FAR-ULTRAVIOLET STUDIES. VIII.
APOLLO 17 SEARCH FOR ZODIACAL LIGHT

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Solar System dust particles reflect sunlight, producing the so-called zodiacal light (Leinert 1975). The spectrum of the zodiacal light in the far ultraviolet has been a matter of controversy in the past, and remains a subject of great interest.

In Paper VI of this series (Anderson, Henry, and Fastie, 1980) we reported analysis of a large quantity of far-ultraviolet spectrometer data from the Apollo 17 mission. The discussion centered on a search for diffuse galactic light. In the present paper we re-examine these data, searching for zodiacal light. We set an upper limit similar to existing upper limits at somewhat longer wavelengths.

The spectrometer scanned from 1180 to 1680 Å every 12 s, while the spectrometer line of sight scanned the sky: the spacecraft rolled, with a 20 m period. Figure 1 gives (solid line) the intensity (corrected for instrumentally-scattered solar-system Lα radiation) observed in the band 1385 to 1474 Å during the first hour of the third astronaut sleep period

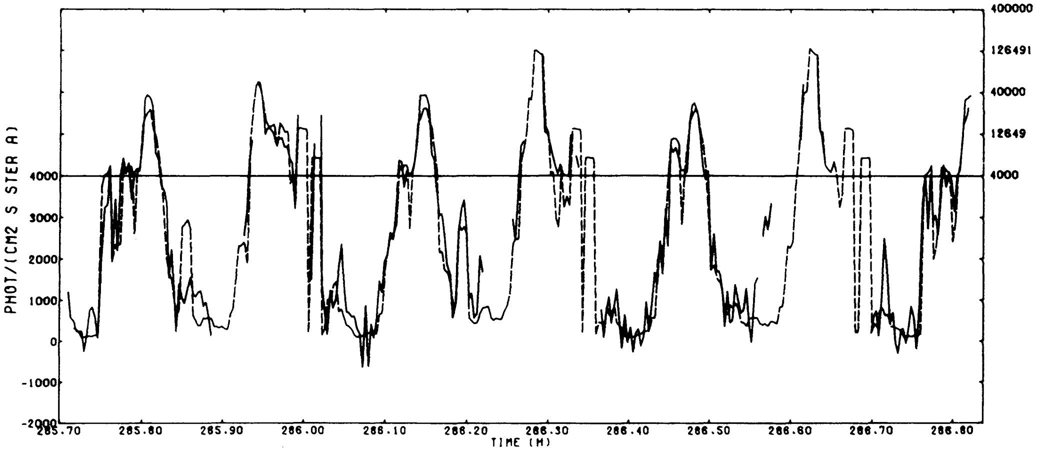

Figure 1. Data (solid line), and the star catalog integration (broken line).

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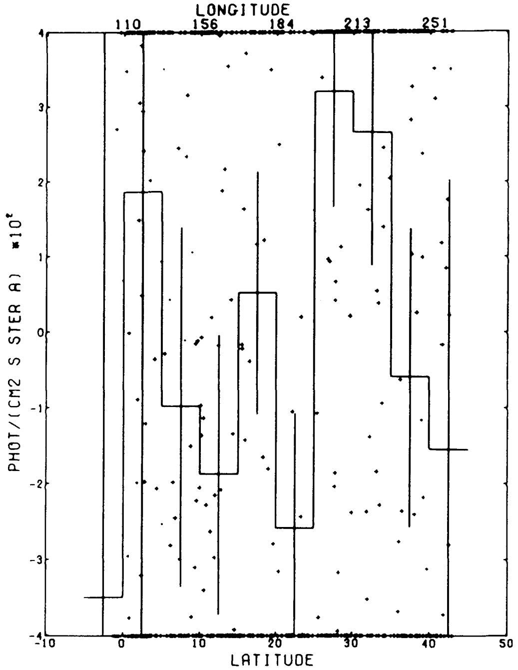

Figure 2. Sample residuals.

of trans-earth coast. The intensity scale is linear below the horizontal line; logarithmic above it. For comparison, the dashed line gives the result of integrating the SAO Star Catalog calibrated to the far-ultraviolet, following Henry (1977; Paper I).

