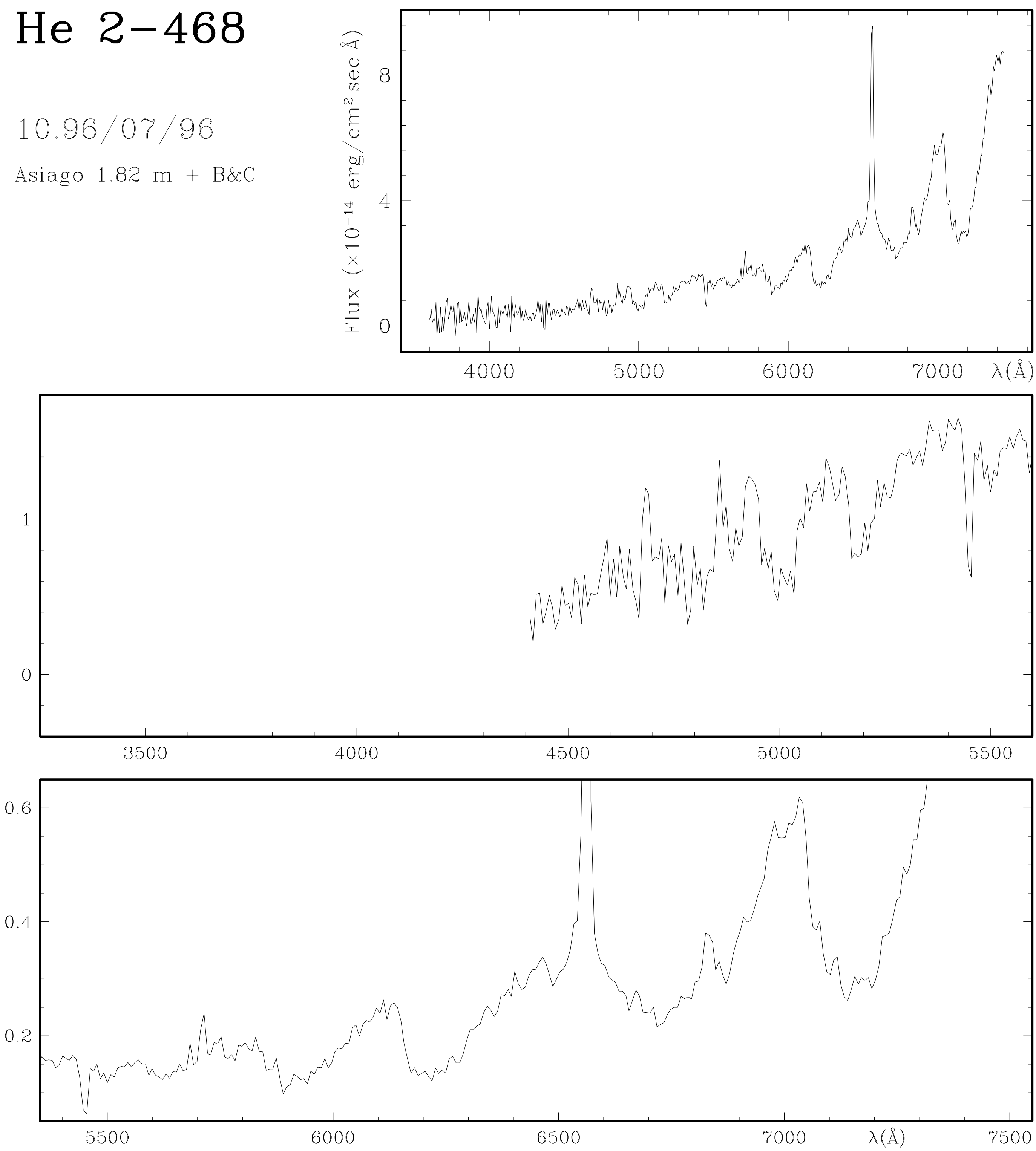


Fig. 191. Asiago 1.82m + B&C spectrum of Hen 2-468

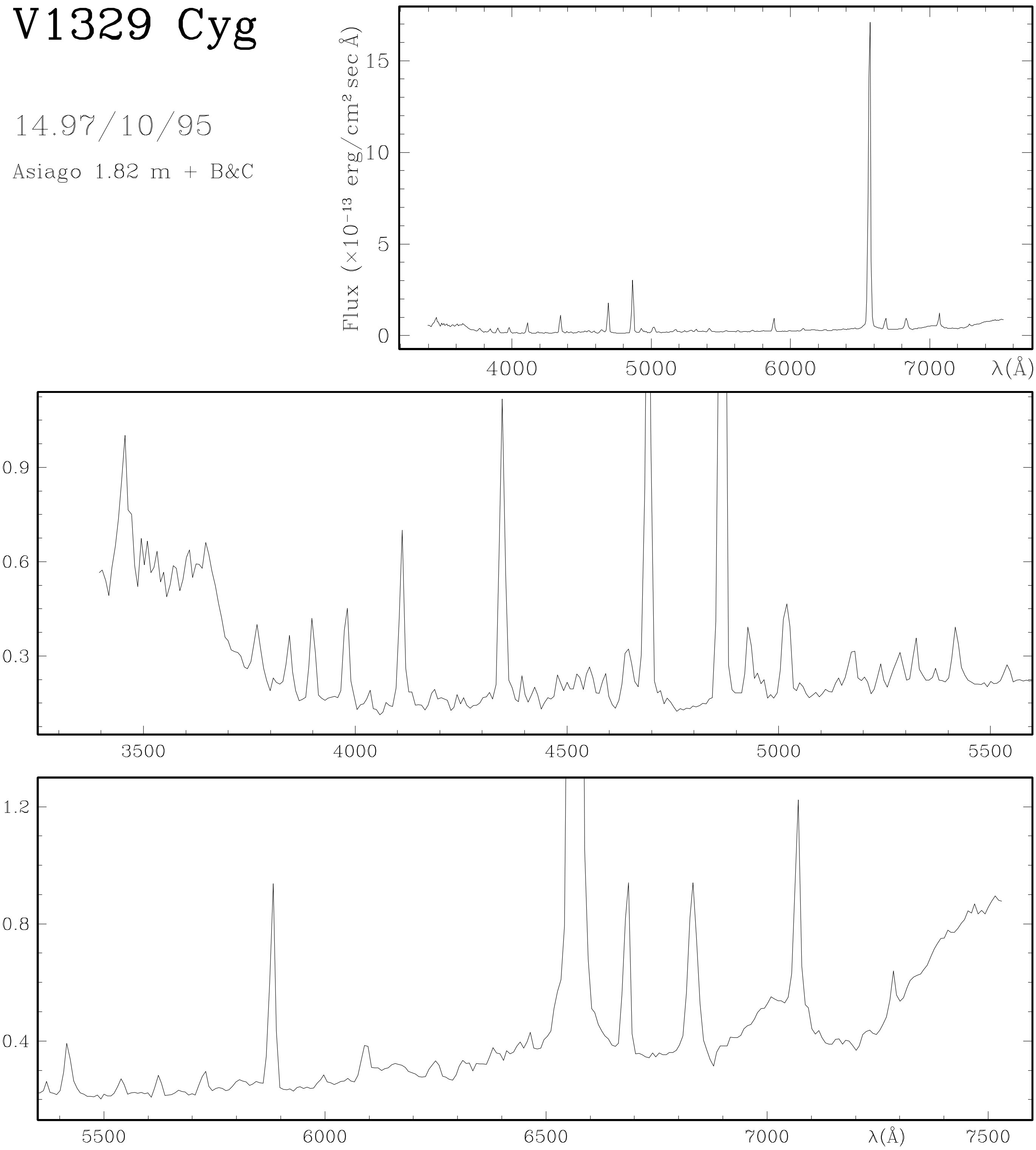


Fig. 192. Asiago 1.82m + B&C spectrum of V1329 Cyg

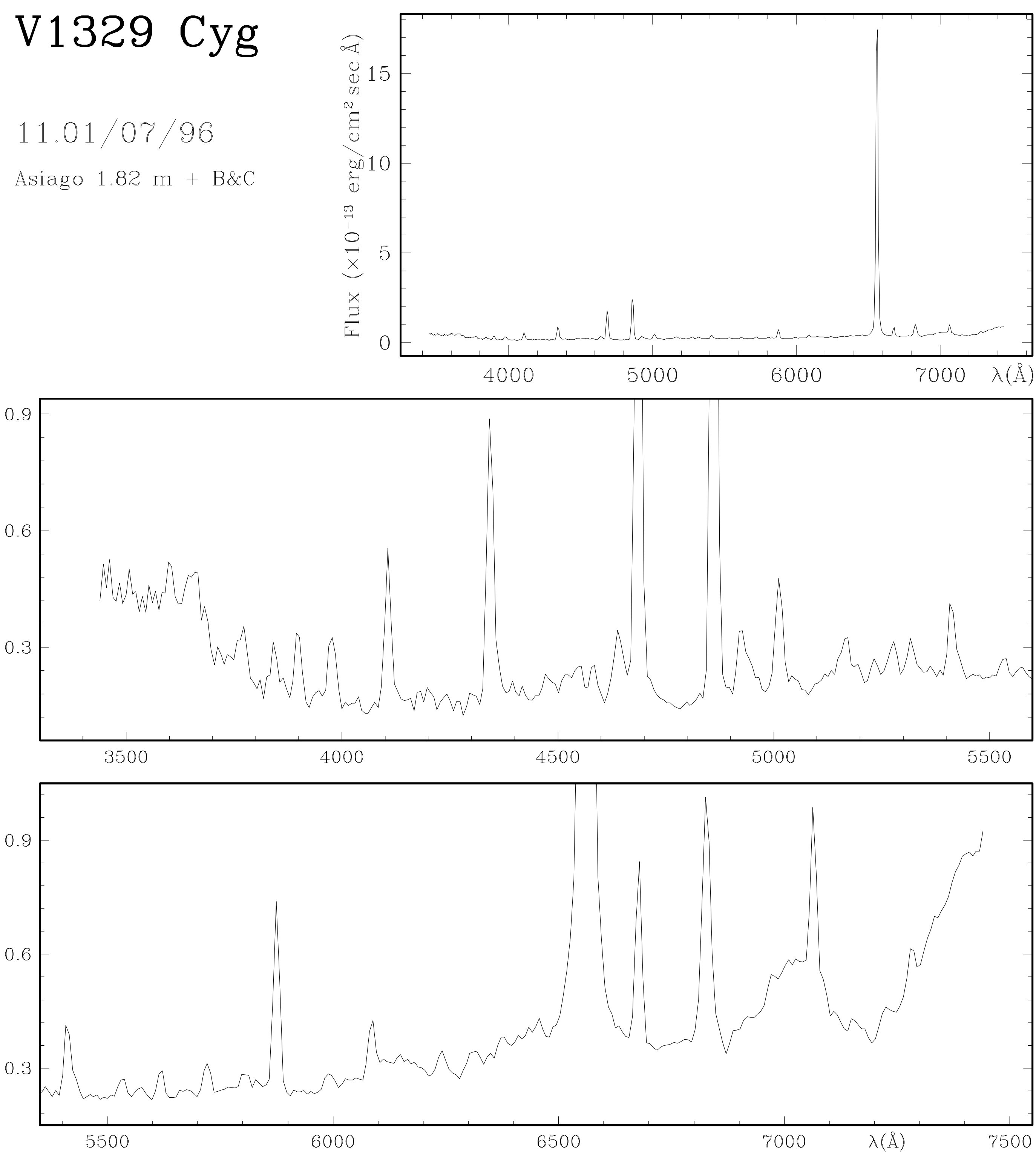


Fig. 193. Asiago 1.82m + B&C spectrum of V1329 Cyg

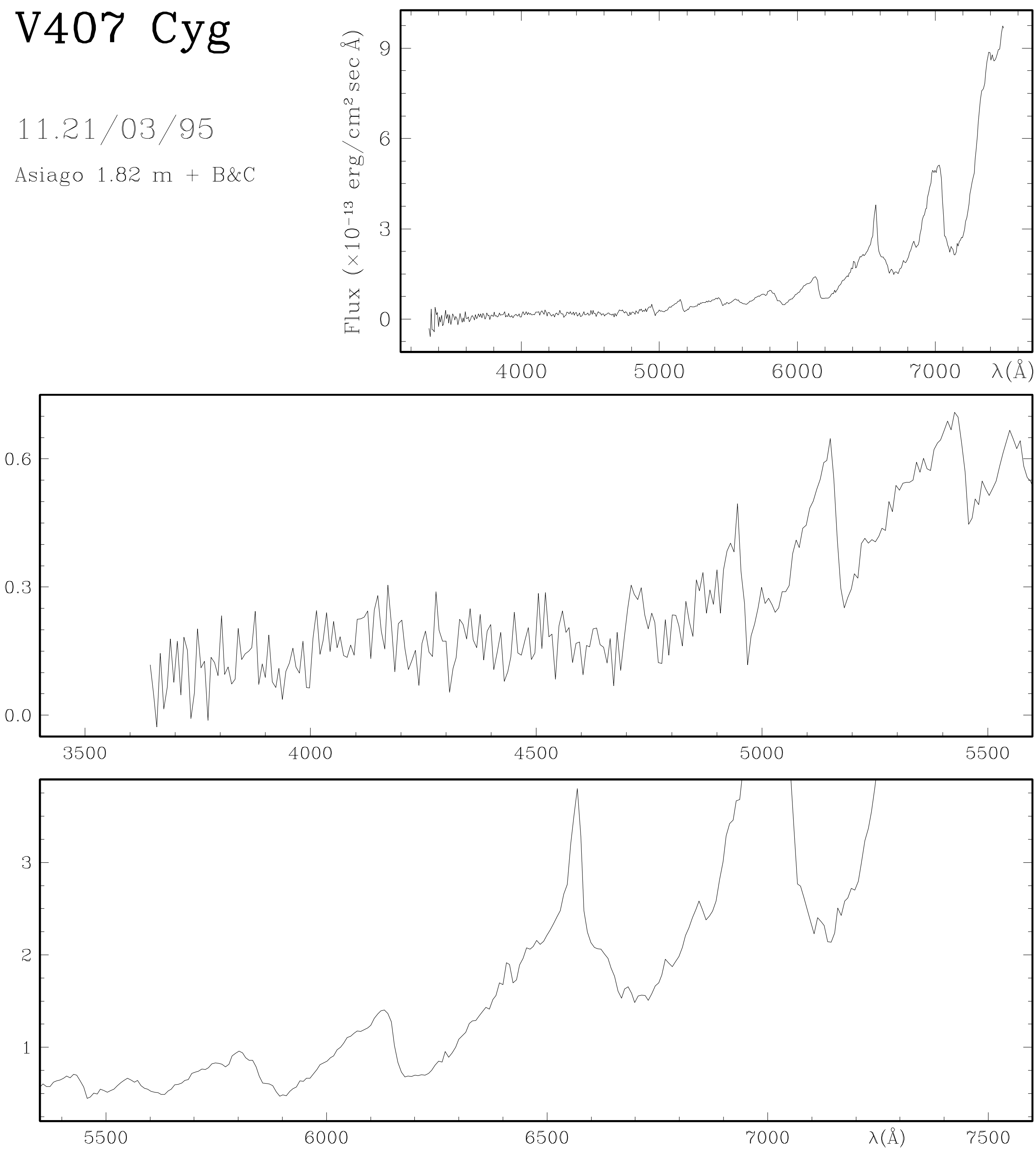


Fig. 194. Asiago 1.82m + B&C spectrum of V407 Cyg

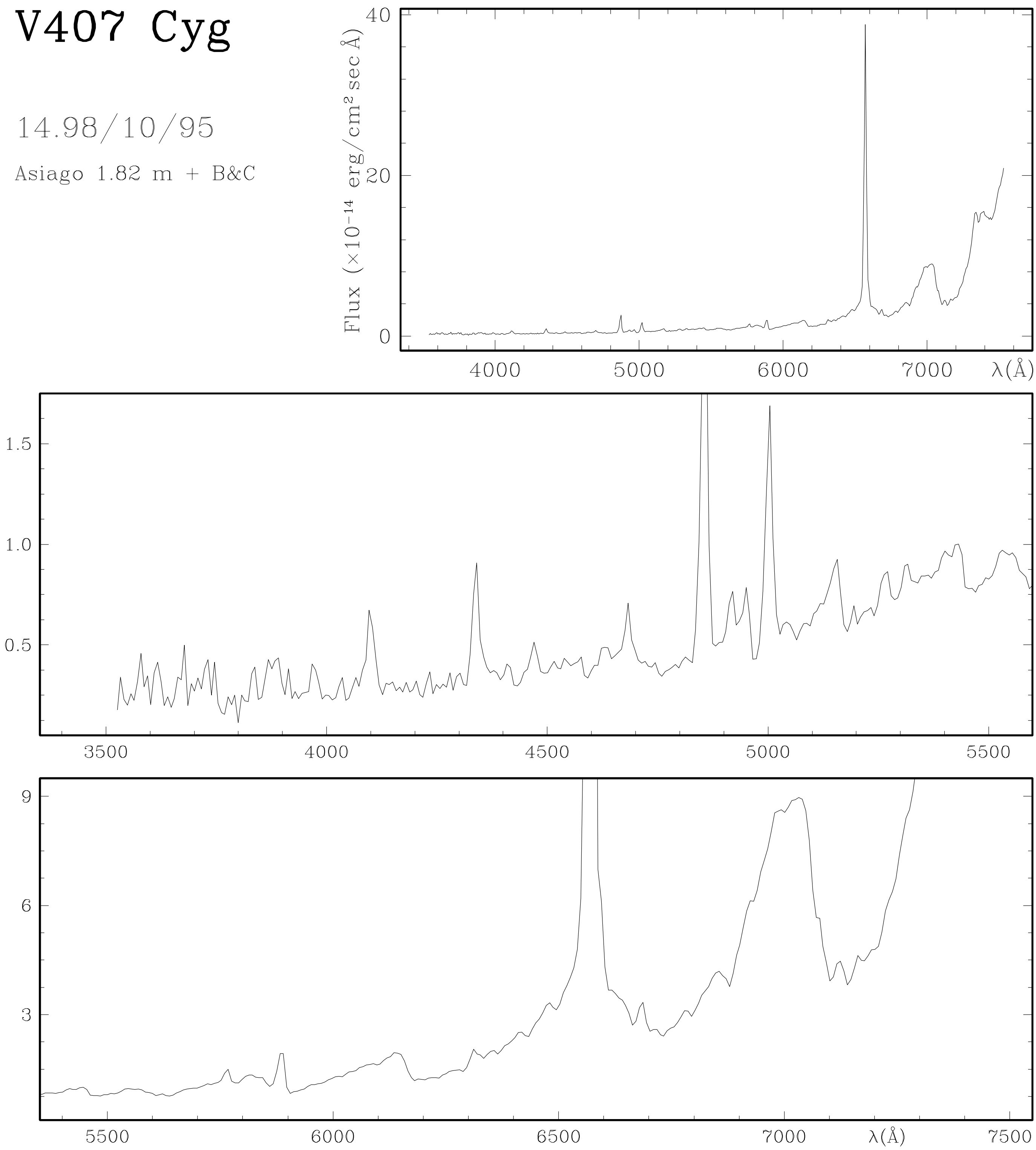


Fig. 195. Asiago 1.82m + B&C spectrum of V407 Cyg

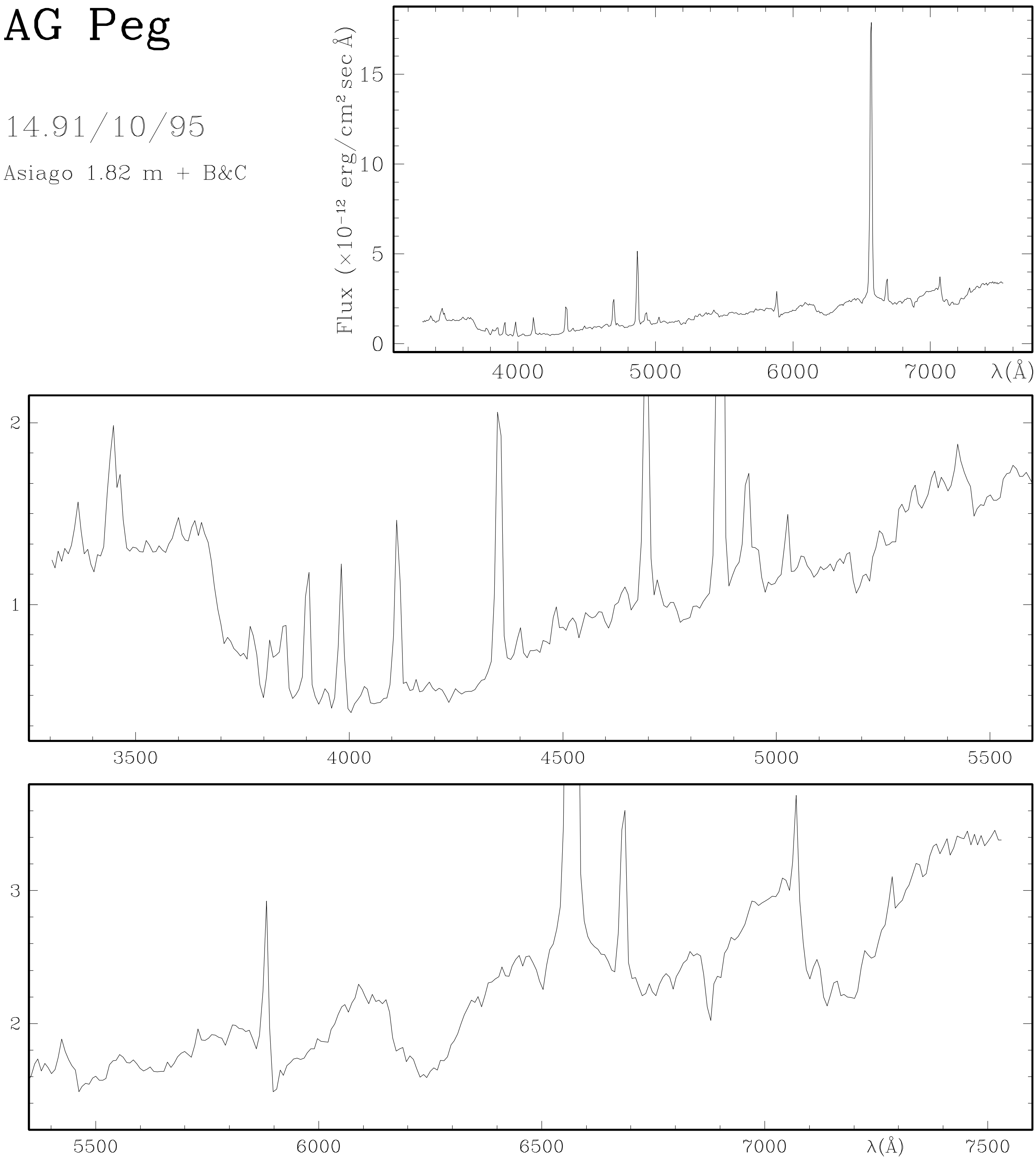


Fig. 196. Asiago 1.82m + B&C spectrum of AG Peg

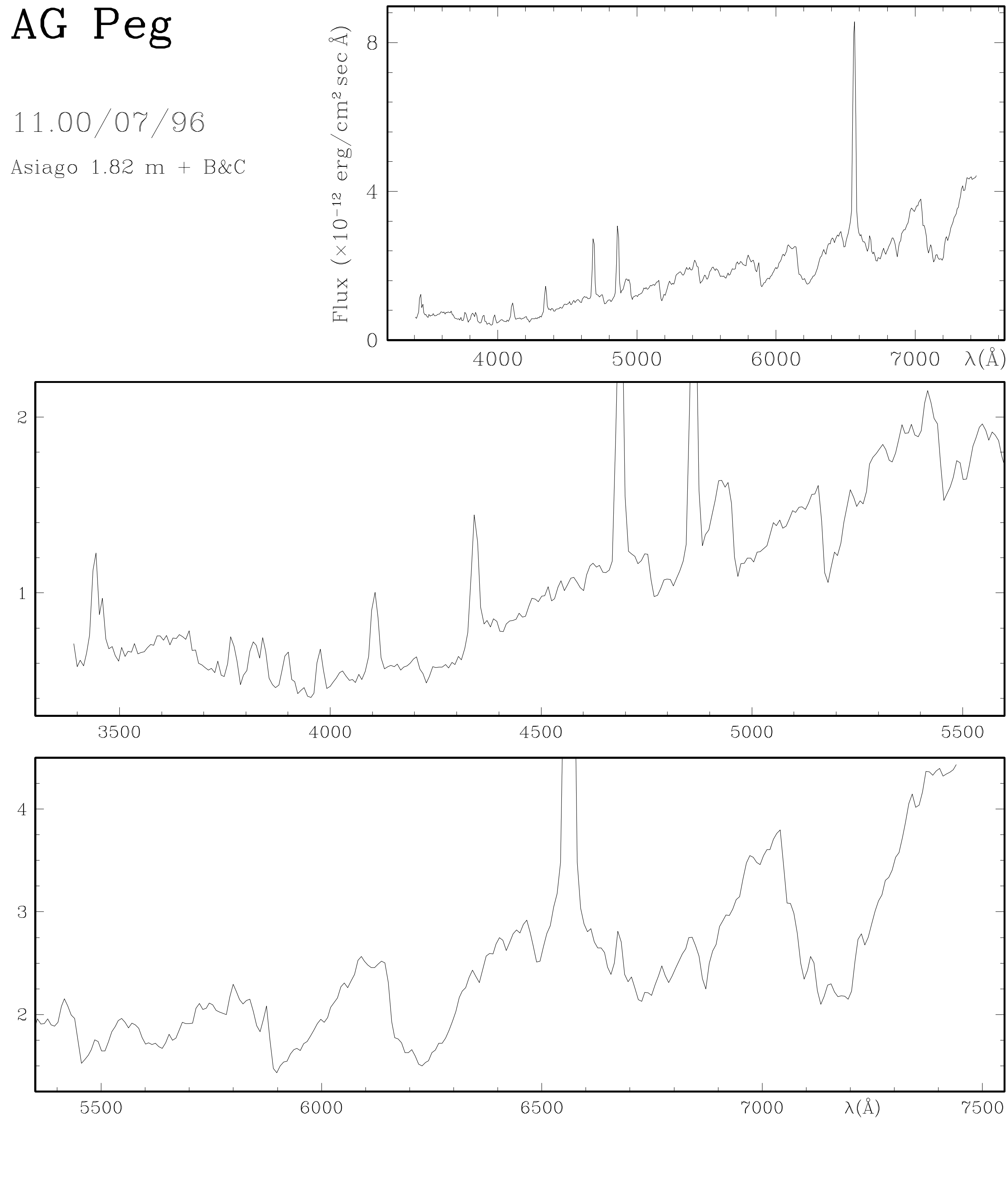


Fig. 197. Asiago 1.82m + B&C spectrum of AG Peg

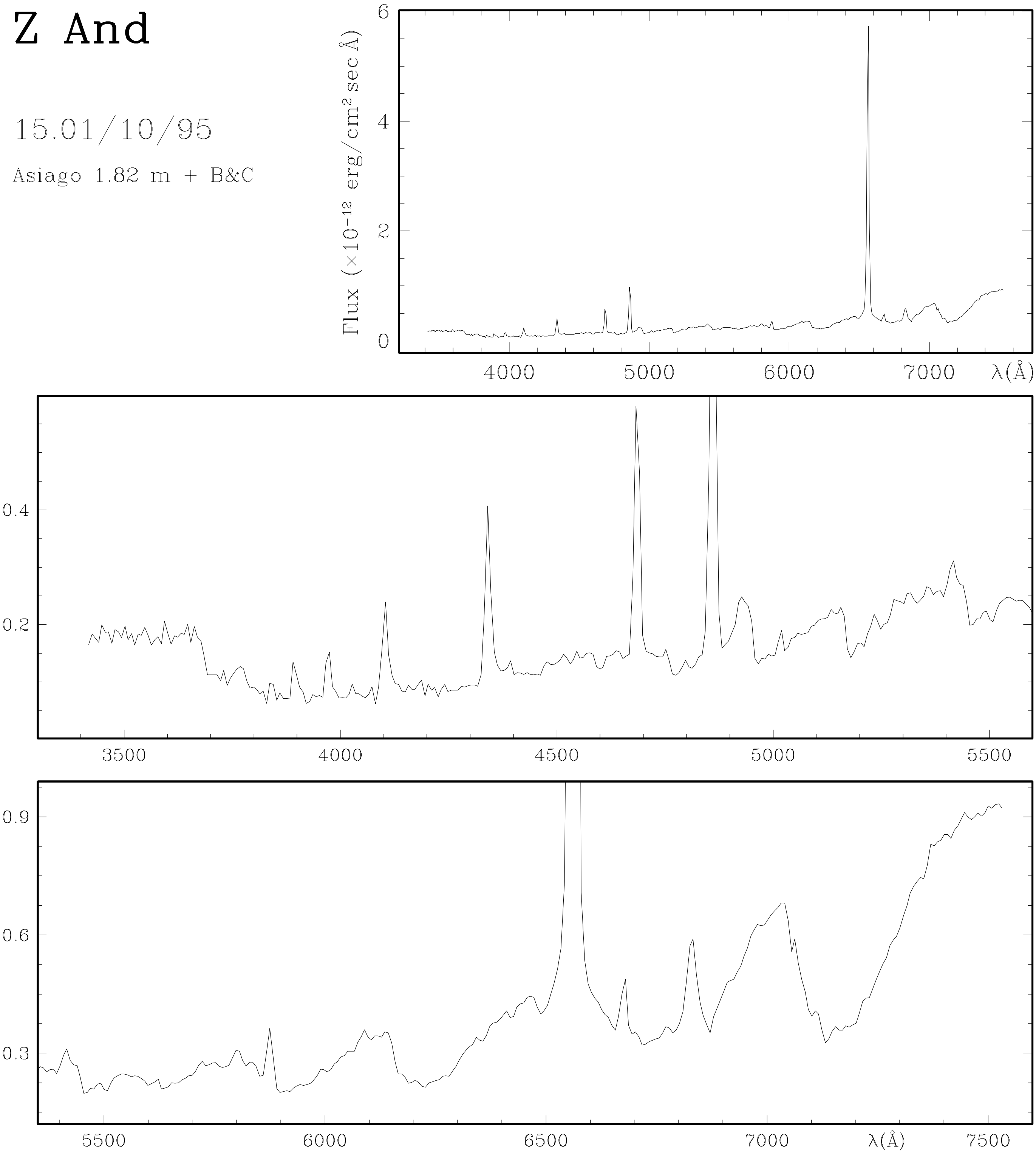


