ABSOLUTE CALIBRATION OF IUE HIGH RESOLUTION SPECTRA: CHANGES WITH THE NEW SOFTWARE *

1. INTRODUCTION

High resolution spectra of point sources obtained through the spectrograph's large entrance apertures can be calibrated in terms of absolute fluxes using the high resolution calibration curves by Cassatella, Ponz and Selvelli (1981).

This calibration however, is only applicable to spectra processed with the software available at GSFC before November 10, 1981 and at VILSPA before March 11, 1982. At the above dates a new high resolution data processing software was installed at both IUE ground stations.

The new software, documented by Bohlin and Turnrose (1982) and references therein, makes use of substantially better geometric and photometric correction procedures. It also allows for a better registration of the orders, providing a more precise matching of the order's center with the wavelength dispersion overlays. Moreover, the slit height is optimized as a function of the order width and separation, instead of being fixed to about 6.4 pixels (for point source spectra) as in the old software. These changes, but in particular the upgraded precision in localizing the orders and the background in the images, have the global effect to increase the net flux extracted from the higher spectral orders (at the short wavelength ends of the cameras).

In the present report the influence of the new software on the high resolution calibration is studied, and preliminary results are provided.

2. CALIBRATION SAMPLE AND DATA ANALYSIS

Two pairs of low-high resolution spectra of the same star are used for each camera to redetermine the calibration factors C_λ defined by Cassatella et al. (1981). These are SWP 9842 (low) and SWP 9843 (high) for BD +75 325; SWP 8703, SWP 8704, LWR 8703 and LWR 8704 for HD 60753.

The results were verified by taking the ratio of the spectra processed with the new and old software. This provides directly the corrections to be applied to the old C_λ curves. The smoothed calibration curves are shown in

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Figure 1 and Figure 2 for the SWP and LWR camera, respectively, together with the previous curves in Cassatella et al..

The values are also reported in Table 1.

3. RESULTS AND DISCUSSION

The internal consistency of the new high resolution calibration, although based on a smaller sample of spectra, is similar to that of the old one, i.e. about 10% shortward of 2200 A and about 5% longward of these wavelengths.

Examples of the new absolute calibration applied to high resolution spectra processed with the new software are given in Figure 3 and and 4 for both the SWP and LWR Cameras.

In Figure 3a the calibrated high resolution spectrum of HD 187473 (from SWP 8280) is compared with a low resolution spectrum (SWP 8279) of the same target after rebinning both data at 2A intervals. The corresponding r.m.s. deviation is about 4%. A slightly better accuracy is obtained in the case of BD $+28^{\circ}4211$ (using SWP 5778 and SWP 5779), as shown in Figure 3b. A similar comparison for the LWR camera is presented in Figure 3c for BD $+75^{\circ}$ 325 using LWR 8305 and LWR 8304. The r.m.s. deviation is about 6%. These comparisons are quite satisfactory although the selected spectral regions, corresponding to high orders, are the most sensitive to errors. Better precisions are obtained at longer wavelengths. This is shown in Figure 4, where the original LWR high resolution spectrum of HD 144668 is compared with a low resolution spectrum taken close in time, in a region around 2580 A. The r.m.s. deviation is about 3% in this case.

It is clear from Figures 1 and 2 that the new calibration factors C_{λ} are systematically lower at the short wavelength end of the cameras than in the old software. This is due to the gain in extracted flux expected as a consequence of the improved data extraction. In particular, the gain in extracted net flux is about 10% around order 110 in both cameras (near 1250 A in the SWP and near 2100 in the LWR), and decreases regularily with decreasing order number. This is in good agreement with the new software evaluation tests reported by Bohlin and Turnrose (1982). Longward of 1450 A in the SWP camera and 2425 A in the LWR, the new software does not show any significant gain compared with the old software. As a consequence, the new and old curves C_{λ} coincide longward of

these wavelengths.

