Effective date:
13:47 GMT 10 July 1981

IUE Data Reduction

XXIII. Further Modifications to the Extrapolation of the Intensity Transfer Function

In memo XIII of the IUE Data Reduction series (NASA IUE Newsletter No. 8), the introduction of an extrapolation step in the photometric correction procedure in certain cases for DN values near the upper end of the Intensity Transfer Function (ITF) was discussed in the context of the "old" software (program FICOR6). In memo XVIII of the series (NASA IUE Newsletter No. 12), the extrapolation procedures pertinent to the "new" software (program PHOTOM) were discussed. In this memo we announce two modifications to the extrapolation made by PHOTOM: 1) a more conservative definition of the highest valid DN level in the ITF is adopted (DN = 250), which results in both more instances of extrapolation and the use of lower DN values in establishing extrapolations; and 2) a least-squares linear fit to the last 3 valid points ($DN \leq 250$) of the ITF is used to define the extrapolation instead of the previous linear extrapolation of the last 2 points of the ITF for which $DN \leq 254$. Note particularly that these changes, detailed more fully below, apply only to the "new" software photometric correction done by the program PHOTOM. At present, only the low-dispersion production processing uses the new software; high dispersion continues to use the program FICOR6 and the extrapolation procedures discussed in memo XIII. When the new software is released for production processing in high dispersion, extrapolation procedures discussed herein will apply.

1). Highest valid ITF DN = 250.

Formerly, the maximum valid ITF DN level used for interpolation or to establish extrapolation was chosen to be DN = 254. However, because of noise in the ITF images and the fact that the production ITFs are composed of averages of several independent and geometrically corrected flat-field images at each exposure level, even ITF values a few DN below 255 may be affected by saturation in some of their raw constituent images. To alleviate such hidden saturation effects, the maximum valid ITF DN level has been redefined to be DN = 250. This means specifically that all $DN > 250$ in spectral data images will be converted to FN by extrapolation, and, further, that only points with $DN \leq 250$ will be used to define any extrapolations (c.f. the two generic extrapolation situations designated as Case A and Case B in memo XIII). In essence, DN levels > 250 in the ITF are ignored.

2. Extrapolation by 3-point linear least squares fit.

Previously, extrapolations were made by exact linear fit to the last 2 valid (in the sense discussed above) points of the ITF. Because of noise in the ITF components, this procedure placed undue weight on the 2 points used. As an alternative, a linear least-squares fit to the last 3 valid ITF points has been adopted. This procedure is illustrated in Figure 1.

The combined effect of changes 1) and 2) discussed above is most evident in the reduction of excessively large extrapolated FN values resembling "spikes" in the data. This is attributed to both the better behavior of the 3-point fit and the elimination of the influence of nearly saturated ITF levels. Figure 2 illustrates the excessive extrapolation that could occur before July 10, 1981 in the upper portion and the effect of the improved extrapolation in the lower panel.

Note that since all data image DN values in the range 251 to 254 (as well as, of course, 255) are now always converted to FN by extrapolation, more extracted data points are now being flagged as extrapolated.