Fig. 198. Asiago 1.82m + B&C spectrum of Z And

Z And

07.73/02/96

Asiago 1.82 m + B&C

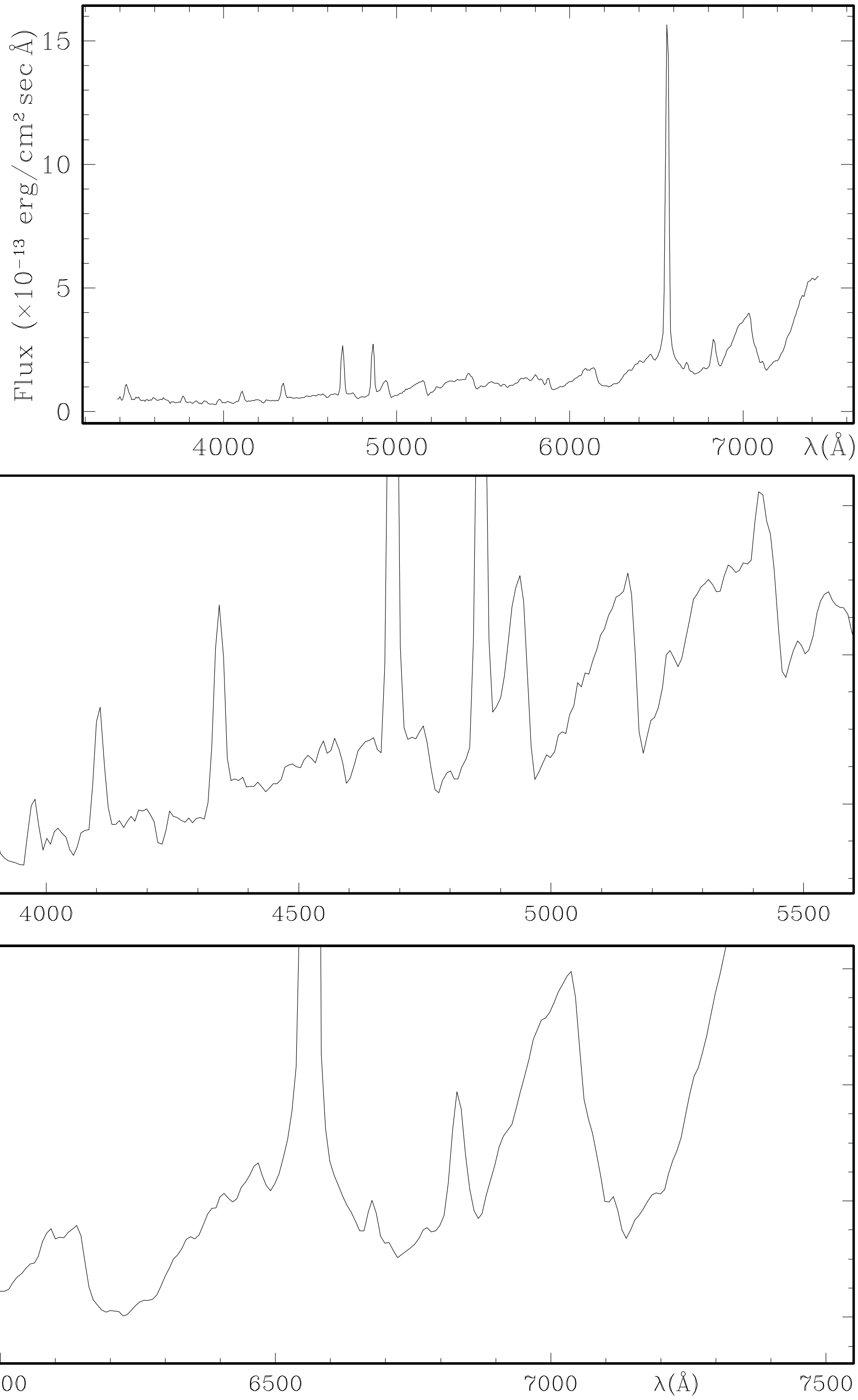


Fig. 199. Asiago 1.82m + B&C spectrum of Z And

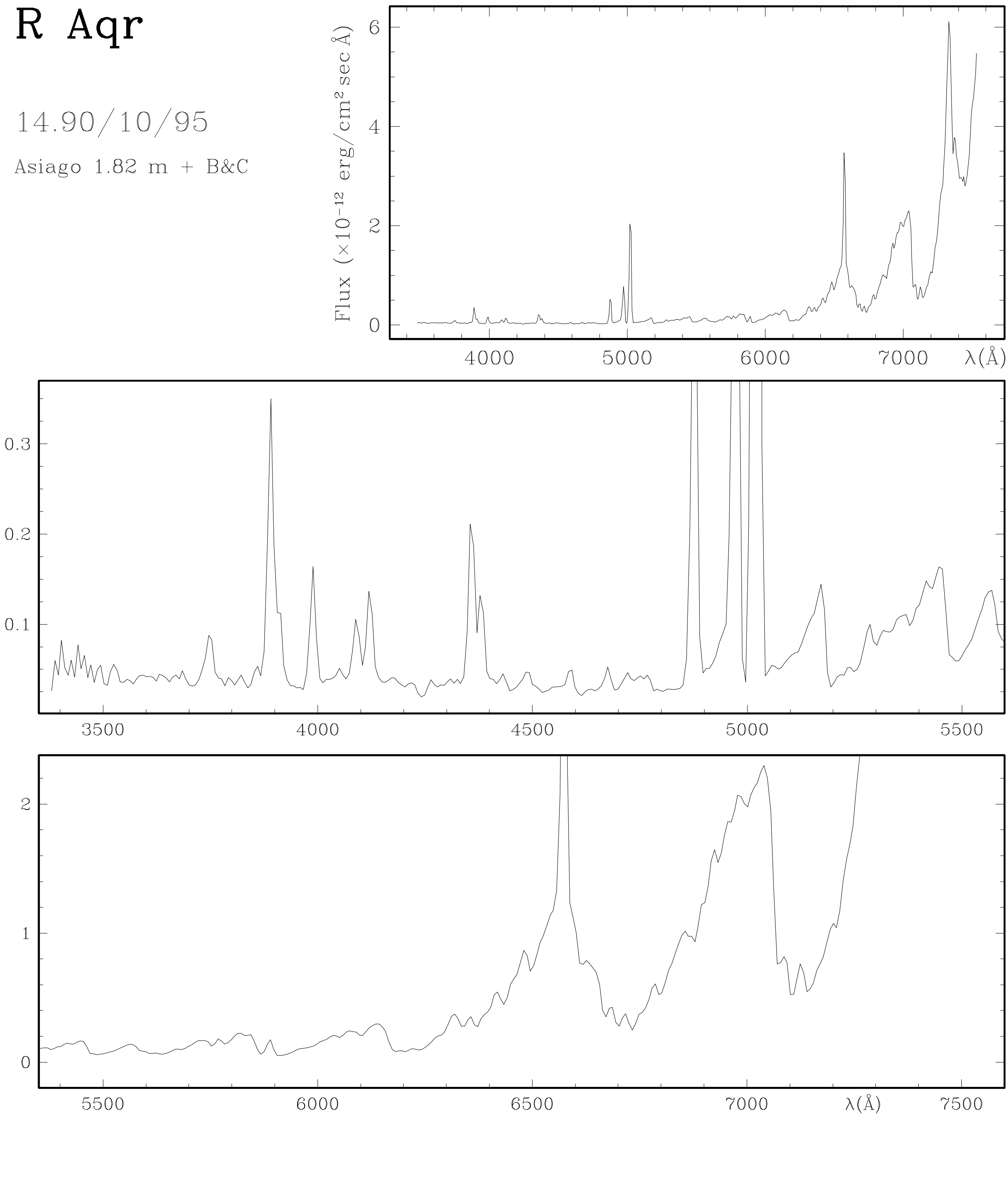


Fig. 200. Asiago 1.82m + B&C spectrum of R Aqr

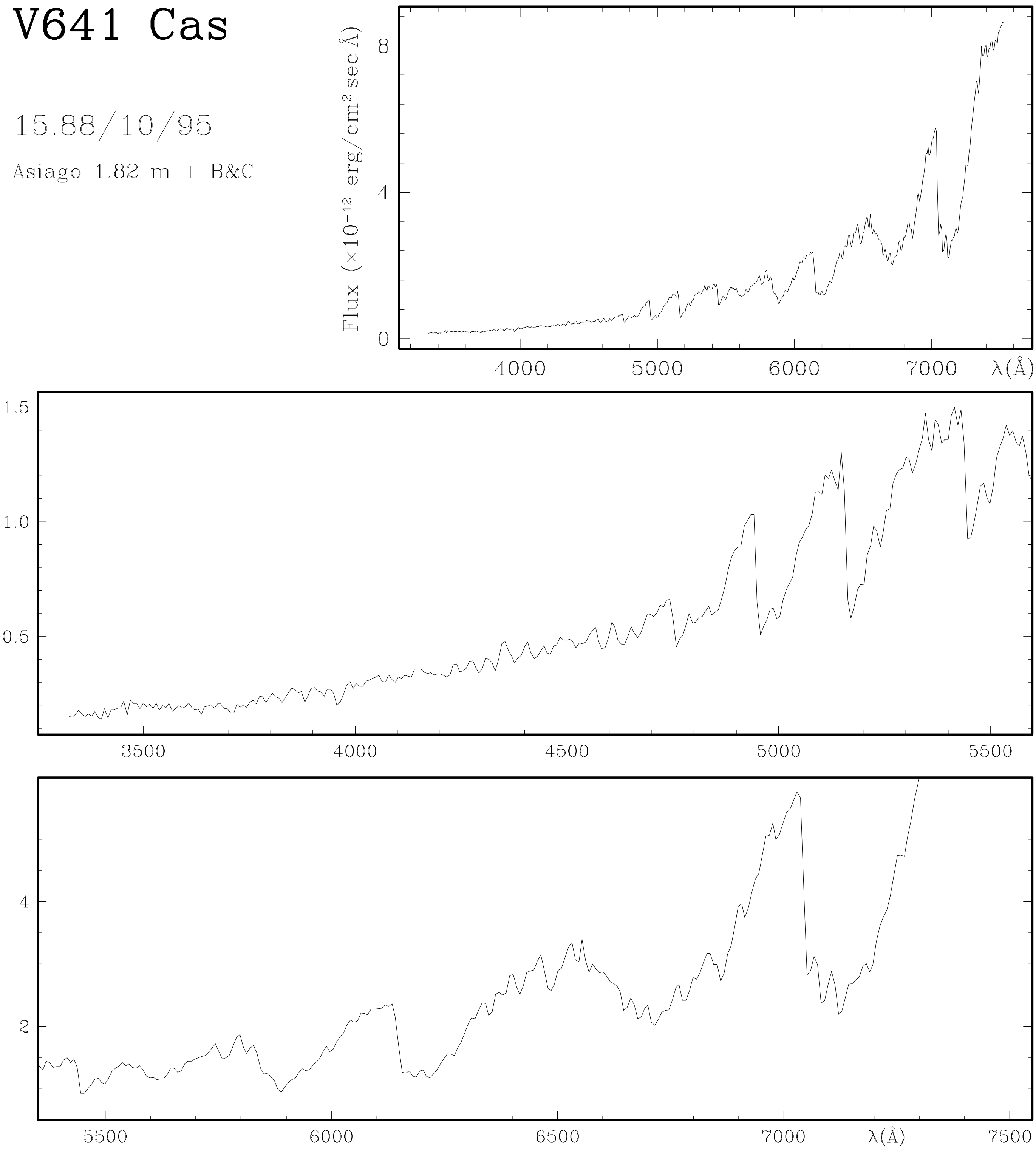


Fig. 201. Asiago 1.82m + B&C spectrum of V641 Cas

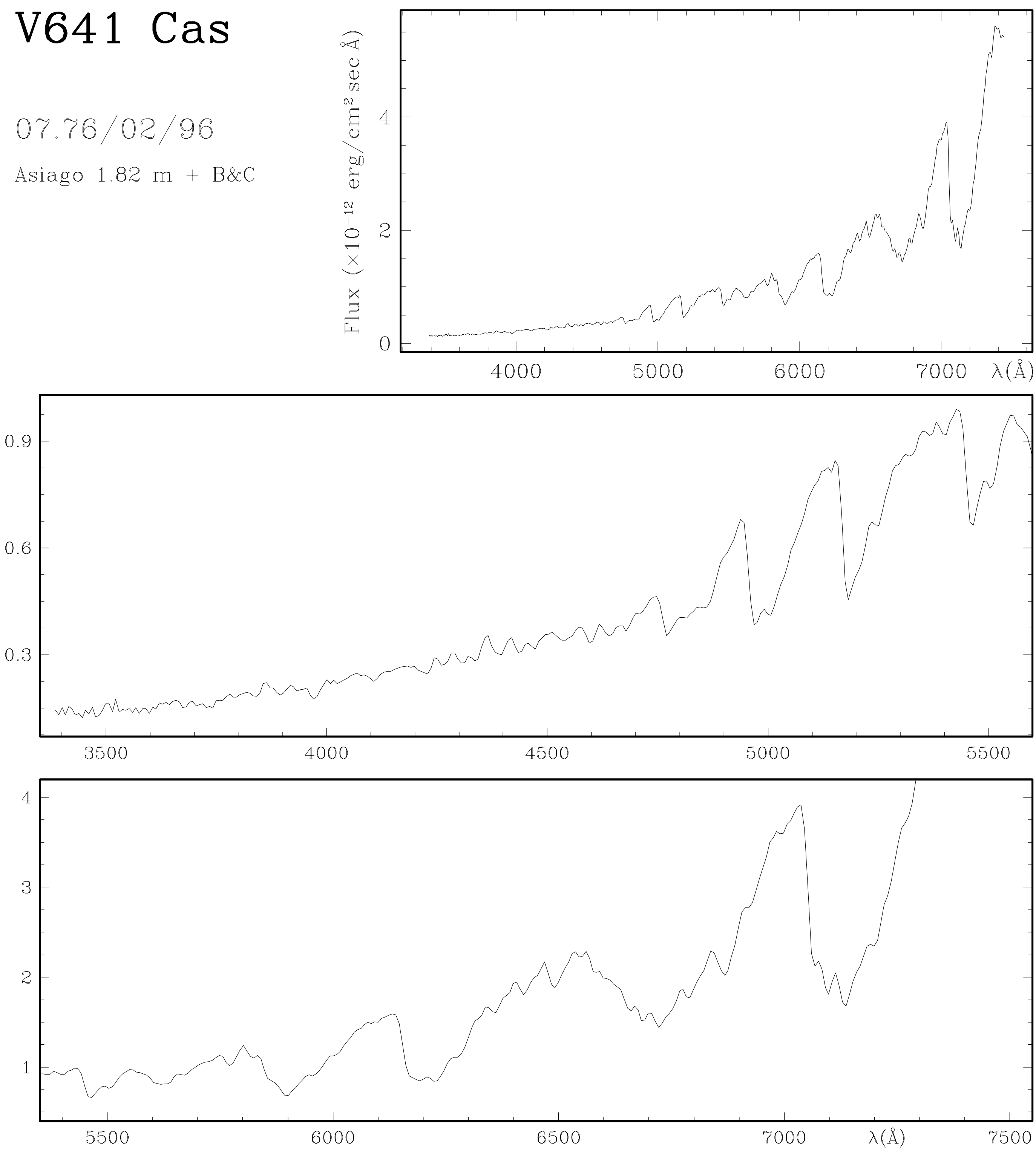


Fig. 202. Asiago 1.82m + B&C spectrum of V641 Cas

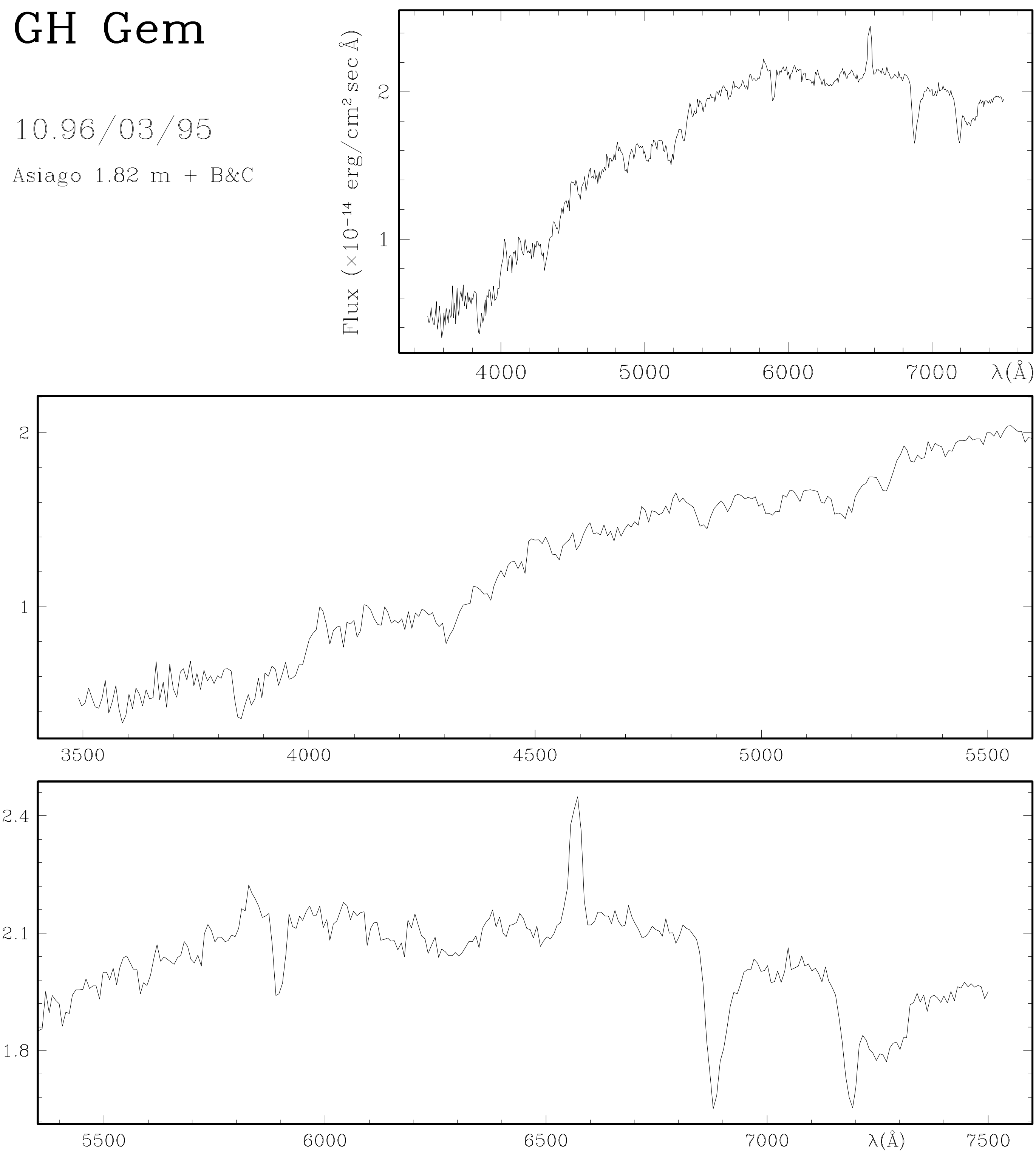


Fig. 203. Asiago 1.82m + B&C spectrum of GH Gem

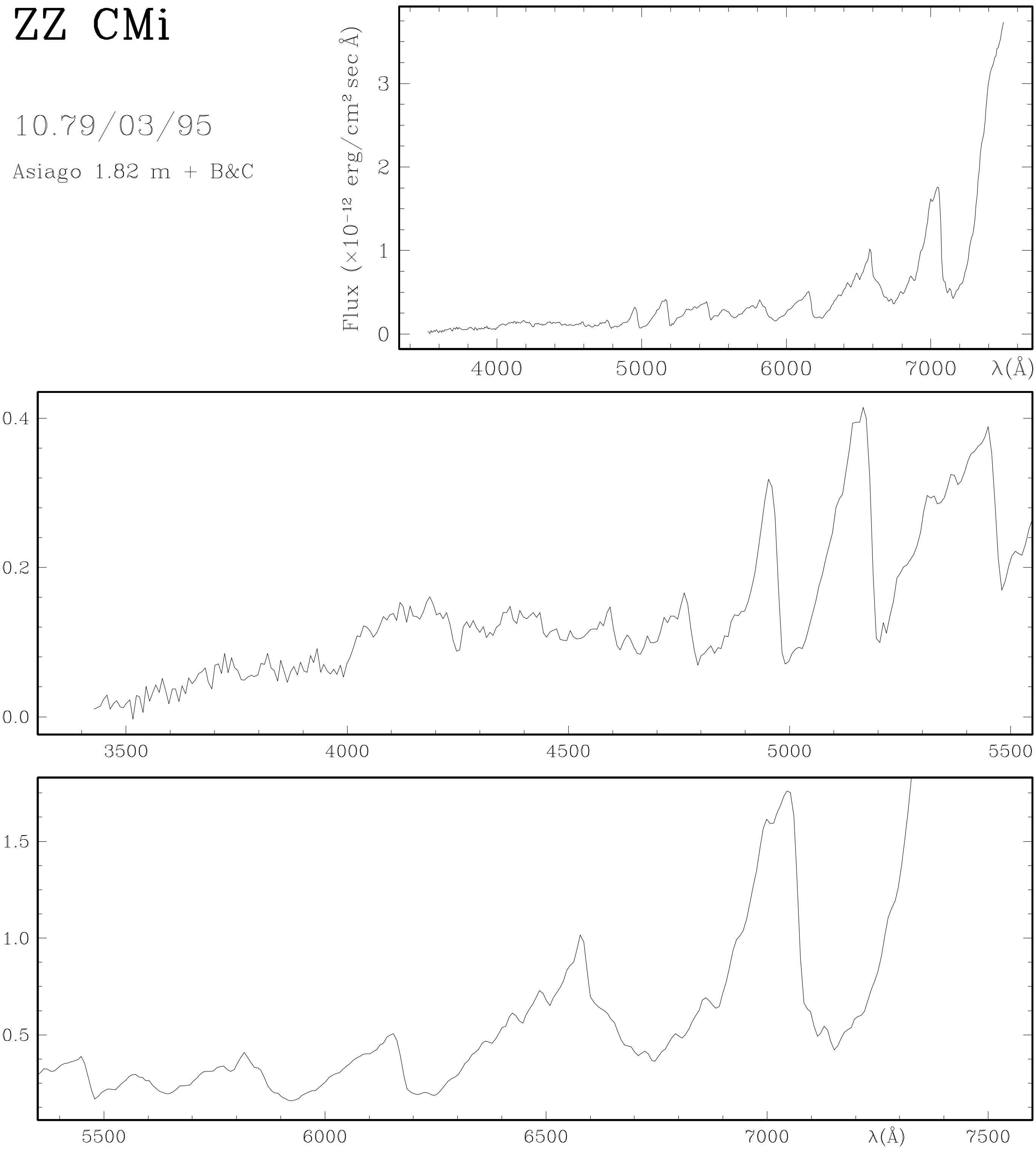


Fig. 204. Asiago 1.82m + B&C spectrum of ZZ CMi

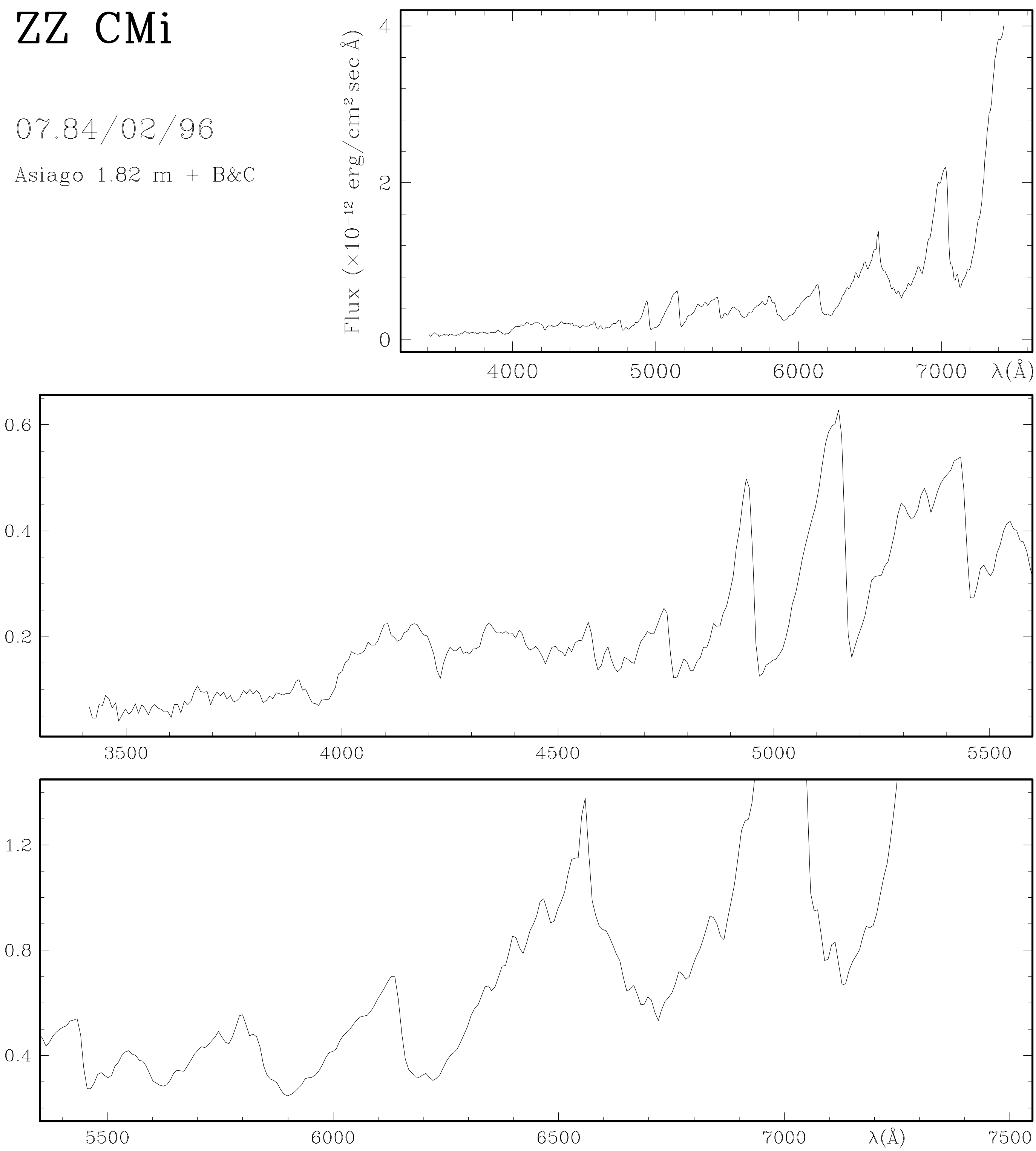
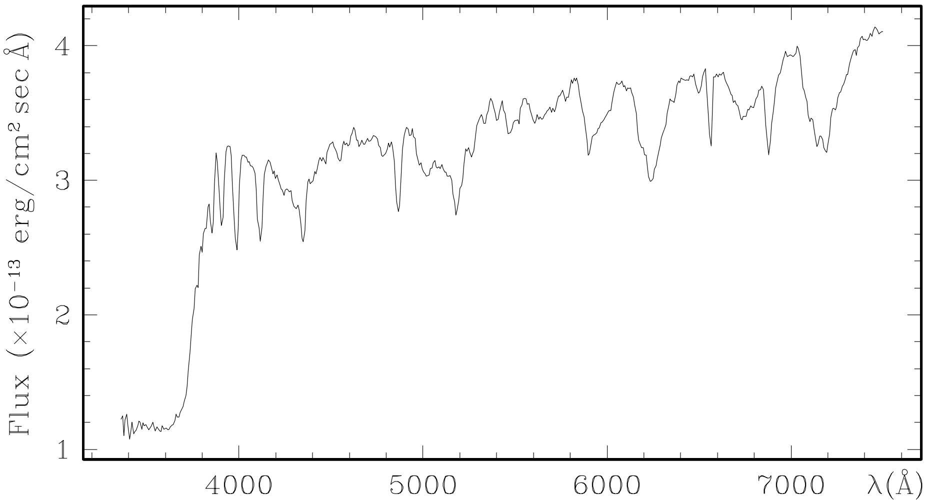


