2.07

Surface Waves in an Incompressible Fluid: Resonant Instability due to Velocity Shear

G. Yang, J.V. Hollweg (UNH/Durham)
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Magnetohydrodynamic (MHD) surface waves may, in general, decay via a process called 'resonance absorption' which is a possible candidate for solar coronal heating. We consider the effects of velocity shear on the resonance absorption of incompressible MHD surface waves. We find that there are generally values of the velocity shear for which the surface wave decay rate becomes zero. In some cases the resonance absorption goes to zero even for very small velocity shears. We also find that the resonance absorption can be strongly enhanced at other values of the velocity shear. The most interesting results of our work are that there can exist resonances which lead to instability of the global surface mode, and that instability can occur for velocity shears significantly below the usual Kelvin-Helmholtz threshold. These instabilities may play a role in the development of turbulence in regions of strong velocity shear in the solar wind, but an extension of our work to include compressibility is required before we can say anything definitive about the solar wind.

2.08

Evidence for Degree-Dependent Variations in the Frequency Splittings of Solar Sectoral p-Modes

E. J. Rhodes, Jr. (USC and JPL), A. Cacciani (U. Rome and JPL), and S. Kostenuik (UCLA)

We will present evidence that the rotationally-induced frequency splittings of intermediate- and high-degree sectoral p-mode oscillations vary systematically as a function of the degree, l, of the modes which are being sampled. We will demonstrate the existence of such systematic variations by comparing the splittings which we have obtained from two different observing programs which were carried out at the 60-foot solar tower of the Mount Wilson Observatory during the summers of 1984 and 1986. In the earlier program all of the spherical harmonics for \( \ell \leq 120 \) were employed and the sectoral harmonic frequency splittings were obtained by fitting a series of Legendre polynomials to the \( m \)-\( \ell \) frequency-splitting multiplets and then summing the odd expansion coefficients (i.e. \( \Delta \ell = a_1 - a_3 + a_5 \)). In the more recent study we obtained full-disc solar Dopplergrams with a 1024x1024 pixel CCD camera and a Na magneto-optical filter at a rate of one per minute for up to 11 hours per day on 5 consecutive days beginning on July 1, 1988. From the 5-day time series of these Dopplergrams 32,768-point power spectra were computed for the sectoral harmonic modes for \( \ell \leq 600 \). The frequency splittings of these sectoral modes were then obtained from a cross-correlation analysis of the prograde and retrograde portions of the power spectra. For \( 250 \leq \ell \leq 600 \) we have obtained splittings which are consistent with the rotation rate of the photospheric gas (i.e. 452 mHz). Between degrees of 100 and 250 these splittings begin to increase with decreasing degree until they are close to the rotation rate of magnetic features in the photosphere (i.e. 462 mHz). Between degrees of 80 and 150 the new splittings show much scatter than do the higher-degree splittings; however, even here many of the splittings are also consistent with magnetic-feature rotation rate. Below \( \ell = 80 \) the 1988 results are consistent with the systematic decrease with decreasing degree which was seen in the 1984 observations. The comparison of both sets of splitting measurements suggests that the solar internal angular velocity is not independent of radius throughout the convection zone and probably varies with radius beneath the convection zone as well.

2.09

Rotational Splitting of the Low-Degree Solar P-Modes

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Measurement of solar p-mode frequencies allows one to investigate the internal angular velocity profile of the Sun. The rotation of the energy-generating core is sensed by the frequencies of the low-degree modes and is of particular interest as it will provide information on the evolution of the Sun. However, making accurate measurements of the low-degree p-mode splittings is difficult due to: a) the small number of modes which can be observed and b) frequency fine structure in the power spectrum due to the finite lifetimes of the modes and modulation by the observing window function. Observations made of the solar disk without angular resolution are further complicated by the overlapping of the prograde and retrograde modes of a given degree in the power spectrum.

During the austral summer of 1987, full disk images with \( \sim 8 \) arc sec pixels and filtered to \( \sim 7 \)A passband centered on the Ca II K line were obtained at the geographic South Pole. These observations, which cover a period of 425 hours for a duty cycle of 55\%, were reduced to spectra in degree \( \sim 1 \), angular order and frequency. This has the advantage that prograde and retrograde modes at a given \( \ell \) are cleanly separated into different power spectra.

This paper presents the rotational splittings for degrees 15 < \( \ell \) < 10 obtained from the South Pole measurements and compares the results with other reports in the literature which come mainly from zero angular resolution measurements.

Session 3: Plans for Solar Cycle 23

1:30 pm, Classroom

3.01

The Ultraviolet Coronagraph Spectrometer For SOHO

John L. Kohl (CFA), Giancarlo Noci, (U. of Florence)

The Ultraviolet Coronagraph Spectrometer (UVCS) for SOHO consists of an occulted telescope system and two high resolution spectrometers. It is designed to determine plasma parameters that describe the solar corona from its base to 10 solar radii from sun-center. UVCS uses ultraviolet spectroscopic observations and diagnostic techniques to provide a sufficient number of empirically derived parameters to constrain significantly, theories of solar wind acceleration, coronal heating and solar wind composition. The measured line profiles and intensities determine random velocity distributions, densities, and outflow velocities of protons, minor ions and electrons.

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3.02

LASCO - New Generation Coronagraph for SOHO

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A new coronagraph has been designed to exploit the extraordinary observing opportunities of the ESA/NASA SOHO Mission to the L1 libration point. A very wide field of view (1.1 to 30.0 R\( _{\odot} \)) is achieved through a combination of three separate optical channels. In the inner portion of the field, 1.1 to 3.0 R\( _{\odot} \), spectral profiles of coronal emission lines are provided by a high resolution imaging Fabry-Perot interferometer. Extensive on-board processing and quasi-autonomous control allow an adequate flow of data despite the restrictions imposed on telemetry by the deep space orbit.

The experiment will be developed by an international consortium including the Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau, FKG, the Laboratoire d'Astronomie Spatiale, Marseille, and the University of Birmingham, England.

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