

**SCATTERED RED LIGHT Preliminary Version  
(Calibration Plan 12A)**

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*Abstract*

A quick look analysis was performed on the ambient Scattered Light data obtained on 23 and 26 Aug 1984 for both the red and blue Digicon detectors. The results for the red tube are compared to those of Koornneef's January 1984 analysis.

Apparent line-like features in the scattered light from a line source are not understood.

*I. Data*

The data to be discussed here were obtained by placing several different blocking filters in front of the tungsten continuum source. The wavelength region shortward of the filter cutoff was observed to measure the stray light contribution. This method is particularly relevant as it mimicks the observation of late type stars, which have rather steep cutoffs in their energy distribution in the ultraviolet.

The filters used were spare flight (Schott) units, designated OG530, GG375, WG295 and WG230. Their approximate transmission curves are shown in Figure 1.

*II. Results*

The corrected countrates obtained through the C3 aperture are shown in Figures 2 and 3 for the blue and red tube, respectively. For each filter, four different gratings were used (H13, H19, H27 and H40 for the blue tube and H19, H27, H40 and

H57 for the red tube). Paired-pulse corrections using very preliminary time constants  $t_1 = -2.0 \times 10^{-6}$ s and  $t_2 = 8.0 \times 10^{-6}$ s were applied to all data. Due to the large uncertainty in the time constants, corrected countrates in excess of 70,000 count/s are not plotted.

Of particular relevance are the observed countrates using the H13 grating (1150-1610 Å) for the blue tube (Fig. 2) and H19 grating (1570-2330 Å) for the red tube (Fig. 3). For the blue tube, the three curves shown in the H13 region correspond to each of the three filters used; and the countrates increase from roughly 1 count/s for GG375 to 3 count/s for WG230. For the red tube, the four curves in the H19 region correspond to the four filters used and the countrates range from roughly 5 count/s for OG530 to 20 count/s for OG230. These increases are easily understood as the consequence of the increase in bandwidth of the incoming flux from the tungsten lamp. Note that although Figs. 1 and 2 are labeled in Angstroms, the measured counts in the ultraviolet region of H13 and H19 are obviously from stray photons scattered from longer wavelengths. Verification of the fact that the filters themselves are not leaking at short wavelengths comes from the lack of any discontinuities at 1850Å, the approximate air cutoff.

The effective bandwidths of the incoming light are limited at the long wavelength side by the photocathode cutoffs, which occur around 5500Å for the blue tube and 8500Å for the red tube. Towards the short wavelength side the observed cutoffs at the 0.1 level for both tubes are approximately 5000, 3500, 2800 and 2200 Å for OG530, GG375, WG295 and WG230, respectively. (There is some confusion with respect to filter GG375. The FOS Scientists Notebook calls this filter GG395, whereas Harms *et al.* in NASA CP-2244 quote GG375). Although the increase of bandwidth in going from

OG530 to GG375 for the red tube is larger by a factor 1.3, the increase in scattered light for H19 rises by a factor of 2.4. The scattering efficiency increases as the separation in angle decreases between the direction of the diffracted light and the direction of the scattered photons. Therefore most of the photons counted in H19 through the GG375 filter have wavelengths between 3500 and 5000Å. The increase in scattered light from one filter to another is less in the blue tube.

The March 1983 data (Fig. 4) is consistent with the August 1984 data (Fig. 3), since the increase of the scattered light by about a factor of 2 is expected from the increase of lamp brightness of about a factor of 2. The two sets of data are in agreement except that the unidentified feature in Fig. 4 at 3700Å (H40) is not as pronounced in the August 1984 data (Fig. 3). The observed curves of Figures 2 and 3 are generally well understood in a qualitative sense. The final Scattered Light report will involve quantitative analysis to determine countrates of scattered light in the UV region as a function of countrates in the near UV and visible region. To obtain the very large countrates for the H57 region, on the red tube, data from the Absolute Photometric Calibration will be used after the measured transmission curves for the four filters are received from Martin Marietta Corp.

Additional evidence for scattered light appears in the July 1984 vacuum Wavelength Calibration data for grating H13 (blue tube, internal Pt-Cr-Ne lamp). Around and below the MgF<sub>2</sub> cutoff (1150Å) are several features superimposed upon a continuum (see Fig. 5). The countrates of both of these features are at least 100 times above the dark background specifications (0.002 count/s/diode) of the FOS. The marked spikes in Fig. 5 appear on both of the independent spectra of H13 and are, therefore, not due to statistical fluctuations. Multiple reflections or some other form of ghost

images of bright lines are their most likely cause. Profiles of two of these spikes are shown in Figure 6. The presence of these spikes from the external Pt-Cr-Ne lamps of the UVSTOS will be investigated as the next step in solving this mystery.