Fig. 205. Asiago 1.82m + B&C spectrum of ZZ CMi

TX CVn

10.98/03/95

Asiago 1.82 m + B&C



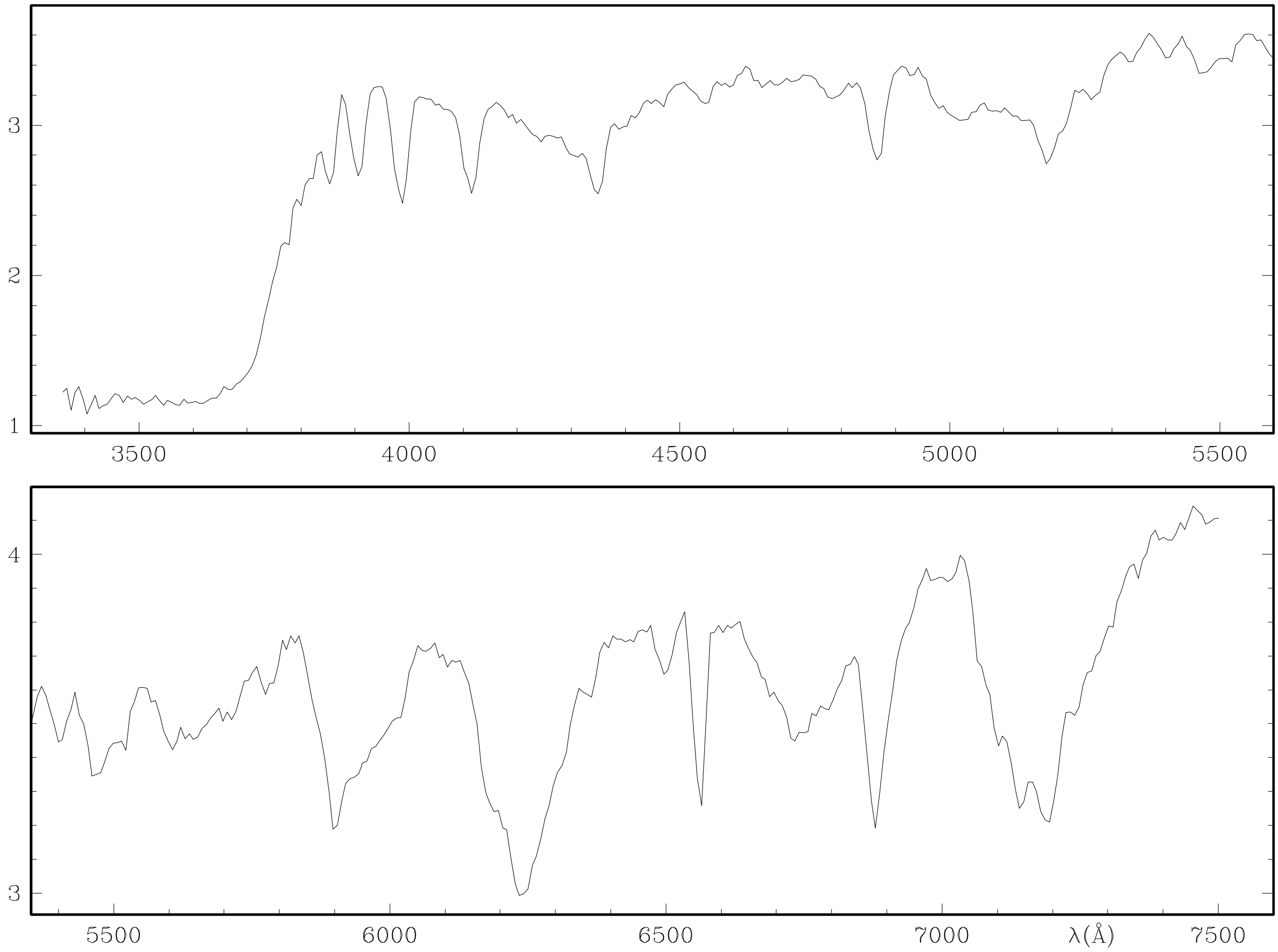


Fig. 206. Asiago 1.82m + B&C spectrum of TX CVn

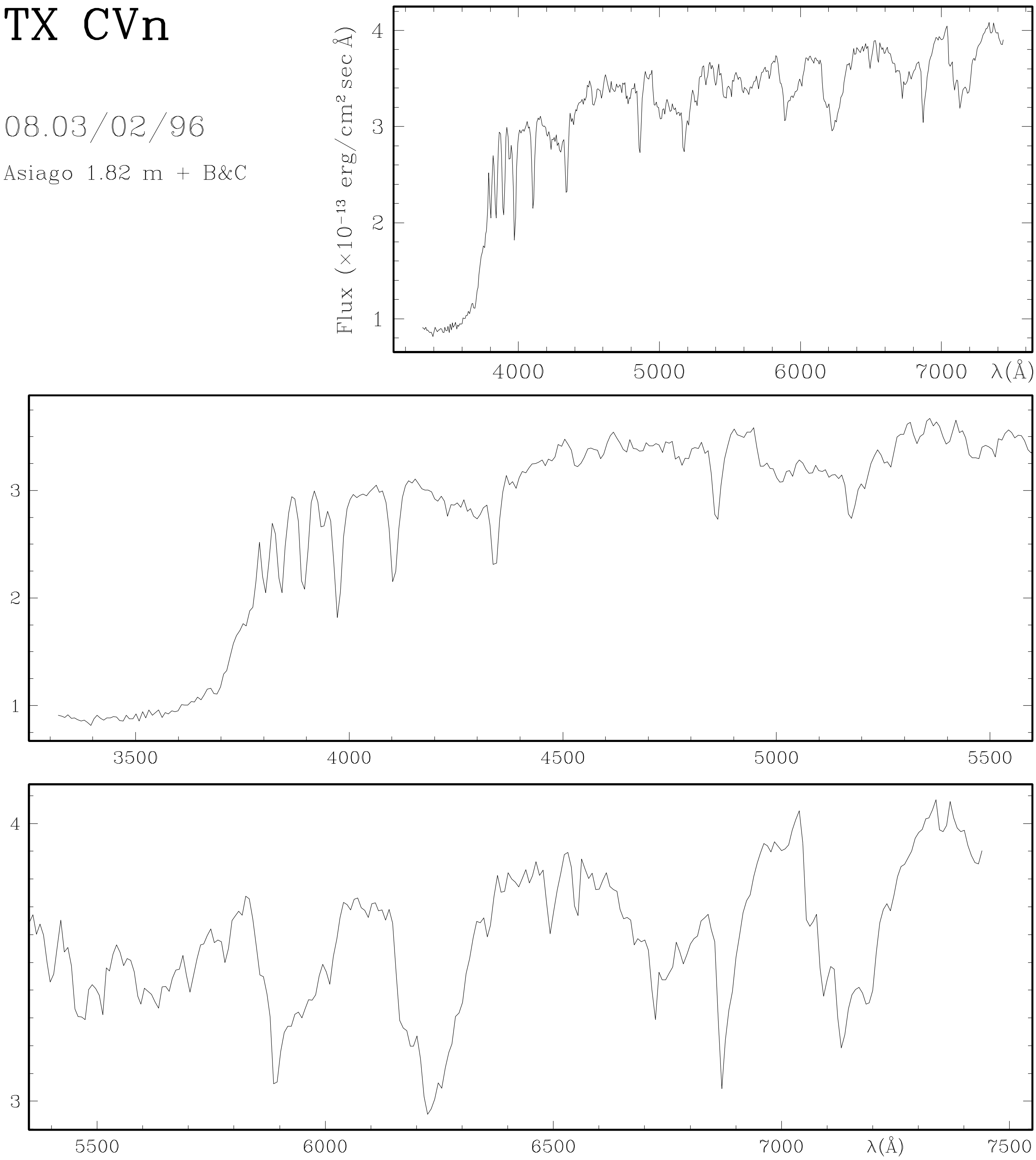


Fig. 207. Asiago 1.82m + B&C spectrum of TX CVn

V503 Her

15.77/10/95

Asiago 1.82 m + B&C

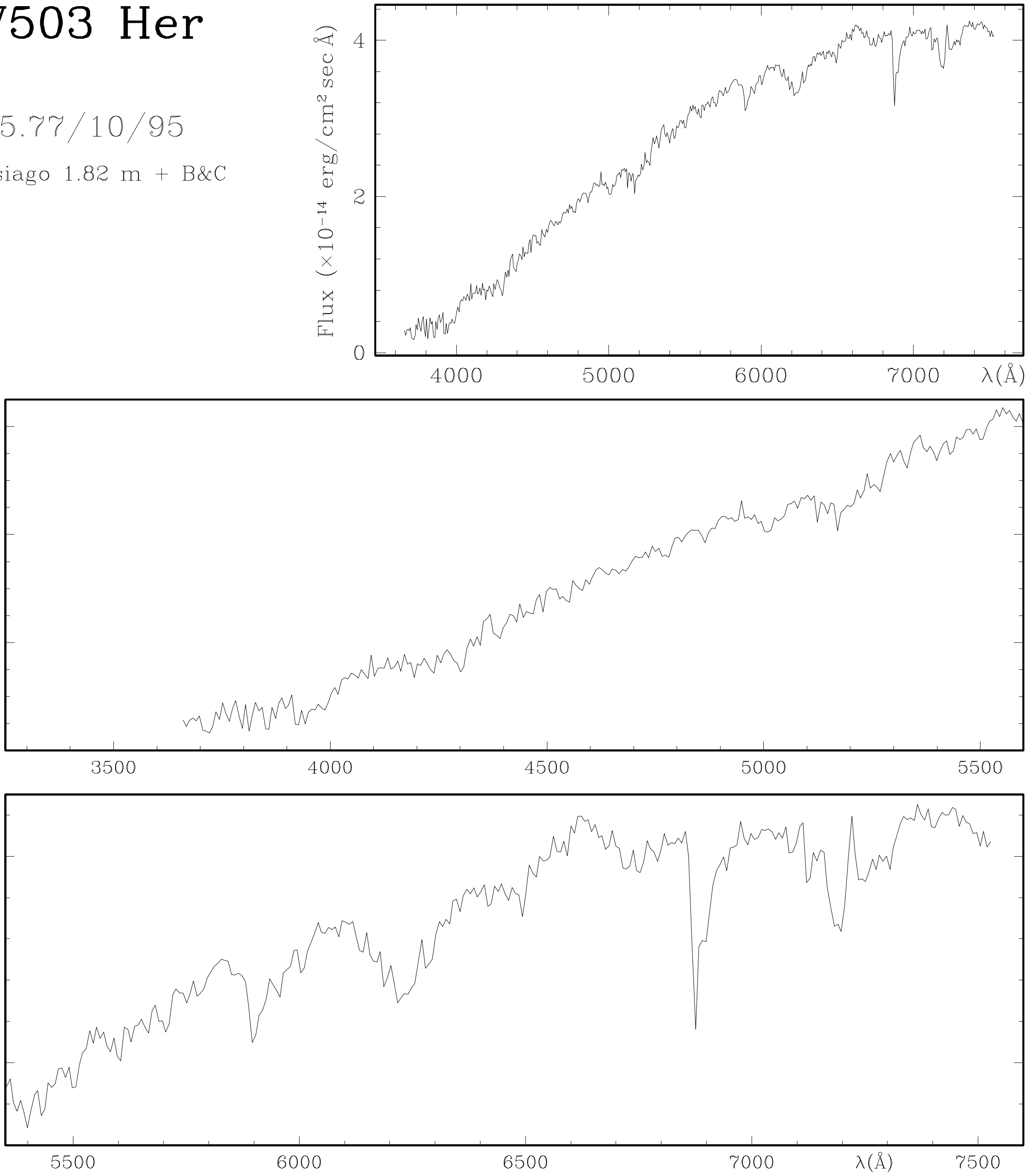


Fig. 208. Asiago 1.82m + B&C spectrum of V503 Her

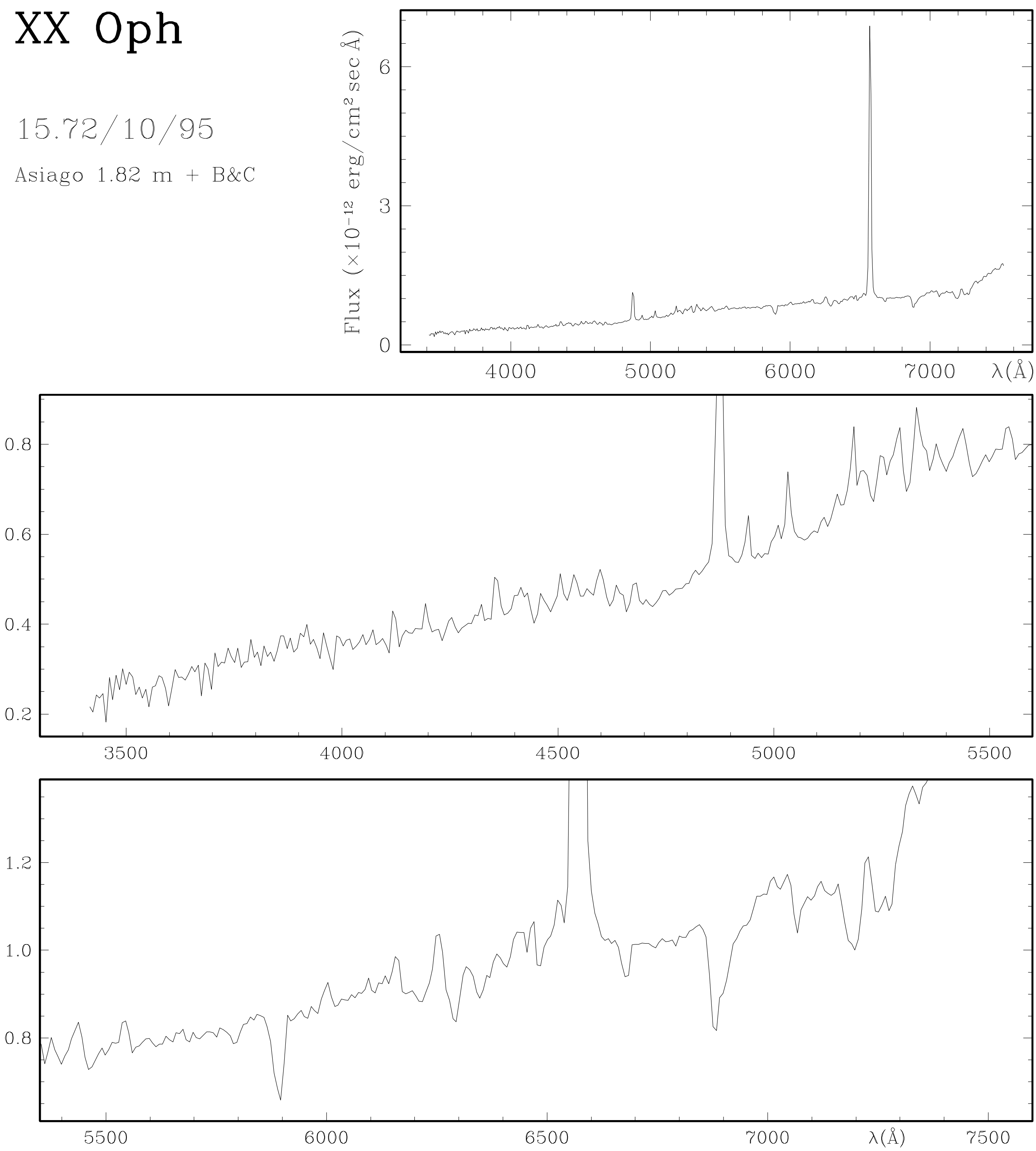


Fig. 209. Asiago 1.82m + B&C spectrum of XX Oph

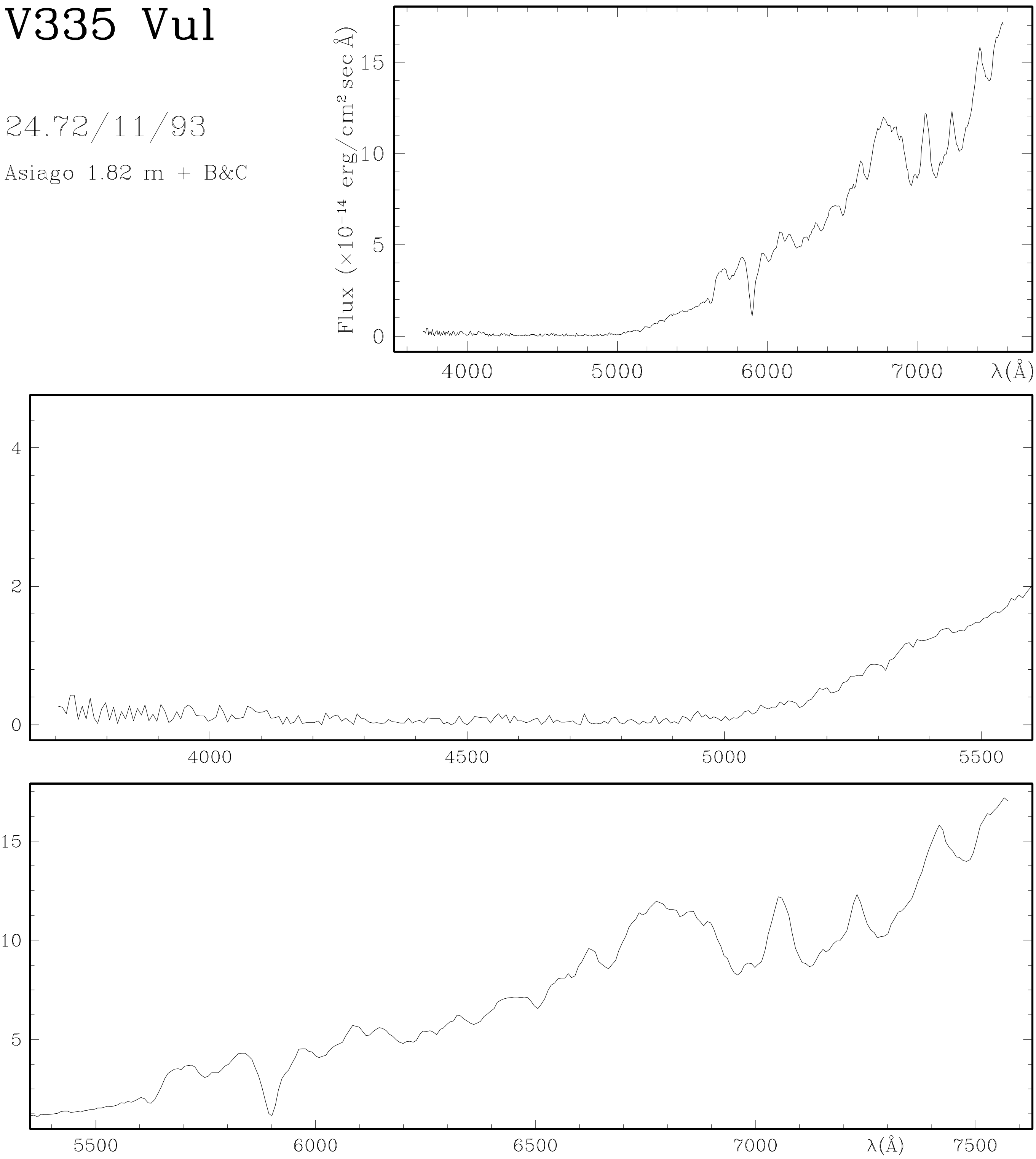


Fig. 210. Asiago 1.82m + B&C spectrum of V335 Vul

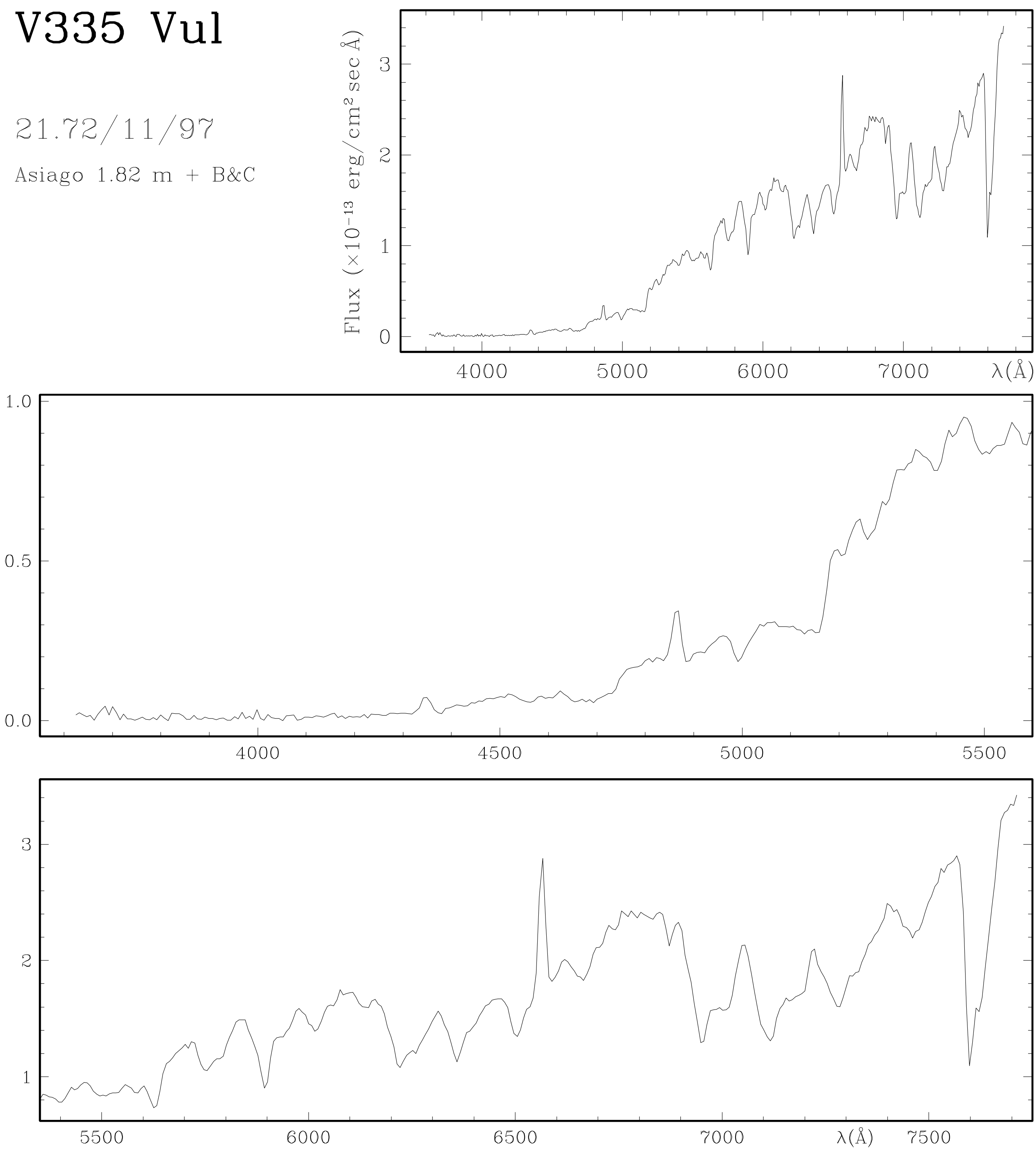


Fig. 211. Asiago 1.82m + B&C spectrum of V335 Vul

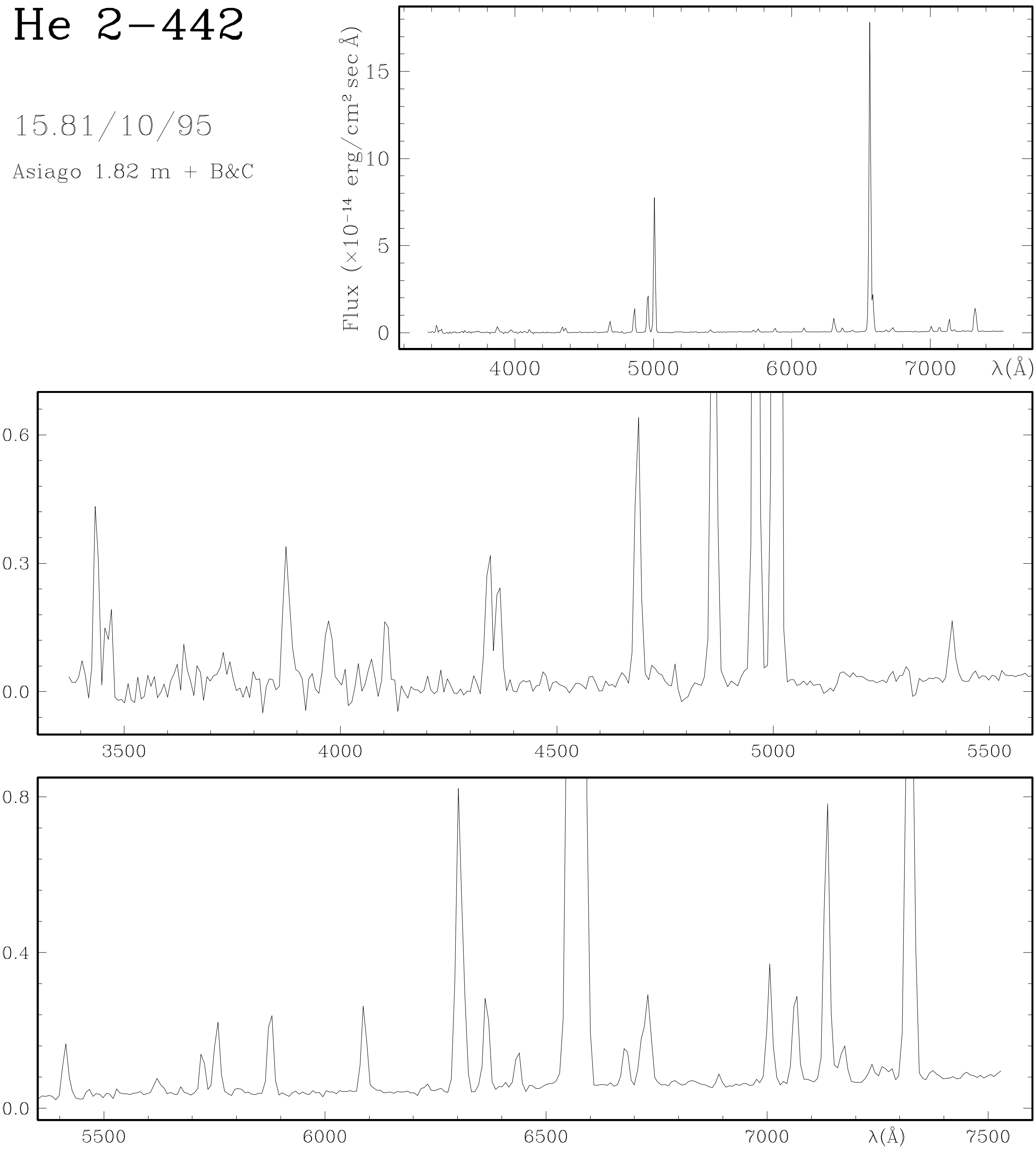


Fig. 212. Asiago 1.82m + B&C spectrum of Hen 2-442

OY Cyg

15.81/10/95

Asiago 1.82 m + B&C

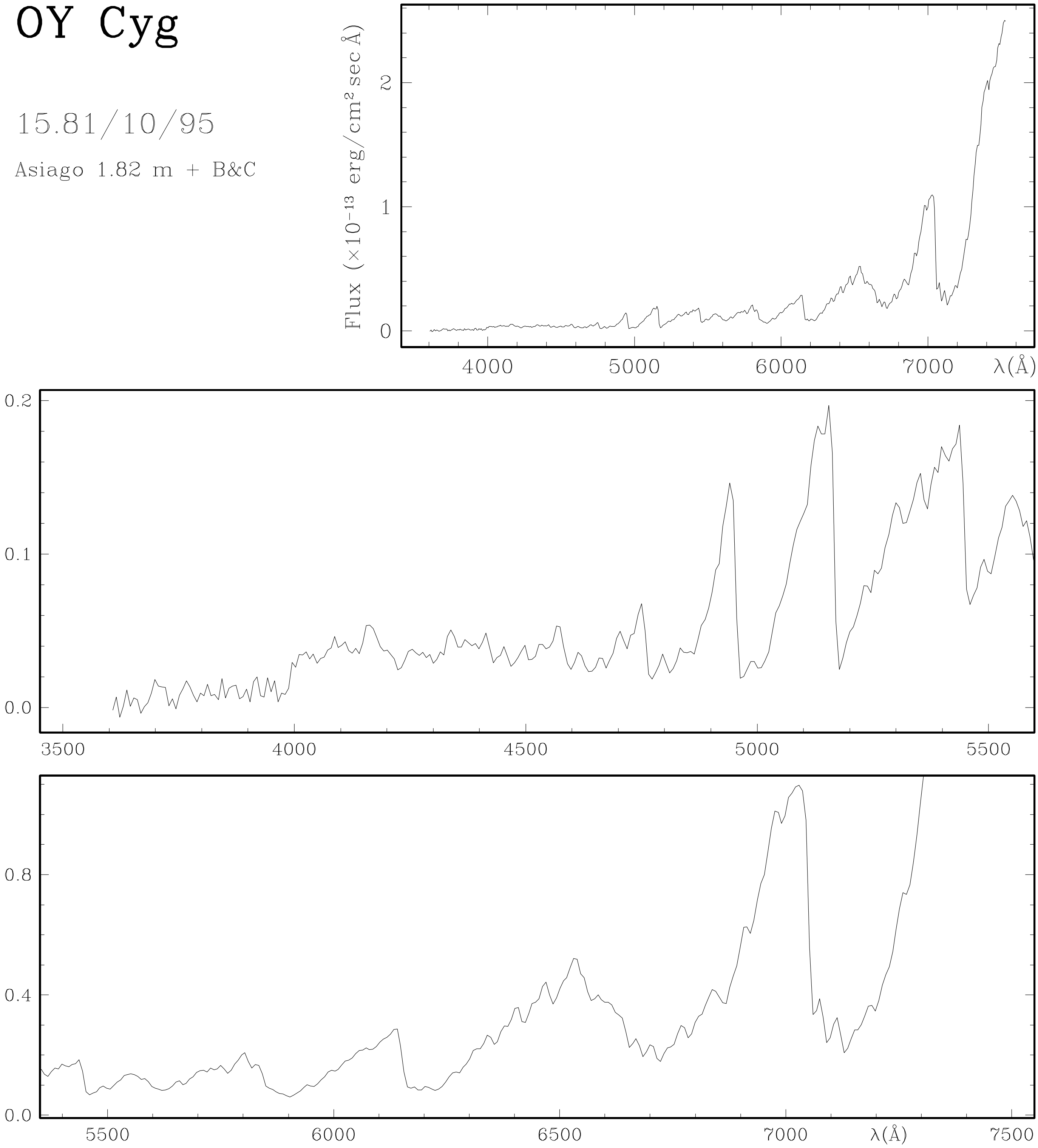


