correlation tracking can provide basic observational input for theories of wave generation. There are three types of waves in the thin flux tube approximation: sausage (longitudinal) modes, kink (transverse) modes, and Alfven (torsional) modes. Each of these families of modes is driven by fluctuations in a different property of the horizontal flow: sausage modes by the divergence of the velocity, kink modes by the velocity itself, and torsional modes by the curl (vertical component of vorticity). From SOUP and La Palma data, we have measured temporal power spectra of these three quantities. These spectra are compared with the more conventional spectra of vertical velocities from Doppler shifts. The horizontal velocities can also be used to estimate the diffusion constant for flux tubes, which is important in some theories of heating by dissipation of field-aligned electric currents.

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Spatial discretization is second order FD on a staggered mesh, stretched in the radial direction. The equations, in conservative form, for density, momentum, vector potential, and total energy are integrated in time using an ADI technique.

Proof-of-principle results will be presented, as well as preliminary results on the effects of the magnetic field on the characteristic length and time scales of the interaction.

This work is supported by NASA (NAGW-777) and USAF (AFOSR-85-0054)


54.04

Detailed Comparison of Quiet and Magnetic Sun

K. Topka, S. Ferguson, R. Shine, T. Tarbell, A. Title (LP ARL), C. Balke (Utrecht), G. Schärmer (SSO), W. Schmidt (KIS)

We present a summary of our detailed measurements showing significant physical differences between quiet and magnetic areas on the Sun. The observations were obtained at the Swedish Solar Telescope on La Palma in the Canary Islands during September, 1988. The Solar Optical Universal Polarimeter (SOUP) tunable filter was used. Other equipment used included a 1024 x 1024 CCD camera developed for the Orbiting Solar Observatory (OSL), and a sunspot tracker for image stabilization. Narrow bandpass images were obtained in the several spectral lines including Fe I 6302.5 (g=2.5) at $-60$ mÅ from line center in the two opposite states of circular polarization (for magnetograms), in Ni I 6767.8 at $-90$, $-30$, $+30$, and $+90$ mÅ from line center (for Dopplergrams), and in the continuum. The appearance of the continuum inside and outside of magnetic areas has been characterized. The relationship between photospheric filigree, line center bright points, and the magnetic field has been determined. Our measurements also show a substantial supression of the f- and p-mode oscillations in magnetic areas as compared to quiet Sun. Finally, intensity fluctuations slower than the f- and p-modes (convective processes, for example) show a supression in the continuum in magnetic areas but are enhanced in the bright points seen in line center.

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54.05

Magnetic Interaction with Compressible Convection

M. L. Theobald, P. A. Fox, and S. Sofia (Yale/CSSR)

Solar activity, from its source (dynamo) to its manifestations (e.g., sunspots) involves the coupled interaction between magnetic fields and convective flows. In order to simulate this type of phenomena, we have extended an existing 2-D compressible convection code [1] to include magnetic fields. This is accomplished through the advancement of the magnetic vector potential, guaranteeing divergence-free magnetic fields.

Spatial discretization is second order FD on a staggered mesh, stretched in the radial direction. The equations, in conservative form, for density, momentum, vector potential, and total energy are integrated in time using an ADI technique.

Proof-of-principle results will be presented, as well as preliminary results on the effects of the magnetic field on the characteristic length and time scales of the interaction.

This work is supported by NASA (NAGW-777) and USAF (AFOSR-85-0054)


54.06

On the Theoretical Distribution of Solar Granulation and Solar Mesogranulation

P. A. Fox, S. Sofia (Yale/CSSR) and K. L. Chan (NASA/GSFC)

During the past few years, there has been a joint GSFC/Yale effort to understand the nature of the solar convection region by means of a numerical model that properly accounts for the compressibility and the deep stratification that is found in the solar interior. The principal diagnostic tool to verify our model is its ability or failure to reproduce surface layer observations (those around and below its effective temperature) on varying spatial scales. In this poster, we will present an attempt to carry out such a test by examining the ability of our models to reproduce the horizontal scale distribution of solar granulation (mean cell size 1.5-5 = 1.8m) and possibly mesogranulation (cell size 5 to 10 Mm). These scales are derived by considering various correlations between flow and thermodynamic quantities (such as the vertical velocity and temperature (intensity) fluctuation). By filtering our monogranular (and above) scales (using the techniques of running means or moving averages), the correlations provide confirmation of the solar granulation scales. A discussion will also be presented regarding the convective nature of mesogranulation.

54.07

Granular Flows in the Solar Photosphere

S. Keil (GL)

Real time image motion compensation, correlation tracking techniques, and very narrow-band imaging make it possible to study solar atmospheric motions and structure in great detail. We have measured velocity and brightness fluctuations in the solar photosphere on spatial scales comparable to the solar granulation using several combinations of these methods. A very narrow-band filter (20mÅ) was stepped through the Ca I 6162 Å line in 10 mÅ steps. Correlation tracking methods were applied to the sequence of filtergrams to remove image motion and line bisector positions were computed at 23 intensity levels in the line. Five minute oscillations were suppressed with a spatial filter. A second method used an image stabilization system (spot tracker with agile mirror) and echelle spectrograph. A time sequence, lasting one hour and having a 1.5 sec sampling rate, was made in Fe I 5434 Å with the agile mirror locked onto a dark pore. Bisectors were computed at several intensity levels in the line for each horizontal position along the slit. Five minute oscillation were suppressed with a sub-sonic filter. Finally, a high speed video data collection and processing system was used to obtain measurements of granular evolution over a similar time scale. These images were correlation tracked and destretched to remove residual atmospheric blurring effects. The three data sets have been combined to form a picture of granular penetration in the photosphere. Results to be presented include vertical and horizontal cross sections of the photospheric flow field and its evolution.

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