Ly-α Removal in Low Dispersion SWP Spectra

Various users have expressed the desire to have the Ly-α geocoronal line removed from their spectra, since this sometimes hides astrophysically important information which would otherwise be present. We describe here a program which does this using the data available on the G.O. tape.

From a survey of sky-only SWP spectra we have made a model that allows the correction of this emission in long exposure, low dispersion images using least squares techniques. The correction is made on the fourth file of the G.O. tape. The sample of sky-only spectra used for modelling was collected between June 79 and February 80 with exposure times ranging from 30 to 190 minutes. The data were taken with different orientations of the telescope, but assuming the large and small aperture profiles to be constant a Ly-α model was constructed by averaging over the sample. The analysis of the data shows no evidence of variations in the aperture ratio, which is found to be 31.45 ± 1.66, 25% larger than the measured value of 25.6. This difference is probably a consequence of the spatial extent of the geocoronal Ly-α.

The model of sky-Lα emission is generated by averaging, after background subtraction, all spectra in the sample prior to averaging, each single image was shifted in line and sample to match the centroid of the large aperture component; fractional pixel shifts are performed by interpolation and improve the accuracy considerably.

In the decontamination procedure, the contribution of sky-Lα in the actual spectrum is estimated using the area without data from the observed target; from the large aperture for spectra collected through the small aperture, and from the small aperture and part of the large aperture for spectra collected through the large aperture.

The observed spectrum is corrected by the subtraction of the geocoronal Ly-α model which has the form:

$$A \cdot h_{ij}$$

where h_{ij} = the Ly-α model and A is a scaling factor, determined from:

$$A = \frac{\sum_{i,j} w_{ij} f_{ij} h_{ij}}{\sum_{ij} w_{ij} h^2_{ij}} ,$$

w_{ij} = weighting function (0 or 1), defining the area where only sky-Ly is present, and f_{ij} = the observed spectrum.

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The success of the method is obviously strongly dependent on the exposure time. The errors are shown in figure 1 as a function of exposure time for both large and small aperture.

Although at the time of writing no general code is available, we expect to have this by the end of January 1981. Users wishing to obtain this code are requested to write directly to the first author (J.D.P.).

A more detailed description is included in the Proceedings of the Workshop on IUE Data Reduction held at Vienna, November 17-19, 1980 (see elswhere in this Newsletter).

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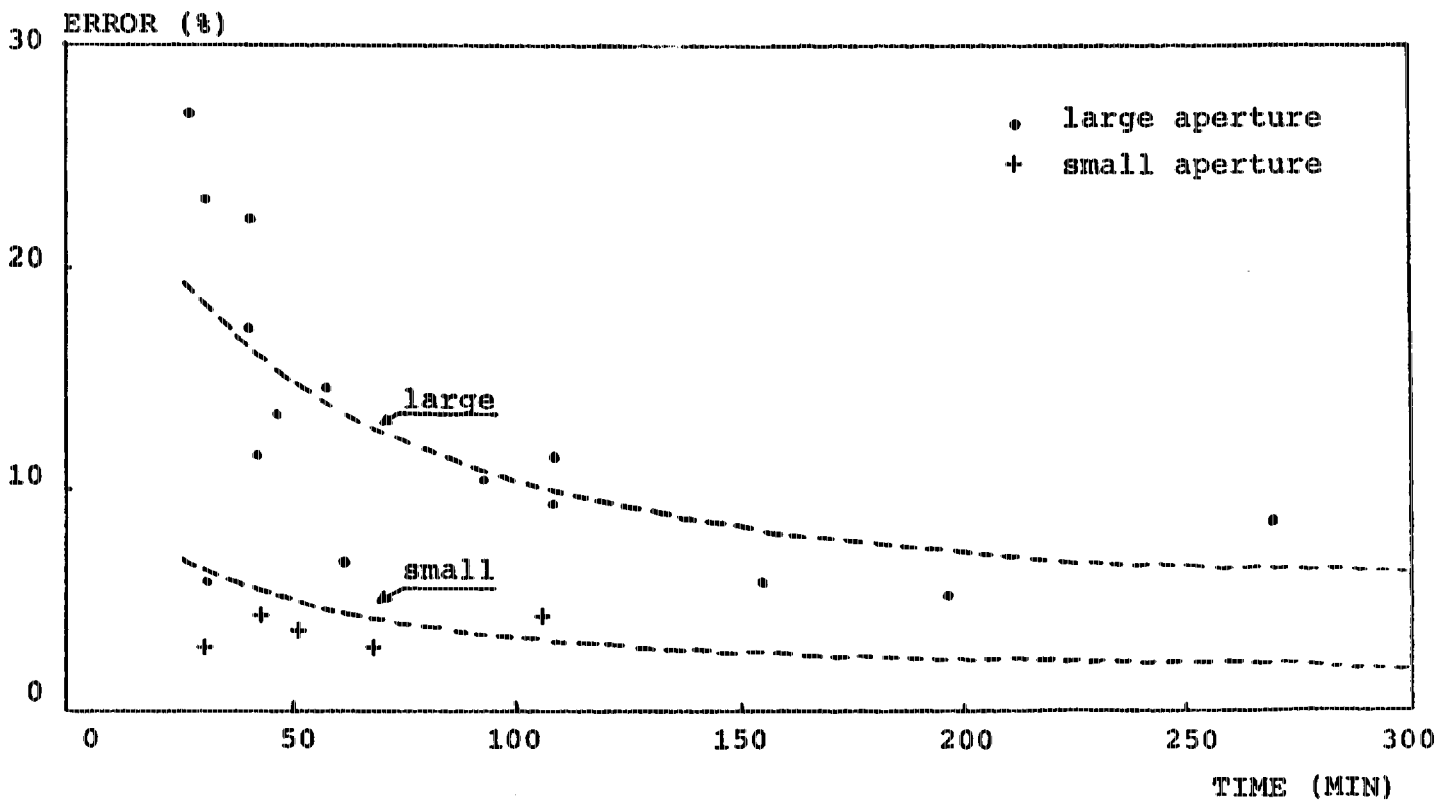
FIGURE 1



Errors in the correction method as a function of the exposure time for typical exposures. This mainly represents the variation in S/N with exposure time, shown as dotted lines.