Fig. 213. Asiago 1.82m + B&C spectrum of OY Cyg

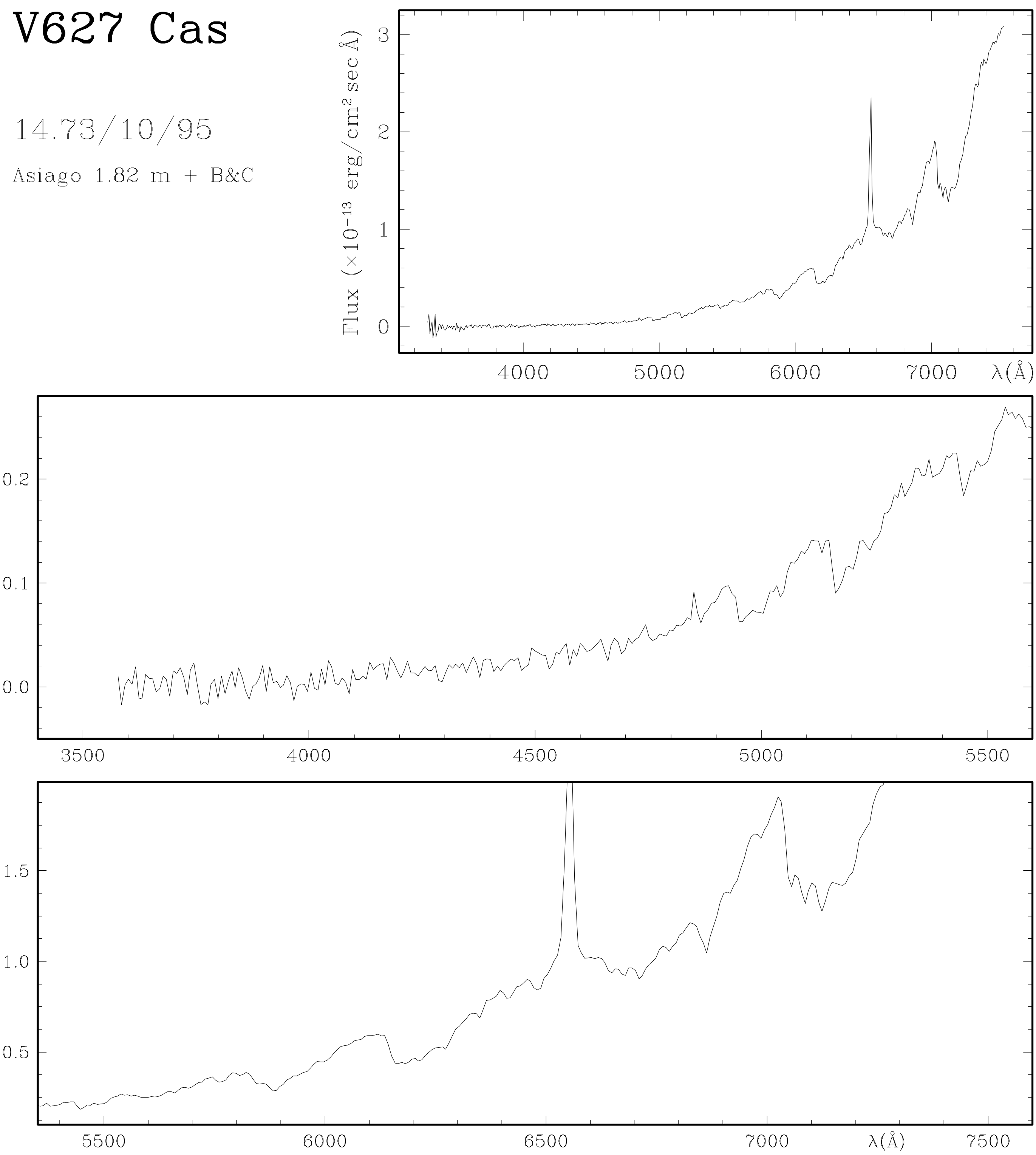


Fig. 214. Asiago 1.82m + B&C spectrum of V627 Cas

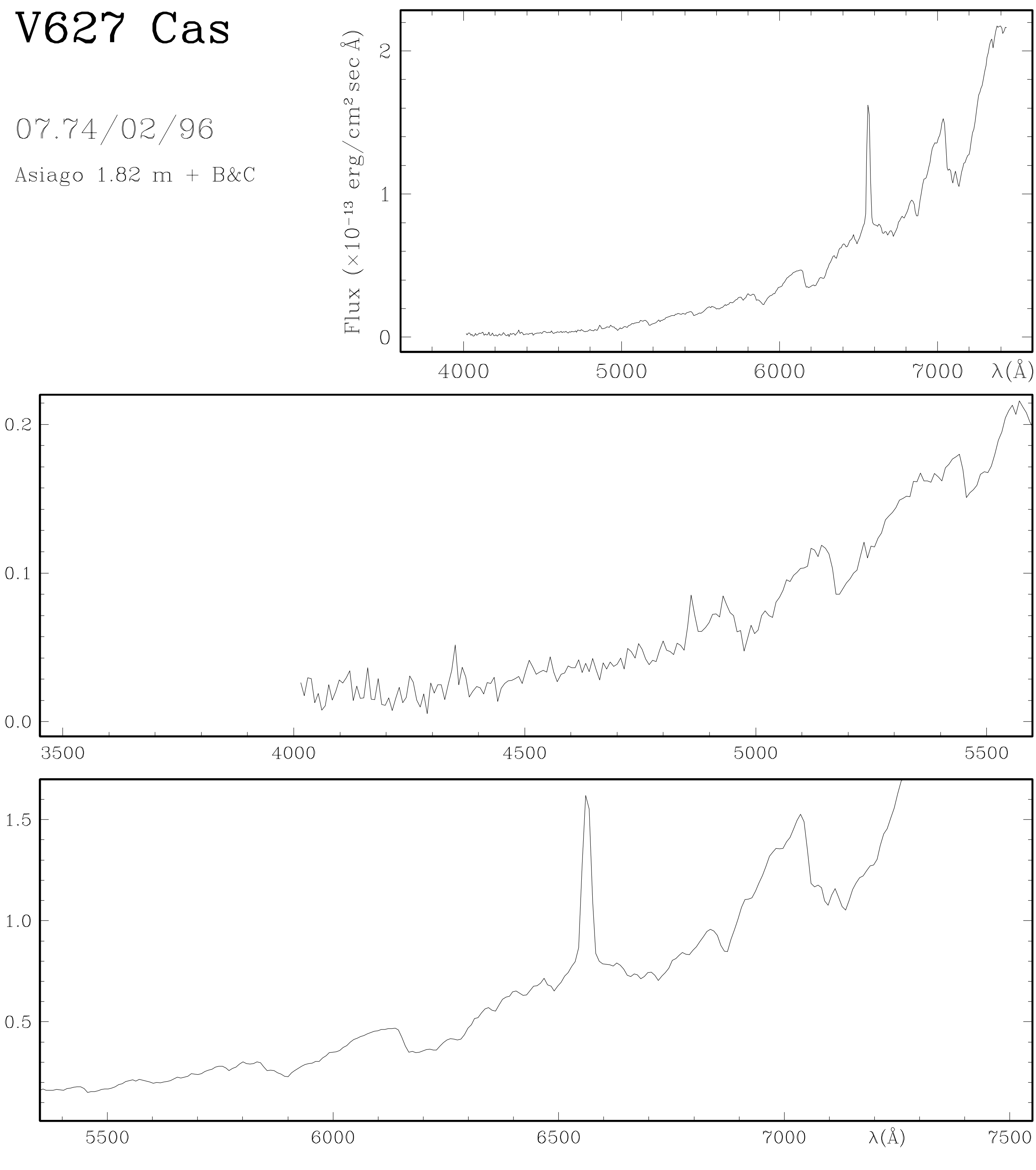


Fig. 215. Asiago 1.82m + B&C spectrum of V627 Cas

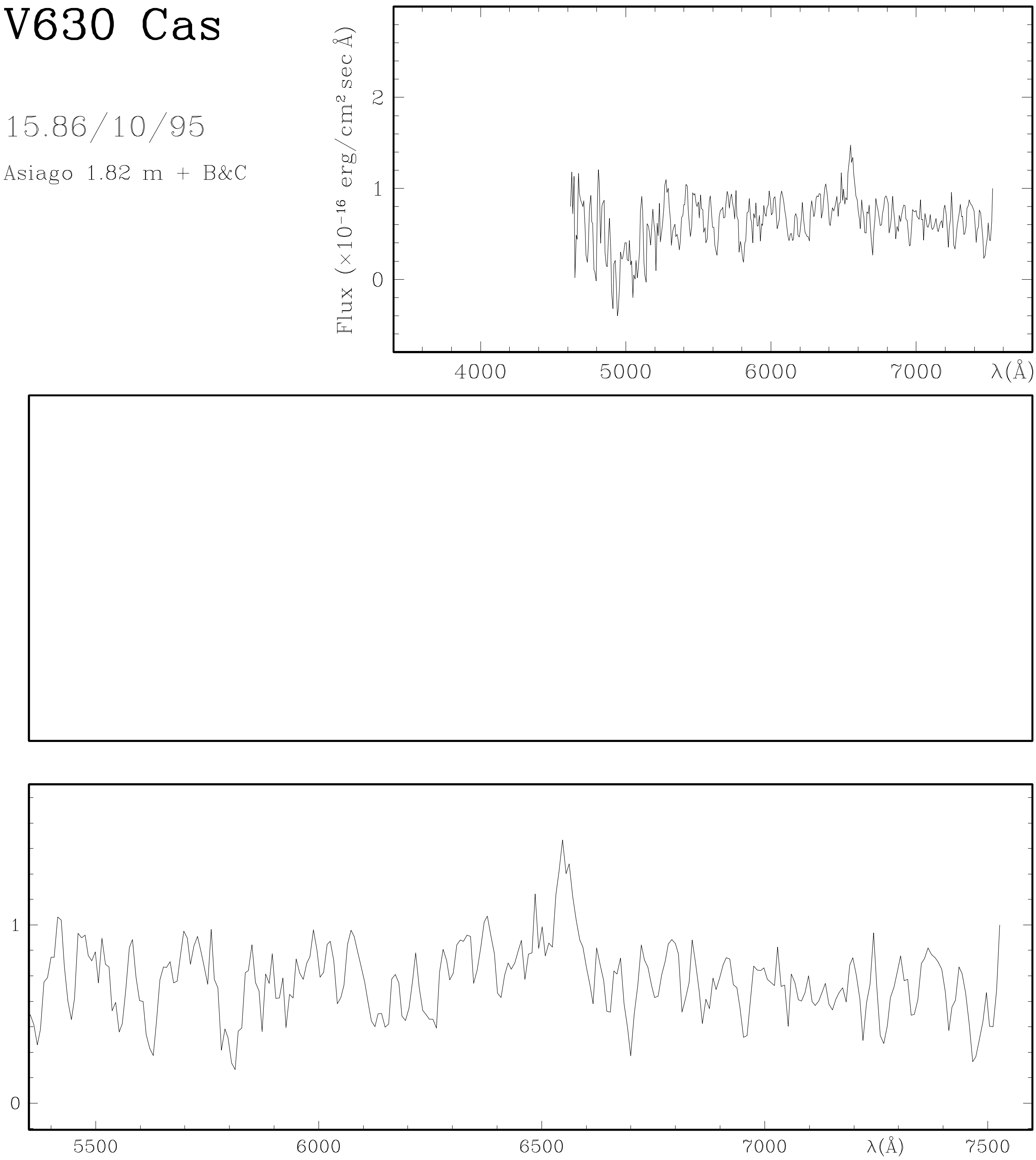


Fig. 216. Asiago 1.82m + B&C spectrum of V630 Cas

F0 III

HD 159876

ESO 1.5 m + B&C

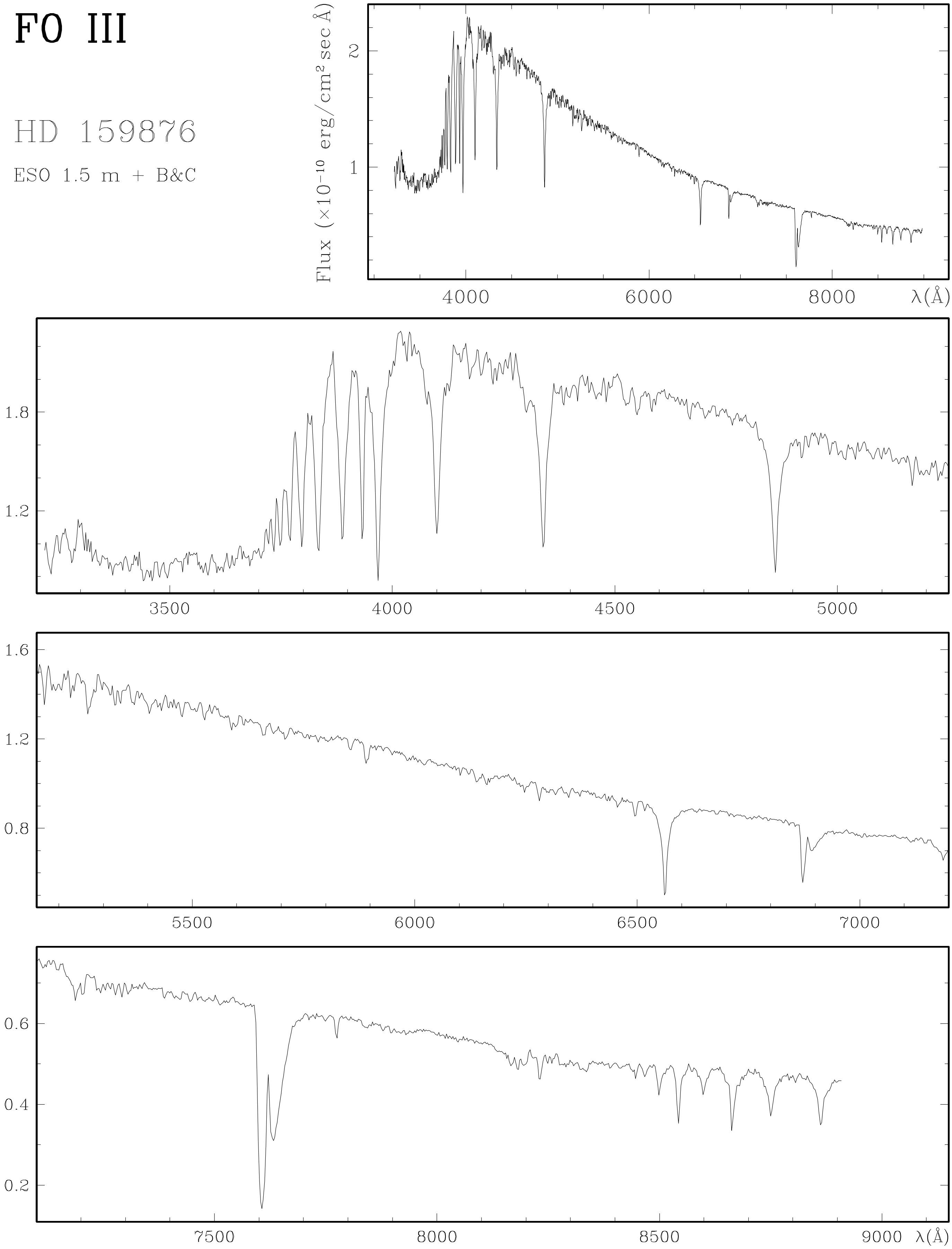


Fig. 217. ESO 1.5m + B&C spectrum of HD 159876

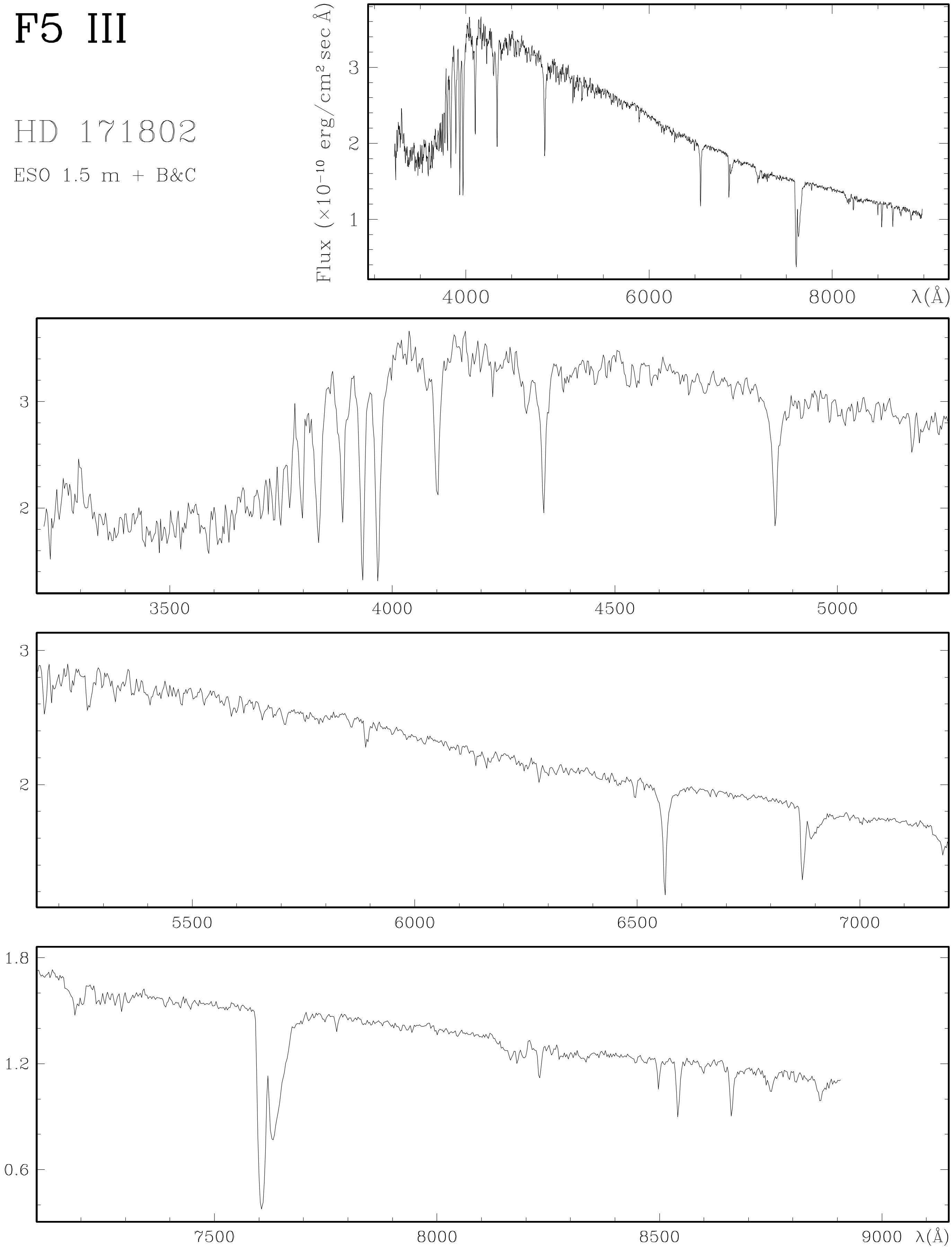


Fig. 218. ESO 1.5m + B&C spectrum of HD 171802

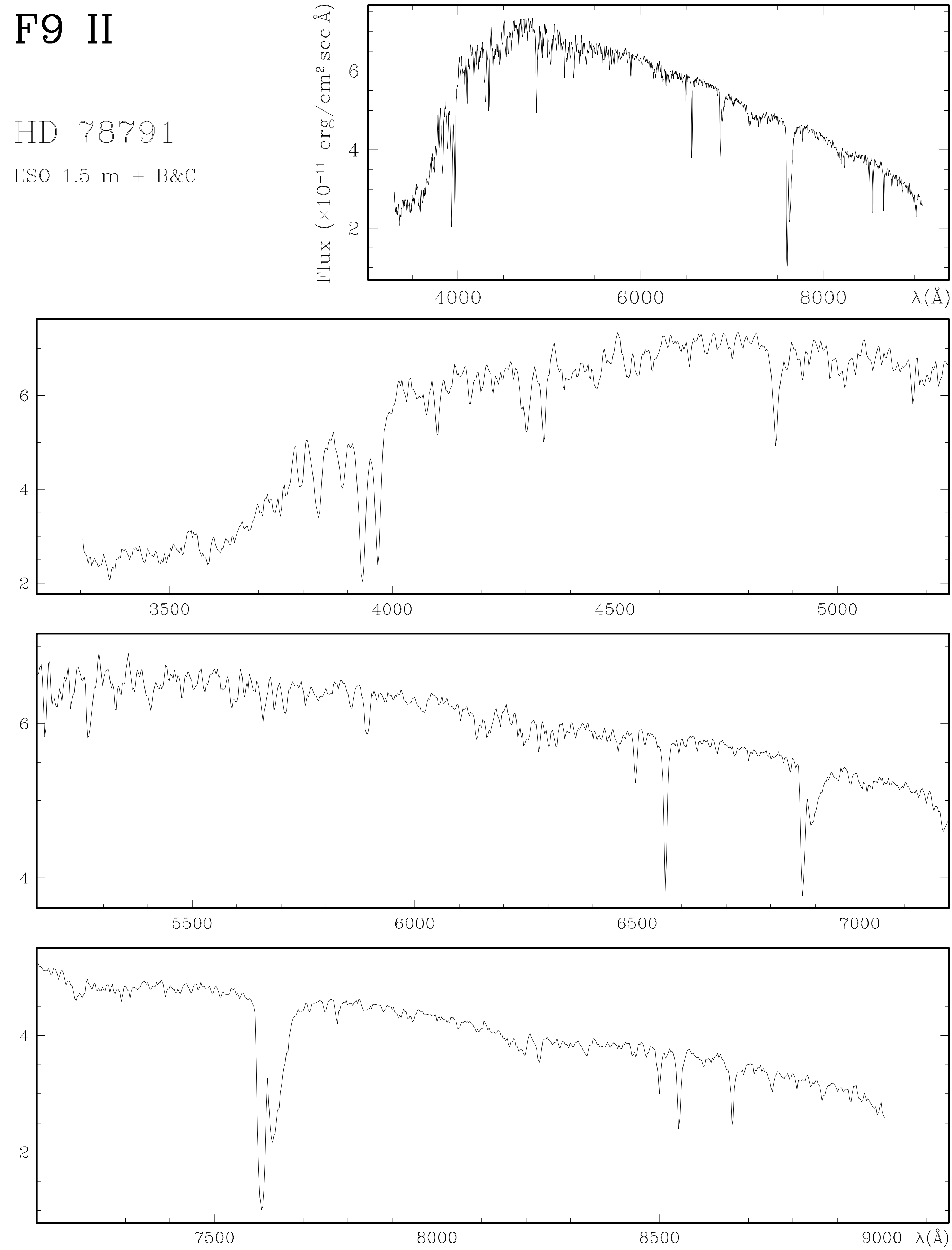


Fig. 219. ESO 1.5m + B&C spectrum of HD 78791

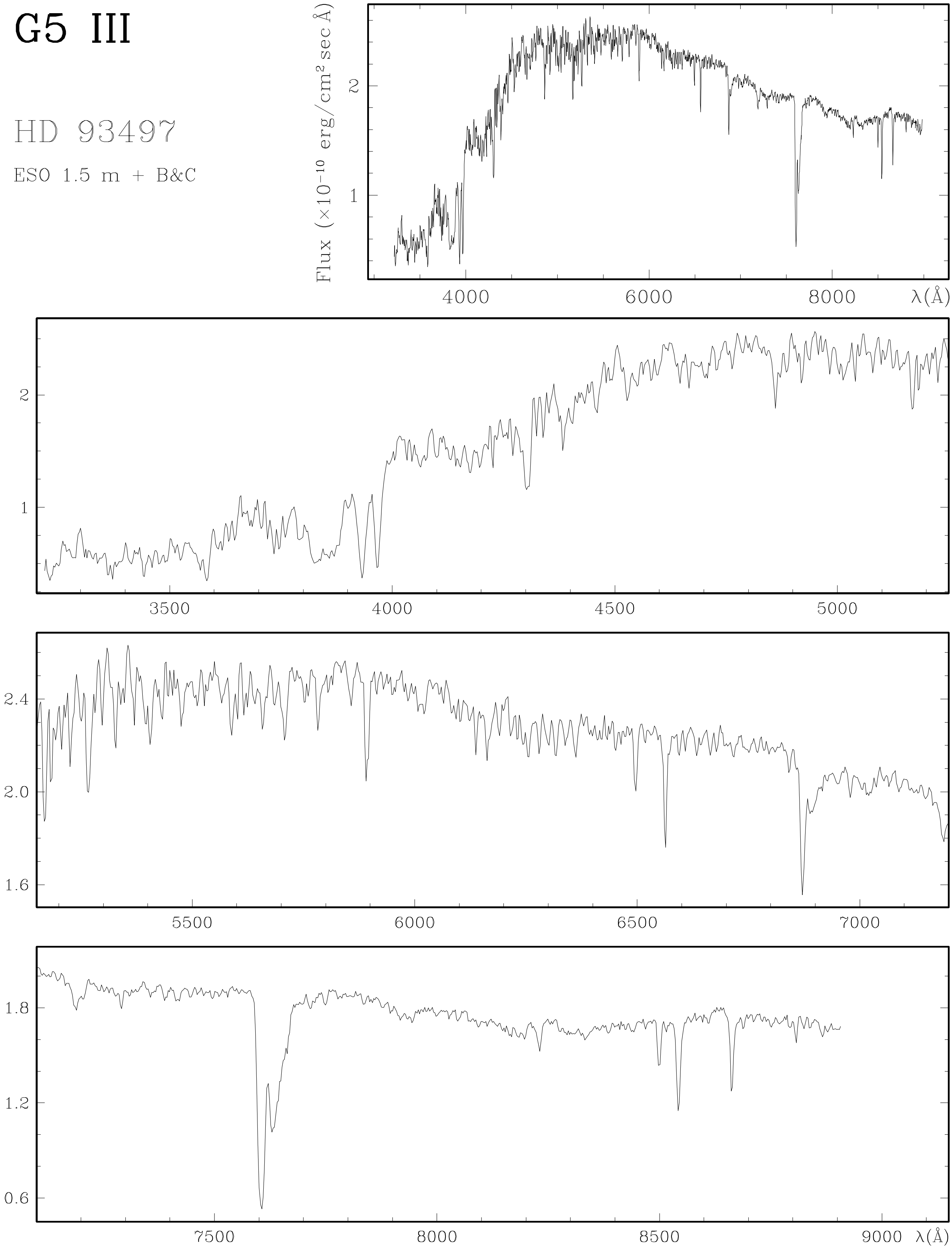


Fig. 220. ESO 1.5m + B&C spectrum of HD 93497

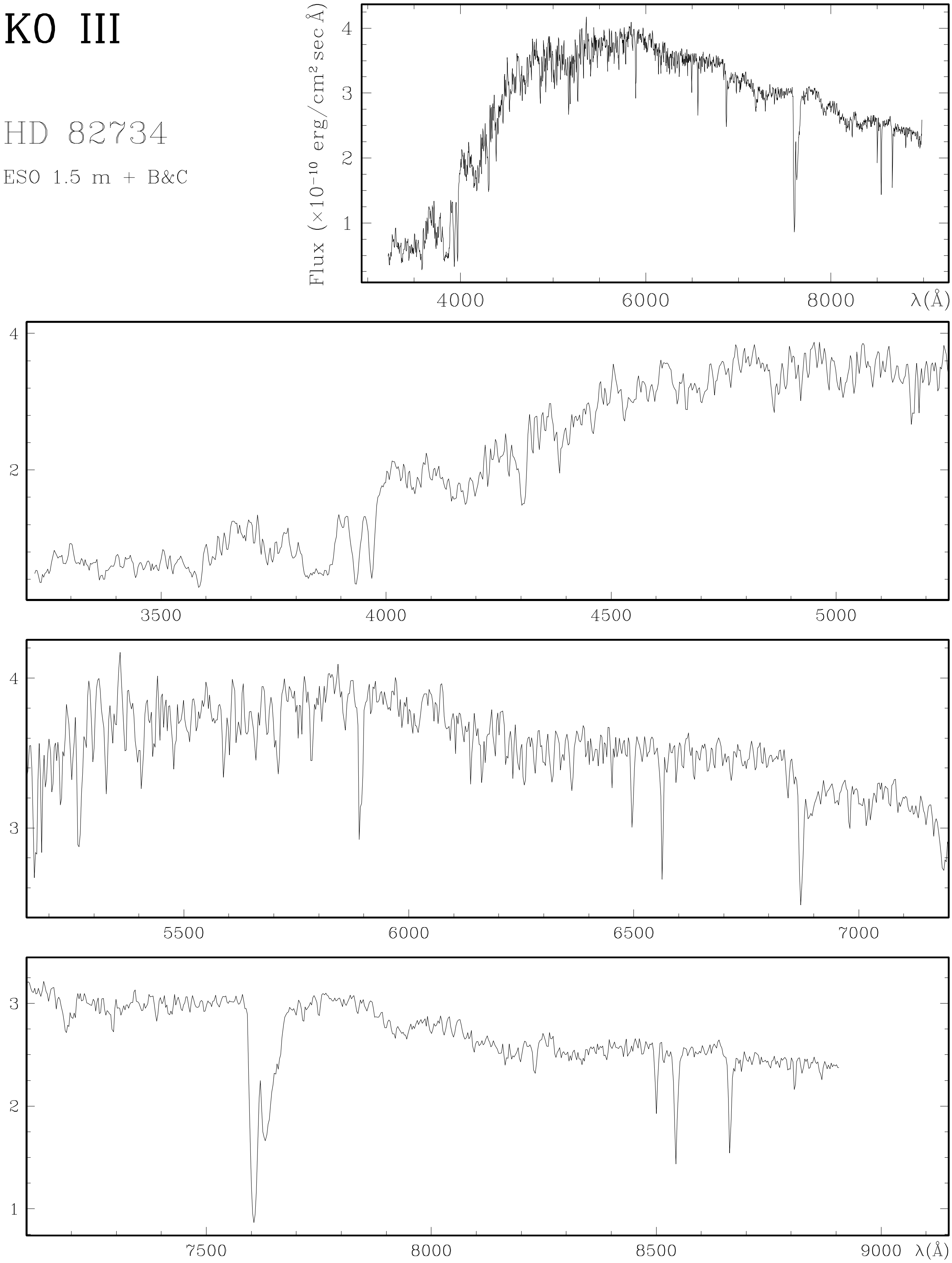


Fig. 221. ESO 1.5m + B&C spectrum of HD 82734

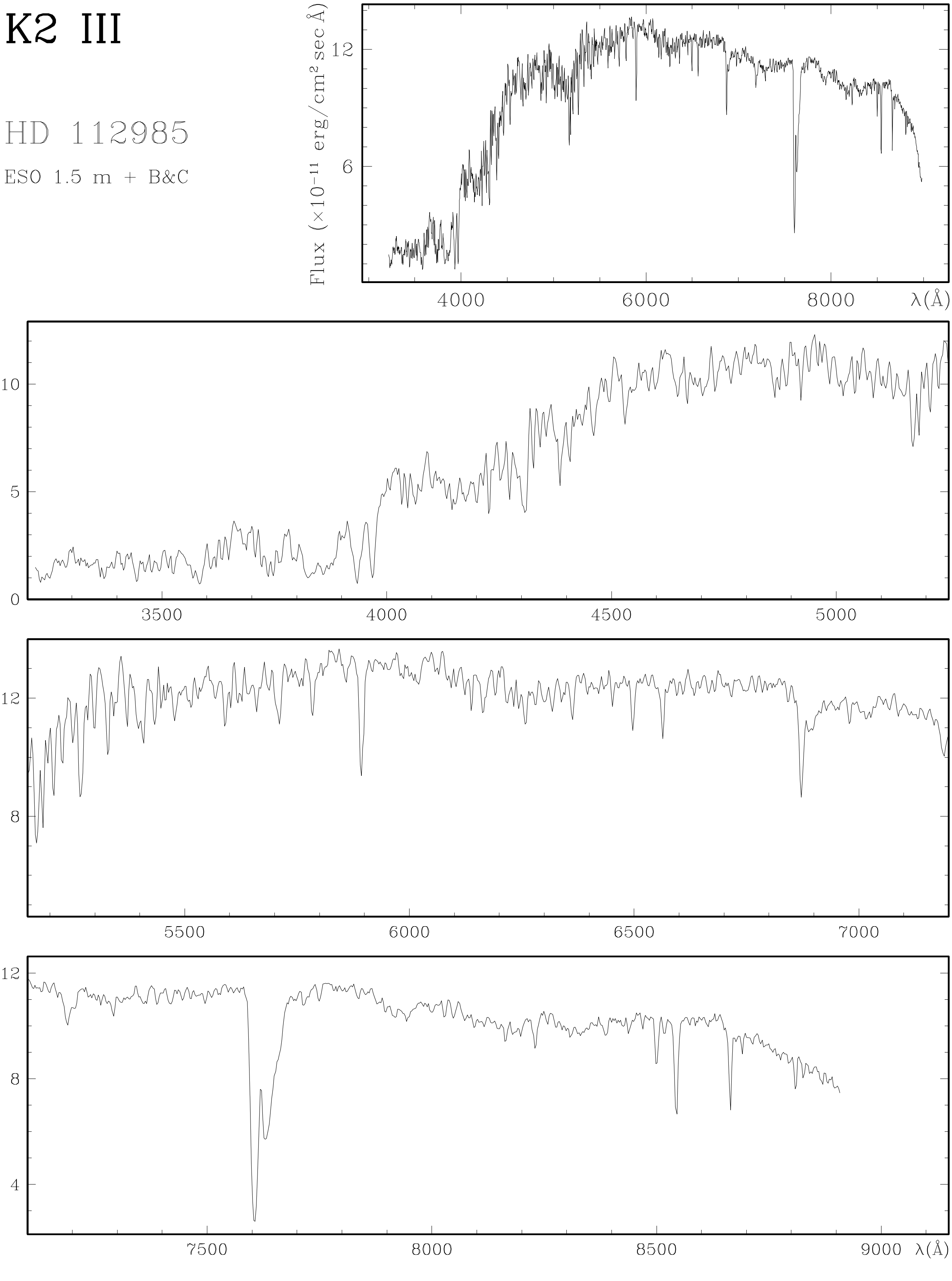


Fig. 222. ESO 1.5m + B&C spectrum of HD 112985

