A Model for Long-Term Variations of Interplanetary Magnetic Field Strength
Y.-M. Wang, N.R. Sheeley, Jr. (E.O. Hulburt Center for Space Research/NRL)

Spacecraft measurements over the past two sunspot cycles have shown that the average strength of the interplanetary magnetic field (IMF) undergoes surprisingly modest long-term variation, unlike the total magnetic flux observed on the Sun. Attempts to simulate the IMF behavior using a potential-field source-surface extrapolation of the observed photospheric field yield calculated IMF intensities which vary by an order of magnitude and which are far too low near sunspot minimum. We obtain much better agreement with a model containing both interplanetary sheet currents, which deflect polar flux toward the ecliptic, and interplanetary volume currents, which maintain a residual latitudinal gradient in the IMF intensity. We conclude that: (1) the solar source of the radial component of the IMF can be represented by a first approximation by a dipole field whose axis is aligned with the rotation axis near sunspot minimum, but tilts closer to the ecliptic near sunspot maximum; (2) the radial IMF intensity is strongest in the direction of the dipole axis; (3) magnetograph measurements systematically underestimate the photospheric field by roughly a factor of 2; (4) the average strength of the photospheric field above latitude 55° is of the order of 10 G around sunspot minimum.

Session 20: Astrophysical Deductions from Astronomical Polarimetry
10:00–11:30 am, Empire A

20.01
Optical Polarization Measurements of Dark Cloud Magnetic Field Structures
F.J. Vrba (USNO/Flagstaff)

Measurement of the optical linear polarization of background starlight passing through the dust of molecular clouds provides a mapping, projected in two dimensions, of the magnetic field structures within those clouds. Recent observations of star-forming dark clouds, including Lynds 1661 and the Chamaeleon and Lupus complexes, are beginning to present a coherent observational picture of the role of magnetic fields in their evolution and subsequent star formation, which is consistent with theoretical expectations. Clouds with flattened morphologies generally have highly ordered magnetic field structures parallel to their minor axes and evidence for a lesser degree of star formation. In such clouds magnetic pressure may have prevented collapse perpendicular to the field lines. More highly star-forming clouds tend to have less ordered magnetic fields. There is clear evidence, however, that on more local size scales (103 au) magnetic fields play a significant role in the star formation process, even in non-magnetically dominated clouds.

20.02
Diagnostics based on Visible and Ultraviolet Observations of Intrinsic Linear Polarization
K. H. Nordseth (U. Wisconsin-Madison)

In the past several decades, one of the most familiar applications of polarimetry has been the use of linear polarization by scattering to probe stellar envelopes and circumstellar nebulae. Such observations yield otherwise unobtainable diagnostics related to the geometrical structure of unresolved objects.

The basic information available for analysis is the polarization amplitude and its wavelength and time dependence. In the stellar case (scattering source in the observer's beam), the amplitude depends on the nature and optical depth of the scatterers and on their geometrical distribution. Polarity wavelength dependence arises from wavelength dependence of the single scattering polarization, of the scattering cross-section, of any competing unpolarized opacity, and of any "diluting" unpolarized light. Time dependence arises when the asymmetry or the optical depth of the scatterers varies with time, as in a variable stellar wind or a binary system.

Wider use of this technique has been slowed by the problem of correction for interstellar polarization, a slow development of the required analysis tools, and a general lack of observations. Several advances in the field are removing these obstacles. The most common use of spectropolarimeters will result in identification of specific spectral features in the polarization, allowing the clear identification of the polarizing process and the removal of interstellar polarization. Polarization modeling has become more sophisticated. Future space instrumentation will extend polarimetric observations into the vacuum ultraviolet, where it is expected that the interstellar polarization will be reduced while most polarizing processes will be enhanced. Finally, the development of imaging polarimeters gives hope that in the next decade the database of polarimetric observations will expand dramatically as many- object survey projects become practical.

20.03
Spectropolarimetry of Active Galaxies and QSO's
J. Miller (Lick Obs.)

Session 21: W GAS: FITS, Data Analysis, Techniques and Systems
10:00–11:30 am, Empire B

21.01
Classification of Multi-Band Astronomical Images Using the NASA/GSFC Land Analysis System: X-Ray Applications

We investigate the usefulness of spectral and textural classification algorithms developed for use with Earth oriented remote sensing data (such as Landsat) when applied to multi-band astronomical data. The software tool used is the Land Analysis System (LAS) developed at NASA/GSFC for use with Landsat and related data. This image processing package is similar in philosophy and structure to AIPS and IRAF. It has a high level command