Figures 2 and 3 show the results of subtracting the star catalog integration from the observed signal (1558 - 1669 Å) for two portions of the sky. Regions near the galactic plane have large error bars, because of the large, uncertain, stellar subtraction. Elsewhere, no evidence for a zodiacal-light signal is seen. Solar ecliptic longitude was 265°.

The entire body of residuals, for 1558 - 1669 Å, is collected in Figure 4, as a function of ecliptic latitude. Whatever the faults of the star-catalog integration as a means of correcting for the stellar contribution, it is at least certain that the star catalog does not "know" the location of the ecliptic plane. If a zodiacal light signal were present, a "bump" should appear centered on 0°

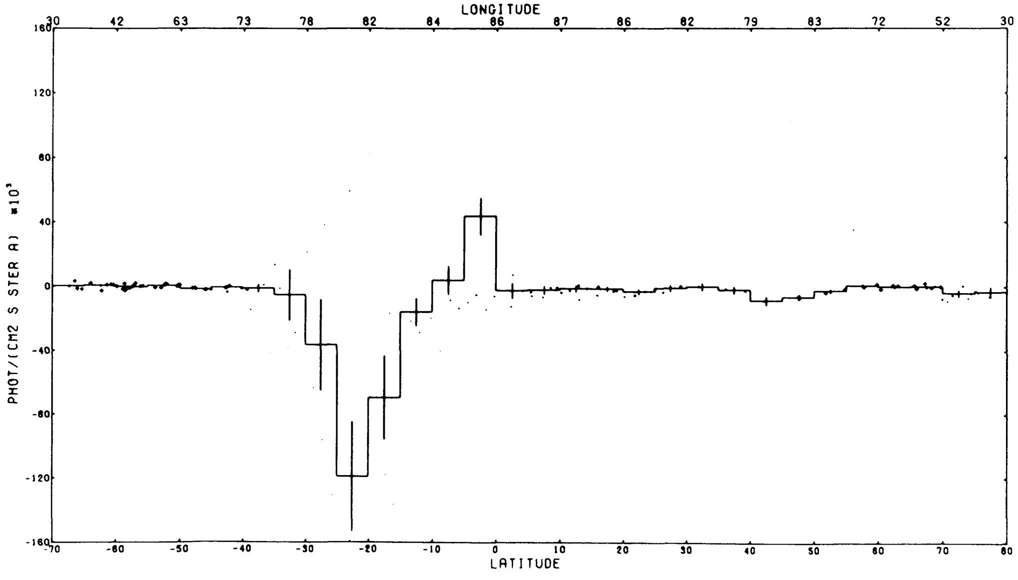

Figure 3. The same as Figure 2, but for another region of the sky.

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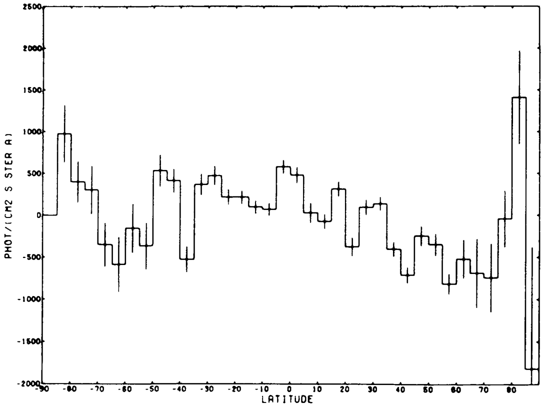

