56.03
Preliminary results from the Video Spectra-Spectrohelio-graph at the San Fernando Observatory
G. A. Chapman and S. E. Walton (SFIO/CSUN)

Observations of the irradiance fluctuations of the sun due to active regions have been augmented by observations of their magnetic and velocity fields using the SFO Video Spectra-Spectrohelio-gram (VSSHG) system. Consecutive, daily observations of a large active region, from 15 August to 22 August 1989, have been processed. At this time, the VSSHG data processing produces give simultaneous images from the video data. These five images have amplitudes which are proportional to (1) a weighted Stokes V signal, (2) a weighted Doppler signal, (3) a Babcock magnetic signal, (4) a relative line core intensity and (5) a continuum intensity. The weighted Stokes V signal should be proportional to line strength and line-of-sight magnetic field strength. The weighted Doppler signal should be proportional to the line-of-sight velocity and the line strength. These data have been obtained with the 28-cm vacuum telescope and vacuum spectrohelio-gram. The detector has been a COMU CCD camera and a Sony 5600 U-matic VCR. The spatial resolution is usually limited by the seeing to about 2", but in cases of high seeing, it is limited by the pixel size of about 1", in the E-W direction and about 2" in the N-S direction. Each line of video signal is from the sum of 3 video frames. Sunspots and faculae data from full-disk irradiance images from the CFDT (Chapman, et al., 1989) will be compared with the VSSHG results. VSSHG continuum images will be compared with images obtained in the nearby continuum using a linear diode array (Walton, et al., 1985) and the same telescope and spectrohelio-gram but at a wavelength of 6264 A. Most of the computing and video equipment have been purchased through funds from the Department of Physics and Astronomy, CSUN. This research has been supported by NSF Grant AST-8603309 and NASA Grant NAGW-688. We thank our departmental colleagues for their support.

56.05
Photometric Observations of Net Energy Excesses in Small Solar Active Regions
J. K. Lawrence, G. A. Chapman and A. D. Herzog (SFIO/CSUN)

Wide-area, dual-channel, photometric solar images were made daily from 29 July to 6 September 1984 with the San Fernando Observatory 28 cm vacuum telescope, vacuum spectrohelio-gram and 512 element Reticon linear diode arrays. In two swaths, the images covered the solar disk between 60° N and S latitude with pixel spacing 0.94". Simultaneous, co-registered images were made in the Ca II line at 8664 A and in nearby continuum at 8644 A.

Facular irradiance excesses and spot deficits were measured daily for several small, new active regions. Facular pixels were identified by a 3σ brightness excess in the line channel and spot pixels by a 3σ deficit in the continuum. The continuum irradiance changes were converted to luminosity changes using the center-limb variation of facular and spot contrasts.

Seven small, new regions were observed whose entire sunspot evolution apparently occurred within the observed disk crossing. Five of these showed a net energy excess during this time, and the other two showed energy balance with faculae still present when data taking ended. One additional new region showed only faculae. None of these regions returned on the next rotation. One much larger region showed a net energy deficit, but returned on at least one subsequent rotation as faculae.

We conclude that small, short-lived active regions, with spotless faces, show a net radiative energy excess of a few times 10¹¹ ergs during their lifetime.

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56.04
Comparison of SFIO Full-Disk Photometric Images with NSO Full-Disk Magnetograms
S. R. Walton, R. J. Wilson, G. A. Chapman (SFIO/CSUN)

Full-disk photometric images of the sun are produced daily, weather permitting, at the San Fernando Observatory (SFIO) with the 2.5 cm Cartesian Full Disk Telescope (CFDT). A 512 element linear diode array is positioned ahead of the sun and the earth's rotation is used to create a 512 x 512 image with 5 arc second pixels. Solar irradiance fluctuations due to sunspots and faculae have been inferred from these images for the month of July 1988. Sunspots were identified with pixels having a contrast of at least 8.5% below the quiet sun at 6723Å with a 100A bandpass. Faculae were identified by a contrast greater than 3% in a passband of 10A centered on the Calcium K-line (3934Å). The faculae were identified without regard to active region boundaries; thus, the photospheric network is also included. These data have been compared with full-disk magnetograms obtained from the National Solar Observatory (NSO) to determine the relation of magnetic flux to irradiance excess and deficit. The magnetograms are 2048 x 2048 with one arc second pixels. The Image Reduction and Analysis Facility (IRAF) developed at NSO was used to process the images. The CFDT images were registered with the magnetograms to within 1 CFDT pixel. The analysis of these data at the time of this writing is still in its early stages. However, we see at least a delay in the evolution of the magnetic field. For example, even though the Ca K images and NSO magnetic field strength, in the sense that the Ca K images and NSO magnetic field strength, in the sense that the Ca K images indicate that a coronal magnetic flux is present, this is not seen in the higher field strength regions. This research has been supported by NASA Grant NAGW-688 and NSF Grant AST-8603309.

56.06
Emergence of Solar Magnetic Flux from the Convection Zone into the Photosphere and Chromosphere
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Using a two dimensional magnetohydrodynamic (MHD) code, we study the nonlinear dynamics of solar magnetic flux emerging from the convection zone into the photosphere and chromosphere. An isolated horizontal magnetic flux with beta = 4 in initially located in a convectively unstable layer (the solar convection zone) beneath a two-temperature layered atmosphere (the solar corona-photosphere/photosphere). We assume ideal MHD, except in the photosphere, where we employ an approximate form for radiative cooling. The combined effects of convection and magnetic buoyancy carry the magnetic flux from the convection zone into the photosphere, whereupon it then expands through the photosphere and chromosphere. Gas slides down the expanding loop, resulting in the loop's evacuation and further rise due to enhanced magnetic buoyancy. Initially weak, the convection zone magnetic flux (B ~ 800 G) is amplified up to ~ 1000 G after emerging into the photosphere, due to the convective collapse of the flux tube. Subsequently, the flux is only seen in higher field strength regions. This research has been supported by NASA Grant NAGW-688 and NSF Grant AST-8603309.