### FIGURE CAPTIONS

Figure 1. Approximate transmission curves for the four Schott filters. Accurate transmissions are being measured by Martin Marietta Corp.

Figure 2. Corrected countrates *vs.* wavelength for the blue tube. For each of the four gratings up to three spectra were obtained for three filters. In each grating region the lowermost curve is from GG375, the next lowest from WG295 and finally the third curve (if present) from WG230.

Figure 3. Corrected countrates *vs.* wavelength for the red tube. For each grating up to four spectra were obtained using the four filters. Starting with the lowest plot in each grating region, the curves are from filters OG530, GG375, WG295 and WG230, respectively.

Figure 4. Observed counts *vs.* wavelength for the March 22, 1983 data. The plotted curves are as in Figure 3. The broken lines indicate countrates that are corrected for non-linearity.

Figure 5. Counts *vs.* wavelength for two H13 Pt-Cr-Ne spectra showing scattered light near and below the  $\text{MgF}_2$  (1150Å) cutoff. The indicated spikes appear in both spectra.

Figure 6. Profiles for the two spikes labeled "c" and "e" in Figure 5.

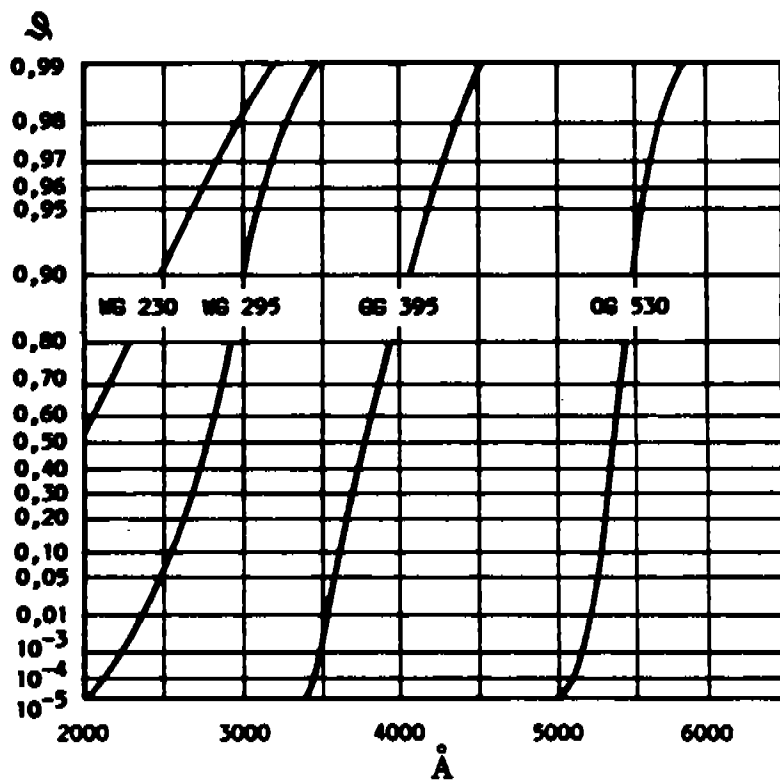


Figure 1.

