ABSTRACTS

In the normal corona, this episodic heating and cooling will be accom-
panied by chromospheric evaporation and subsequent condensation.
We anticipate that the situation is simpler in prominences, where we
consider that a fixed amount of gas is trapped in each magnetic unit.
We present a calculation of the time-averaged differential emission
measure for such a system and compare it with observational data for
prominences.
We also discuss briefly the plasma processes that may be involved in
the proposed episodic heating of the corona.
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2.03
Alfven Wave Trapping and Heating in Coronal Holes

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S. T. Suess (NASA/MSFC) and Z. E. Musielak (U. Alabama,
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As we have recently demonstrated with a numerical simulation
propagate in a nonuniform medium where the medium does not
change too much over a wavelength; at long enough wavelengths
(or periods) reflection becomes important. The critical period, at
and above which reflection is so great that propagation is largely
cut off, is given by $P_a = 2\pi|dV_0/da|$, where the derivative of the
Alfven velocity $V_0$ is taken along the magnetic field. We evaluate
this cut-off period in hydrostatic isothermal coronal hole models
with power-law radial decreases in magnetic field: $B \propto R^{-\beta}$. For
values of $B$, $\beta$, and mass density representative of observed
coronal holes, we find that there is a temperature near $10^6$ K for
which all wave periods $P > 10^6$ s are trapped below a solar radius
above the surface, and that a small factor ($\approx 2$) increase in tempera-
ture removes the trapping to $P > 10^7$ s, allowing all waves with
shorter periods to escape into the solar wind. Because the ob-
erved temperature in coronal holes is about $10^6$ K, because the
period range $10^2 - 10^3$ s may contain most of the power in the Alfven
waves in the solar atmosphere, and because this power may be
as large as $10^6$ erg cm$^{-2}$ s$^{-1}$, our findings on the dependence
of trapping on temperature suggest that the temperature in coronal
holes is regulated by heating by trapped Alfven waves.

This work is supported by NASA OSSA through the Solar Physics
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Space Physics Division.

2.04
Subphotospheric Excitation of Alfven Waves and Their Role in
the Solar Atmosphere

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The results presented in the previous paper by Moore, An, Suess
and Musielak favor a range of periods ($10^2 - 10^3$ s for Alfven waves
if they are to be important in heating solar coronal holes. An
interesting problem is whether transverse tube waves generated in
the solar convective zone have periods in this range, and whether
they carry enough energy to balance losses from coronal holes.
Based on our studies of the excitation of purely transverse tube
waves by "forced" turbulence, we point out that for magnetic fields
of order $10^5$ G in the flux tubes, the wave energy spectrum peaks
at $2 \times 10^6$ s. For the amount of magnetic flux observed in coronal
holes, these waves would carry an energy flux of order $10^6$ erg
cm$^{-2}$ s$^{-1}$, enough to balance coronal hole heating and solar wind
acceleration. In addition, we find that the wave spectrum shows a
long period ($> 10^3$ s) tail, which becomes stronger as the plasma
$\beta$ increases. We suggest, however, that these long period waves are
unlikely to contribute to the flux of Alfven waves observed in the
solar wind far away from the sun because these waves are trapped
in the solar corona, i.e., they cannot escape into the wind.

2.05
Generation of Waves on Magnetic Flux Tubes by Horizontal
Velocities in the Photosphere

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Waves on magnetic flux tubes have been suggested as a signif-
ificant component of coronal heating in open-field-line regions such
as coronal holes. These waves are presumably generated by mo-
tions of the field lines in the photosphere and below, where the
energy density in convective flows greatly exceeds the magnetic
energy density. Estimates of the rate of wave energy generation
depend on poorly known properties of horizontal flow velocities.
Measurements of horizontal velocities as a function of time by
correlation tracking can provide basic observational input for the-
ories 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, both at fixed points in space and following the
motion of a flux tube advected by the flow. Initial examples of
these power spectra will be presented.

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2.06
Resonant Decay of MHD 'Surface' Waves on a Thick
Surface

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MHD waves supported by a 'surface' which is not
discontinuous decay via resonance absorption,
which is a candidate for coronal heating. Previous
analytical calculations of the decay rate assume that
the surface is thin, i.e. $k_s \ll 1$, where $k_s$ is
wavenumber and $s$ is the surface thickness. In this
paper we estimate the behavior of the decay rate
when $k_s$ is not small. We utilize an imaginary
 tunable antenna to excite the global surface mode.
The decay rate is obtained from the width of the resonance
curve which results when the antenna
frequency is continuously varied. The resonance
curve is obtained by numerically summing the
appropriate Frobenius series. For a cold plasma,
we find that the decay rate peaks when $k_s = 0.5-1.0$,
depending on the angle between $k$ and $B$. For a
 coronal loop, the decay rates are fast enough to heat
the coronal plasma.

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