Concerning the absolute calibration of emission line sources with faint or no continuum, the same equations hold as for the old software, i.e.:

$$C_\lambda = 228.009 - 0.0755\lambda \quad \text{for } 1400 \leqslant \lambda \leqslant 1975 \text{ A}$$

$$C_\lambda = 167.099 - 0.0229\lambda \quad \text{for } 2300 \leqslant \lambda \leqslant 3100 \text{ A}$$

These equations fit very well the new calibration for continuous sources longward of 1575 A in the SWP, and of 2500 A in the LWR camera.

Cross checks of the above equations, using spectra of RR Tel, confirm their validity.

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REFERENCES

Cassatella, A., Ponz, D., Selvelli, P.L., 1981, ESA IUE Newsletter No. 10, p. 31, and NASA IUE Newsletter No. 14, p. 170

Bohlin, R.C., Turnrose, B.E., 1982, ESA IUE Newsletter No. 13, p. 14 and NASA IUE Newsletter No. 18, p. 29

TABLE 1 - CALIBRATION FACTORS C_λ

Lambda (A)	New	Old
1250	205	230
1275	192	208
1300	178	193
1325	168	176
1350	158	163
1375	148	152
1400	142	143
1425	136	136
1450	131	
1475	126	
1500	122	
1525	118	
1550	114	
1575	110	
1600	108	
1625	105	
1650	103	
1675	101	
1700	100	
1725	98	
1750	96	
1775	94	
1800	92	
1825	90	
1850	88	
1875	86	
1900	84	
1925	82	
1950	81	
1975	80	

Lambda (A)	New	Old
1925	230	292
1950	206	259
1975	190	229
2000	177	207
2025	168	191
2050	159	180
2075	153	171
2100	146	165
2125	142	159
2150	138	153
2175	134	149
2200	131	143
2225	129	139
2250	126	136
2275	124	132
2300	122	129
2325	120	126
2350	119	122
2375	118	120
2400	117	118
2425	116	116
2450	115	
2475	114	
2500	113	
2525	112	
2550	110	
2575	109	
2600	108	
2625	107	
2650	106	
2675	105	
2700	104.5	
2725	104.0	
2750	103.5	
2775	103.0	
2800	102.5	
2825	102.0	
2850	101.5	
2875	100.5	
2900	100.2	
2825	100.0	
2950	99.0	
3000	98.5	
3025	98.0	
3050	97.5	
3075	97.0	
3100	96.5	

FIGURE CAPTIONS

FIGURE 1:

C_λ curve applicable to SWP high resolution spectra of continuous sources processed with the new software (crosses) and the old software (dots). The two curves coincide longward of 1450 A.

FIGURE 2:

C_λ curve applicable to LWR high resolution spectra of continuous sources processed with the new software (crosses) and old software (dots). The two curves coincide longward of 2425 A.

FIGURE 3 (a,b and c) :

Comparison between a low resolution (thick line) SWP spectrum and a calibrated high resolution spectrum (thin line) of the the stars HD 187473 and BD $+28^{\circ}4211$. both resampled at 2 A intervals. Figure 3c shows the the same comparison for BD $+75^{\circ}325$.

FIGURE 4:

Calibrated high resolution spectrum of HD 144668 compared with a low resolution spectrum (dots) taken close in time.