BLUE TUBE 26 Aug 84

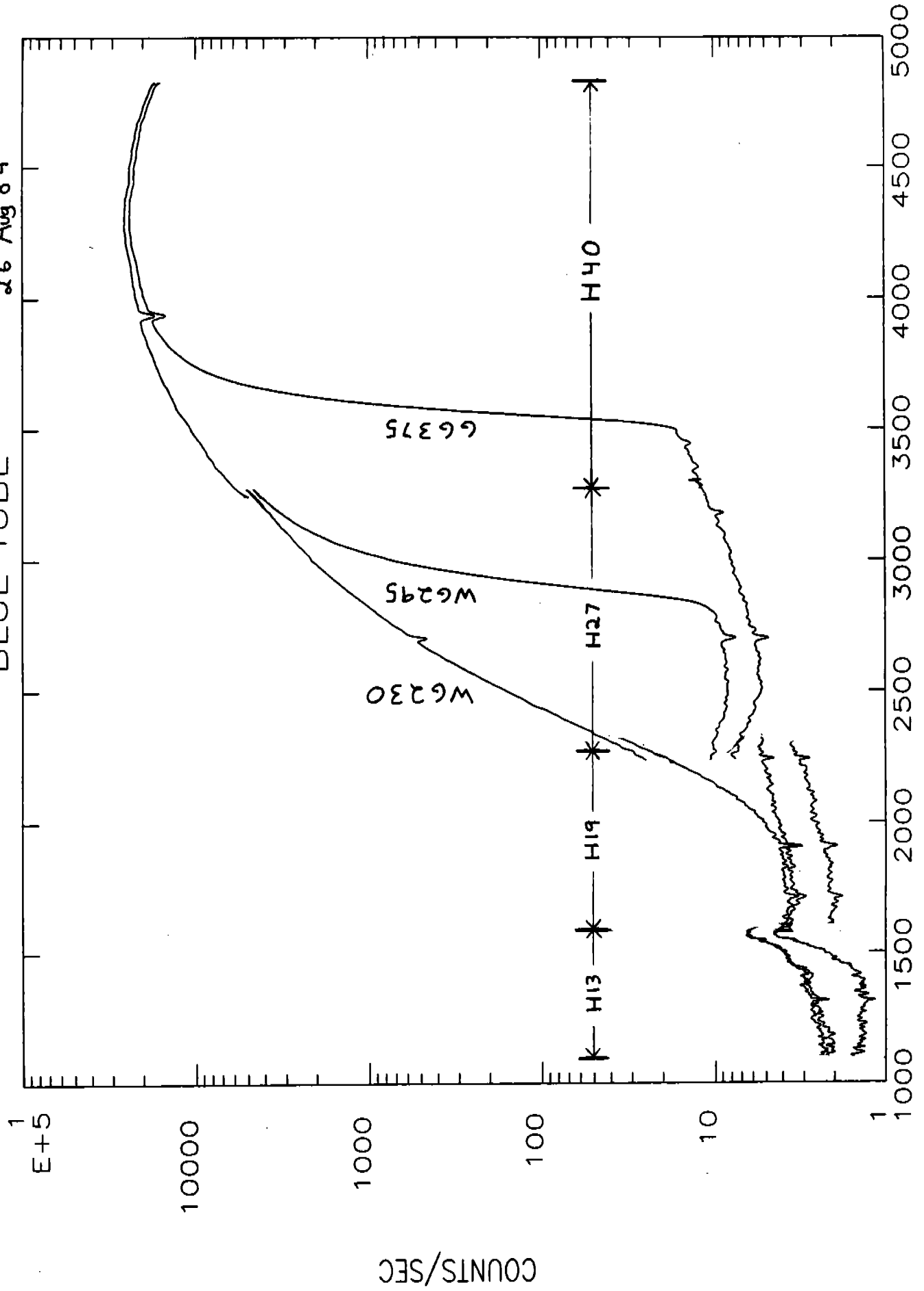


Figure 2.

