29.03
A demonstration of how crosstalk affects the polarization measurements of the MSFC Vector Magnetograph

E. A. West
NASA/ Marshall Space Flight Center
K. S. Balasubramaniam
National Research Council
NASA / Marshall Space Flight Center

In the "ideal" world the sun creates linear polarization that is either parallel or perpendicular to the transverse magnetic field and the solar scientist only has to worry about instrumental crosstalk in these polarization measurements. Unfortunately in the real world, vector magnetic field measurements are also complicated by polarization crosstalk created by the sun. Therefore, many of the problems plaguing the development (and intercomparisons) of vector magnetographs are associated with determining what is instrumental crosstalk and what is solar. This paper will discuss both instrumental and solar crosstalk showing how they change the linear polarization of the "ideal" sun into the linear polarization detected by the MSFC vector magnetograph.

29.04
Spatial Power Spectra of Mesogranulation and Supergranulation Velocity

Laurence J. November (NSO / Sacramento Peak)

Observations of large-scale steady horizontal motions are derived from cross-correlation analysis of a 3 hour time series of white-light granulation taken in quiet sun with the Sacramento Peak Vacuum Tower Telescope. The horizontal velocity reveals the 20-50 Mm supergranulation, whereas the divergence of the horizontal velocity shows mainly the 5-10 Mm mesogranulation. Spatial power spectra are computed from the horizontal velocity vector components. Most of the power in the velocity amplitude is for spatial scales larger than 20 Mm, whereas the velocity divergence shows little power for spatial scales larger than 15 Mm. We conclude that what was formerly identified as a separate scale of convection, mesogranulation, is actually the source for the observed supergranulation velocity. A statistical distribution of strengths in the source points can explain the disparate spatial scales. The divergence of the horizontal flow must be proportional to the vertical component of the 3D velocity field; mesogranulation may be taken as an indicator of the vertical component of the supergranular convection.

29.05
Spatially Resolved Measurements of Magnetic Field Strength Outside Sunspots

D. M. Rabin (NSO)

Slit spectra of the Zeeman-sensitive infrared line Fe i 6388.7 cm\(^{-1}\) (formed in the deep photosphere) enabled a direct measurement of magnetic field strength and its spatial variation in an active-region plage. The fields are strong (2-1000 gauss), in agreement with previous measurements in the infrared and indirect diagnostics in the visible. However, the data are not consistent with the hypothesis of a unique field strength in plage fluxtubes. Observed variations of ±25% in field strength cannot be attributed to instrumental uncertainties, although more data are needed to determine a field-strength distribution. The measurements employed the NSO McMath Telescope and vertical spectrograph, the NOAO infrared array imager (58 x 62 InSb), and ferroelectric liquid crystals to rapidly modulate circular polarization.

29.06
Disintegration of Colliding Sunspots

K.L. Harvey (SPRC) and V. Gaizauskas (HIA/NRC)

We report a sharp contrast in the interactions between different pairs of sunspots which collide within an activity complex of three bipolar pairs nested successively inside one another. The largest (and oldest) pair of p-spots are seen to slowly push against each other for 13 days without fully merging. The p-p pair rotate out of view over the western limb with a narrow (~ 1') light bridge still separating their umbrae. A younger p-spot, adjacent to the f-compassion of one of the older, colliding p-spots, grows quickly to match the f-spot in size. The slow approach (~10 m/s) over 5 days of the oppositely polarized spots to within 1' of each other produces no flare activity of consequence. Late on the fifth day, however, and within an interval narrowed to 7 hours, the circumstances of the p-f collision change dramatically. The f-umbra splits apart while the younger p-umbra elongates. We attribute the sharp change in geometry to the sudden release of an instability. A likely candidate is the interchange instability, triggered in the p-f collision when the approaching p-spot finally increases the usual backward tilt of the f-spot beyond a critical threshold.

29.07
Return Flux Sunspot Model: Zeroth Order Approximation

V. A. Oshervich (NAS/NRC), D. Deming (NASA/GSFC), and T. Hewagama (Univ. of MD)

The Return Flux (RF) parameter Xo relates the amount of the magnetic flux which returns to the photosphere in the vicinity of a sunspot and the total magnetic flux. According to the RF model this parameter depends on the umbra-penumbra relative size. We present a zeroth order approximation, which allows us to derive the magnetic field distribution from the relative umbra-penumbra sizes only. Comparison of our analytical formulars with observed fields for different sunspots supports the claim based on the RF model that the relative umbra-penumbra size is the main parameter in magnetic classification of sunspot umbre.

Session 30: Normal Galaxies
Oral Session, 10:00–11:30 am
Cochiti

30.01 (Dissertation)
M51's Spiral Structure

S. Howard (Georgia State University, now at Los Alamos National Lab)

A close encounter of the tidal kind can produce much of the spiral structure seen in many disk galaxies. As the encounter progresses the side of the galaxy nearer to the disturbing body usually develops a strong, thin arm from a fan shaped section of disk material. The opposite side's arm will be, in general, broader. The M51 system (NGC 5194/5195) presents an ideal case to study this effect. A combined analytic and numerical model of the interaction between M51 and its companion gives estimates for the orbit of NGC 5195 and time scales for some of the bright spiral features in M51 as well an explanation for the triggering of the optical spiral features. The success of this study of an individual galaxy has led to a gen-