The ISG will disperse incident starlight using a transmission diffraction grating and focus the light onto a charge coupled device (CCD) detector which will measure the spectral irradiance reaching the instrument. The planned spectral resolution of the measurements is 3 - 5 nm, and the wavelength range from 400 to 780 nm will span the Chappuis bands of ozone, as well as absorption bands of NO_2 at shorter wavelengths and NO_3 at longer wavelengths. The CCD detector readout will undergo lossless compression and will be transmitted, together with the data from the GPS receiver and the other sensors, via an interface to the telemetry system, which will transmit the data to a receiving system on the ground over an S-band PCM-FM link.

2.1 Description of Experimental Methods

The NiteOwl experiment will measure ozone concentrations using a stellar occultation technique. The rotation of the payload during its descent through the atmosphere allows observations of stars all around the horizon, and measurements of ozone column concentrations at all azimuths where sufficiently bright stars are seen. The technique allows measurements to be made at any local time during the night, as it does not depend on tracking any particular star. The sun and moon need only be far enough below the horizon that scattered light may be neglected. Several stars will be visible in each 1-s image from the ISG; however, the signal-to-noise ratio (SNR) of 100:1 required for accurate spectral and tomographic inversion will only be achieved for stars of magnitude 3.0 or brighter. Repeated observations of each star from successively lower altitudes provide an array of lines of sight through the atmosphere. The combination of all sight lines through the region to be reconstructed provides the raw data on which tomographic analysis will be performed. Figure 1-4 illustrates the change with altitude of the spectrum of a third-magnitude G-type star when viewed tangent to the atmosphere. Ozone absorbs most strongly at 550 - 620 nm, while Rayleigh scattering reddens the transmitted light.

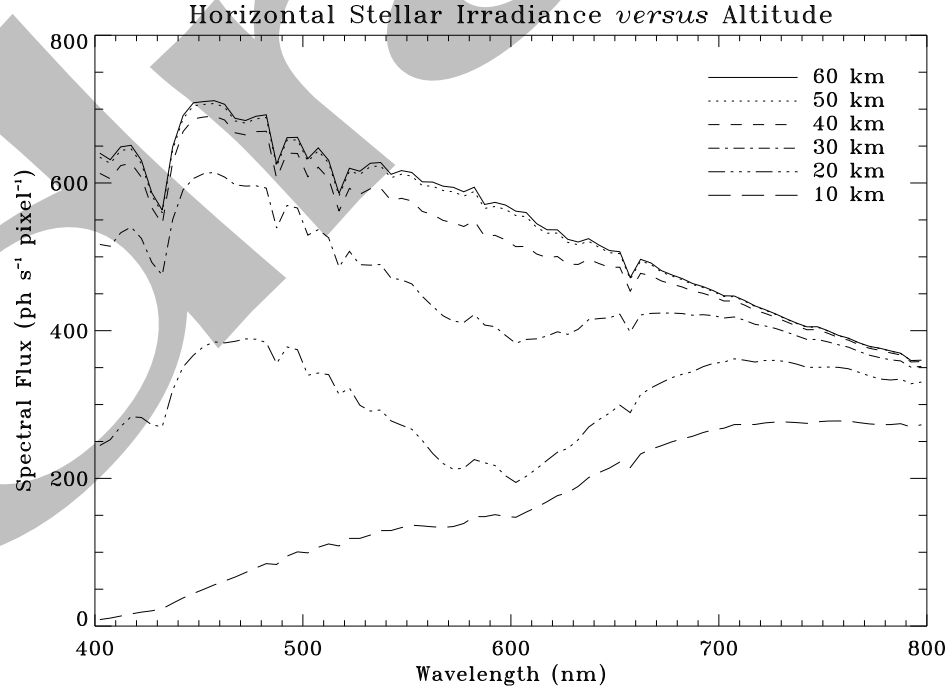

Fig. 1-4. Spectrum of a 3rd-magnitude G-type star viewed horizontally through the atmosphere at various altitudes.

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