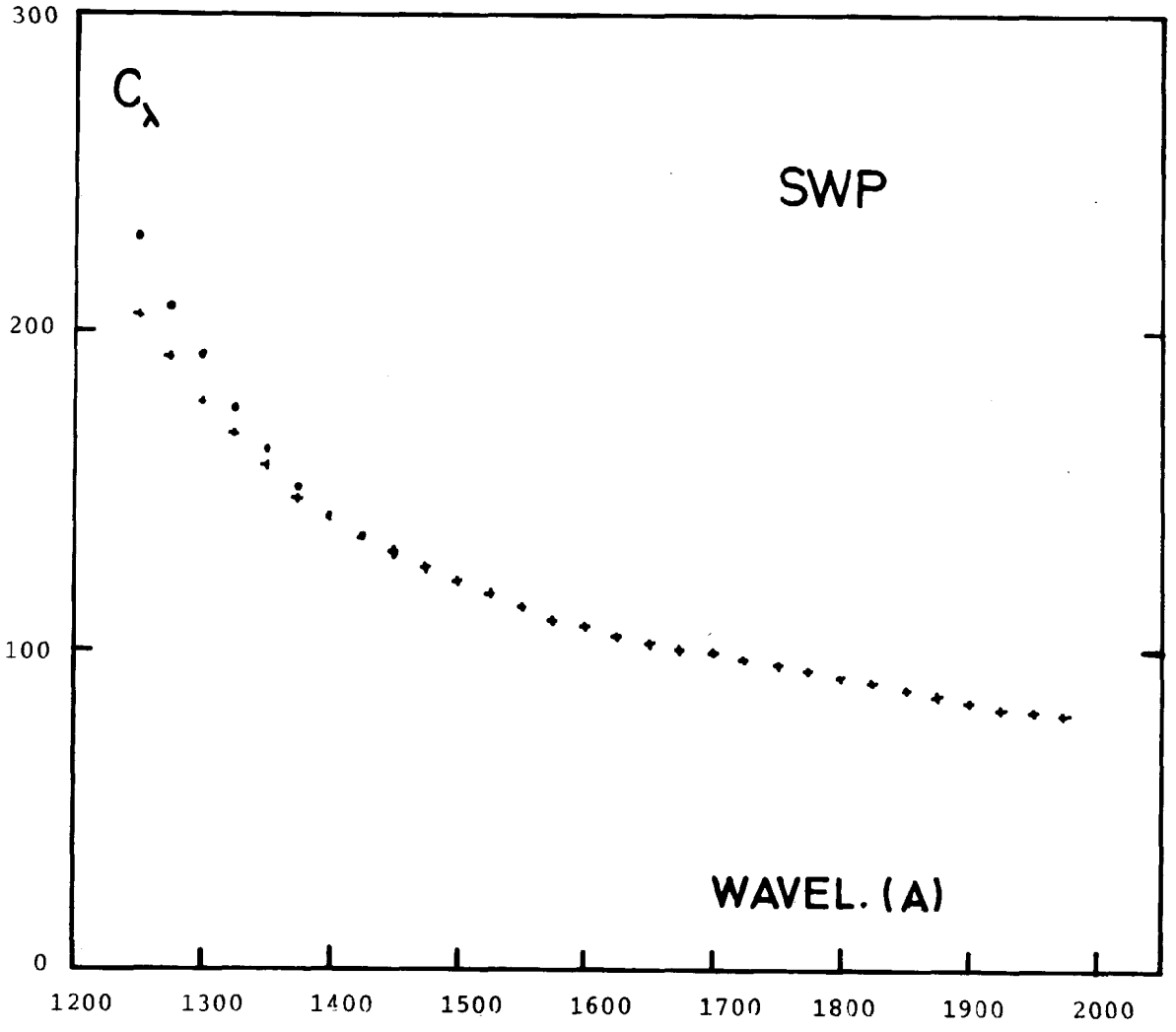
300
200
100
0
C_λ
SWP
WAVEL. (A)
1200
1300
1400
1500
1600
1700
1800
1900
2000

Figure 1.

