19.01
A Magnetograph Comparison Workshop

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Accurate measurement of magnetic fields is important for many areas of solar research, but quantitative comparison of magnetograms from different instruments has traditionally been difficult and often unsatisfactory. We describe here organizational and procedural aspects of a workshop designed to alleviate many previously encountered problems in communication, data handling, software, and distribution of workload. Details of the results are given in a companion poster paper. Participants in a small working group representing seven southwestern spectrographic magnetographs were loosely organized to observe three comparably stable sunspot/active regions (NOAO/SEL regions 7194, 7197, and 7201) during 15-19 June 1992. Observations and data reduction for each instrument were carried out by local standard procedures prior to the workshop. One worksession per magnetograph was installed in a meeting room and linked to the local NOAO/DSS network. Progress was reviewed periodically during the workshop, and discussions took place continually. This interactive process was unexpectedly successful in stimulating important exchanges of ideas and allowing participants to overcome many difficulties which have traditionally hampered such investigations. Comparisons were facilitated by bringing data in a common (FTTS) format which was easily interfaced with individual analysis software and internal data formats. Both IRAF and IDL were used at the workshop with similar productivity, and communication of both data and procedures was largely independent of software packages. Relatively good agreement was obtained between longitudinal magnetographs outside of spots and between vector or true-field magnetograms in spots, but important discrepancies were found in other comparisons. Seeing, scattered light, and instrumental polarization appear to be dominant sources of differences. In the future, we hope to use similar methods to compare spectrographic with filter-based instruments.

19.02
Simultaneous 1.6 μm and 12 μm Magnetic Field Measurements in Sunspots and Plages

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We have measured Zeeman splittings in the 1.56 μm and 12.32 μm infrared lines simultaneously. We used the Math-Chaffee FTS with a broadband facility detector at 1.6 μm, and a NOAA facility cryogenic postdisperser at the second FTS output. Since this configuration used the dual output capability of the FTS with a single input, the measurements at the two wavelengths are strictly co-spatial, and differences in the Zeeman splitting can be unambiguously attributed to height differences in the field strength. Although the data are still under analysis, a preliminary examination shows that the 1.6 μm field strengths in a sunspot are about 400 Gauss larger than the fields measured - 500 km higher in the 12.32 μm line. We address the question of variations in field strength with height, and the potential of using this technique to get information about the field structure. The data were collected over about two weeks sequence of observations of sunspots at GSFC, a variety of active regions were observed. We compared the results with high resolution magnetograms taken by Kitt Peak National Observatory, and compare the results of observations at GSFC with different techniques. This was supported by NASA RTOP 170-38-53-10.

19.03
Active-Region Evolution From Magnetic Flux Measurements

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An algorithm has been developed that converts a chronological list of magnetic active regions observed on the solar disk into a sequence of individual active regions. The original chronological list was developed by Howard (1989) from the Mount Wilson daily magnetograms. The original list has been modified to compensate for magnetic flux averaging over the variable sized bins. Over 200 different active-region sequences were extracted from the data that covered January 1974 through December 1989. Examples of active-region sequences resulting from this algorithm will be presented.

Since the active region observations are limited to ±65° Central Meridian Distance, any one active region will be observed for at most 10 consecutive days. We will attempt to predict the behavior of the active regions during the time it was unobserved by a least-squares fit of the observed data points to a standard curve of the form

\[ F(t) = \frac{A}{\tau} e^{-t/\tau} + D e^{-t/\tau} + G \]

where A, B, C, \( \tau \), D and E are free parameters, and G is the minimum magnetic flux of the active region. Initial results from the curve-fitting analysis show promise in the parameterization of the evolution of the magnetic flux of active regions over a lifetime of several solar rotations.

19.04
The Shape of the Solar Sunspot Cycle

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The temporal behavior of sunspot cycles, as described using the International sunspot numbers, can be represented by a simple function of four parameters. These are the parameters that govern the total number of sunspots, and the time interval from minimum to maximum, and the time interval from maximum to minimum. The parameters are obtained by fitting the function to the data and are found to be related to the amplitude of the cycle, the time interval from minimum to maximum, and the starting date for the cycle (not to be confused with the date of sunspot minimum). Because the time interval from the start of one cycle to the start of the next is related to the time interval from minimum to maximum, with both parameters being related to the amplitude of the cycle, the representation of each sunspot cycle can be reduced further to a function of only two parameters, the amplitude and the starting time. Examination of the sunspot record reveals that these parameters can be reliably estimated after the first 3 years of a cycle, thereby providing a good prediction for the remaining 7-9 years of the cycle as well as an early estimate for the start of the next cycle. Our analysis of cycle 22 (through 1992) indicates that cycle 23 should start near March 1996, with smoothed sunspot number minimum following about 6 months later.

19.05
ACTIVE REGION AREA COVERAGE ON SOLAR-TYPE STARS

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Both solar observations and studies of sun-like stars reveal that sun-like luminosity variations are correlated with "activity" that is spatially associated with sunspots. The magnetic fields themselves are regarded as the surface manifestations of an interior dynamo mechanism which involves the interaction between rotation, convection, and an extend magnetic field. The further development