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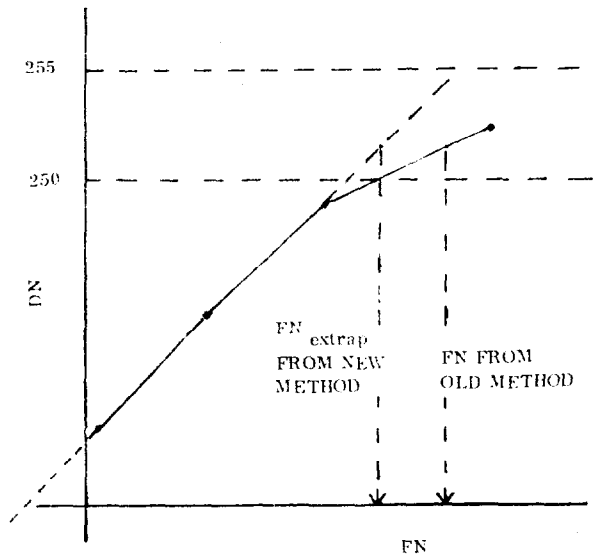
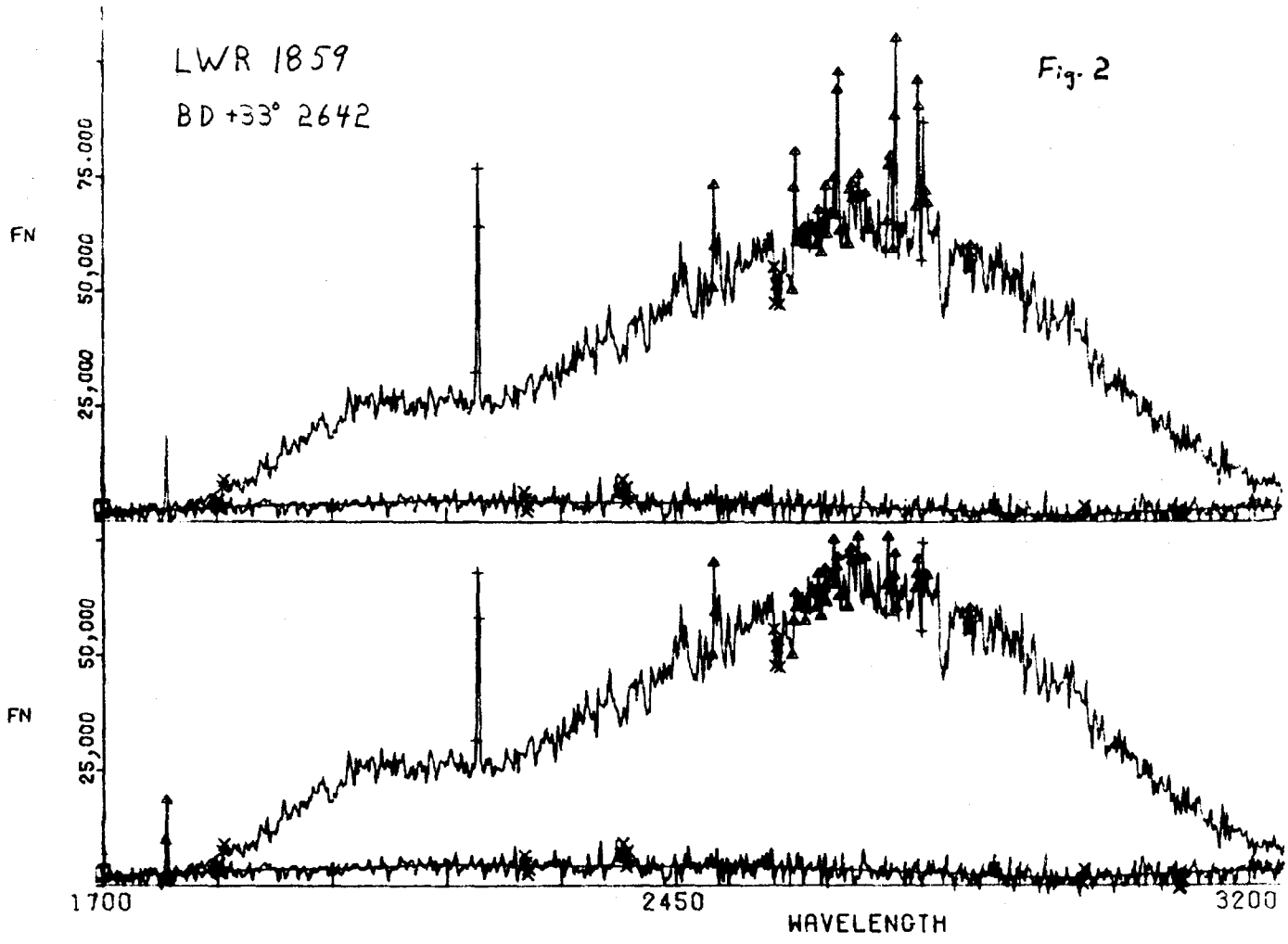
Fig 1


255
250
DN
FN extrap
FROM NEW
METHOD
FN FROM
OLD METHOD
FN


LWR 1859
BD +33° 2642
Fig. 2
FN
75,000
50,000
25,000
FN
50,000
25,000
1700
2450
3200
WAVELENGTH