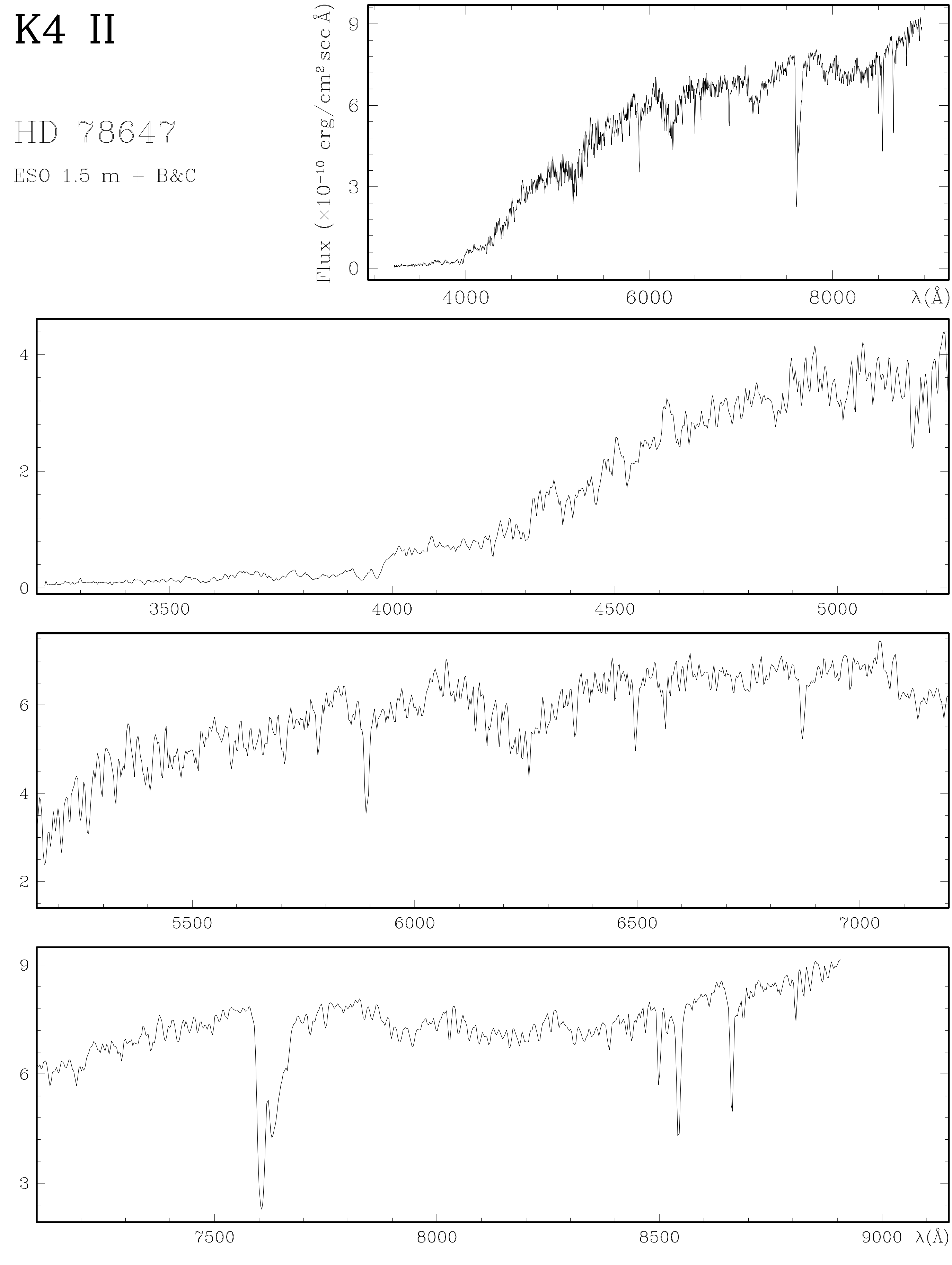


Fig. 223. ESO 1.5m + B&C spectrum of HD 78647

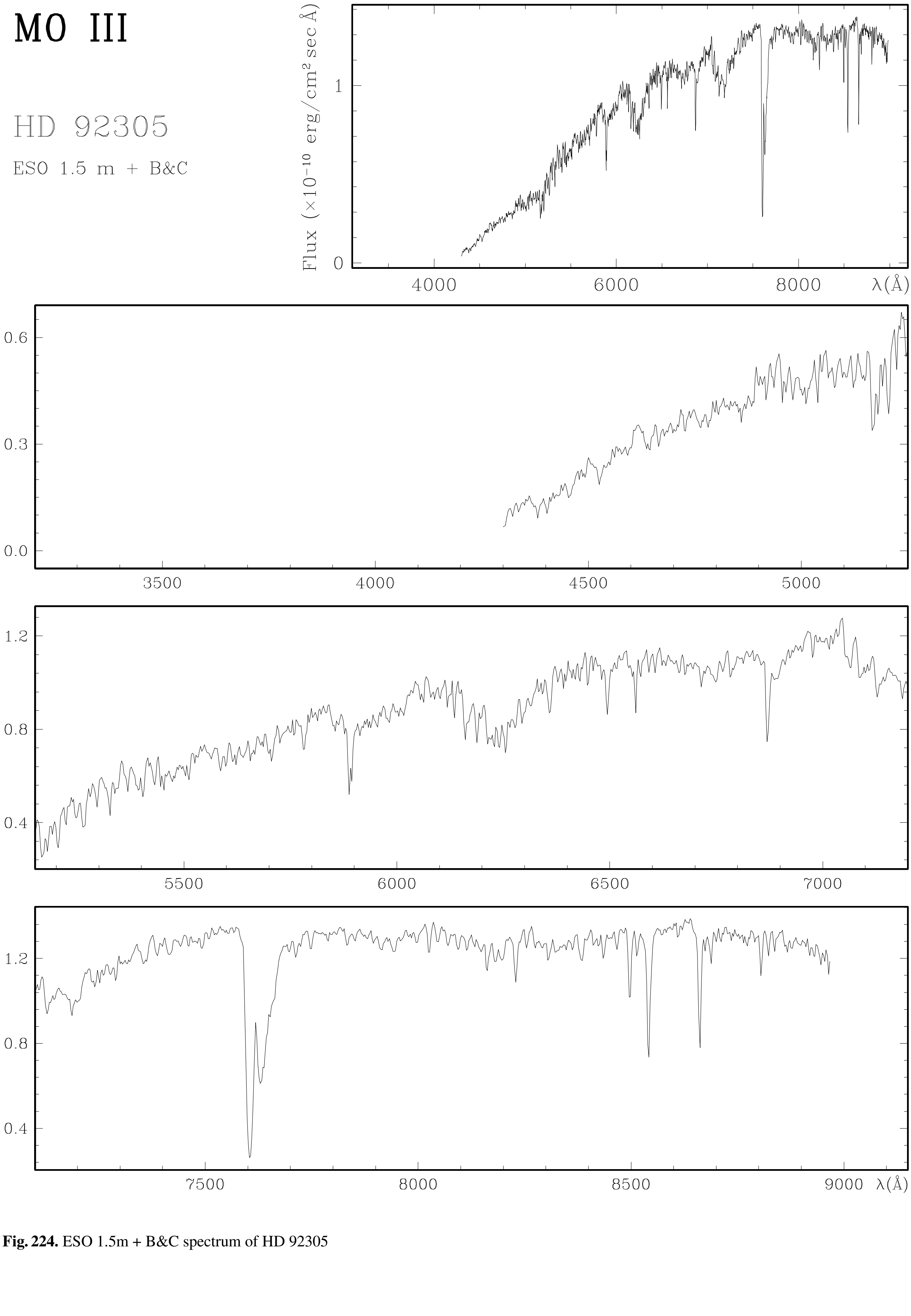


Fig. 224. ESO 1.5m + B&C spectrum of HD 92305

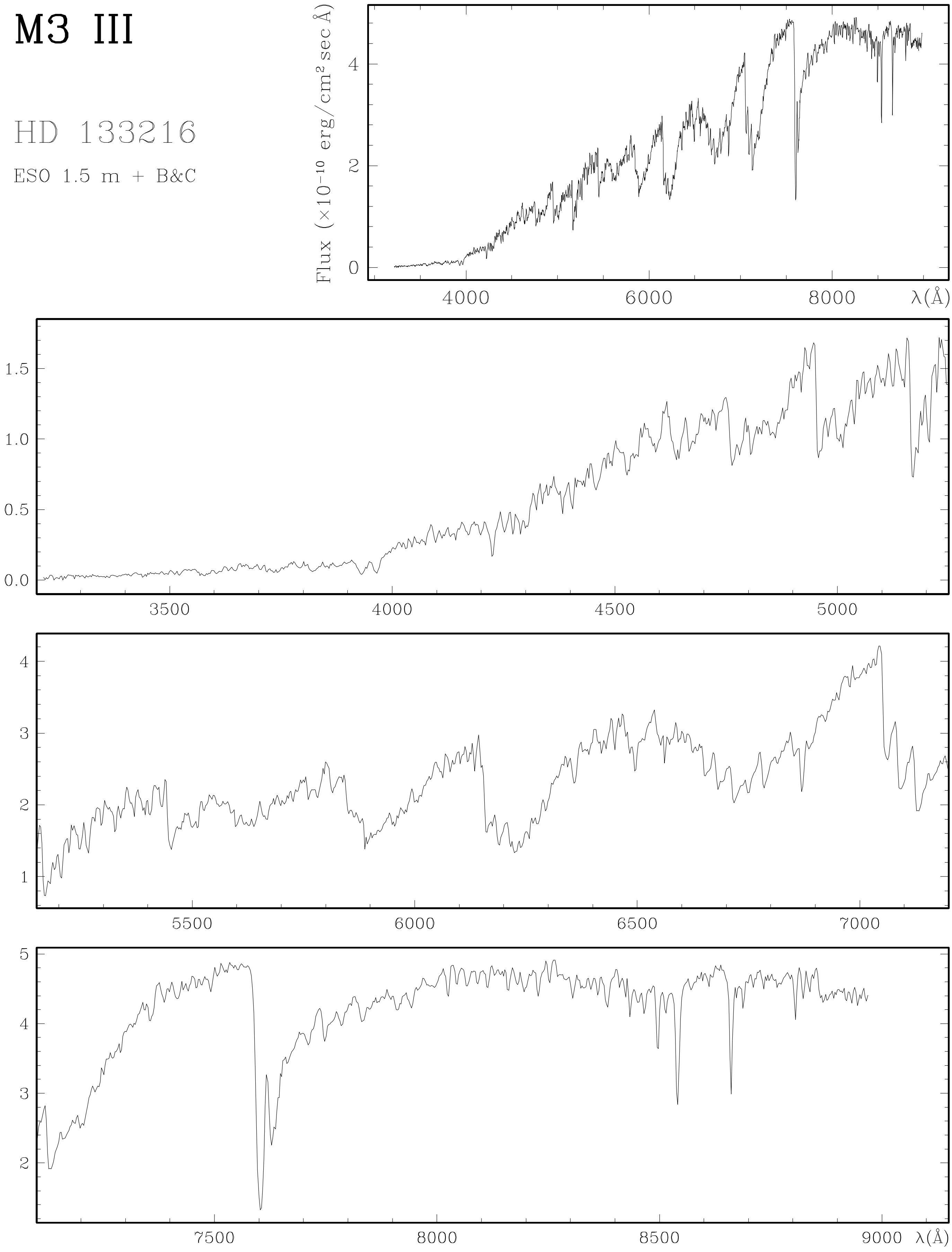


Fig. 225. ESO 1.5m + B&C spectrum of HD 133216

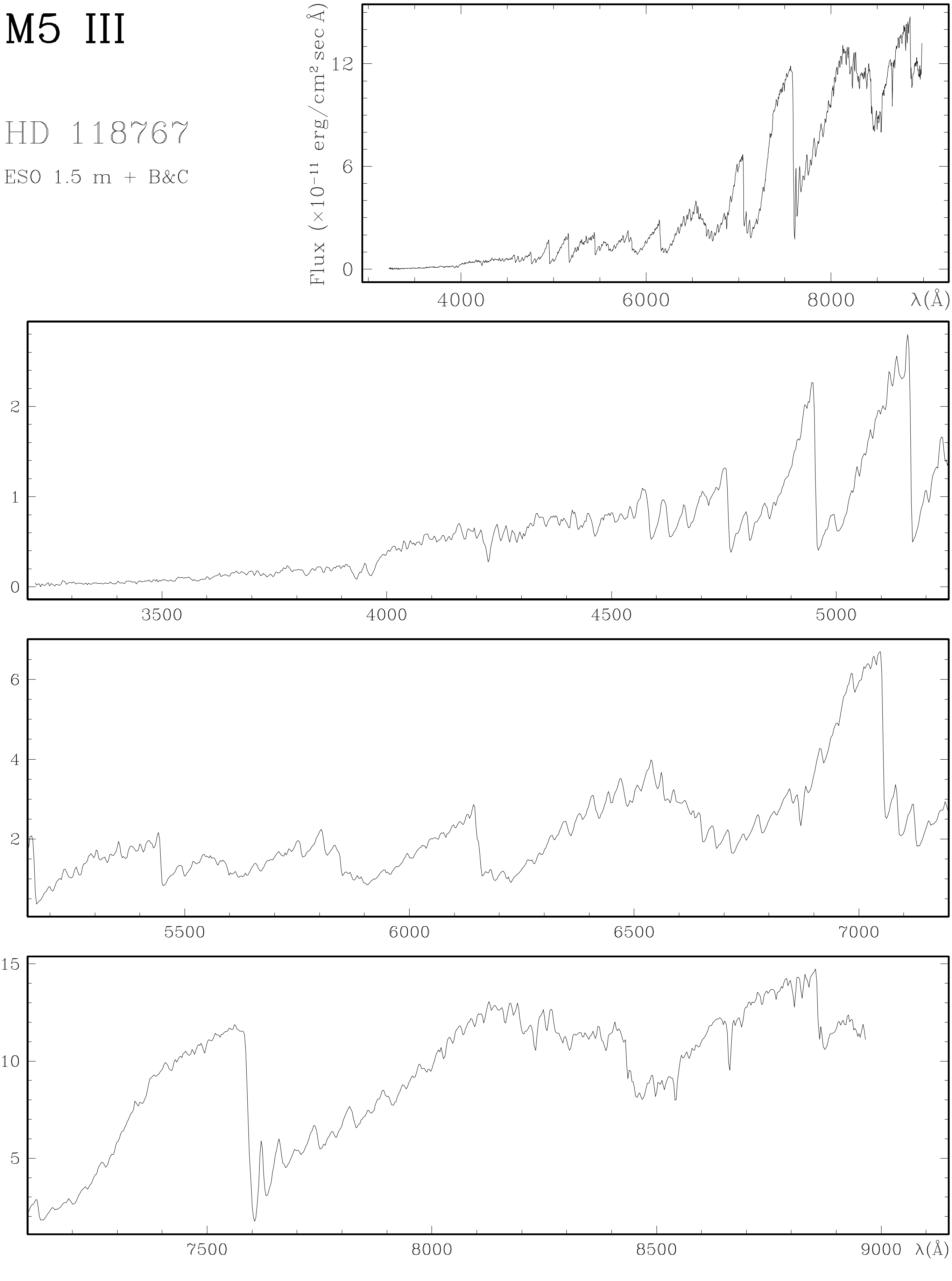


Fig. 226. ESO 1.5m + B&C spectrum of HD 118767

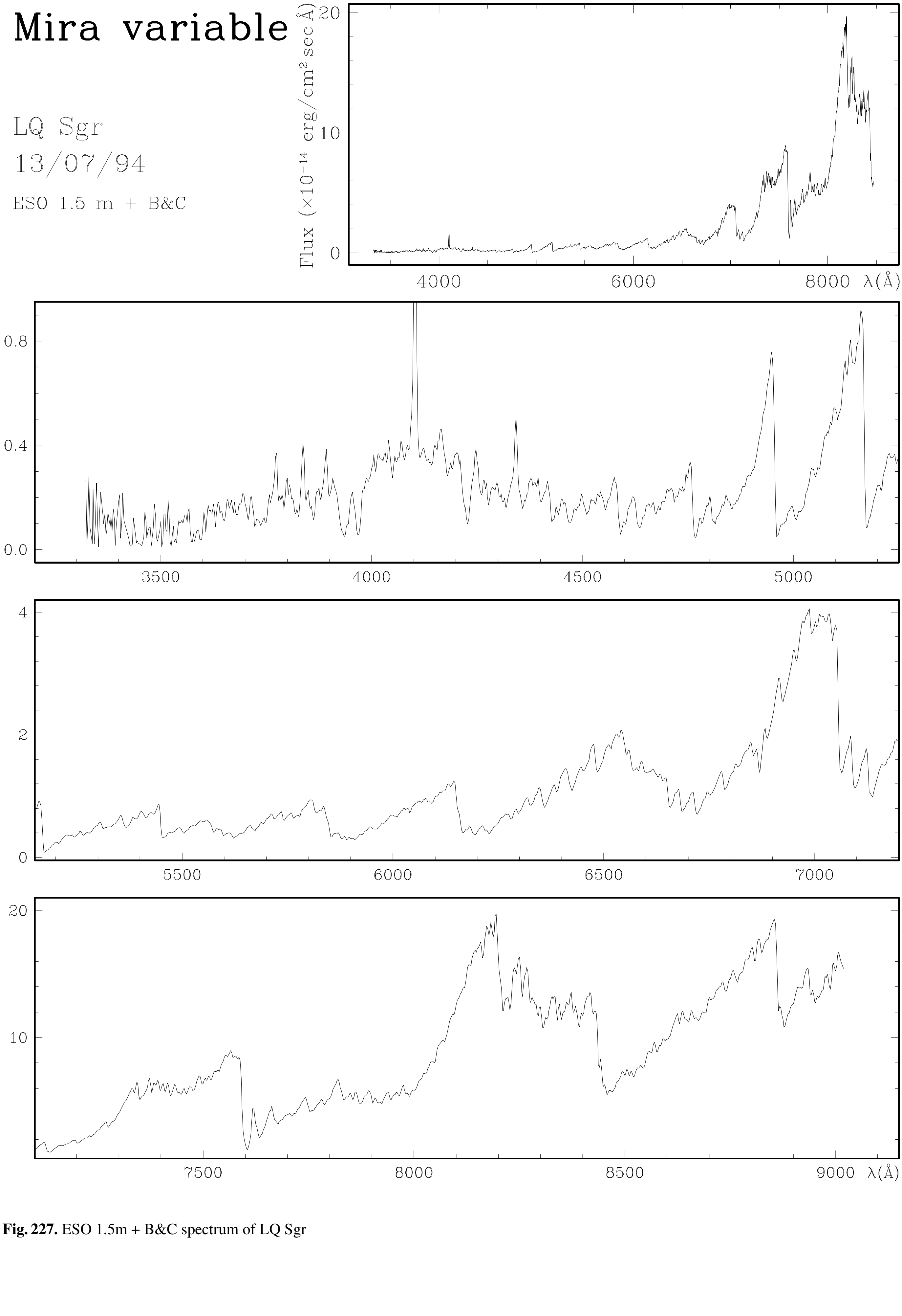


Fig. 227. ESO 1.5m + B&C spectrum of LQ Sgr

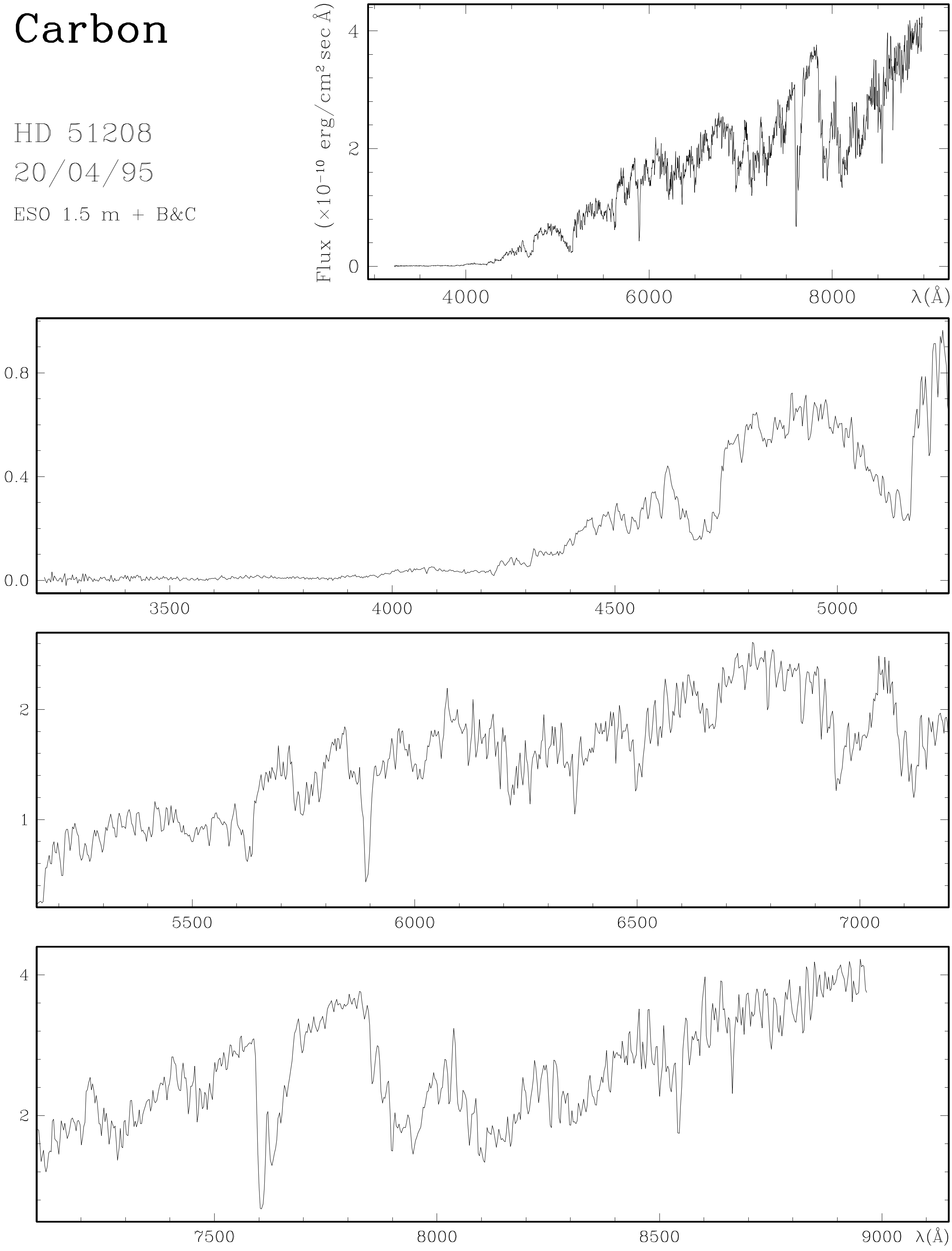


Fig. 228. ESO 1.5m + B&C spectrum of HD 51208

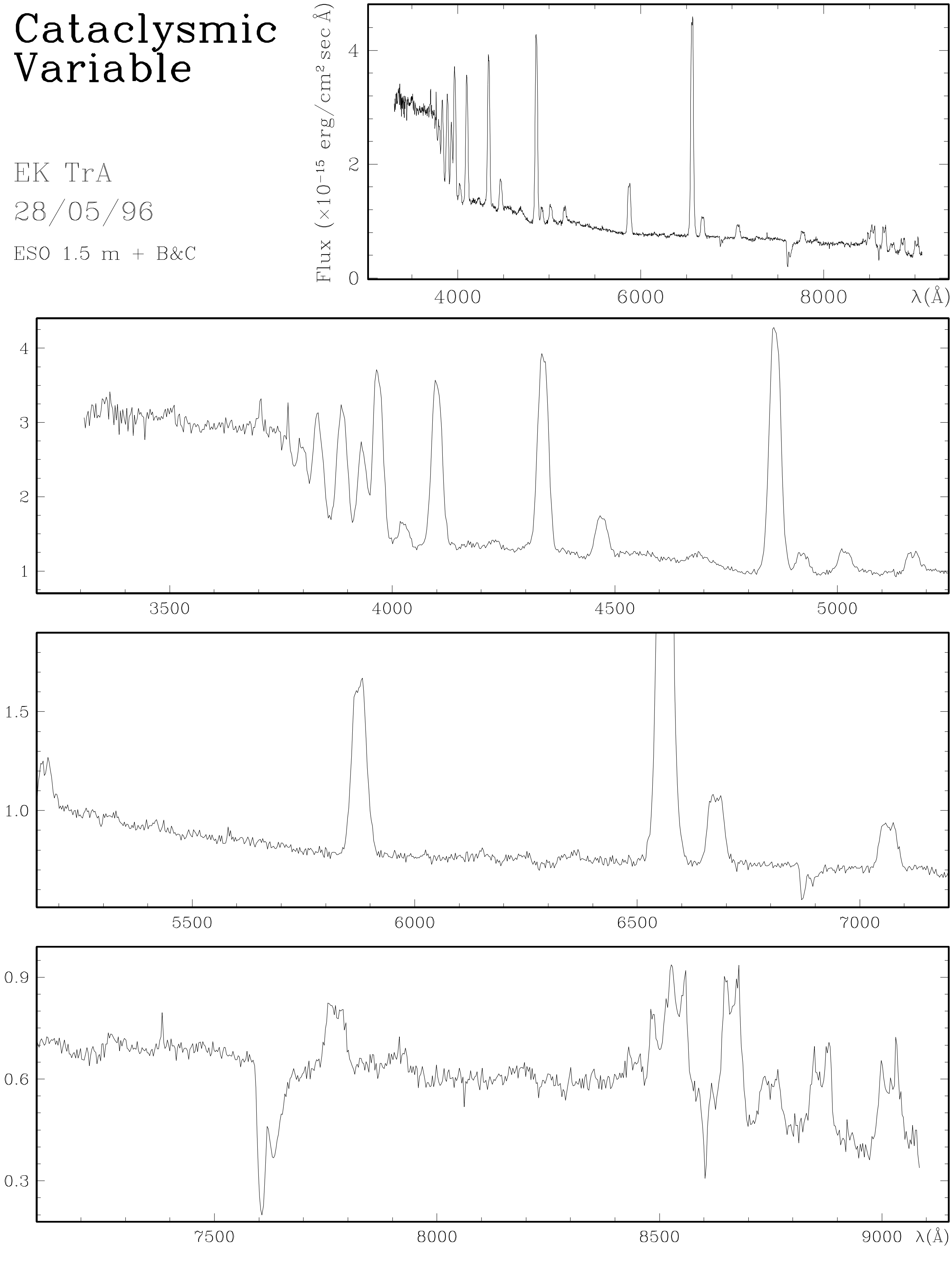


Fig. 229. ESO 1.5m + B&C spectrum of EK TrA

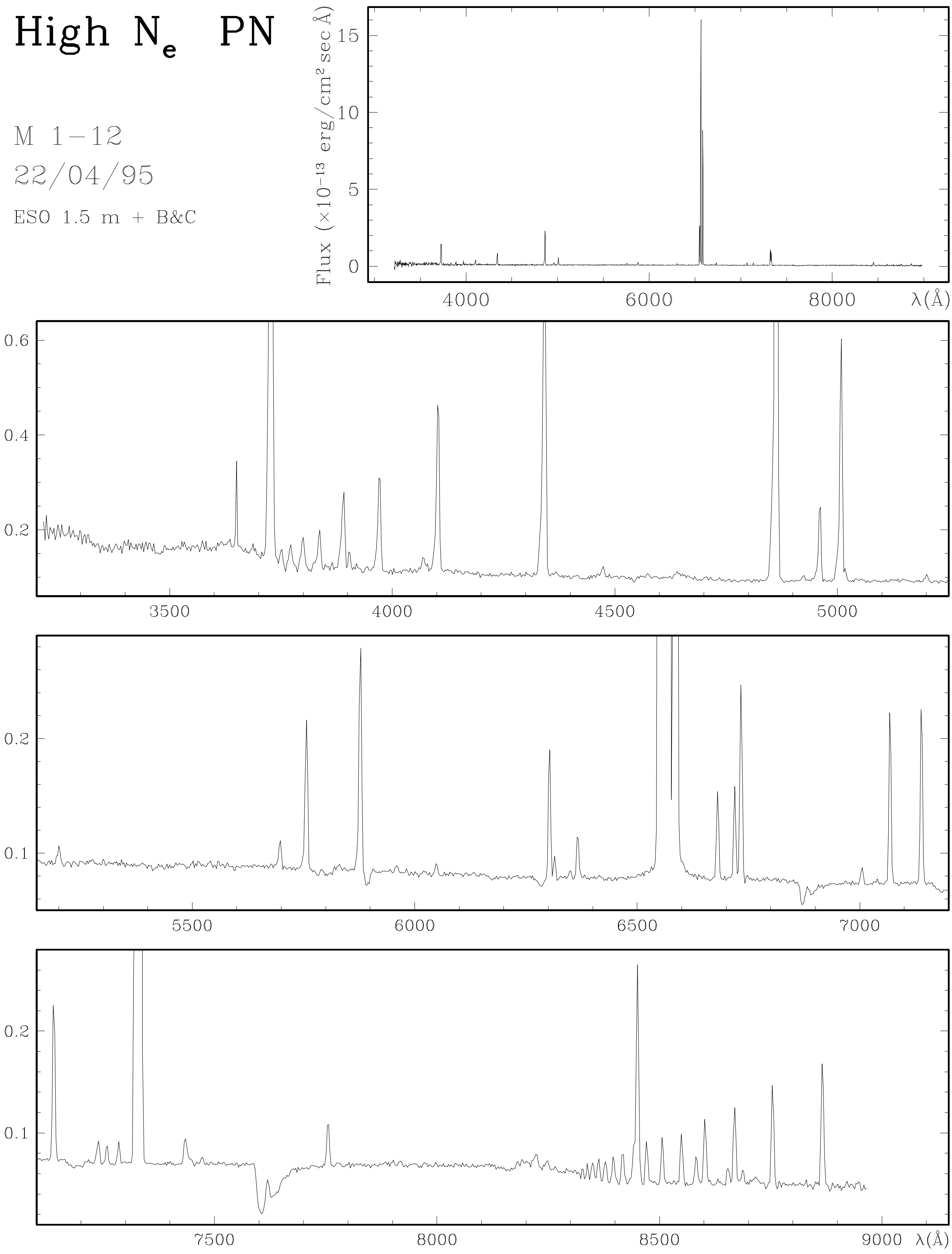


Fig. 230. ESO 1.5m + B&C spectrum of M 1-12

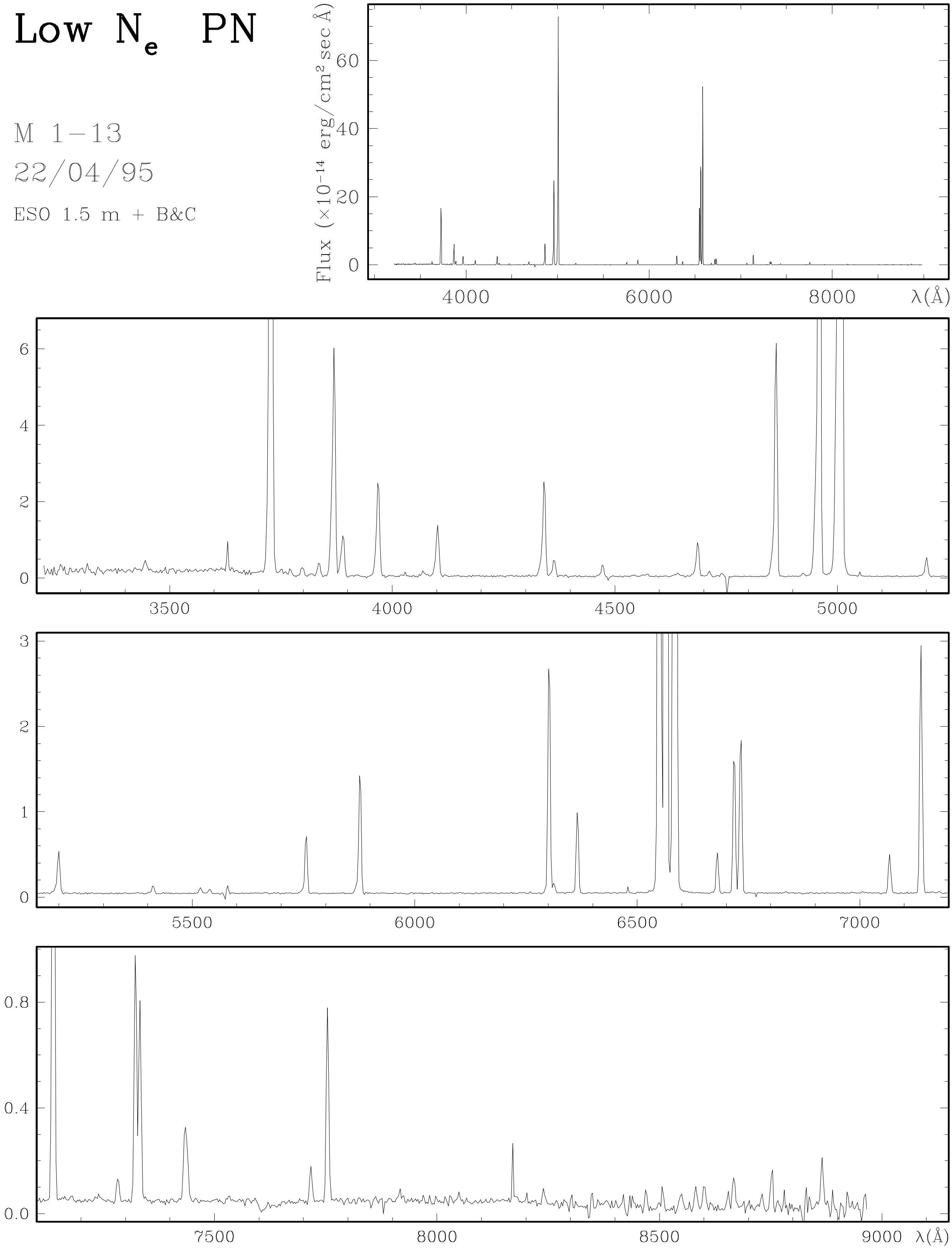


Fig. 231. ESO 1.5m + B&C spectrum of M 1-13

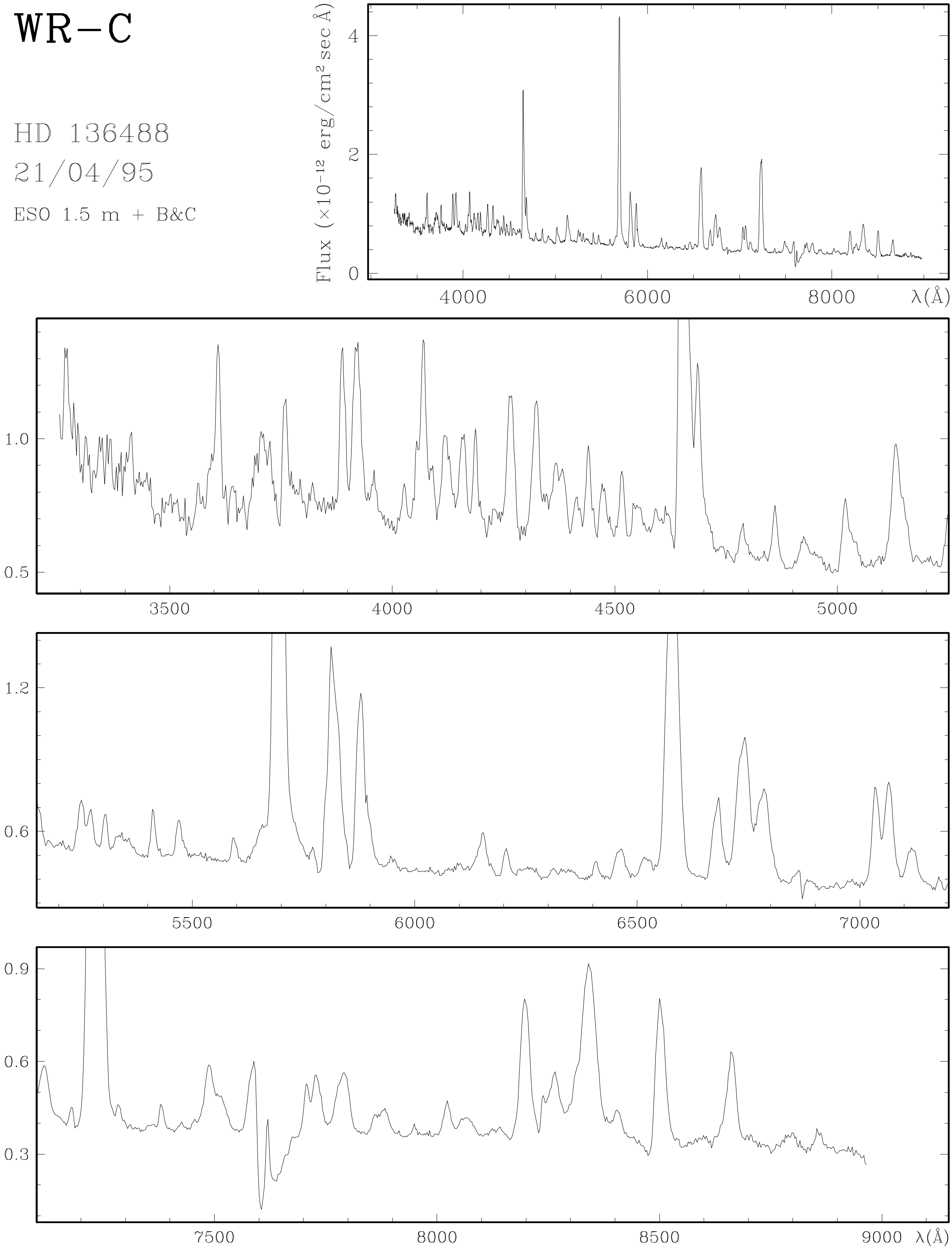
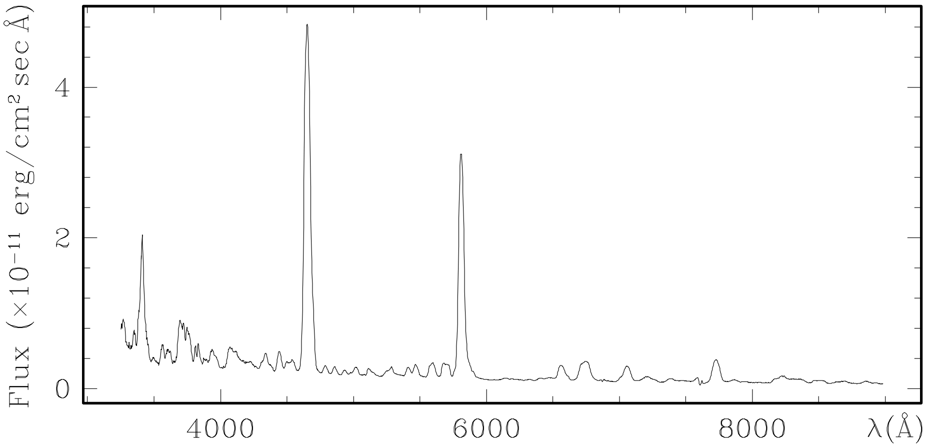