RED TUBE 22 Aug 84

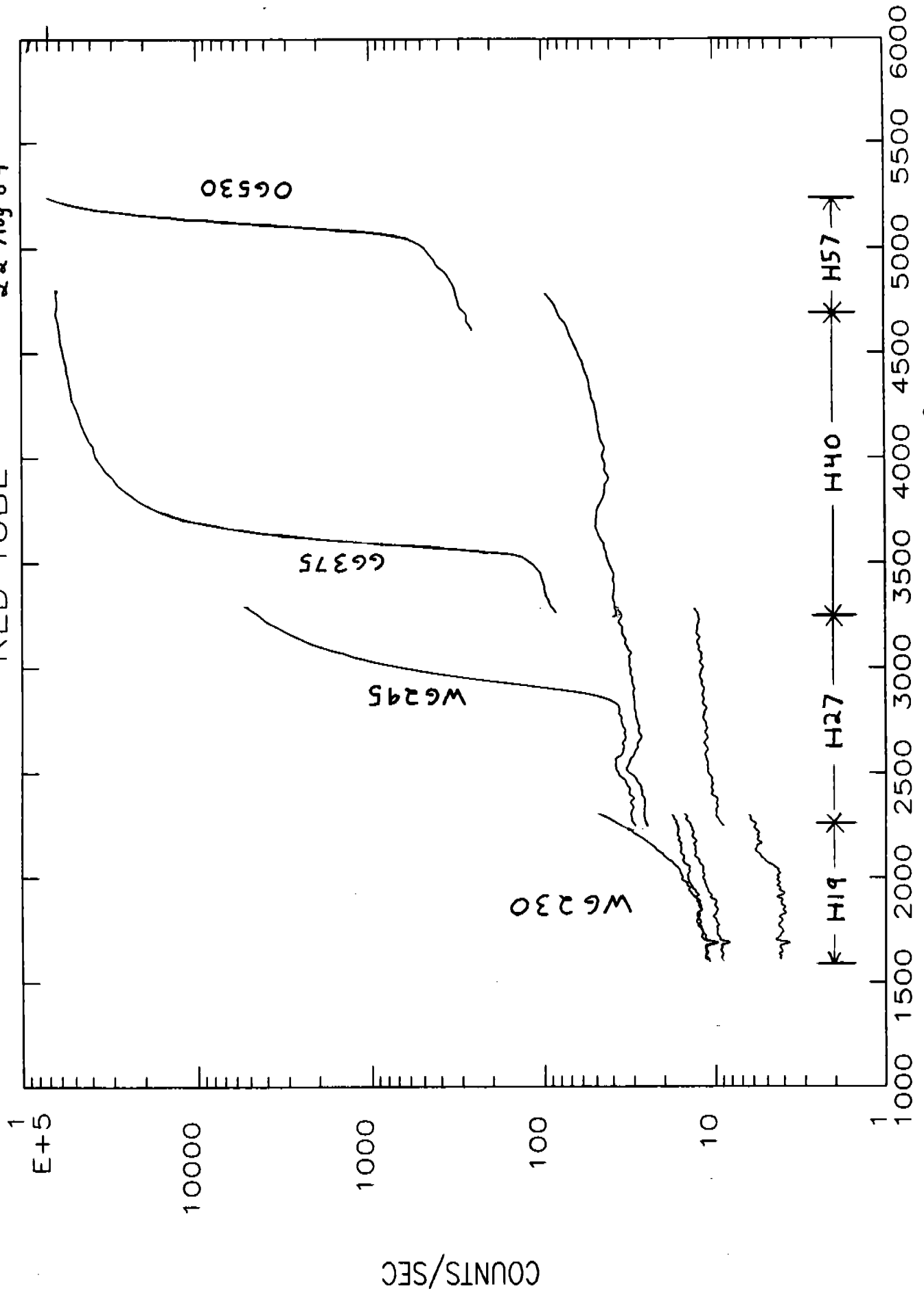


Figure 3.