Figure 4. Residuals vs. ecliptic latitude

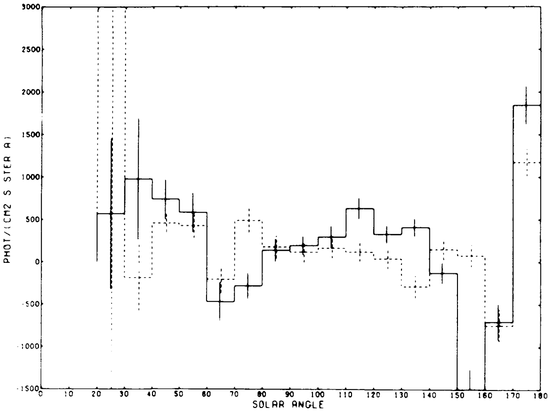

Figure 5. Residuals vs. solar angle,E&W

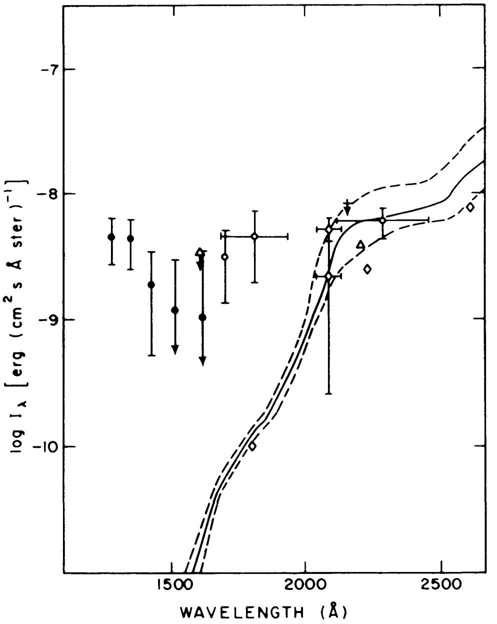

Figure 6. The spectrum

ecliptic latitude; little evidence for such a bump appears in the figure.

Similarly, the residuals are gathered as a function of solar angle in Figure 5. Again, the figure shows little evidence for a dependence of the residuals on an ecliptic parameter.

The residual spectrum for the observed parts of the entire sky is shown as the filled circles in Figure 6. Figure 6, adapted from Maucherat-Joubert et al. (1979), shows observations of the zodiacal light at a solar angle of 90°. The present data points are of a rather different character; they represent some kind of average over a large part of the sky. While positive residuals are obtained, this most certainly does *not* represent a detection of far-ultraviolet zodiacal light, or indeed of any light - it just reflects the limitations of the star catalog integration. The filled circles in Figure 6 should be taken as reasonable *upper limits* on the zodiacal light. The continuous line is the relative solar spectrum (the dashed lines, its upper and lower limits). Diamonds represent the data of Pitz et al. (1979); circles, Maucherat-Joubert et al. (1979); cross, Frey et al. (1977); and triangle, Feldman (1977). The present data are not inconsistent with any of these other data, but they are not adequate to resolve remaining questions.

ACKNOWLEDGEMENTS

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DISCUSSION

Zook; Roach: How does your result compare with that of Lillie (1972)?

Henry: We are at least a factor 10 below Lillie's 1680 Å intensity.

M. Hanner: How do your total brightnesses *before star subtraction* compare with the zodiacal light brightness reported by Lillie?

Henry: This may be determined by examining Figure 1. Our upper limits, Figure 6, correspond to about 300 photons/(cm^2 s sr Å). The observations shown in Figure 1 are very near this level, for high galactic latitudes, without any star subtractions at all. These high-galactic latitude regions contribute very heavily to the weighted mean residuals of Figure 6 because the associated errors are very small, compared to the errors associated with lower-galactic-latitude observations (the method of determining the errors is spelled out in Paper VI).

Greenberg: What changes, if the interstellar dust albedo is low?

Henry: Nothing, because high-latitude nearly dust-free regions dominate the weighted mean. Incidentally, if the results of Lillie (1972) are in error, the interstellar dust albedo and phase-function results of Lillie and Witt (1976) are affected: they state that "the zodiacal light correction (Lillie 1972) approaches 100% of the measured flux at all wavelengths for high galactic latitudes."