Abstracts

9.02
Short Term Evolution of Fine Scale Magnetic Structures

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We show high resolution (0.3° to 0.5°) continuum, magnetic and Doppler image sequences of a dense plage region in an active region over a 2 hour period taken on 29 September, 1988, at the Swedish Solar Observatory (SSO) on La Palma, Canary Islands. The data were collected using a system consisting of a high speed steering mirror for image stabilization, reimaging optics, a polarization analyzer, a blocking filter wheel, the SOUP flight tunable filter (bandpass 75 mA), and the OSL broadband CCD camera that uses a Texas Instruments 1024 x 1024 uniphase detector. The 29 September data show many examples of filigree in the continuum and Na 6768 line center images and intricate fine magnetic structure down to the spatial resolution limit of our magnetograms, some of which is precisely co-spatial with the filigree. It has long been known that bright filigree evolve significantly on time scales of 5 to 15 minutes. However, lower resolution magnetograms have not shown magnetic structures to evolve so rapidly. Indeed, it would be quite surprising if the magnetic field appeared and disappeared in a unipolar region on the time scale of minutes. Our movies reveal that magnetic structures both move and change shape on such short time scales. Although the total magnetic flux is not changing, the detailed magnetic configuration evolves and presumably causes the much larger brightness fluctuations.

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9.03
The Physics of an Interface Dynamo

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A simple cartesian model is used to discuss the physical interactions that can occur in a thin layer dynamo located in the interface region between the convection zone and the radiative zone in the Sun. In particular we will examine how the velocity field that is driven by the Lorentz force can lengthen the period of the dynamo waves. This same velocity field also tends to increase the horizontal wavenumber in the magnetic field. So that the primary constraints on the model equations come from the need to reproduce the period of the solar cycle with the correct spatial structure (k=1 in the horizontal direction). The regions of parameter space for which these conditions can be met will be discussed.

9.04
Results of Round-the-Clock Videomagnetograph Observation

H. Wang (BBSO, Caltech)

Videomagnetograph data of 6 coordinated observing runs between BBSO and Hinotori Observatory have been studied. Duration of observations range from 70 to 155 hrs. Night gaps are 4 to 6 hours. In this paper, we discuss some preliminary results related to the decay and diffusion of sunspot magnetic fields.

(1) Magnetic network cells have an average lifetime of 68 hours. More than half of the cells appear by breaking up and expanding from an existing network element; also more than half of the cells disappear by contracting into a single magnetic element.

(2) The rate of magnetic diffusion from the active region to the quiet sun is far less than expected from Leighton’s diffusion model. In some regions, we even found “negative diffusion”.

(3) From the run of July 8-11, 1988, we studied some properties of moving magnetic features (MMFs). In this region, polarities of MMFs are mixed and roughly balanced; there is almost no net flux accumulation at the boundary of the most; cancellations of MMFs with opposite polarities correspond to small flares and surges.

9.05
Sunspot Deficits for 1985 determined with a 2.5 cm Telescope and Linear Diode Array

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A small (2.5 cm aperture) telescope and photometer began full disk observations of the sun in 1985 on a daily basis. These images have a pixel size of approximately 5 arc-sec and require about 3 minutes to acquire. The observations in 1985 were obtained at 6778A with a bandpass of 30A. Typically, two images were obtained within a few minutes of each other. The images are calibrated for the gain and zero point of each of the 512 photodiodes and the resulting image processed with a software package (FDAP) that has been described previously. The result of each image is a summary, in 50 arc-sec square cells, of the corrected sunspot area, in fractions of the solar hemisphere, and the photometric deficit in millionths of the mean solar irradiance. Also obtainable is the Photometric Sunspot Index (PSI) based on location and the digital sunspot area. These data are available for about 2/3 of the days in 1985. The fluctuations in irradiance, as indicated by the PSI are compared with the fluctuations in the solar irradiance as measured by the ACRIM on board the SMM satellite. The ACRIM measurements are referenced to 1367.03 W/m². A lower value for the irradiance of the quiet sun is probably more appropriate. This research has been supported, in part, by NSF Grant No. AST-8603309 and NASA Grant No. NAGW-688.

9.06
On the Two-dimensional Inversion of Heliocentric Data to Obtain the Internal Rotation Curve of the Sun

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We discuss the inversion of helioseismology data to obtain the internal rotation curve of the sun as a function of radius and latitude. By assuming a functional form for the rotation curve, the two-dimensional Fredholm equation can be reduced to a set of three one-dimensional Fredholm equations. The data is then inverted using an iterative technique which generates both the maximum likelihood rotation curve as well as the confidence intervals on the inversion; results based on this technique are compared to results obtained by analyzing the forward problem and by other inversion techniques.