RED TUBE 22 Mar 83

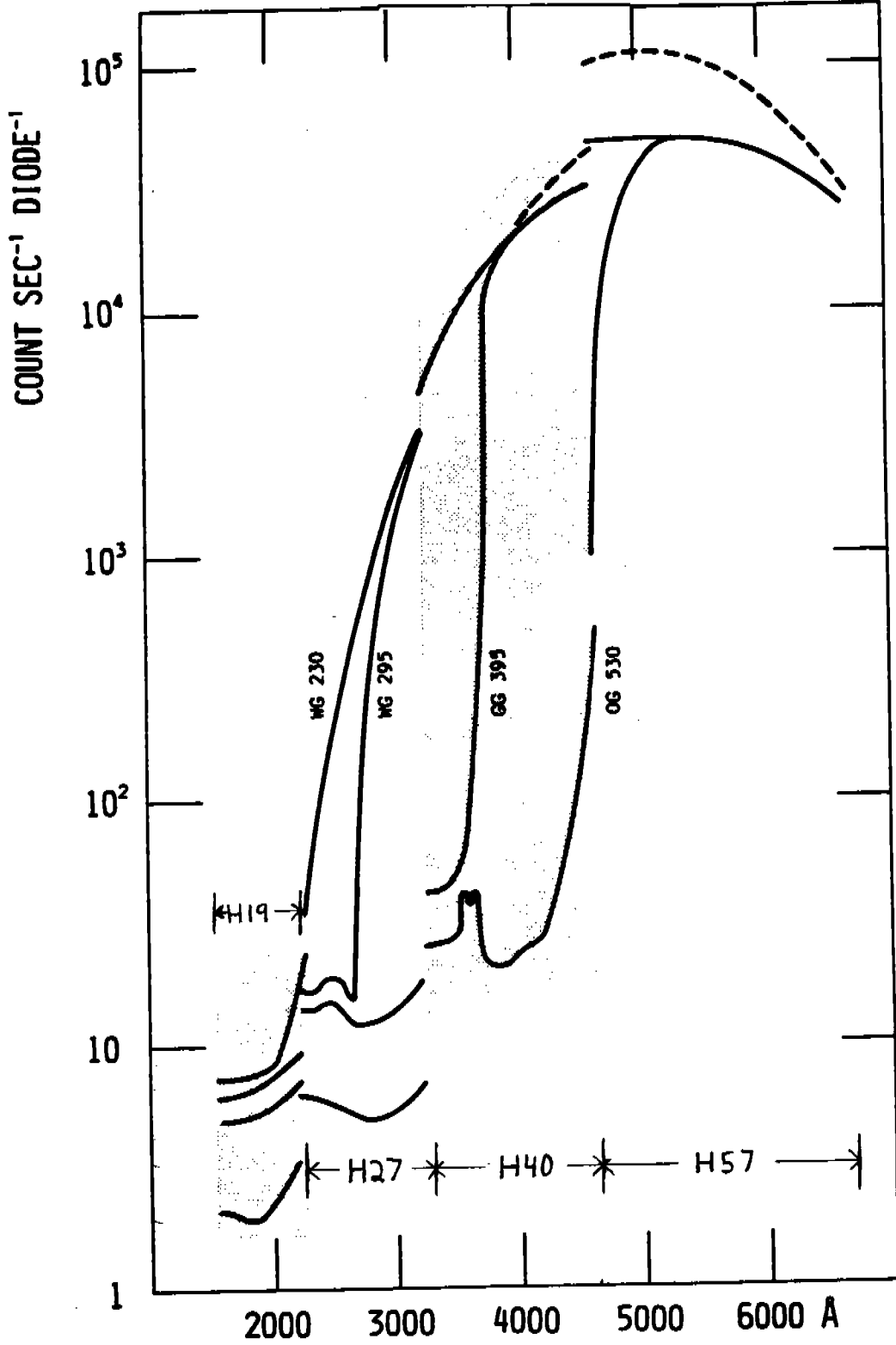


Figure 4.