Fig. 232. ESO 1.5m + B&C spectrum of HD 136488

WR–C

HD 165763
21/04/95
ESO 1.5 m + B&C



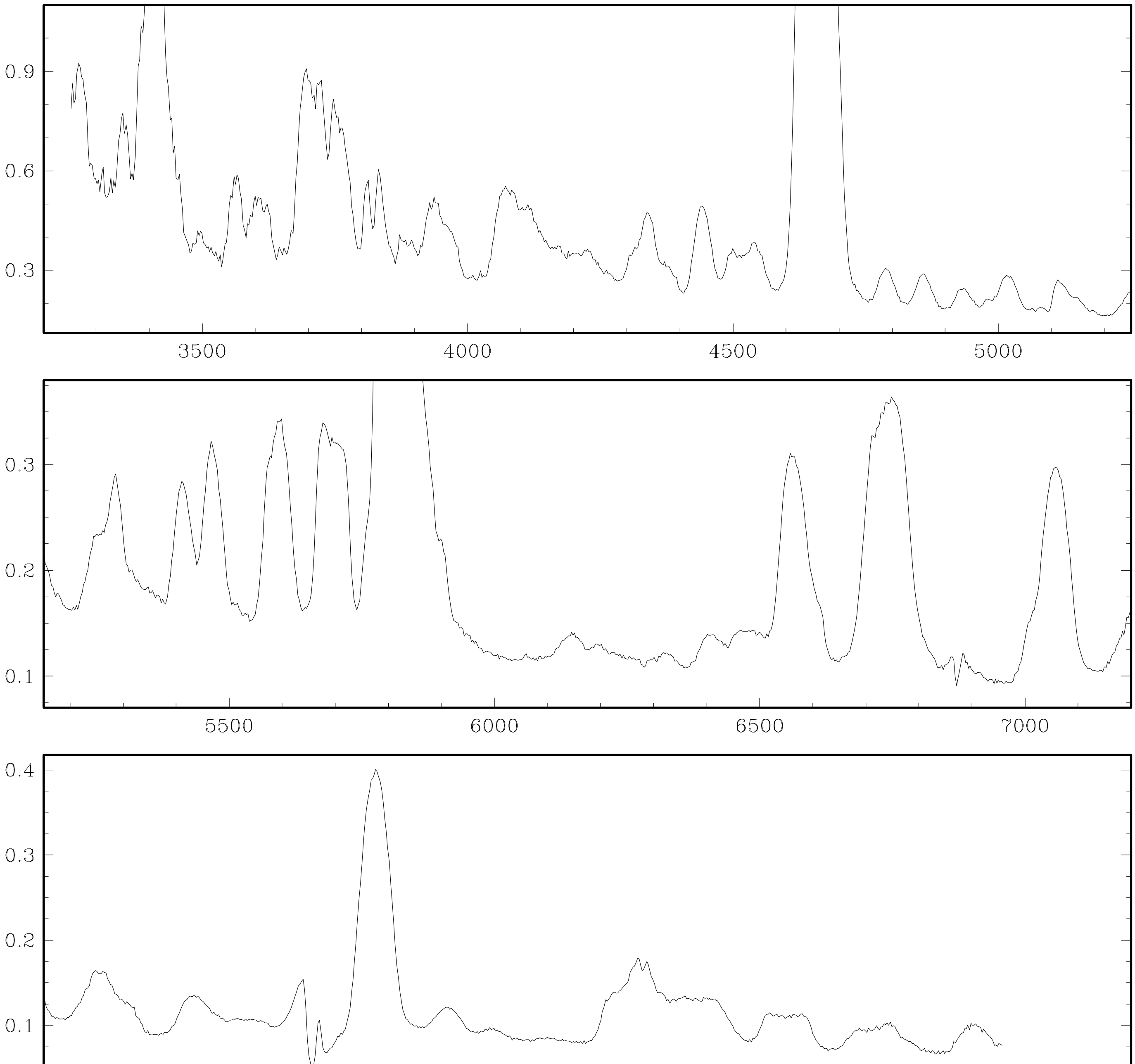


Fig. 233. ESO 1.5m + B&C spectrum of HD 165763

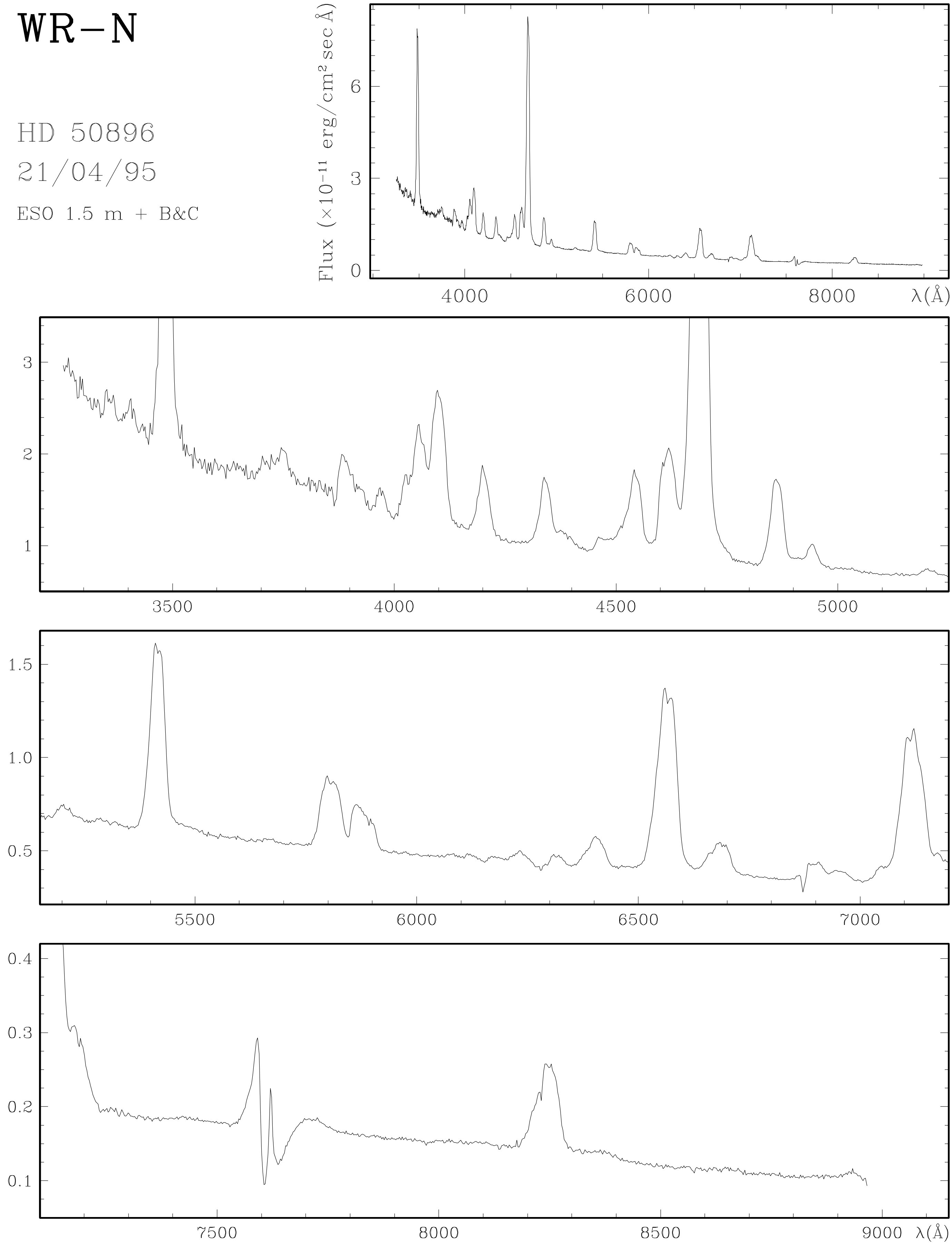


Fig. 234. ESO 1.5m + B&C spectrum of HD 50896

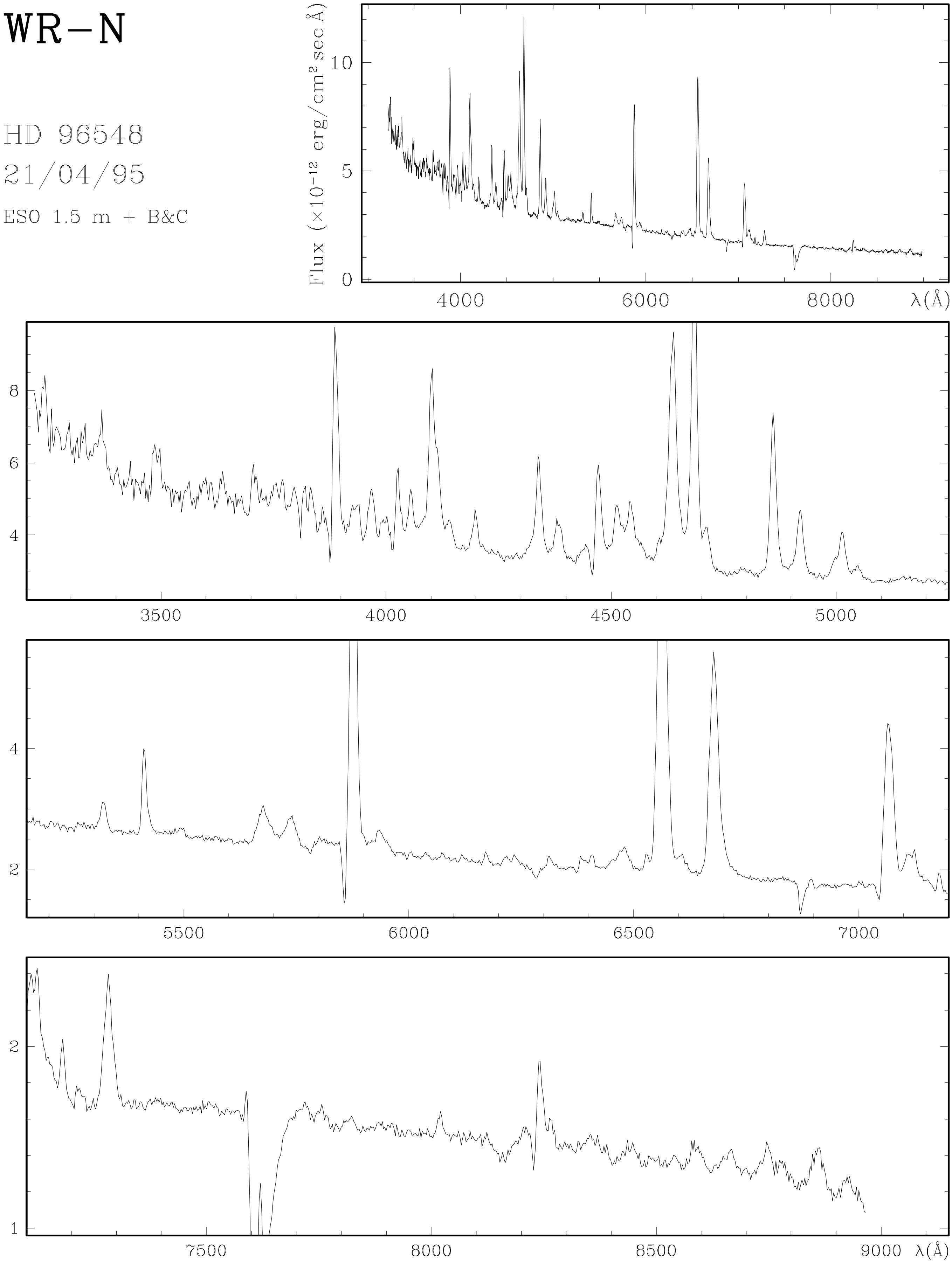


Fig. 235. ESO 1.5m + B&C spectrum of HD 96548

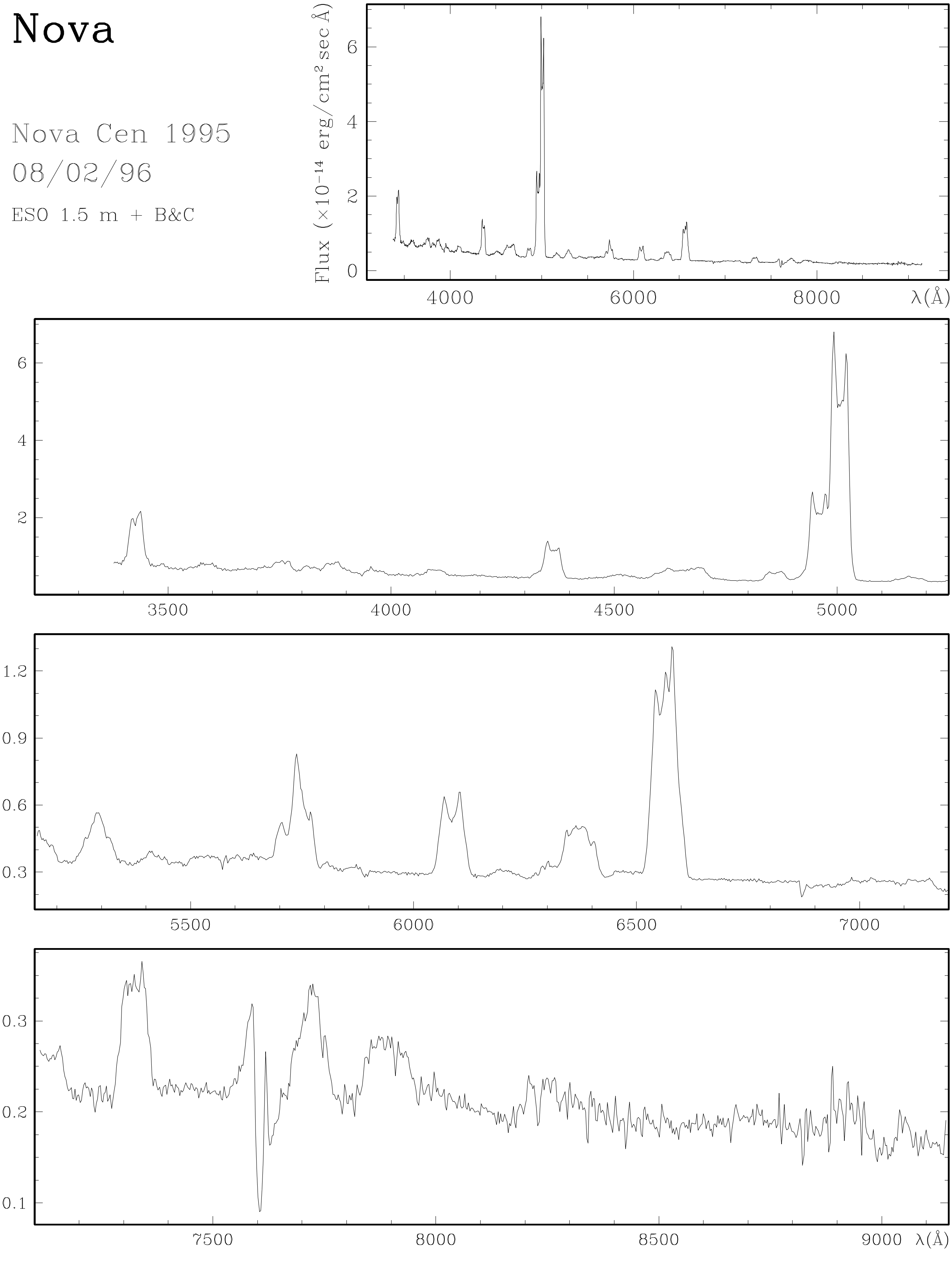
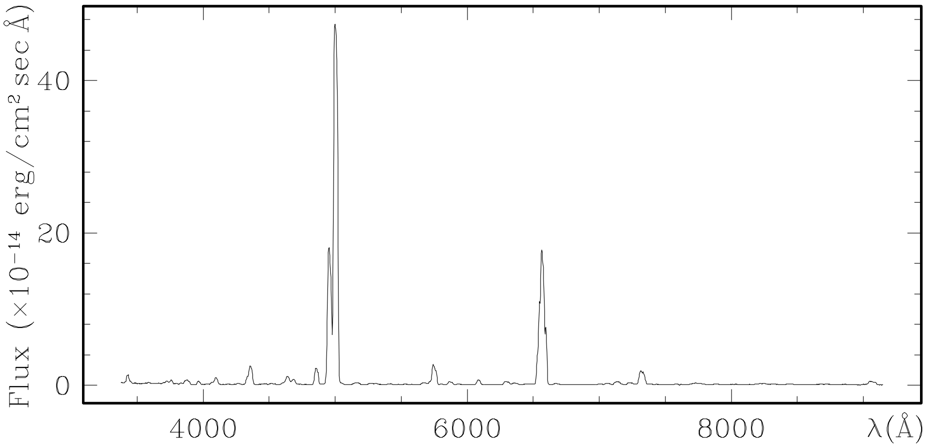


Fig. 236. ESO 1.5m + B&C spectrum of Nova Cen 1995

Nova

Nova Cir 1995
08/02/96
ESO 1.5 m + B&C



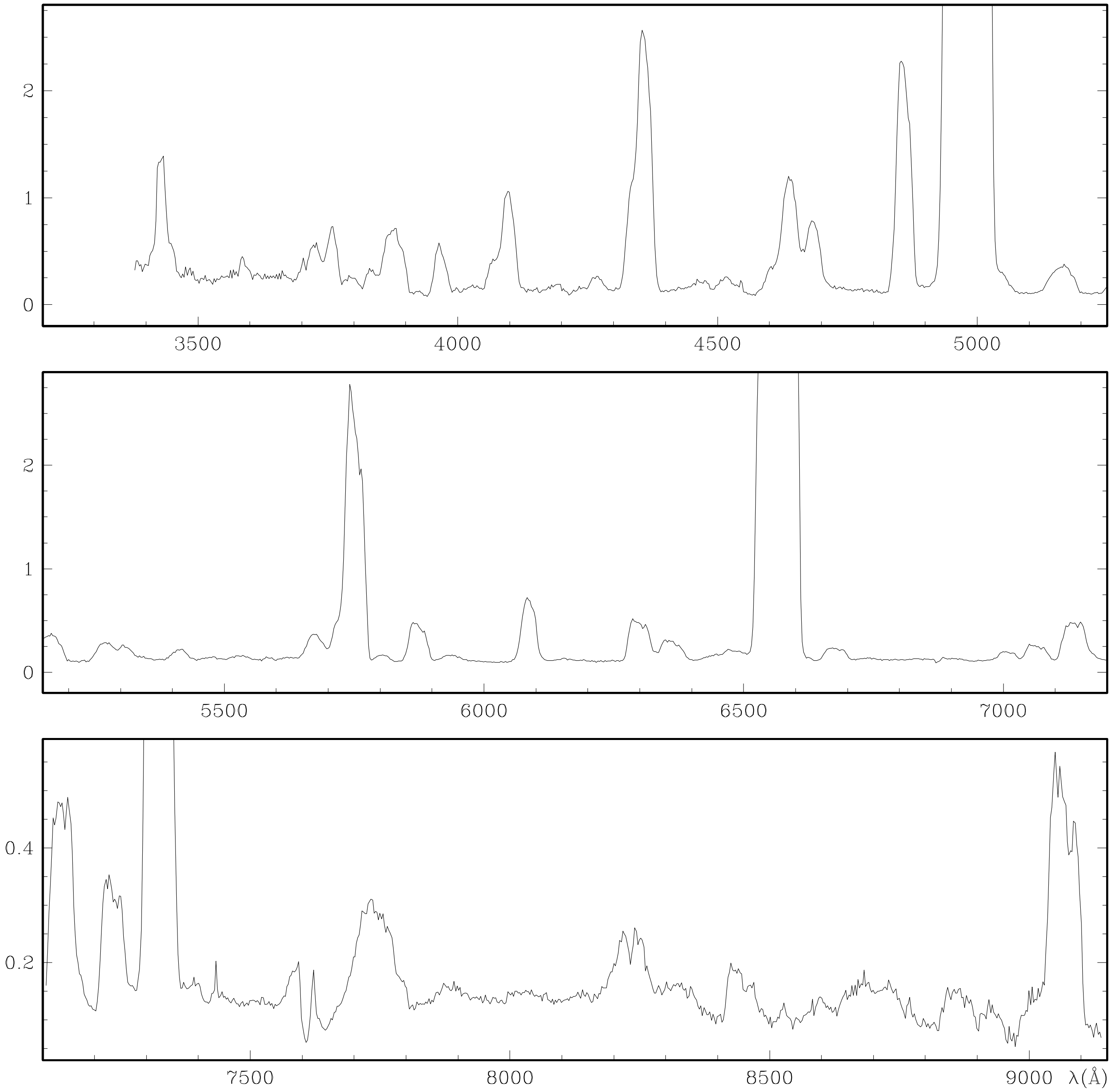
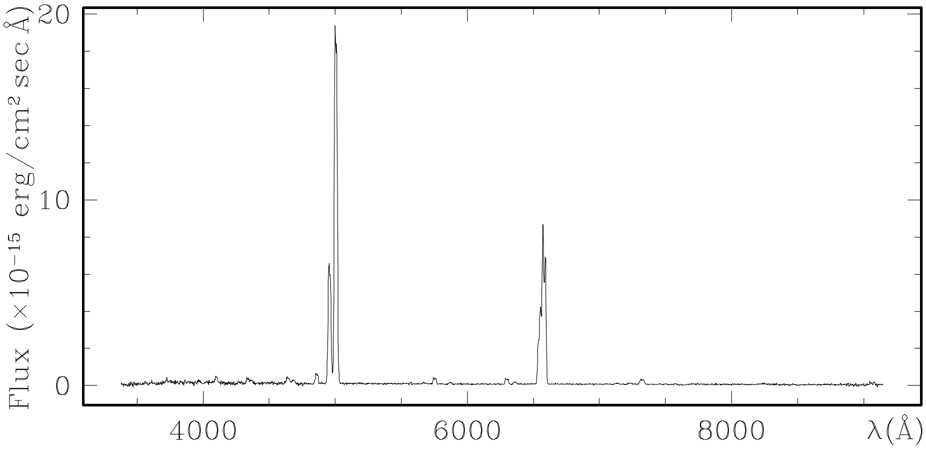


