the coronal plasma by the reflected waves. In the present paper, we check the viability of this mechanism in terms of the plasma lifting and sinking velocities required to provide the heating in an empirical coronal hole model from Withbroe (Ap. J., 325, 442, 1988). We find these required vertical velocities to be comparable to the transverse velocities in the required Alfvén waves. Vertical velocities of this magnitude are substantial but still plausible if the reflecting waves are strongly absorbed by lifting the plasma. For a field of 10 gauss at the base of the hole, the required flux of Alfvén waves would give an observed rise velocity of 10 km/s above the limb of about 40 km/s, in good agreement with the broadening of EUV emission lines observed at this height in the corona by Hassler et al. (Ap. J., 348, L77, 1990). Hence, intermittent magnetic levitation is plausibly the main heating mechanism in coronal holes.

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55.07

The Effects of Kelvin-Helmholtz Instability on Resonance Absorption Layers in Coronal Loops

J.T. Karpen, R.B. Dahlburg (NRL), J.M. Davis (NASA/GSFC)

Resonance absorption was first proposed as a possible mechanism for heating the solar corona about 15 years ago. In this theory, individual coronal loops act as high-quality resonance cavities for Alfvén waves propagating up from the turbulent photosphere. Wherever the global resonance frequency of the loop equals the local Alfvén wave frequency, a narrow layer is set up in which small scale waves are excited and dissipated. One of the long-standing uncertainties in this scenario is the geometry and stability of the resonance layer. We have begun to investigate the effects of the Kelvin-Helmholtz instability (KHI), which can produce enhanced small-scale structure and turbulent broadening of shear layers on relatively rapid timescales. Using a series of MHD numerical simulations, we first explored the stability of a characteristic velocity profile with a range of peak amplitudes (Mach numbers from 0.05 to 0.5) and shear layer widths (from 0.01L to 0.2R, where R is the loop radius). The layer is considered unstable if the KHI grows to saturation within the resonance half-period (5-50 s). Our calculations demonstrate that the shear layer is stable only for low peak velocities (M ≤ 0.2) and large widths (> 200 km). As expected, the instability grows more rapidly for higher-speed flows. Next, we studied the effects of a velocity forcing that varies sinusoidally with time, which more accurately portrays the flows driven by the resonant Alfvén waves. For cases in which the KHI growth time (as derived from the constant-forcing case) is less than the resonance half-period, the standard KHI eddies form initially. The subsequent behaviour differs substantially from the constant-forcing case, however, consistent with the results of hydrodynamic simulations of periodically driven turbulence. In particular, the eddies are disrupted and cross-stream flows are enhanced, possibly increasing energy transport out of the resonance layer. We will illustrate the evolution of the unstable shear layer in the most interesting cases, and discuss the implications for wave-resonance models of coronal heating.

Session 56: Transition Region and Corona

Oral Session, 10:00–11:30 am

Fairfield

56.01

Are Microbursts Structureless?

N. Gopalaswamy (Univ. Maryland)

Microbursts are of lowest brightness temperature of all the radio bursts in the meter-decimeter wavelength regime. Since the low brightness temperature is a consequence of low level of Langmuir turbulence, it was thought that a nonlinear process such as the second harmonic plasma emission would be unimportant. The probable cause for low levels of Langmuir turbulence is the presence of isotropic density fluctuations in the corona which isotropicize the beat-generated Langmuir waves. The isotropy of the Langmuir turbulence favors the head-on collision of plasma waves needed to satisfy the kinetic conditions of harmonic plasma emission. For reasonable beam parameters, we find that the second harmonic plasma emission always dominates; the fundamental brightness temperature never exceeds 10^6 K. Thus we conclude that the microbursts may be structureless. We also find that the microburst electron beams are no different from the normal type III electron beams.

56.02

X-Ray Observations of Coronal Loops

K. Waljeski (NRC/NRL)

The plasma properties of solar coronal loops are investigated using broadband soft X-ray observations from the American Science and Engineering (ASE) High Resolution Soft X-Ray Imaging Sounding Rocket Payload and coordinated simultaneous X-ray emission line and ground-based observations. Two aspects of this work are presented:


2. Coronal Heating - The plasma properties (temperature, emission measure, and density) and lengths of coronal loops are determined from ASE broadband X-ray images. The radiative energy loss rate for each loop is determined from the observed plasma properties using the calculations of Cook et al. (1987, Ap. J. 338). The observed relationship between the radiative loss rate, loop length, and magnetic field strength is compared with the scalings predicted by various proposed coronal heating mechanisms.

56.03

The Determination of Temperature and Emission Measure from GOES Two-channel, Broadband, Soft X-ray Measurements

H. A. Garcia (NOAA/SEL)

GOES X-ray data are used operationally by the Space Environment Laboratory (SEL) for the primary purpose of prompt detection of solar flares. These data are also made available to external users, for operational purposes, and to the larger scientific community, as a reference for comparison with other phenomena. Some researchers have used GOES X-ray data to compute time-dependent plasma temperatures and emission measures. A number of problems should be considered when computing T and EM from these data. These problems have to do mainly with the constants, known as the transfer functions, that are used to transform the measured electric currents in each ion chamber into equivalent X-ray fluxes.

Operationally it is convenient to assume that the transfer functions, $G_{1.8}$ (soft) and $G_{0.54}$ (hard) are unvarying over all coronal temperatures. This is a reasonably valid assumption for the soft (1-8A) channel. For the harder (0.5-4 A) channel, however, a constant transfer function is valid only at very high temperature, $>30$ MK. The assumption $G_{0.54}$ constant becomes increasingly less valid at lower temperatures. A gradual increase in $G_{0.54}$ is observed below 20 MK; however, below 10 MK it turns sharply upwards, increasing without bound as temperatures progressively decrease.

A second problem with the transfer function affects the high temperature computations. The laboratory calibrations of $G_{1.8}$ and $G_{0.54}$ are based on a few discrete lines of FeXV. These evaluations are not sufficiently accurate for a rigorous application to the broadband solar X-ray spectrum.

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