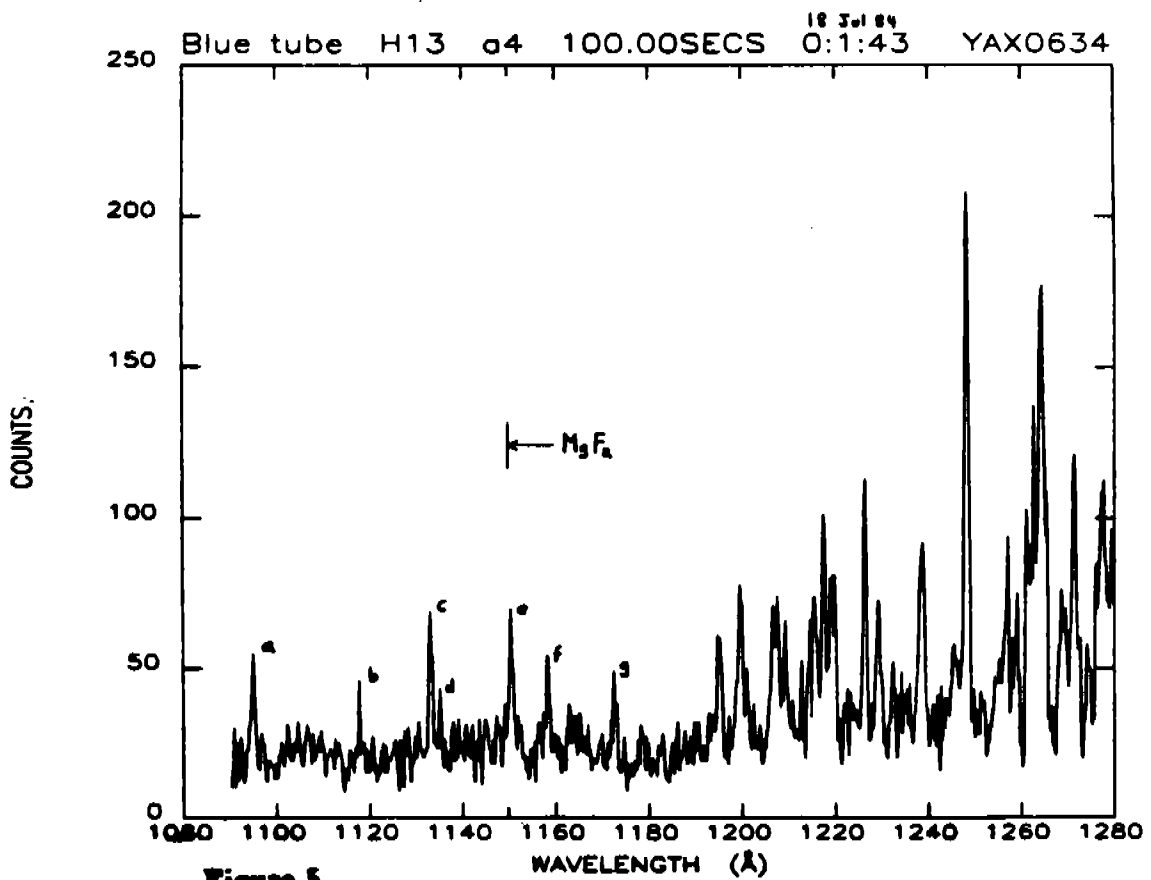
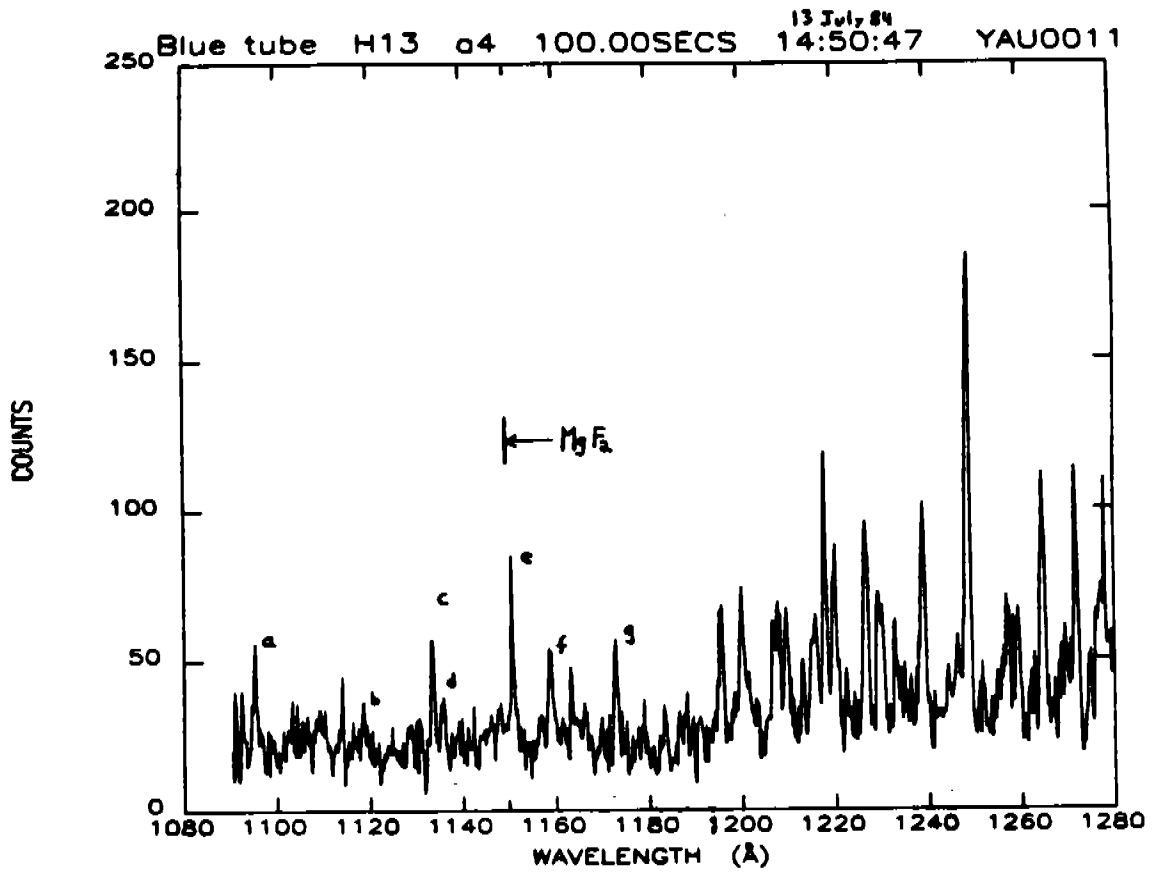