Fig. 237. ESO 1.5m + B&C spectrum of Nova Cir 1995

Nova

Nova Lup 1993
10/02/96
ESO 1.5 m + B&C



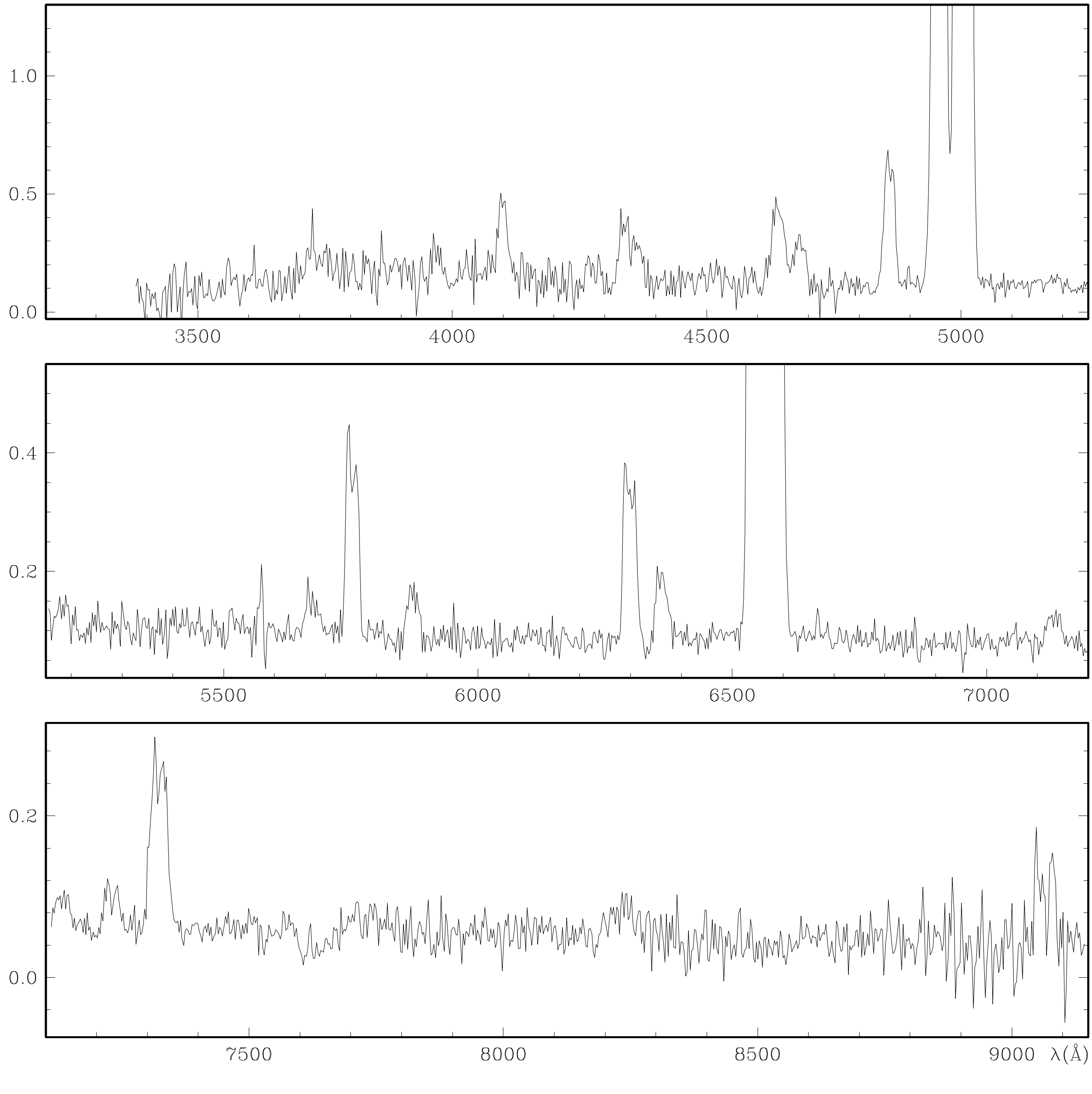


Fig. 238. ESO 1.5m + B&C spectrum of Nova Lup 1993

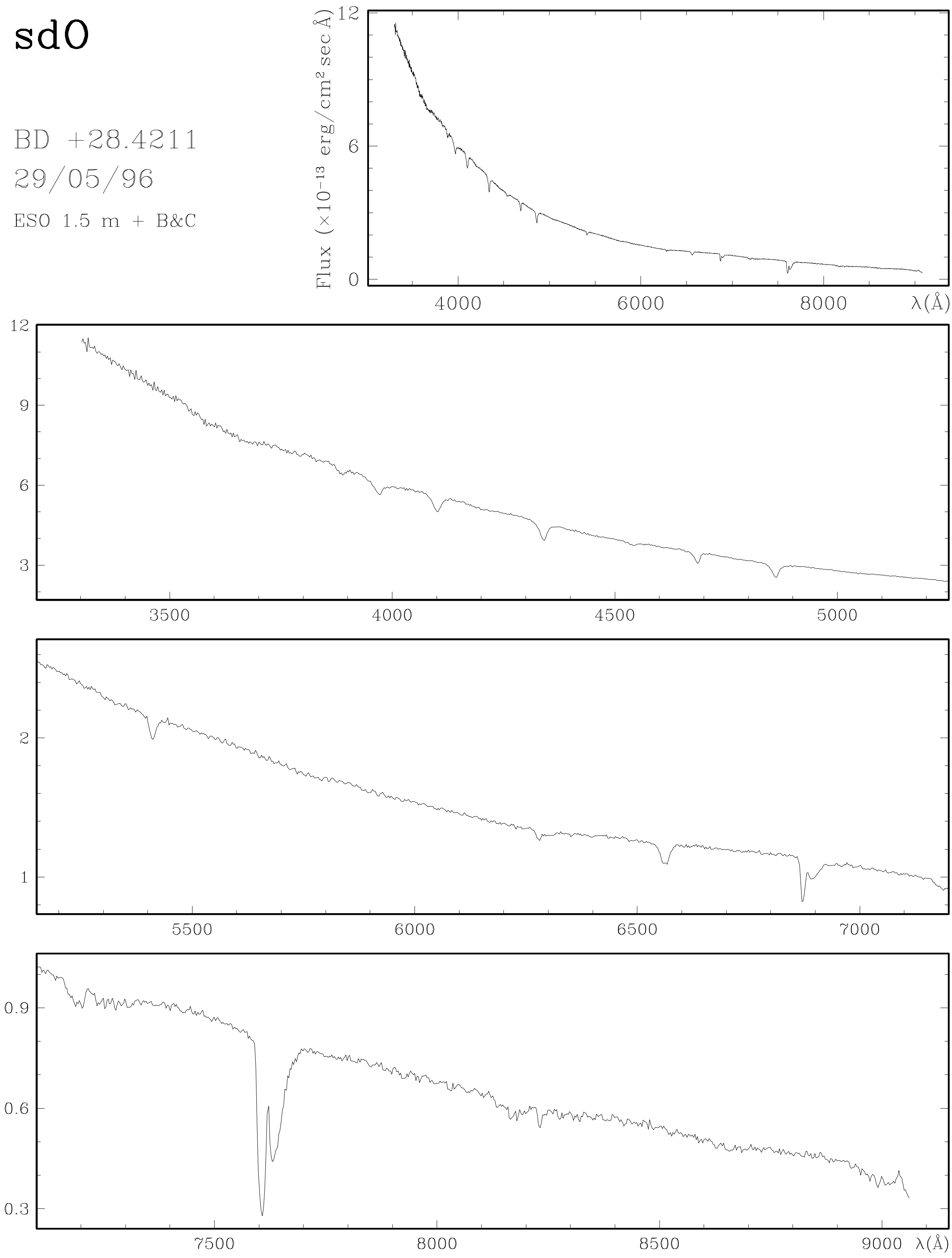


Fig. 239. ESO 1.5m + B&C spectrum of BD +28.4211

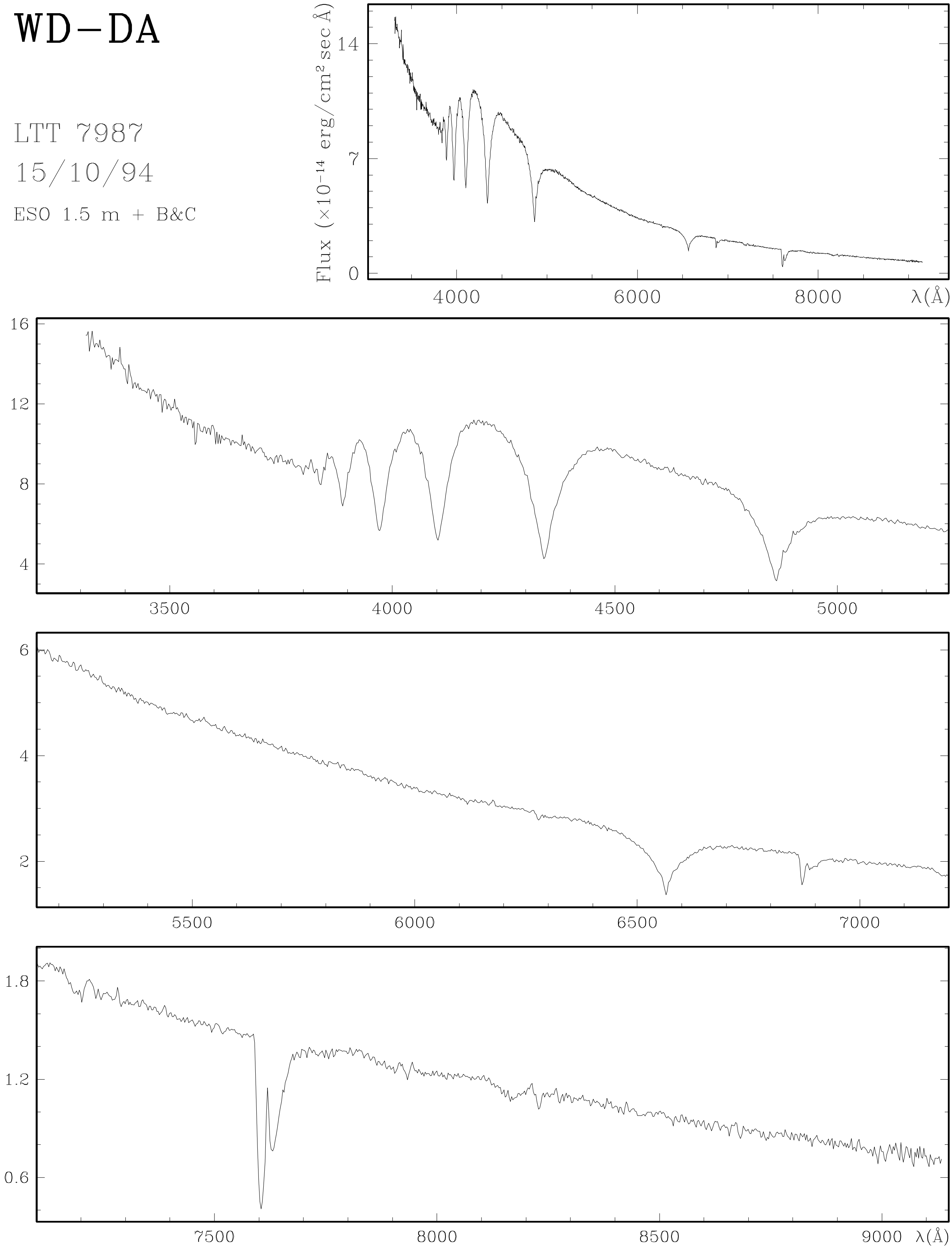


Fig. 240. ESO 1.5m + B&C spectrum of LTT 7987

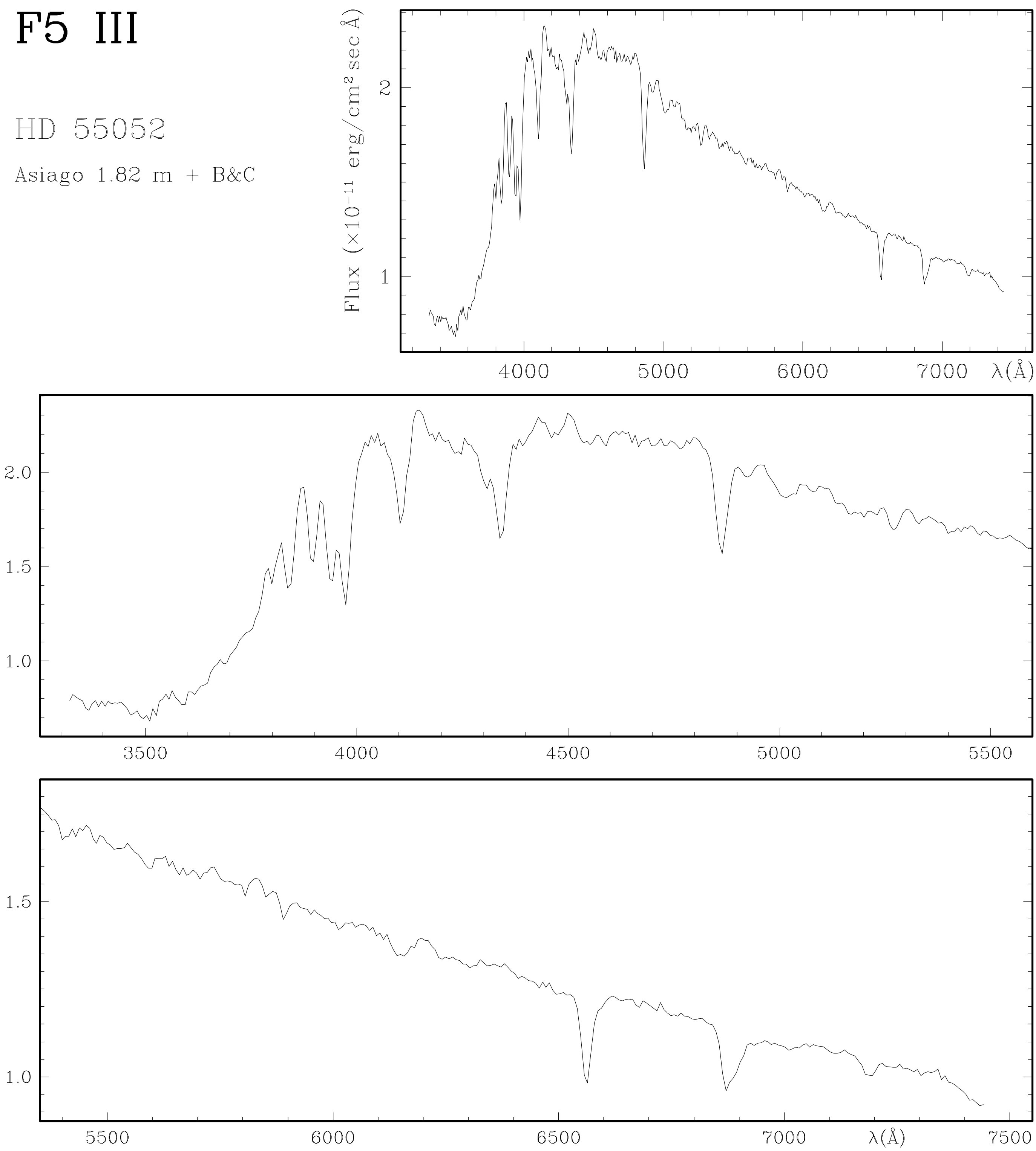


Fig. 241. Asiago 1.82m + B&C spectrum of HD 55052

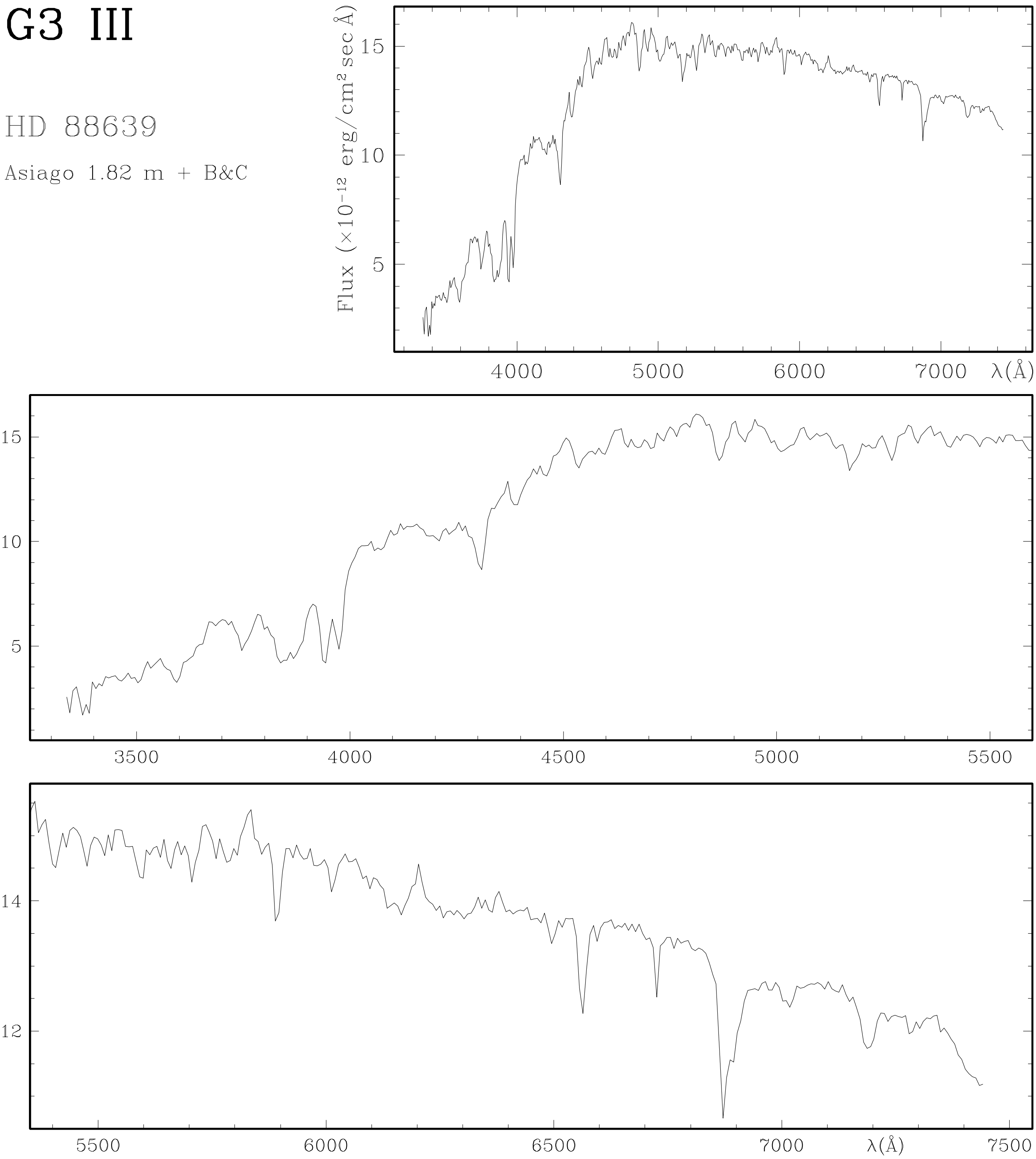


Fig. 242. Asiago 1.82m + B&C spectrum of HD 88639

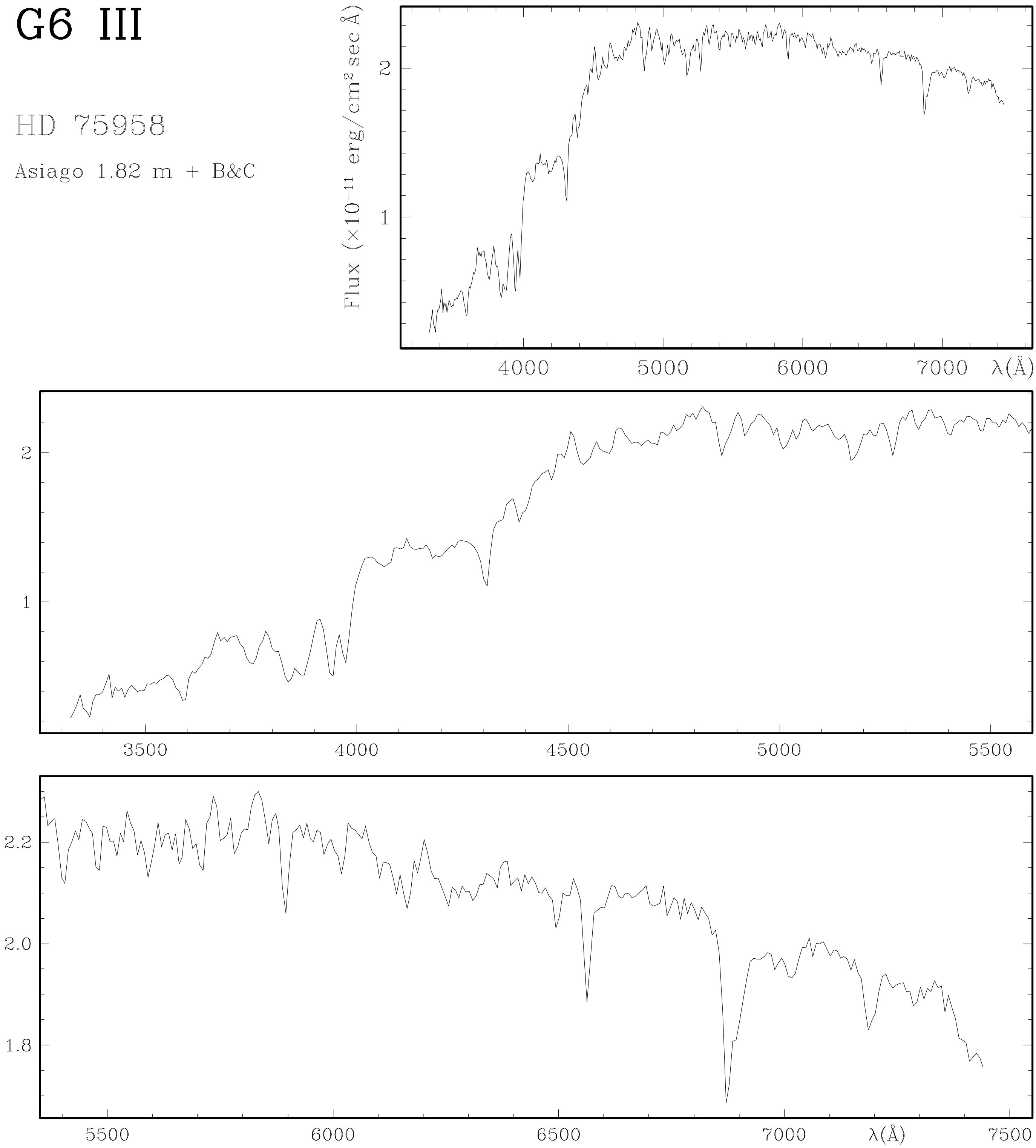


Fig. 243. Asiago 1.82m + B&C spectrum of HD 75958

K1 III

HD 91810

Asiago 1.82 m + B&C

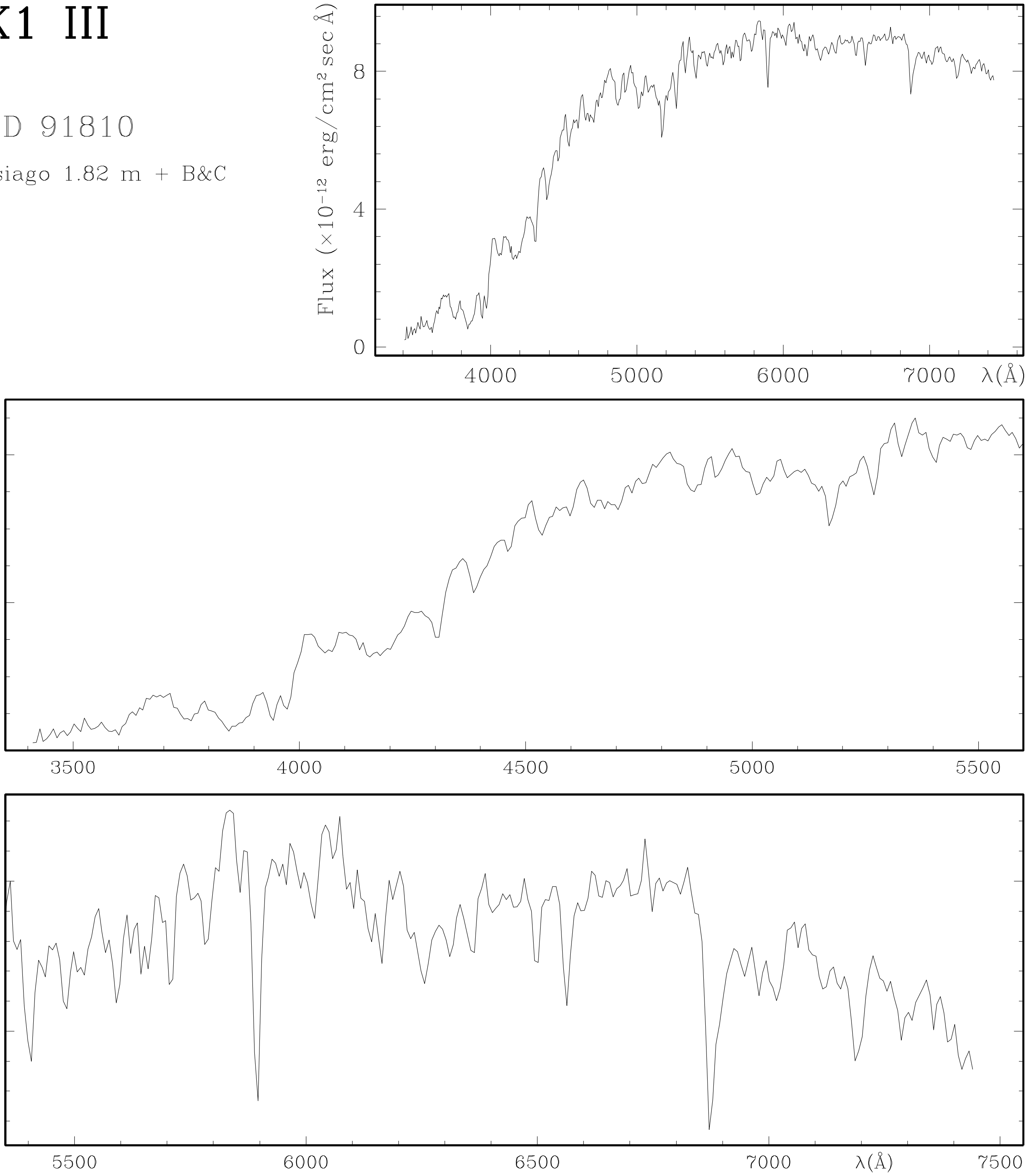


Fig. 244. Asiago 1.82m + B&C spectrum of HD 91810

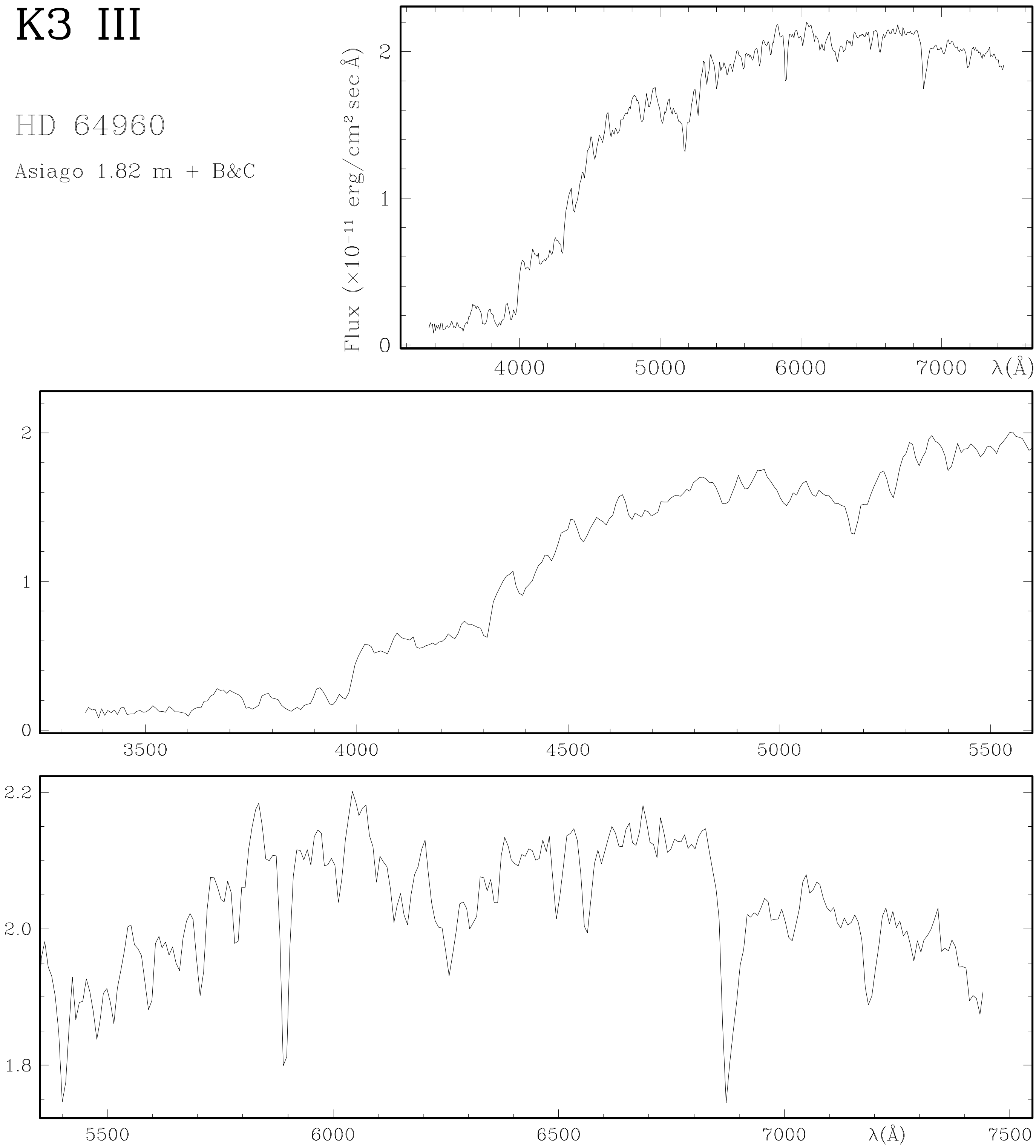


Fig. 245. Asiago 1.82m + B&C spectrum of HD 64960

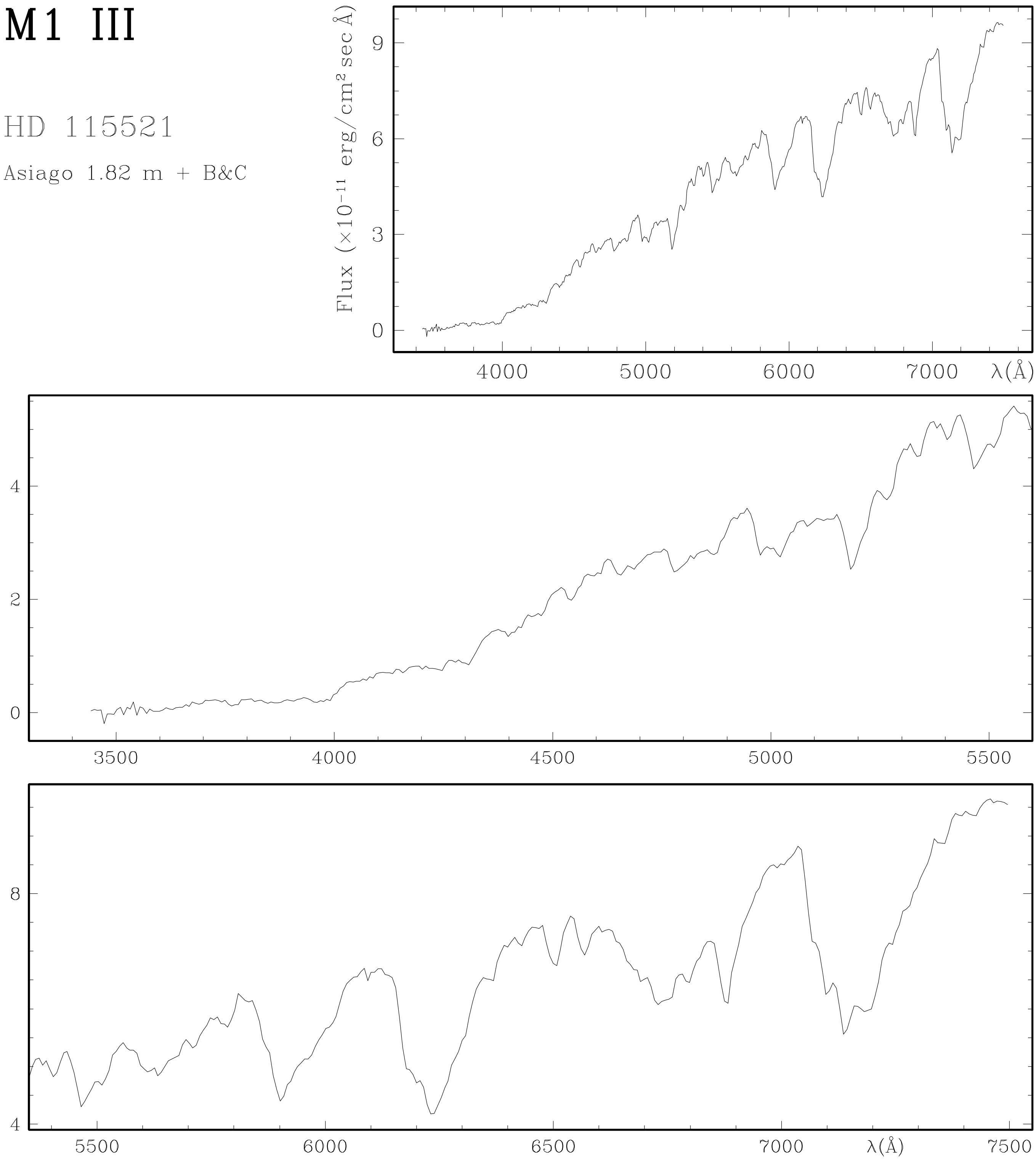


Fig. 246. Asiago 1.82m + B&C spectrum of HD 115521