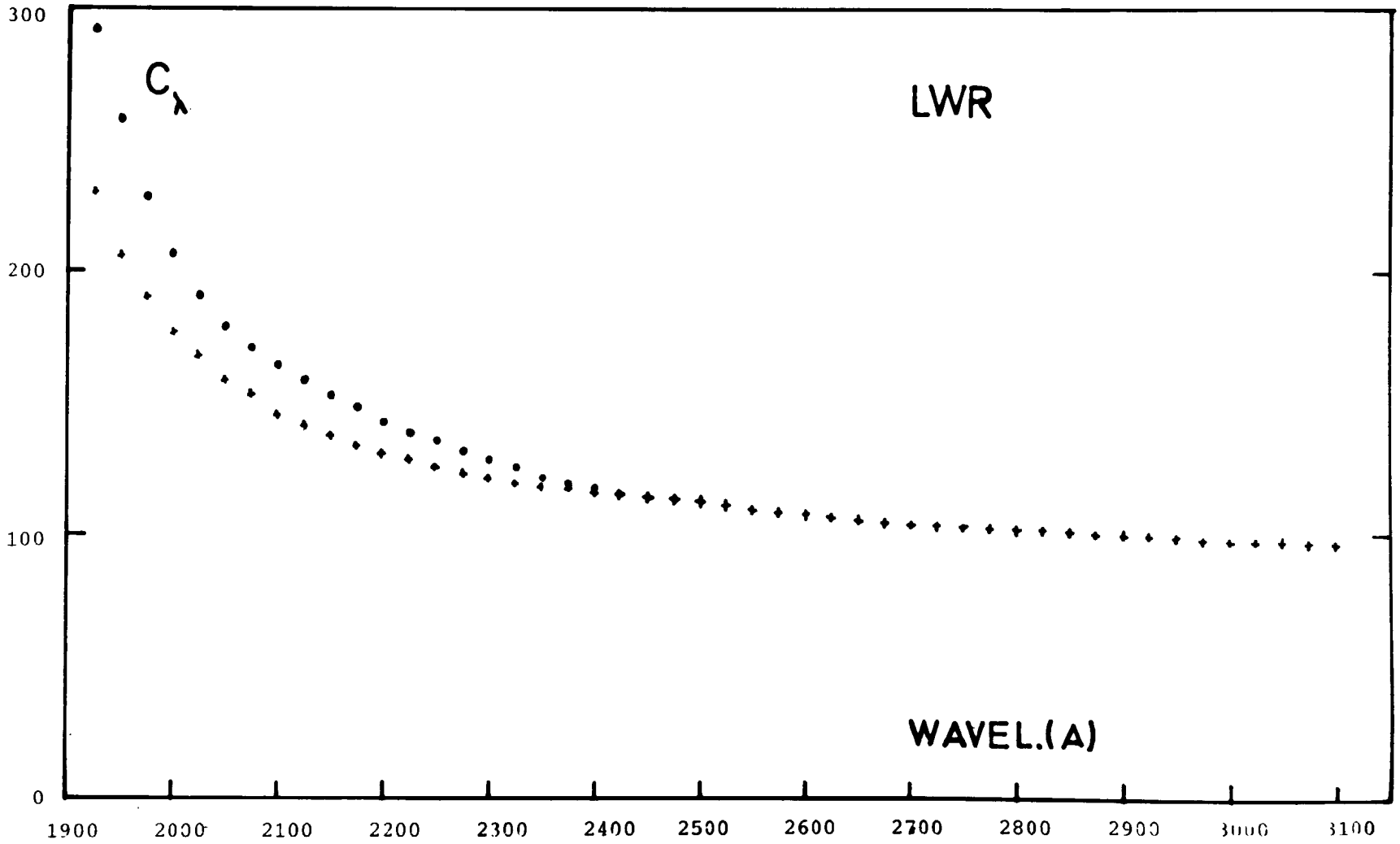
300
200
100
0
C_λ
LWR
WAVEL.(A)
1900
2000
2100
2200
2300
2400
2500
2600
2700
2800
2900
3000
3100

Figure 2.

