Spectroscopy to be performed by observation of the Sun as the line of sight intersects the Earth’s limb ("Solar Occultation Spectroscopy"). However, observation of the Sun will begin or end outside the inner limits of atmospheric absorption so a large number of atmosphere-free solar infrared spectra will be acquired.

The spectrometer is a single-channel Fourier Transform spectrometer offering a spectral resolution of 0.013 cm⁻¹ over the range 550-4800 cm⁻¹ (2.1 - 18 µm) in 4 bands. Individual scans are accumulated in 1 second with a resultant signal/noise of 100 or more. Co-adding spectra can improve this to ~1000. Fields of view of 1, 2 and 4 mrad are available, with the capability of offsetting from the center of the solar disc. Concurrent visual images are acquired with a boresighted camera.

Following this initial flight, the ATMS spectrometer is destined to become a facility instrument and to be reflowed annually. In this phase, data collection and utilization will open to all investigators via the usual proposal route to the NASA Environmental Observation Division. Solar spectra from the initial flight will be published as part of an atlas of spectra of the Earth’s mesosphere.

The research described in this abstract was performed by the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration.

41.10 Oscillatory Phenomena in a Sunspot

Oscillatory phenomena in a large sunspot are studied by means of time series of high resolution photometric spectra in photophoric and chromospheric lines, taken with the vacuum tower telescope at SPO. Umbra oscillations and flashes are observed in the Ca II H and K lines. The dominant period (183 s) of umbral chromospheric oscillations observed on 1980 August 18 agrees with the period of oscillation in the transition region above the sunspot, measured almost simultaneously by the UPSF experiment on the Solar Maximum Mission. Three days later the dominant period of chromospheric oscillations had decreased to 171 s in the same sunspot. Umbra flashes in the Ca II K line occur regularly, and the time-resolved K line spectrum of these flashes has a characteristic, repeating, 3-shaped signature.

The temporal power spectrum of photophoric velocity in the umbra has a peak at 197 s, corresponding to one of the periods of chromospheric oscillation, and three peaks in the range 260-370 s, which we interpret as the response of the sunspot to forcing by the 5-min p-mode oscillations.

Within a prominent light bridge in the umbra we observe a series of sporadic, strong brightenings and broadenings of the K line, which we call light bridge flashes. The K line emission profile during a light bridge flash is broader, more intense, and more symmetric than the profile during a normal umbral flash.

This research was supported by NASA grant NGR-7562 and NSF grant ATM 80-21305 (U. Rochester).

41.11 Conditions in Solar Prominences: Relative Ba/Sr⁺ Resonance Line Intensities and the Internal Lya Flux
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This is the latest contribution to a continuing study of the physical conditions in the cool parts of prominences (and spicules) through a detailed spectrophotometric analysis of the metal line emission (e.g., Landman 1984, Ap. J., 279). In the present work the differential effect of H Lya on the ionization balance in the otherwise very similar alkali ions Ba⁺ and Sr⁺ -- lya photoionization from the ground state is energetically possible only for the former -- is used to provide a measure of the internal lya radiation field in prominences. The estimates for these ions have been recalculated using expanded model atoms (nine levels plus continuum for each ion) and new photoionization and radiative transition rates computed by the scaled Thomas-Fermi method with core polarization effects included. The calculated (Ba⁺/Sr⁺)/ (Sr⁺/Sr⁺) level population ratios are compared with those derived from relative Ba⁺/Sr⁺ resonance line intensities measured at Haleakula, with the result that our previous qualitative estimates for the internal Lya intensity are indeed appropriate. In particular, the Lya flux is small enough that the Sr⁺ ion in fact occurs predominantly as Sr⁺ under prominence conditions, and the efficiency of the Na/Sr⁺ and Mg/Sr⁺ intensity as a diagnostic is thereby confirmed. This work is supported by grants from NSF (ATF 81-16311) and NASA NGR (12-001-011).

41.12 A Gradient Model of the Sunspot Chromosphere
H. A. Beebe, W. E. Baggett, A. K. Dobson (N M State U), H. S. Yun (Seoul Natl U., Rep of Korea)

A model of the chromosphere above a sunspot umbra is presented which simultaneously satisfies Ca II spectral line observations and transition zone densities determined by a variety of space and ground based techniques. The Ca II H and K line profiles are based on observations made at Sacramento Peak Observatory. We compare average strong core emission features for the part of the umbra covered by the slit with calculated profiles to determine the optimum chromospheric model. The lower chromosphere is further constrained by Ca II infrared triplet lines which we found not to vary in strength over the umbra. Electron densities in the zone above the line formation region are based upon Solar Maximum Mission results reported by Guban et al. 1982, Ap. J. 253, 939, rocket UV spectra reported by Dere et al., 1982, Ap. J. 259, 366, and a number of other studies. Electron densities representative of those investigated correspond to a total mass of 2 x 10⁻¹⁵ g cm⁻³ at the top of the chromosphere.

Recent studies by Zhugzhda and Makarov, 1982, Solar Phys. 81, 245 describe the umbra chromosphere as a resonant cavity for slow-mode waves which produce umbral oscillations. The resulting limits on physical thickness introduce constraints that favor higher densities. Thus we have developed a sunspot chromospheric model which is consistent with a range of observational data. The resulting model differs from that proposed by Avrett (1981, Conf. Proc., Physics of Sunspots, SpO, p. 225) which is also resonant, and of greater physical extent than the current model. The effects upon line shape of differences in the temperature-density relation are reviewed.

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41.13 Evidence for Supersonic Solar Wind Velocities at 2.1 µm
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Results of July 20, 1982 observations of a coronal hole with a joint UV Coronal Spectrometer and White Light Coronagraph payload will be presented. The instruments were used to measure the intensity and line profile of H I Lyman-α, the O VI λ1032 intensity, the geocoronal H I Lyman-α intensity and the polarisation and brightness of visible light.

An analysis of the combined observations has provided strong evidence for supersonic outflow velocities from the coronal hole near the northern solar pole at 2.1 µm from sun center. The derived outflow velocities were obtained through use of a self consistent model that was highly constrained by the measured quantities. The sensitivity to outflow velocity is due to Doppler dimming of the H I Lyman-α and O VI λ1032 intensities. The measured hydrogen kinetic temperature, and the hydrogen and elec-