Session 19: Solar Atmosphere
10:00–11:30 am, Chicago

19.01 Chromospheric Emission Bifurcation of Sunspots


We present a set of observations of active regions in which the area of bright chromospheric emission that covers much of the interior of the active region extends into the umbra of the leading sunspot. The data are NSFC vector magnetograms, Ha filtergrams from Herzberg Institute of Astrophysics, and Lyα spectroheliograms from the Solar Maximum Mission Ultraviolet spectrometer and Polarimeter. In these sunspots, the bright area abruptly ends at a sharp edge that appears to be bifurcated into two regions: the region of bright chromospheric emission contiguous with the interior of the active region and the remainder of the sunspot beyond the boundary of the bright area. The vector magnetograms show that the line of bifurcation of chromospheric brightness in the sunspot closely coincides with the bifurcation line in the direction of the transverse component of the magnetic field. This indicates that the enhanced heating in the bright area is a consequence of the magnetic field in that part of the sunspot being connected to the interior of the active region and that the lack of enhanced heating in the dark area is a consequence of the sunspot field being connected to places outside of the plage area of the active region.

We point out that this is consistent with Parker’s (1983, Astrophys. J. 265, 637; 1983, Astrophys. J. 264, 642) picture for heating in magnetic loops by work done to the feet of the loops by photospheric granulation.

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19.04 Boundary Changes in Coronal Holes

S. W. Kahler (Emmanuel College) and J. D. Moses (American Science and Engineering, Inc.)

Coronal holes are large scale regions of magnetically open fields which are easily observed in solar soft X-ray images. The properties of holes were extensively studied using images from the ASAS X-ray telescope on Skylab. The boundaries of coronal holes separate large-scale regions of open and closed magnetic fields. Photospheric motion of the field lines and magnetic reconnection will both contribute to changes in the hole boundaries. Previous studies by Nolte and colleagues using Skylab images established that large scale (2 x 10⁹ km) changes in coronal hole boundaries were due to coronal processes, i.e., magnetic reconnection, and not to photospheric motions. Those studies were limited to sequences of images separated in time by about one day, and no conclusion could be drawn about the size and time scales of the reconnection process at hole boundaries. However, sequences of appropriate Skylab images with a time resolution of about 90 min (one orbit) over periods of 6-10 hours are available for times of the central meridian passages of coronal holes 1 and 2. We are using these images to search for hole boundary changes which can yield the spatial and temporal scales of coronal magnetic reconnection.

19.02 Solar Helium II Line Profiles

William E. Behring (NASA/Goddard Space Flight Center, Laboratory for Astronomy and Solar Physics)

Profiles of the Solar Helium II line at 304 Å from Quiet and Active Regions on the Sun will be presented and compared. The profiles from the quiet regions are quite flat on top, whereas those from active regions are sharply peaked and considerably more intense. The highest active region also shows a significant red shift approximately 0.03 Å. Some possible implications for coronal active and quiet region structure (dynamics?) are considered. The solar rocket-borne spectograph which has a spectral resolution (∆λ/λ) of 10,000 and spatial resolution of 10 by 60 arc seconds will be briefly described.

19.03 Spectroscopic Coronal Observations Using a High-Sensitivity Camera

R. N. Smartt, S. A. Colley, L. B. Gilliam, S. Koutchmy, and J. B. Zirker (NSO and AFGL/Sacramento Peak)

Observations of coronal spectra have been obtained over different types of regions of the inner corona during sunspot minimum, using a new, high-sensitivity camera and the NSO/SP 40-cm aperture coronagraph. The camera was located at one of the foci of the Universal Spectrograph of the Evans Solar Facility. Some results are presented and discussed: a) almost simultaneous multi-ion observations (Fe XIV (5303Å), Fe XIII (782Å)), b) high-resolution observations of the 5303Å line with a radial slit in a typical enhancement reveal large Doppler shifts (> 9 km s⁻¹); c) observations in the region of a polar coronal hole in the Fe XIII line have been obtained under conditions of very small coronal radianc and sky background. Preliminary results, which include several thousand line profiles, indicate a larger line width than is typical for quiet sun regions.

19.05 Guided Waves in Diverging Coronal Hole Waveguides

Joseph M. Davila (NASA/Goddard Space Flight Center)

Waves within coronal holes are guided by the cross field density inhomogeneities in the solar atmosphere, especially low in the atmosphere r < 5 Rₜₜ. Recent work has shown that if these waves are responsible for the acceleration of high speed streams, then there is good reason to suspect that standard theories of acceleration using unguided, infinite medium, Alfvén waves is not appropriate. These studies however have been based on calculated wave modes propagating in slab (non-diverging) waveguides. In this paper this work is extended to a more realistic, spherically diverging geometry. Wave solutions for the diverging case will be discussed and compared with the slab model. Some of the implications for models of solar high speed streams will also be presented.

19.06 The Solar Wind Mass Flux

G. L. Withbroe (CFA)

In situ measurements indicate that although the temperatures, densities, and flow speeds of the solar wind are quite variable, the mass flux is relatively constant. The cause of the latter is not well understood. We have studied this problem using calculations of solar wind outflow performed with radiative energy balance models (cf. Withbroe, 1988, Ap. J., 325, 442). We discuss the results and their implications.