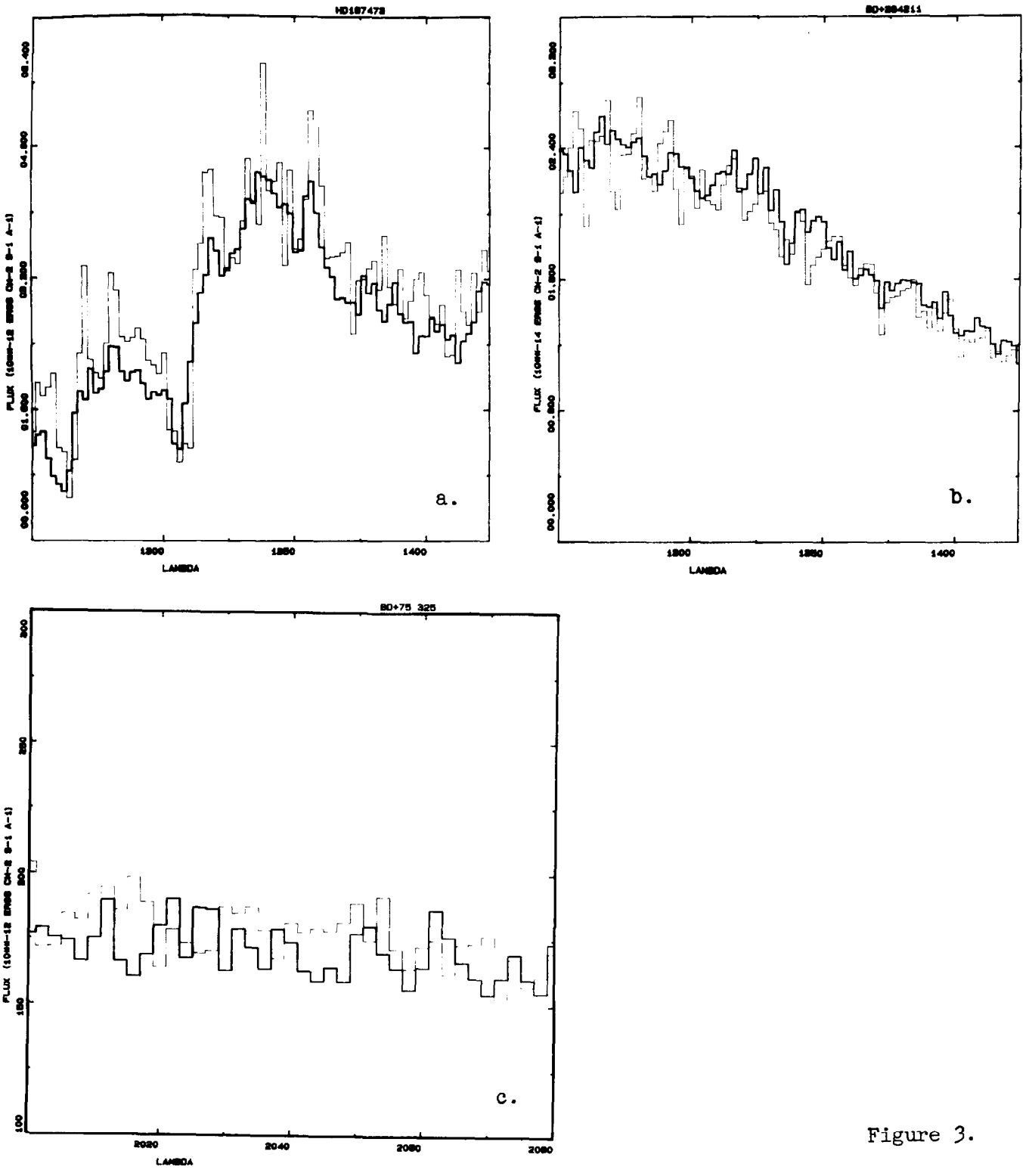
HD167478
BD+284211
BD+75 325
a.
b.
c.
LAMBDA
1900
1850
1400
2020
2040
2060
2080

Figure 3.

