Session 35: The Sun
0930–1130 (Beam Hall 241)

35.01 Resonances of Solar Spicules. J.V. HOLLWEG, UNH, A.C. STEERING, UNH.

We consider the propagation of Alfvénic twists on solar spicules. We show that spicules can act as resonant cavities, and that the energy flux into the spicule can be dramatically enhanced in the vicinity of the resonant frequencies. We suggest that the resonances may account for the observed 'rotation' of spicules. We also suggest that the energy can be dissipated via a Kolmogorov turbulent cascade, mediated by Kelvin-Helmholtz instabilities. The predicted heating rate is enough to ionize the spicule, thus accounting for the tendency of Na spicules to fade. The heating can also raise the spicule to EUV-emitting temperatures.

35.02 The Magnetic Field as a Function of Depth in a Sunspot Umbra. J.B. GURMAN, ARC/GSFC.

Extending the weak-field approximation of Umino (1965, Publ. Astron. Soc. Japan, 17, 108) to the wings of a strong line, it is possible to map circular polarization to longitudinal magnetic field as a function of wavelength. Using an atmospheric model that synthesizes the observed intensity profile, this mapping can be further extended to longitudinal field as a function of continuum optical depth, and, thus, as a function of geometric height. Observations of the Na I D lines obtained with the solar Fourier Transform Spectrometer at Kitt Peak National Observatory have been analyzed in this manner; the results are compared with more traditional methods of determining dB/dh in sunspot umbrae.

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Solar magnetic cycles are usually modelled by solving the $\alpha\omega$-dynamo equations in the convection zone with $B_\text{outer}$ at the outer boundary. Such models give a rather low period of 1.5–6 years for the magnetic cycle of the sun, when one uses conventional estimates of the turbulent diffusion $\eta \sim \frac{1}{2} \nu L$ with $\nu \sim 1$ km/sec, $L \sim 10^8$ kms.

Parker analysed recent observational data to point out that the appropriate magnetic boundary condition at the solar surface appears to be $\frac{dB}{d\tau} = 0$ rather than $B_\tau = 0$, in that little or no net flux is observed to escape through the surface. We solve the $\alpha\omega$-dynamo equations for both boundary conditions in a slab and find that for situations similar to the solar dynamo, the period increases by a factor 2.11 when the boundary condition is changed from $B_\tau = 0$ to $\frac{dB}{d\tau} = 0$, substantially increasing the period toward the observed 22 years.


Using high resolution (48") maps of the $J=\text{K}=2$ CO transition obtained with the Five College Radio Astronomy Observatory 14m telescope, we investigate the morphology of three sources suspected of containing high velocity gas. Two of the three sources (B335, L723) are found to exhibit highly collimated bipolar structure. In the third object (L1455), we have detected the presence of two separate bipolar outflows. Positions of peak emission of high velocity gas in the red and blue lobes of B335 and L723 are offset from the central position of the outflow indicating the existence of a cavity swept out by a wind from a young stellar object. We introduce an emission-weighted distance from the central position and find that this distance is independent of velocity in the high velocity emission. This result indicates that the distribution of emitting gas is not highly dependent on velocity; this is consistent with a model in which the high velocity emission arises primarily from accumulated gas found at the ends of the cavity. Research at the Five College Radio Astronomy Observatory is supported by NSF Grant 82-12252.