Figure 5.

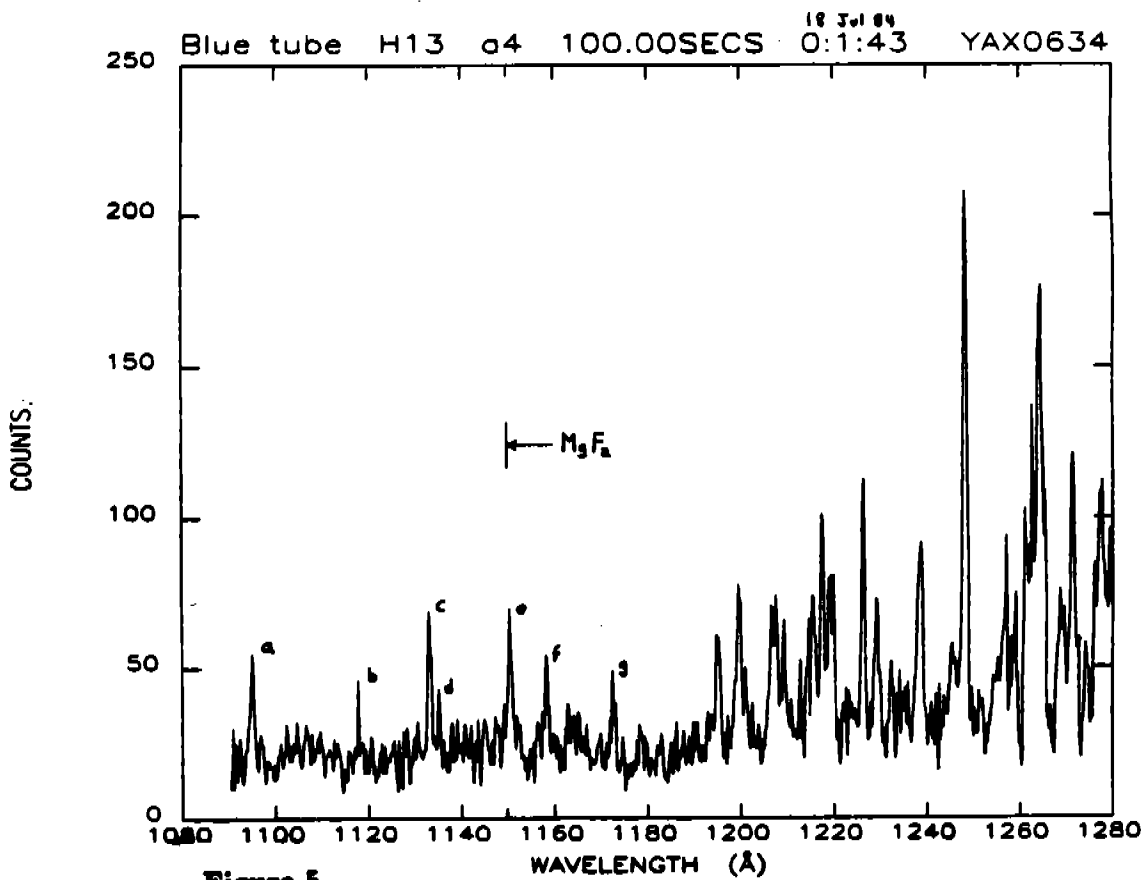
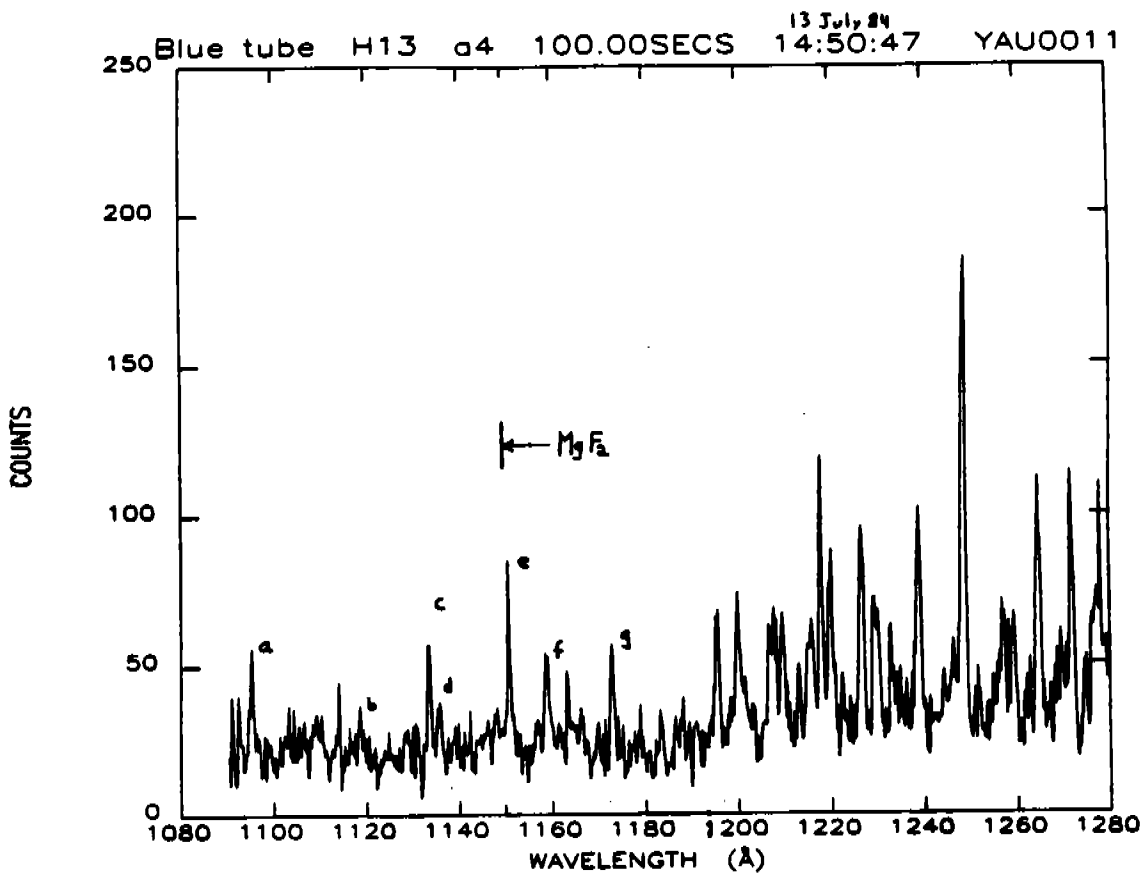


Figure 5.

