

Improvement in Signal-to-noise from Adding Low Resolution Spectra

It was suspected that the IUE cameras might exhibit some level of fixed pattern noise in the spectra; for example, variations in sensitivity of the camera phosphor would present noise spikes and dips at the same wavelengths in all spectra, and summing the spectra would therefore not improve the signal-to-noise ratio. However, the wavelengths shift somewhat from exposure to exposure, which tends to smooth out any non-random noise. The improvement in spectral signal-to-noise ratio with addition of spectra was tested in the course of adding up to fourteen 15-minute SWP exposures of the center of Jupiter. As these exposures were added, the standard deviation of the spectral noise over the wavelength interval 1300-1450 Å (which is continuum background) was plotted as a function of the number of exposures added (see Figure 1); the error bars for the plotted points were determined by the average deviation of several values of 1σ taken from adding different combinations of exposures. If the spectral noise were completely random and followed a Gaussian distribution about the average signal level, the measured value of 1σ would decrease in proportion to $1/\sqrt{N}$, where N is the number of exposures summed. A curve of $1/\sqrt{N}$ normalized to the point at $N=4$ is plotted as a dashed line in Figure 1. The measured decrease in spectral noise, as indicated by the plotted points, appears to reach a plateau level when 8-14 exposures have been added; however, adding up to 8 or 10 exposures provides a significant decrease in the 1σ noise level.

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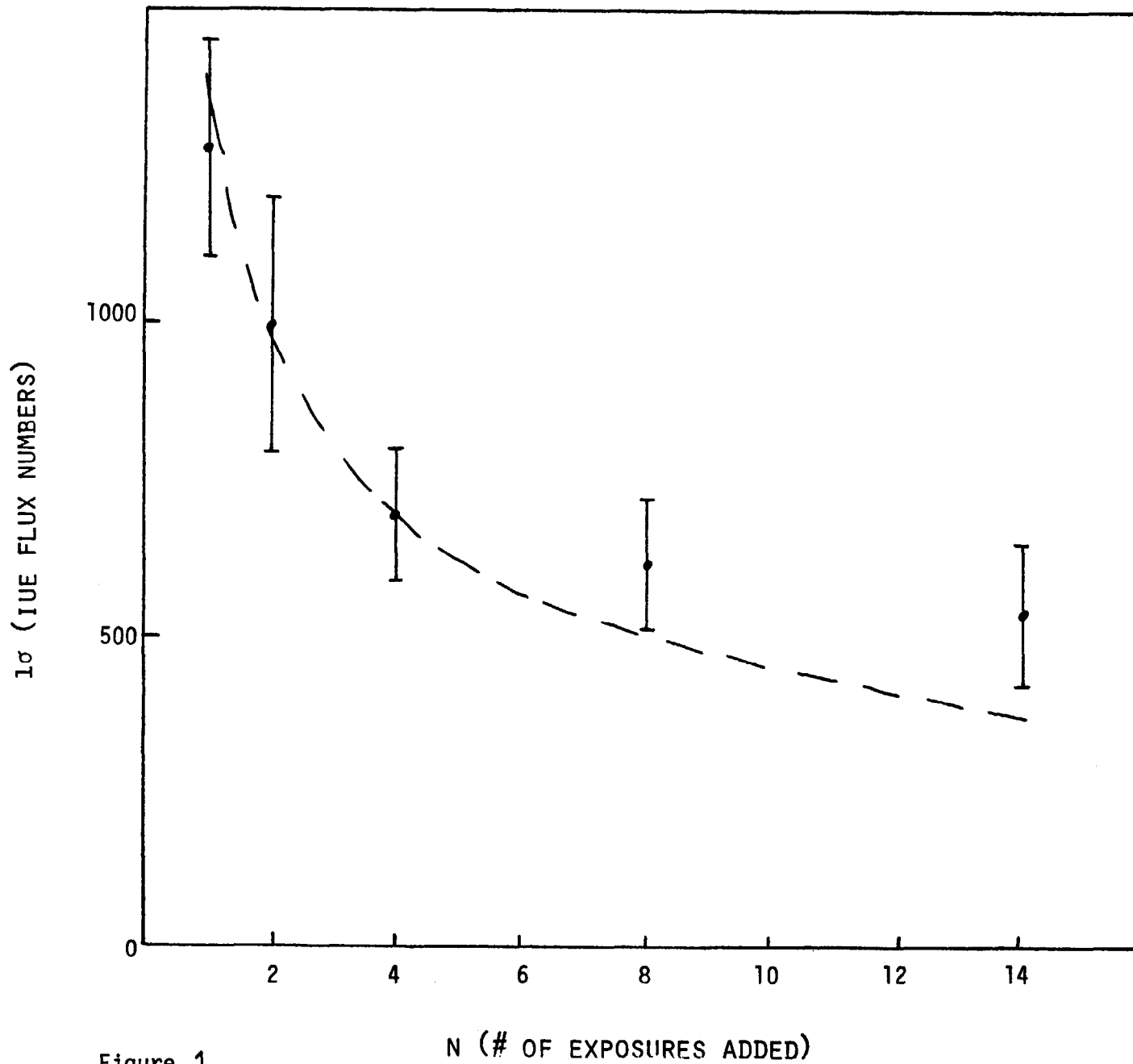


Figure 1