40.04
Facular Contrast Near Solar Disk Center and the Inclination of Magnetic Lines of Force from Local Vertical
K.P. Topka, T.D. Tarbell, and A.M. Title (LPARL)
Photometric data obtained at the Swedish Solar Observatory, La Palma, indicates that magnetic areas in solar active regions, outside of sunspots and pores (faculae), are darker then quiet sun at disk center (by nearly 3%). Furthermore, the relative continuum intensity (contrast) of magnetic areas changes very rapidly with heliocentric angle, becoming greater than quiet sun for angles greater than 20°. The total change in contrast is nearly 6% from disk center to 45° heliocentric angle. These data were taken with the Lockheed tunable filter instrument using a CCD camera, and include continuum images of very high spatial resolution (up to 0.35), and magnetograms (up to 0.45), which have been registered to an accuracy of better than 0.1°. These same observations also reveal substantial differences in contrast in facular areas at the same heliocentric angles. This can be due to variations in the inclination of the magnetic lines of force from local solar vertical at the r(5000) = 1 level, and to variations in the distribution of sizes of the magnetic flux tubes composing faculae. We present evidence showing that most of the observed variations in contrast are due to inclination variations in the lines of force. The results indicate that inclination from local vertical of about 10° at the photosphere is common on the Sun. Footpoints of opposite polarity tend to tilt toward one another. Because of buoyancy forces models of isolated flux tubes predict that the lines of force should be vertical at the photosphere. This work was supported by Lockheed IR Funds, by the Swedish Royal Academy of Sciences, and by NASA contracts NASA-32805 (SOPP), NASA-26813 (OSL), NASA-30086 (MDI), and NASA-38106 (BSOP). and NSF contract ATM-8912941.

40.05
The Haleakala Imaging Vector Magnetograph
D. L. Mickey, R. C. Canfield, B. J. LaBonte, T. R. Metcalf (UI/UFA)
The Imaging Vector Magnetograph, now in daily use at the Maui Solar Observatory, Haleakala, Hawaii, extends our capabilities in the measurement of solar vector magnetic fields by providing high spatial and temporal resolution, together with extended area coverage. The instrument is based on a fast-readout CCD camera as its primary detector, a tunable air-spaced Fabry-Perot filter for spectral selection, and variable acromatic liquid-crystal retarders for polarization selection. A 23 cm aperture reflecting telescope provides an image the size of a large active region; it is coupled to the magnetograph in a configuration compact enough to mount on the Observatory's 3.6 m equatorial spar. The assembly can be pointed independently of the spar to select a region of interest, so the telescope is always used on-axis. A tilt-tilt image stabilizer corrects for image displacement due to spar shake or large-scale atmospheric turbulence. A workstation-based computer control system, incorporating separate processors for user interface, process management, and device control, permits accurate process timing along with a flexible user interface. The latter is implemented in an X-windows framework, so that in fact we have found it quite reasonable to operate the instrument from an X terminal at a remote location. The raw data images are stored on 8mm tape for off-line processing, or can be reduced in a few minutes using the instrument's built-in array processor to provide near-real-time magnetograms. Instrument operational parameters can be adjusted in several ways to favor spatial resolution, spatial field, temporal resolution or magnetic sensitivity, but typically we have a 4.5 x 4.5 arcminute field, 1 arcsecond spatial sampling, and an observation interval of five minutes. Initial solar observations showing current capabilities will be presented.

40.06
Measuring the Super-Hot Component with the BATSE Spectroscopy Detectors
R A Schwartz (Stix/GSFC), G J Fishman, C A Meegan, R B Wilson (MSFC), W S Puckett (MSFC and Univ. Ala. at Huntsville)
The discovery of the "super-hot" component by Lin, Schwartz et al. (1981) was the first clear identification of thermal bremsstrahlung emission at hard X-ray energies above 15 keV during a solar flare. By using balloon-borne germanium detectors with energy resolution better than 1 keV FWHM, the super-hot component was detected shortly after the peak of the impulsive phase non-thermal emission. During the flare decay, the measured photon spectrum was fitted well by the emission from a 35 million degree plasma with an emission measure of $3 \times 10^{71}$ cm$^{-3}$ over an energy range of 15-35 keV. Similar measurements have been unobtainable since the original 27 June 1980 balloon flight. Using the data obtained with the Burst and Transient Source Experiment Spectroscopy (BESPEC) detectors on the Compton Gamma Ray Observatory, we have been able to detect steep spectra above 10 keV during the decay phase of flares which must be due to super-hot component emission. Although the BESPEC detector energy resolution, 4 keV FWHM @ 10 keV, is not as good as that of germanium, it is still possible to measure the spectral parameters of the super-hot component. We will present super-hot component spectra from several flares, their fitted parameters and an estimate of their uncertainties. Lin, R.P., Schwartz, R.A., et al. 1981, Ap. J. (Letters), 251, L109.

40.07
HEIDI: A Balloon-Borne Payload for Imaging Hard X Rays and Gamma Rays from Solar Flares
Hard X rays and γ rays provide direct evidence of the roles of accelerated particles in solar flares. An approach that employs a spatial Fourier-transform technique for imaging the sources of these emissions is described, and the development of a balloon-borne imaging device based on this instrumental technique is presented. The detectors, together with the imaging optics, are sensitive to hard X-ray and γ-ray emission in the energy range from 20 to 700 keV. This payload, scheduled for its first flight in September 1992, will provide 11-arc second angular resolution and millisecond time resolution with a whole-Sun field of view. For subsequent flights, the effective detector area can be increased by as much as a factor of four, and imaging optics with angular resolution as fine as 2 arc seconds can be added to the existing gondola and metering structures.

40.08
How Coronal Loops Brighten: Observational Results from the Normal Incidence X-ray Telescope (NIXT) Sounding Rocket Experiment
L. Golub (SAO), R. Haroon (U. of Chl.), R. Rashid (Harvard U.), and E. Spiller (IBM Res. Ctr.)
We have carried out a search for variability in coronal structures seen during three flights of the Normal Incidence X-ray Telescope (NIXT) rocket payload. The spatial resolution obtained was typically of order one arcsecond or better and the total observing time on each flight was about five minutes. Images taken near the start and end of the flight were digitized, cross-correlated and blinked against each other in a search for changes in the loop structures seen. In each flight there were observed clear and definite changes in some loops, particularly the smaller structures having lengths of 1-2 arcminutes; longer structures tend to show very little change during the five minutes of observing time. What is most striking about the observed variations is that they follow a scenario which has not, to our knowledge, been predicted by any coronal heating theory. The brightening of a loop almost always begins with the appearance of large, isolated "blobs" of emission along the length of a fairly diffuse structure which is nevertheless identifiable as a loop. These brightenings then elongate and become smaller in cross-section, eventually filling in the entire length of the loop and outlining a sharply defined, long thin bright structure. This thin loop thereafter becomes broadened in the transverse direction, eventually becoming a diffuse structure having the appearance of the initial state as described above. A theory of coronal loop heating will therefore need to explain the appearance, at isolated patches along the length of a magnetic field line, of diffuse brightenings which thereafter become connected into a single sharp structure.

© American Astronomical Society • Provided by the NASA Astrophysics Data System