3.04
An Electrograph for the Measurement of Electric Fields in Coronal Structures
T. Moran and P. Foukal (CRI, Inc.)

Macroscopic electric fields play a central role in the process of reconnection and particle acceleration that figure prominently in studies of flares and filament eruptions. Both d.c. and wave-related electric fields might be detected through their Stark broadening of emissions from a non-collinear population of neutral hydrogen in these structures. We have developed a sensitive technique for remote sensing of transverse electric fields using the polarization dependence of hydrogen-line Stark broadening and have constructed an instrument (electrograph) at Sacramento Peak to measure hydrogen Paschen line-width polarization dependence. The electrograph consists of a rotating half-waveplate and polarizer assembly situated behind the occcluding disk of the 40cm coronagraph, and a FC-controlled CCD camera at the focal plane of the Universal Spectrograph. Upper limits of about 20 volts cm\(^{-1}\) have been obtained on macroscopic field strength in several quiescent prominences that we have been able to observe so far. This work is supported by the Air Force under SBIR contract P19626-87-C-0110.

3.05
CoSMiOC IV: Interpretation of Multiwavelength Observations of a Sunspot and Plage

Simultaneous observations of an active region located near disk center were obtained with the Very Large Array (VLA), the Solar Maximum Mission X-Ray Polychromator (SMM/XRP), and the Beijing magnetograph on 18 December 1987, during the Coronal Magnetic Structures Observing Campaign (CoSMiOC). The active region contained a sunspot with longitudinal photospheric fields up to 2500 G and a nearby area of plage. The microwave observations were made at a series of four closely-spaced frequencies within each of the 6 and 20 cm wavebands. The 6 cm emission is closely associated with the sunspot, while the 20 cm emission is associated with the sunspot, with loops connecting the sunspot and nearby regions of opposite polarity, and with the plage. Using the systematic shift in the location of the intensity peak in each of the wavelengths in the 20 cm waveband, we calculate magnetic field strength as a function of height in the loops near the sunspot. In the plage, where the X-ray fluxes are sufficiently high that line flux ratios can be used to determine the plasma temperature and column emission measure, we calculate theoretical 20 cm radio maps based on the assumption that thermal bremsstrahlung is the only contributing emission mechanism. A comparison of these theoretical maps with the observed maps enables us to determine the contribution from thermal gyroemission, and hence to determine the magnetic field in the plage. These results are compared with potential field extrapolations of the Beijing magnetogram using a code developed by T. Sakurai.

3.06
Average Plasma Properties of an Active Region from Broadband and Emission Line X-Ray Observations
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Average plasma parameters of solar active region AR 4901 were determined from the combination of 11 December 1987 observations by the Solar Maximum Mission X-Ray Polychromator and the ASE Soft X-Ray Imaging Sounding Rocket Payload. The broadband filtergram X-ray images complement the XRP emission line measurements by providing a relatively temperature-independent determination of the integral line-of-sight thermal energy density. In addition, the ratios of the filtergrams provide a cross-calibration of the XRP temperature and emission measure determination.

Spatial information is available from each instrument on a scale smaller than the approximately one arc-minute square average area taken for this comparison. Incorporation of this additional spatial information must await the forthcoming deconvolution of the filtergrams since the point response functions of the two instruments are very different. Because of the extensive and independent calibration of each of the instruments, this study provides a unique opportunity to cross-check two observational techniques used to determine solar coronal plasma parameters from X-ray observations.

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3.07
High-Dynamic-Range Multifrequency Radio Observations of a Solar Active Region
S.M. White, M.R. Kundu and N. Gopalswamy (Astro Prgm, Univ MD)

We present the results of high-dynamic-range observations of a solar active region at 3.3, 1.5, 4.6, 8.3 and 15 GHz during the International Solar Month. The active region consisted of two spots of opposite polarity when it appeared on the east limb, with the trailing spot having decayed by the time it reached disk center. The two oppositely-polarized spots show up as two similarly-polarized radio sources at 5 GHz while on the limb, but the polarization of the trailing part of the region has reversed by the time it reaches disk center. At 15 GHz the extraordinary mode is optically thin in the corona and shows only extended emission from the plage in the chromosphere with little effect contributed by the sunspot. The relative contributions of gyroresonance emission from the sunspot and thermal free-free emission from the plage can clearly be distinguished at the higher frequencies, and the way in which the surface of constant magnetic field increases in size with decreasing field strength is readily apparent.

3.08
New Observations of Storm Radiation at Decameter Wavelengths and Their Interpretation

We report multifrequency observations of storm continuum and other radio bursts. Based on their positional study and their correlation with other coronal and photospheric features, we deduce the magnetic field configuration during the storm radiation.

Energetic electrons trapped in the magnetic structures above the spots must be responsible for the storm radiation. We show that spontaneous emission of Langmuir waves by anisotropic distribution can explain the brightness temperatures as large as \(10^{12}\) K at the threshold densities if Landau damping is properly taken.