of dynamo theory and the origins of luminosity variability in the sun and solar-type stars requires crucial observational inputs that include estimates of the fractional area coverage or "filling factor" of magnetic regions on the stellar surface.

We discuss a method to estimate the filling factor of active regions on the spatially unresolved surfaces of solar-type stars. In particular, the He I triplet lines at 587.6 nm and 1083.0 nm, respectively, are excellent tracers of plage on the sun and, by implication, on other solar-type stars. These features do not appear (or appear only very weakly) in the quiet photosphere. Hence, the strengths of these features, as seen in absorption, yield lower limits to the active region filling factor. The utility of this approach depends on the application of model computations to infer the maximum absorption strength that these lines can attain in an active chromosphere. Moreover, joint observations of the D3 and 10830 lines can be used to infer the actual filling factor of magnetic (plage-like) regions on the stellar surface.

We will discuss both the theoretical and observational results thus far obtained in our efforts to calibrate these diagnostics for their use in deducing the fractional area coverage of magnetic regions in sun-like stars.

19.06
Association of a Siphon Flow with the Emergence of New Flux

Thomas and Montesinos (1991) proposed that siphon flows in photospheric flux tubes offer an alternate explanation for the magnetic flux concentration observed in the solar photosphere. In their paper, they suggested certain observational signatures for finding a new magnetic flux region emerging via the siphon flow mechanism. We observed active region NOAA 7216 with the Video Spectra-Spectroheliosgraph (VSHG) at the San Fernando Observatory (SFO). Studies of simultaneous co-registered vector magnetograms and dopplergrams show evidence of new magnetic flux emerging in a manner consistent with the siphon flow mechanism proposed by Thomas and Montesinos. A pair of newly emerging photospheric magnetic elements of opposite polarity was observed in vector magnetograms on 3 July 1992. The pair was separated by a distance of about 30,000 km. Uprifows were observed at the positive magnetic element, and downflows at the negative magnetic element. The Dopplergram on this day shows a stronger downflow in the negative magnetic element, and the next day, this region shows an asymmetric magnetic flux concentration, in the sense that the negative field element has a greater field strength.

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REFERENCE

19.07
Magnetic Field Configurations Basic to Filament Channels and Filaments
S.F. Martin, R. Billmoria and P.W. Tracadas (Caltech)

From analyses of H-alpha chromospheric structure together with line-of-sight photospheric magnetograms, we identify a fundamental rotational magnetic field configuration which characterizes the cross section of filament channels. The channel axis is along the apparent division between opposite polarity line-of-sight network magnetic fields or active region magnetic fields as observed near the center of the disk. The magnetic field along the channel axis is nearly horizontal with the solar surface and nearly parallel to the axis. Orthogonal to the channel axis, and with increasing distance from the axis, the magnetic field direction rotates to gradually increase the outward and inward vertical components of the magnetic field respectively on the two sides of the channel. Two and only two senses of this rotation in direction are found; these are defined as sinistral and dextral. Filament channels are evidently more fundamental than filaments because the channels are often observed to develop prior to the formation of filaments, to be longer than filaments and to survive the reformation and eruption of successive filaments. Filaments are also sinistral and dextral according to the classification of their channels because the magnetic field component along the long axis of fillaments is shown to be in approximately the same direction as the horizontal magnetic field along the axis of the channel. In addition, filaments were found to have two structural variations which relate one-for-one to the sinistral and dextral magnetic configurations. A sample of 82 predominately active region filaments and a sample of 72 filaments representative of the whole sun were analyzed to independently determine their magnetic class and structural class. For quiescent filaments, the dextral magnetic and structural types statistically dominate the northern hemisphere while the sinistral magnetic and structural types dominate the southern hemisphere. However, for active region filaments, no hemispheric pattern was found. From previously published data in the literature and more recent data, it is concluded that the dominance of dextral filaments in the northern hemisphere and sinistral filaments in the southern hemisphere has persisted throughout the current and last 3 solar cycles.

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20.01
Potential Field Extrapolation for the Quiet Sun Magnetic Field
James F. Dowdy, Jr. (NASA/MSFC)

The transition region of the quiet sun was initially modelled as the global interface between a large-scale, homogeneous corona and a cooler surface below. Gabriel was the first to examine the effects of structure resulting from the magnetic field, but his 2-D model still assumed a simple interface below a large scale corona. EUV spectrophotograms of the transition region have revealed that it is too inhomogeneous to be simply driven by the large-scale corona. It is likely that the small-scale magnetic field has a role, but the influence of large loops on smaller loops is not clear. They probably both contribute to the transition region. Until now modeling efforts have assumed either large-scale magnetic structure, like Gabriel's model, or single small-scale loops which are independent of each other and of the large-scale field.

We have developed techniques for extrapolating the 3-D potential field solution above a line-of-sight magnetogram of the quiet sun. Potential field solutions have long been applied to active regions and sun spots where the field is strong and localized within the field of view, thus minimizing edge effects. The quiet sun requires a different set of boundary conditions because the mean field strength and its fluctuations are relatively constant over the field of view right into the adjacent regions where no data are available. The problem cannot be attacked directly. Instead, we develop solutions for two bounding cases representing the two extremes of a spectrum of possibilities for the large-scale field. These solutions permit us to examine the effect of the large-scale field on the small-scale field. We present example plots and discuss their implications for transition region structure.