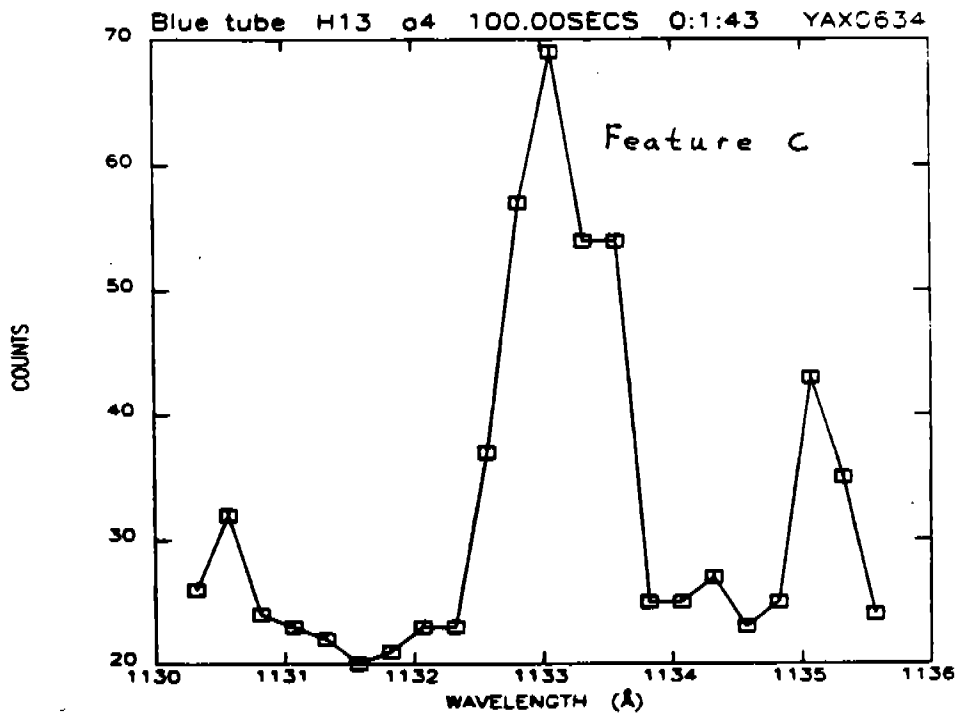
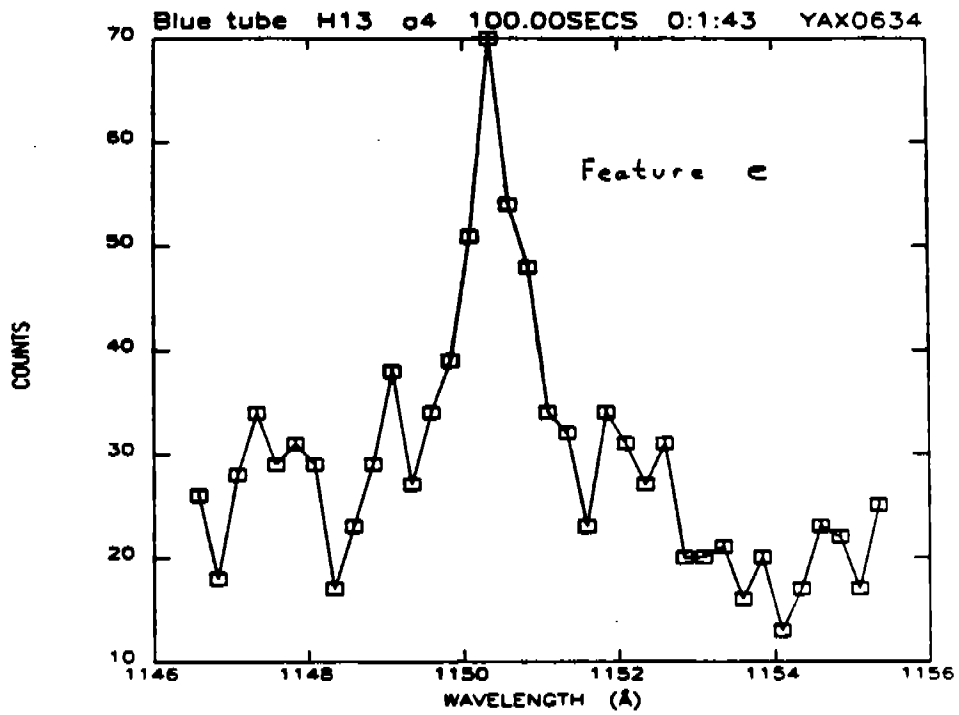


Figure 6.