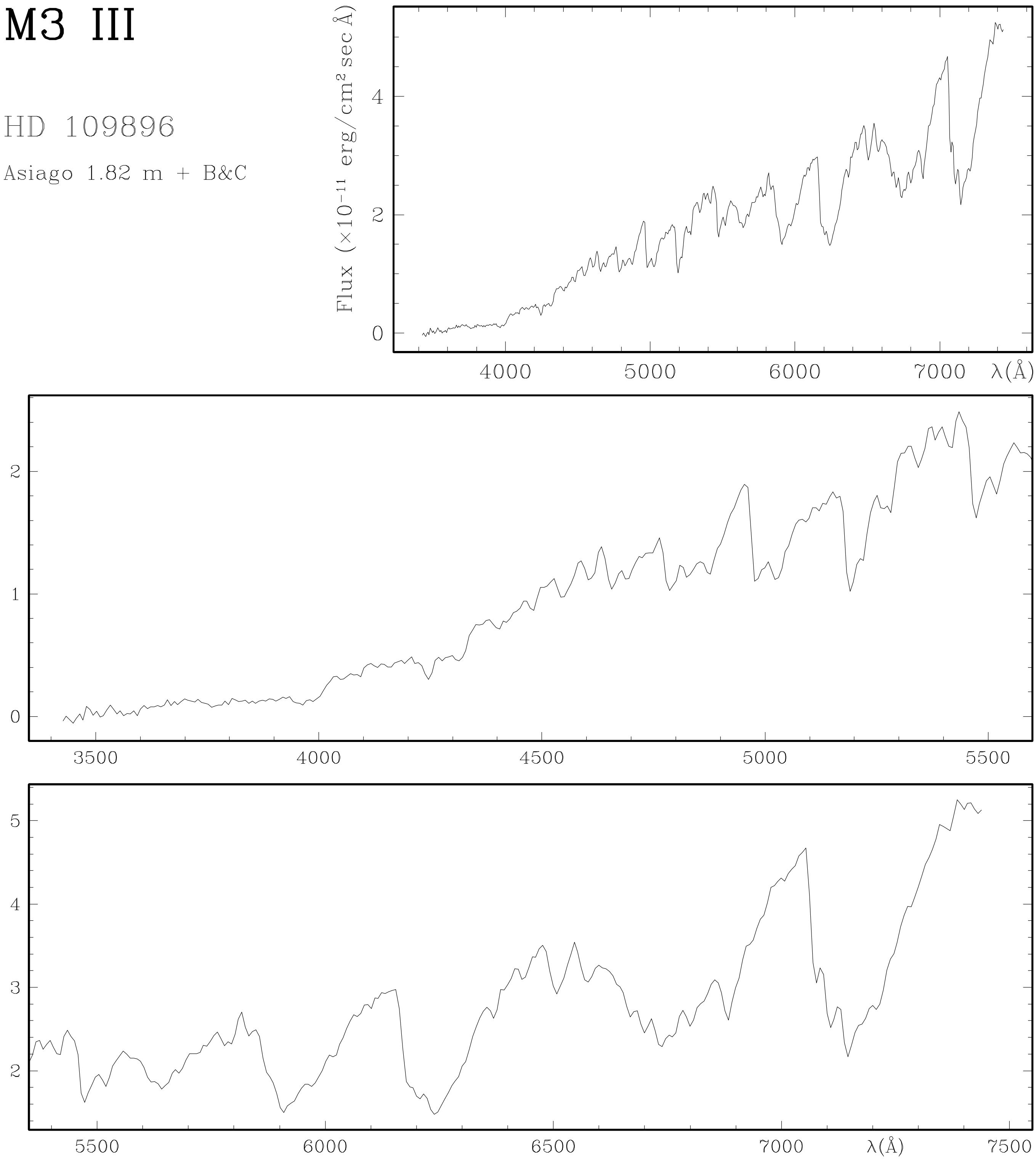


Fig. 247. Asiago 1.82m + B&C spectrum of HD 109896

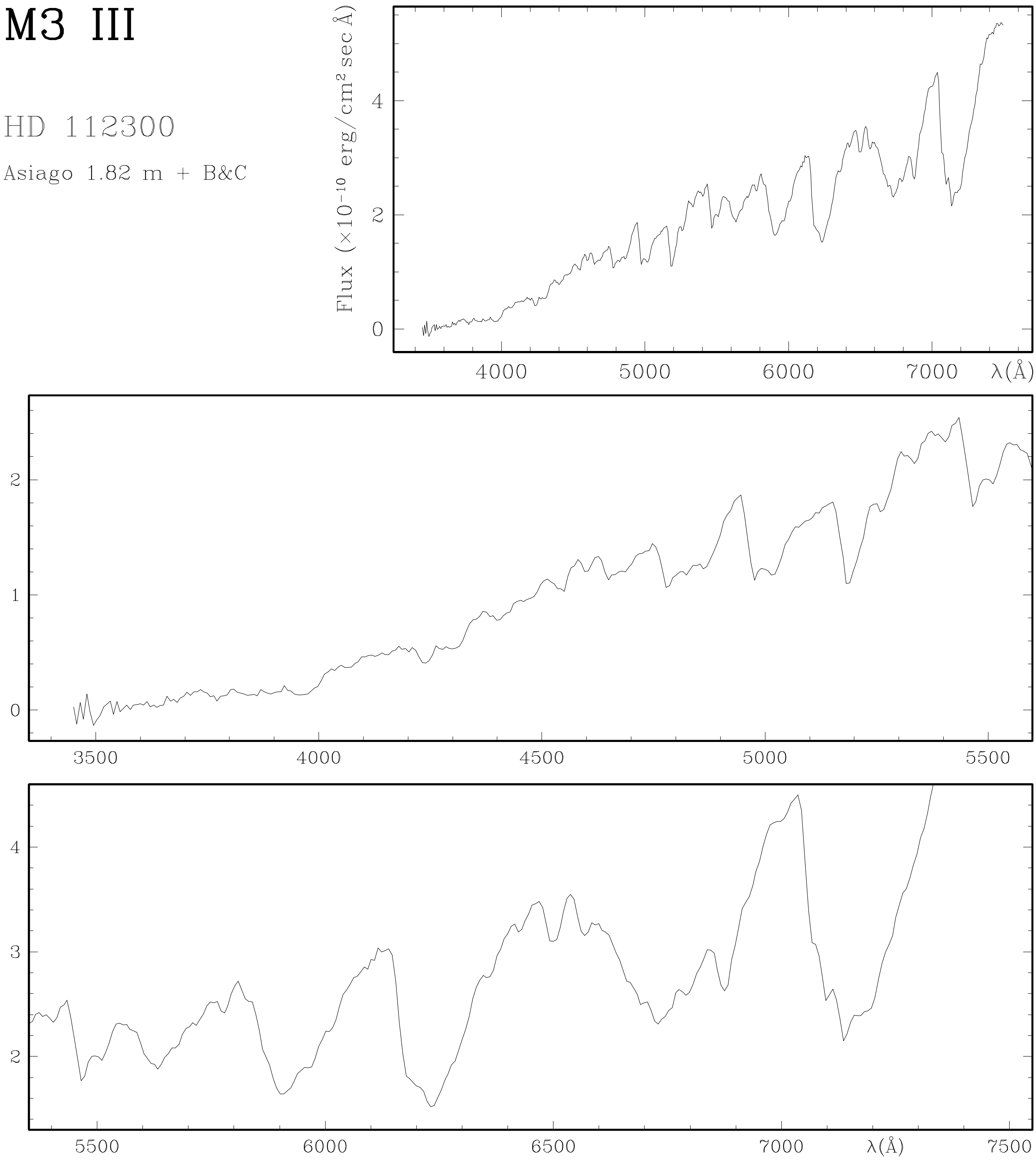


Fig. 248. Asiago 1.82m + B&C spectrum of HD 112300

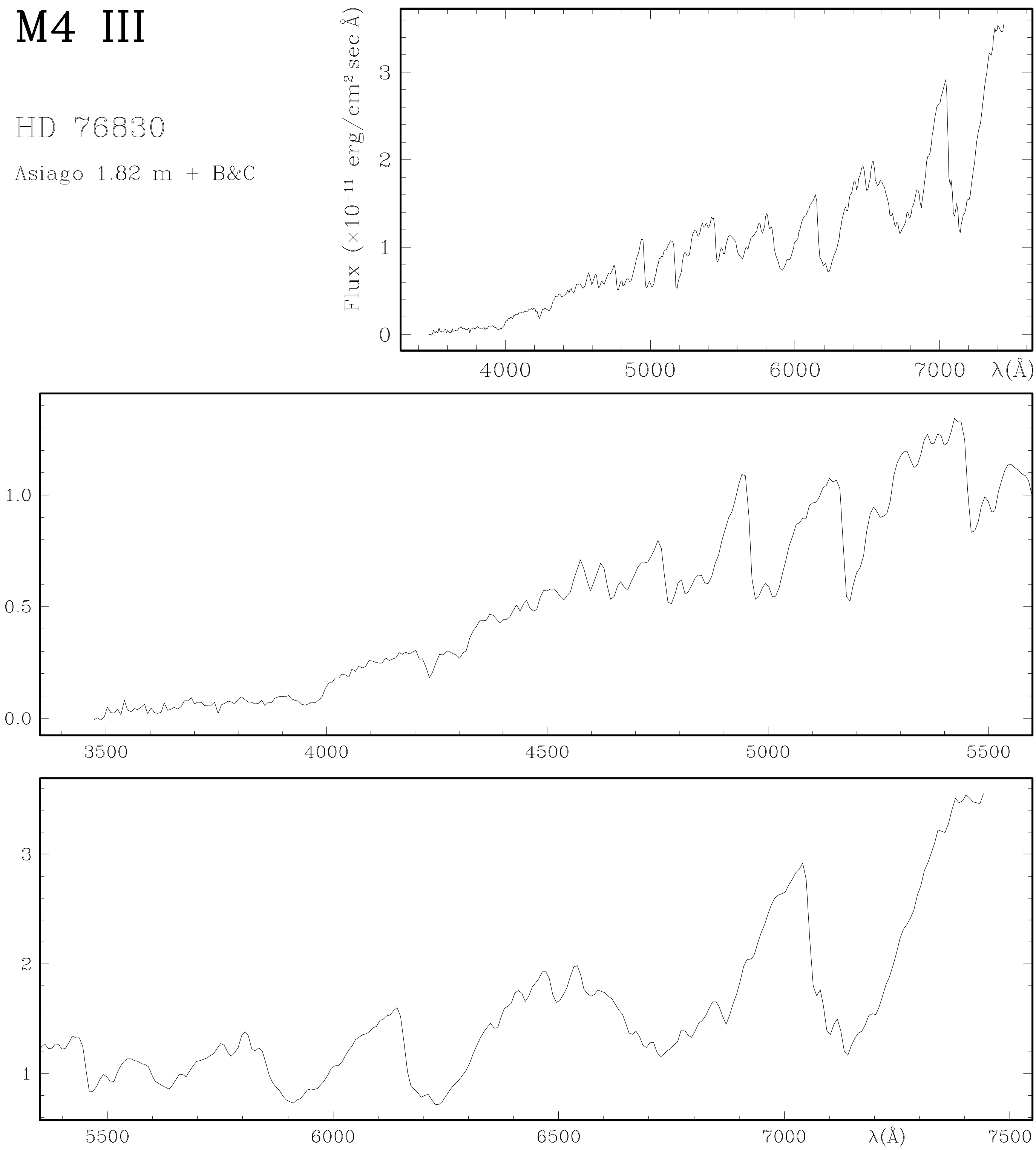


Fig. 249. Asiago 1.82m + B&C spectrum of HD 76830

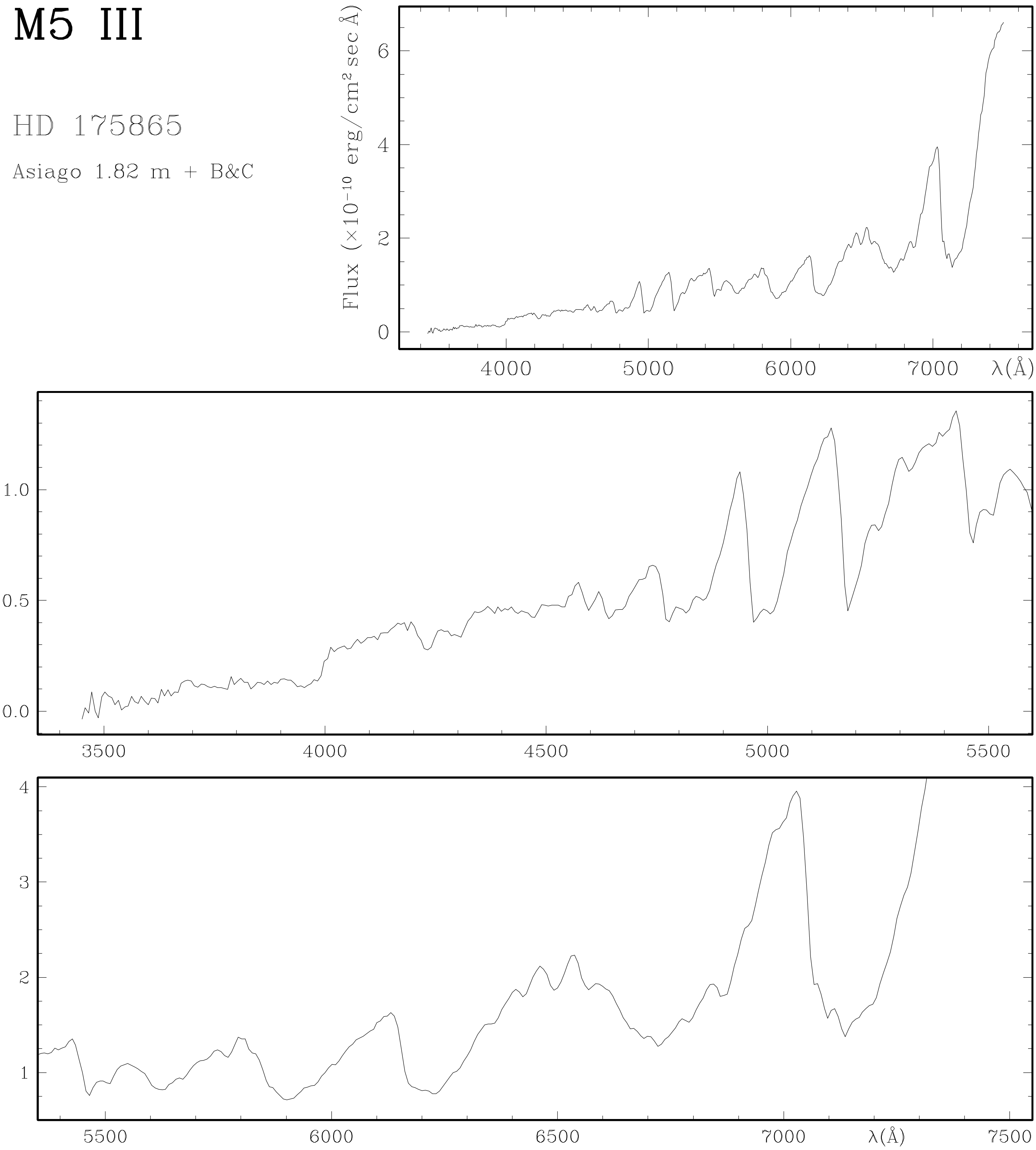


Fig. 250. Asiago 1.82m + B&C spectrum of HD 175865

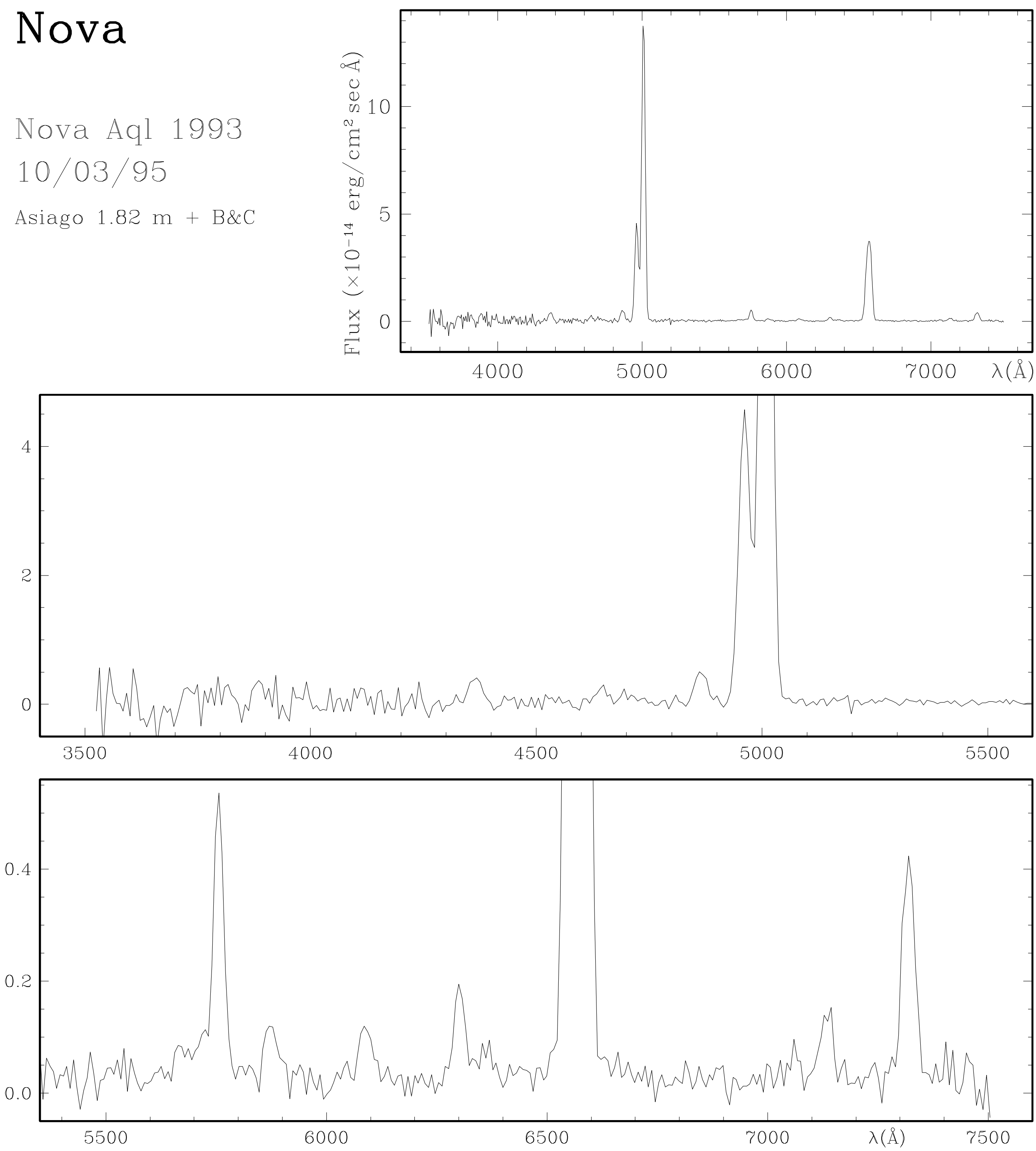


Fig. 251. Asiago 1.82m + B&C spectrum of Nova Aql 1993

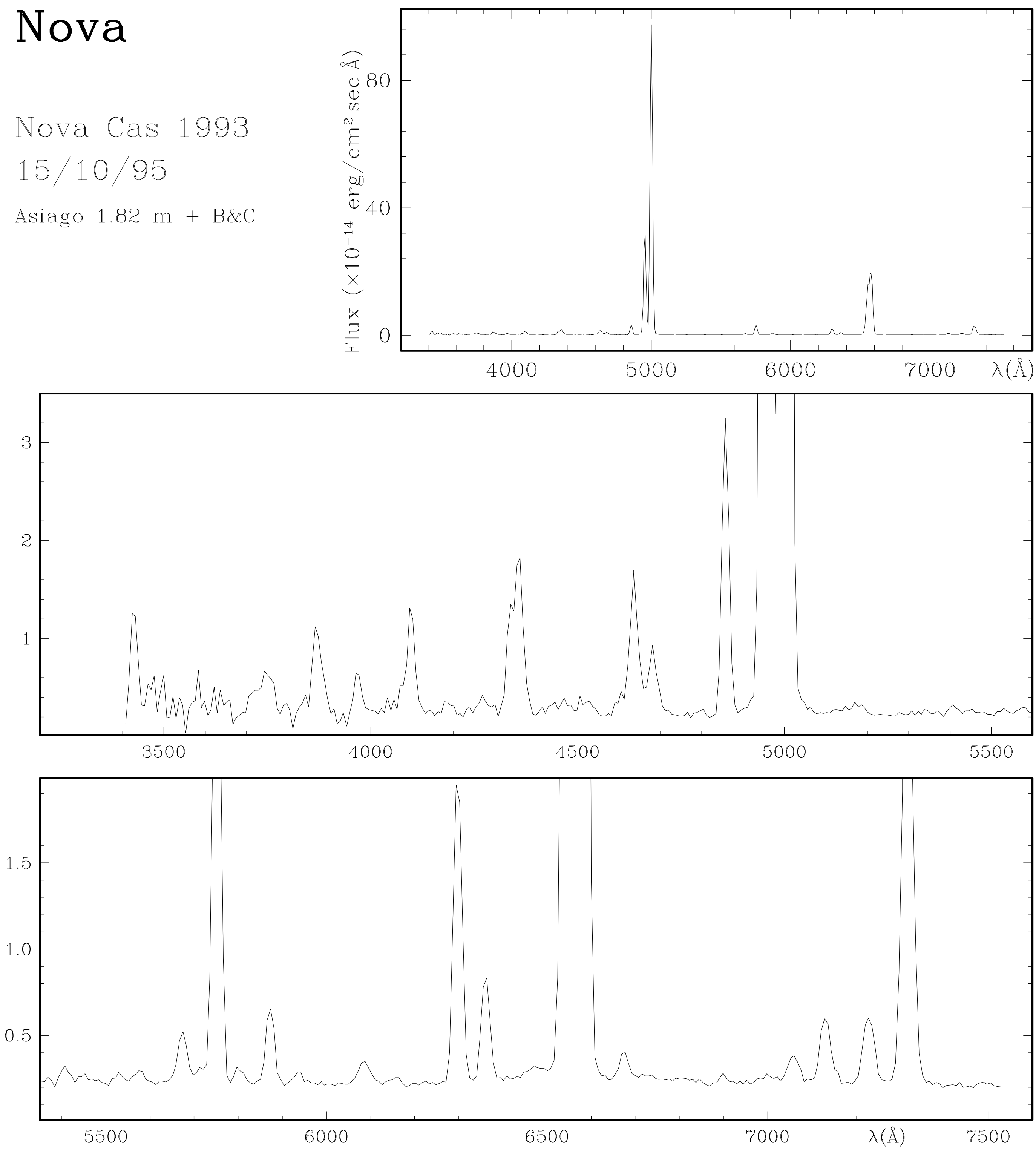


Fig. 252. Asiago 1.82m + B&C spectrum of Nova Cas 1993

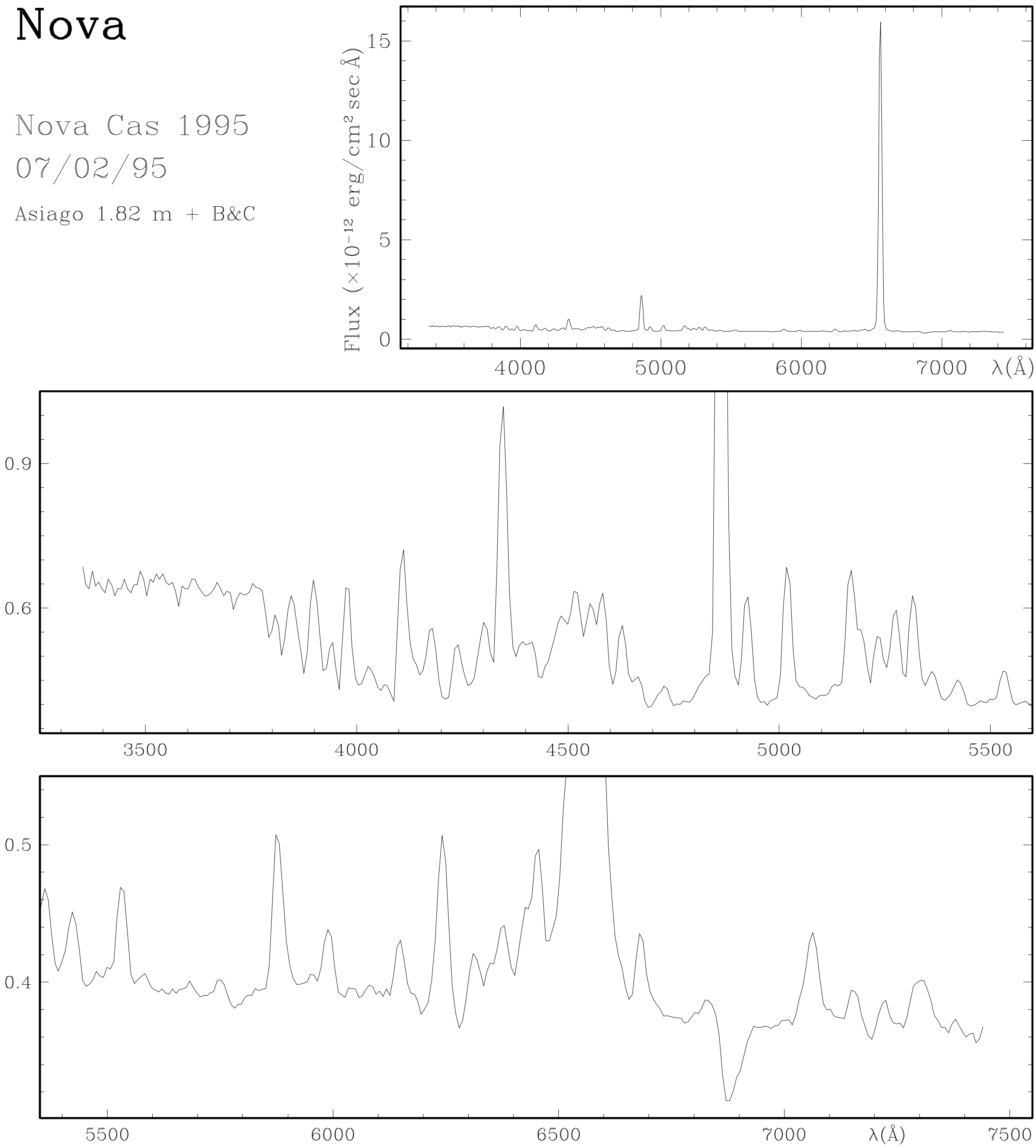


Fig. 253. Asiago 1.82m + B&C spectrum of Nova Cas 1995

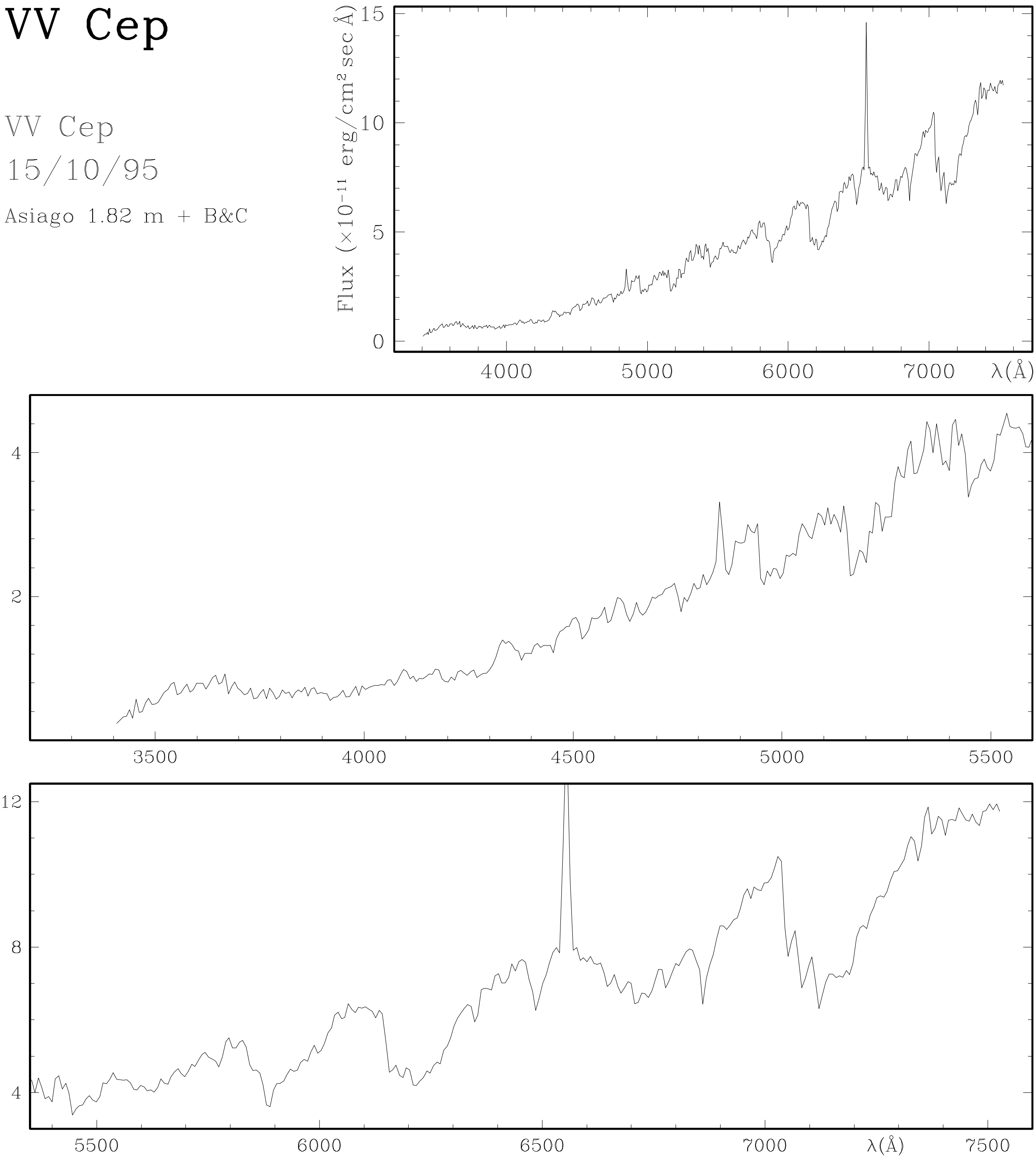


Fig. 254. Asiago 1.82m + B&C spectrum of VV Cep

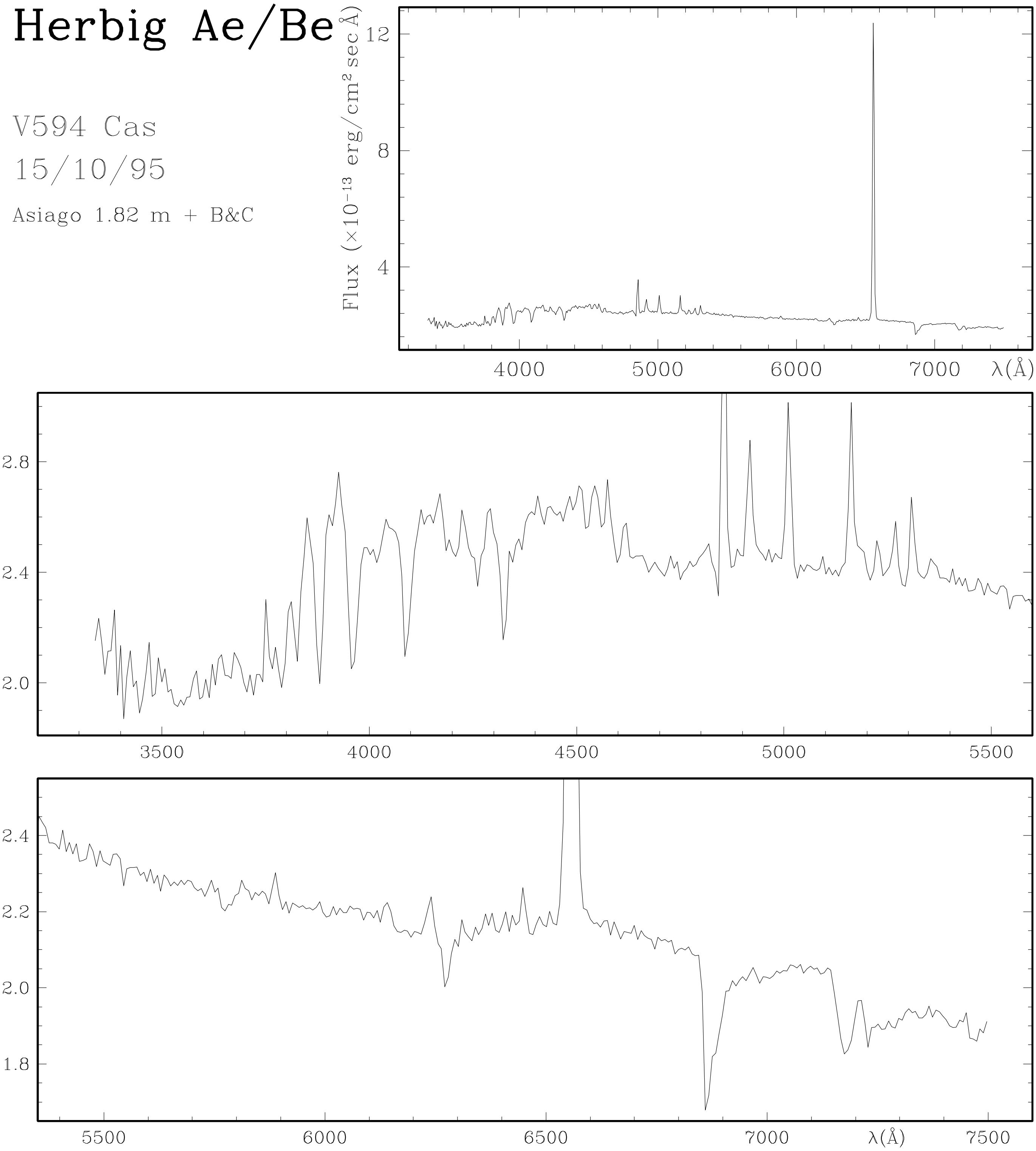


Fig. 255. Asiago 1.82m + B&C spectrum of V594 Cas

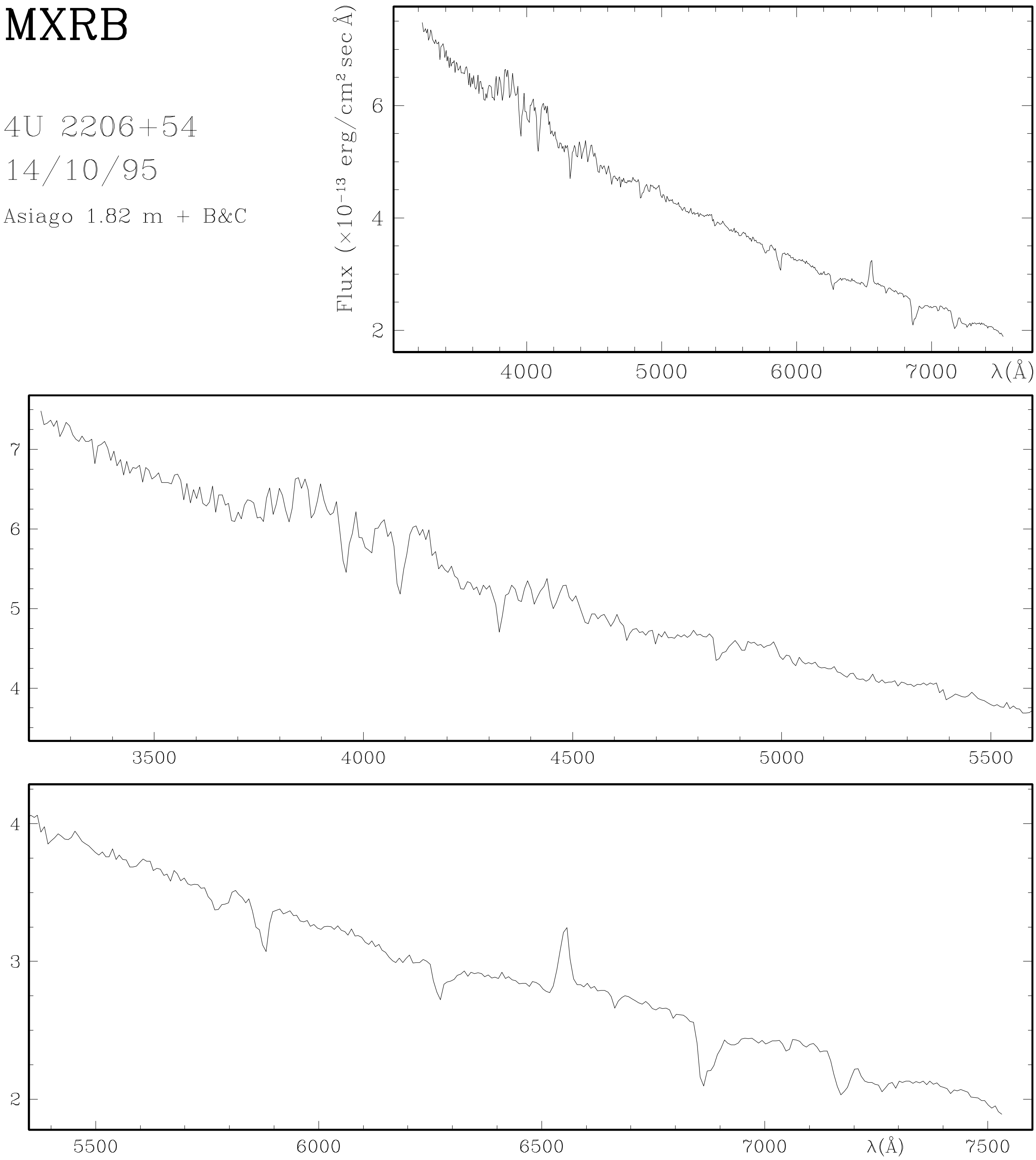


Fig. 256. Asiago 1.82m + B&C spectrum of 4U 2206+54