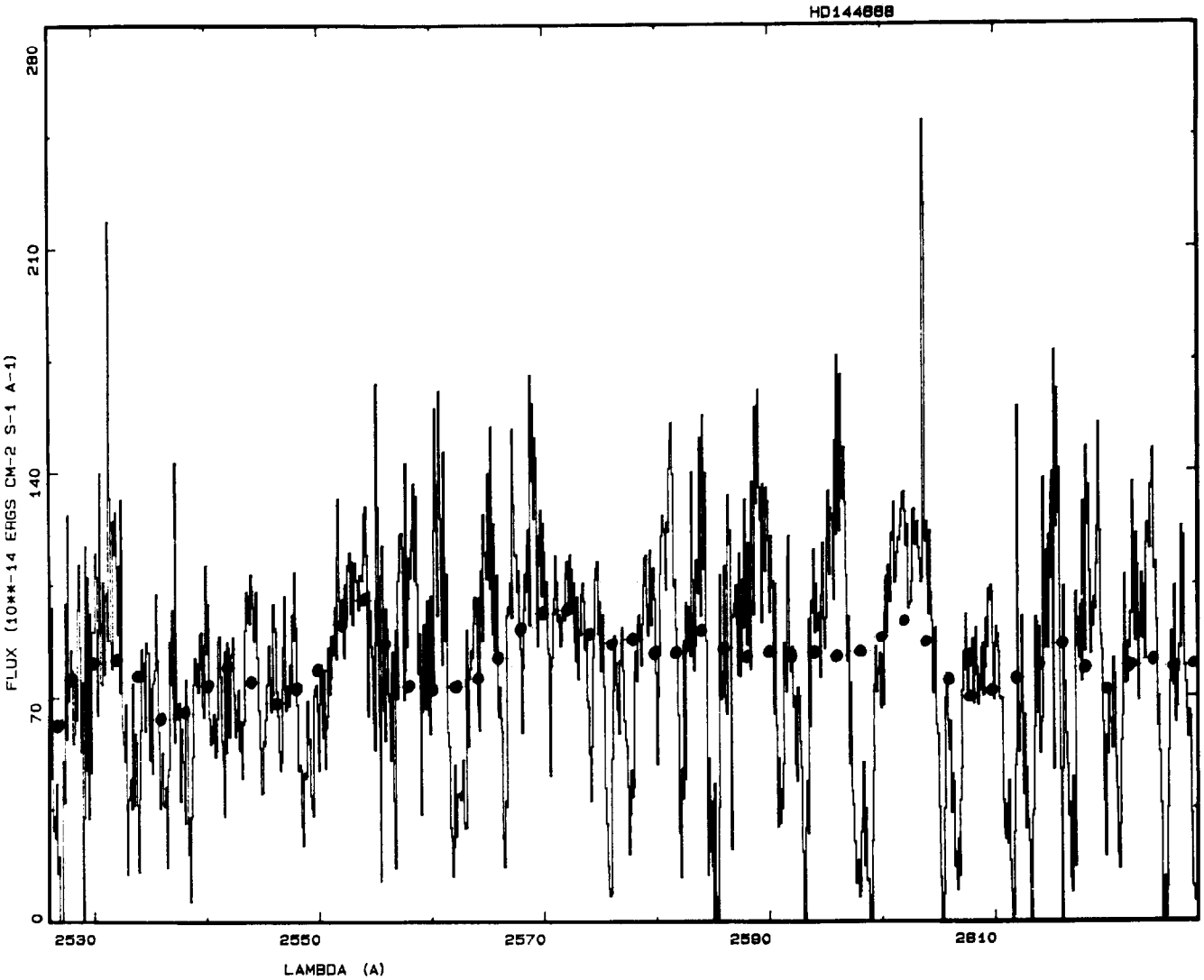
HD144668
280
210
140
70
0
FLUX (10**-14 ERGS CM-2 S-1 A-1)
2530
2550
2570
2590
2610
LAMBDA (A)

Figure 4.