of the solar disc are presented which indicate the presence of low contrast structure on the 20-40 arcsecond scale.  

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49.04
Center-to-Limb Variation of Transition Region Redshifts

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Using the newly re-operative Ultra-Violet Spectrometer Polarimeter on-board the Solar Maximum Mission satellite, we have begun an observational program to explore the nature and temperature dependence of redshifts seen in solar lines formed in the neighborhood of 100,000K. Similar redshifts in the C IV 1550 A doublet have also been observed in several late type stars (Ayres et al. 1983, Ap. J., 274, p801) which has broadened interest in this topic. Our preliminary results using spectra taken within a 180 arc second slit show a definite center-to-limb variation of the line center positions of the C IV 1550 A doublet, the Si IV 1400 A doublet, and several O IV lines near 1400 A. These observations are limited to the behavior of the spatially averaged quite sun. This is the result expected if the disk averaged redshifts in late type stars are the result of stronger C IV emission in downflowing regions. We will also present observations in the O V line at 1371 A and the Fe XII line at 1349 A.

49.05
Extreme Limb Profiles of the Sun at Far Infrared and Submillimeter Wavelengths


We present 30, 50, 100 and 200 μm solar limb intensity profiles determined from EAO observations of the occultation of the solar limb during the total eclipse of 1981 July 31. We find significant but gradual limb brightening at the longer wavelengths consistent with the 8000 K temperature-plateau structure of the model chromospheres of Vernazza, Avrett and Loeser (VAL). The 100 and 200 μm limbs are extended significantly further above the visible limb than the VAL predicts. These results provide a strong basis for modeling of the solar chromosphere free of the assumption of gravitational-hydrostatic equilibrium.

49.06
The Role of Non-Classical Transport in the Formation of the Ly-α Temperature Plateau

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Observations of a large Ly-α flux (> 3 x 10^6 ergs/cm^2/s) from the Sun have led those who empirically model the solar atmospheric temperature structure (e.g. Vernazza, Avrett, and Loeser 1981) to postulate the existence of a ~100 km thick temperature plateau in the lower solar transition region near a temperature of 20,000 K, at which Ly-α is most efficiently formed. Such a plateau, if real, would lose energy at a rate more than an order of magnitude greater than the rest of the atmosphere, and so energy balance would require a very specialized heating mechanism that concentrates its energy deposition to a very narrow layer. Conventional theoretical models in which heating in the transition region is primarily via degradation of the classical conductive heat flux fail by more than an order of magnitude to explain this large radiative energy loss in Ly-α, primarily because the conductive heat flux is limited in classical theory by the local temperature gradient, which by definition is very small in a temperature plateau.

Following a suggestion by Shoup (1982, 1983) that the conductive heat transport in the transition region may not follow the classical form, we argue here that the heat flux carried by a non-classical, high-energy tail population of electrons should dissipate at roughly the correct place (lower transition region), over roughly the correct length (~100 km), with roughly the correct magnitude (~2 x 10^5 ergs/cm^2/s) to explain the observed Ly-α flux. Although this conclusion is based on calculations of the heat flux in a linear Krook model of electron transport, and so must be treated as tentative, it does provide strong motivation for future work on the more difficult non-linear problem of solving for the atmospheric temperature structure when both radiative losses and non-classical heat transport are self-consistently taken into account.

49.07
Vertical Helices in Deep Convection

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Three-dimensional computation reveals that near the top of a convecting gas several scale-heights deep, vertical helicity tends to concentrate along localized columns of strong down-flows. A schematic illustration of such structures is given in the following figures. Fig. 1 shows a side view of a set of flow lines which start (randomly) from a horizontal plane near the top of the gas. The deep density stratification forces the downward flow to converge; funnels are formed. Fig. 2 shows the same trajectories viewed top-down. The discrete nature of the vertical down-flows is evident.

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