1982 BAAS ... 14 ... 977 D

161ST AAS MEETING, BOSTON, MASSACHUSETTS

8 solar radii (R_s) and beyond can be used to determine plasma conditions in regions where solar wind streams are formed. Initial experiments with a rocket-borne UV coronagraph-spectrometer together with a white light coronagraph provided limited observations of H I Lyman-α profiles that have been used to determine kinetic temperatures in coronal holes and in quiet coronal regions out to 4 R_s. These observations also indicate that the outflow of coronal material within 4 R_s is subsonic in a polar region observed near the time of solar maximum (16 February 1980). Spectroscopic observation over a broader wavelength range can provide a more complete empirical description of solar wind generation including an enhanced sensitivity to outflow velocity, and determination of electron temperature, non thermal velocity, kinetic temperature and density of minor ions, and coronal abundances. Rocket observations on 20 July 1982 included measurements of O VI radiation at 1032 Å and 1037 Å as well as H I Lyman-α. New results from this flight will be discussed.

This work is supported by NASA Grant NAG-5128 to Harvard College and by NASA Grant NAG5-613 to the Smithsonian Institution.


Observations indicate the scattering mean free path in the interplanetary medium is much longer than standard quasi-linear theory predicts. The primary reason for this discrepancy is that two important physical effects are neglected in the standard theory. First, standard formulations neglect the finite propagation speed of the magnetic turbulence. This magnetostatic approximation, used extensively in the past, breaks down for particles with pitch angles near 90 degrees, and one must consider the more complicated process of scattering in electromagnetic turbulence. When the notion of electromagnetic resonance is applied to Cosmic Ray propagation in the interplanetary plasma, it is found that a "resonance gap" exists which provides a natural explanation for the observed magnitude and rigidity dependence of the proton mean free path. Secondly collisionless damping can significantly modify the spectrum of waves available to scatter particles. This damping also results in a "resonance gap". Incorporation of this effect allows one to predict scattering free propagation for electrons with kinetic energies 3 x 300 kev. This is in excellent agreement with the observed energy range for these events. One of us (MD) is currently a NASA-NRC Resident Research Associate at NASA-Goddard Space Flight Center.

44.04 MHD Equilibrium and Stability Properties of a Bipolar Current Loop - J. Chen, NRL/SAI

A study is made of equilibrium and stability properties of a semi-toroidal current loop imbedded in a high temperature plasma. The loop carries a toroidal (J_t) and poloidal (J_p) current densities. By explicitly including the global curvature of the loop, the net Lorentz and pressure force acting in the major radial direction are calculated and we deduce a class of equilibrium toroidal current loops satisfying \( j_b c \sim \Phi_p = 0 \). We present the conditions that must be satisfied by the physical parameters such as the pressure, magnetic field, magnetic energy, and geometry. It is found that, for typical loop parameters, the active region coronal pressure cannot support magnetic energy observed in medium to large flares. It is also found that the average pressure inside the loop is less than the ambient pressure in equilibrium. It is shown that "force-free" current loops are not viable equilibrium configurations. In addition, this class of equilibria is shown to be stable to a number of destructive MHD modes (1).


44.05 A Self-Similar Magneto-Hydrostatic Model of a Quiescent Prominence, V. Osherovitch, HOMA.

A self-similar magneto-hydrostatic model of a quiescent prominence is proposed. The basic ordinary differential equation of the new theory is derived along with pressure, temperature and density distributions.

44.06 Resonances of Coronal Loops, J. W. Hollweg, UNH

As first suggested by Hollweg (Solar Phys., 70, 25, 1981), coronal loop resonances may allow large Alfvénic energy fluxes to enter the corona. We consider the resonances analytically using a 3-layer model of the loops. The Alfvén speed is assumed to be constant in the coronal part of the loop, and to increase exponentially with height in the two chromospheric parts of the loop. For a symmetric loop, and for no wave dissipation, the "quality" of the resonance is closely approximated as Q ≈ 2πL, where L is the length of the coronal segment and H is the scale height of the Alfvén speed in the chromospheric segments. For typical parameters, Q ≈ 30, in contrast to the model of Iomam (Ap. J., 254, 318, 1982) where Q is taken to be 10^4-10^5. We will consider how Q is further reduced by wave dissipation and by loop asymmetry. And we will consider how these improved estimates of Q affect the ability of Alfvén waves to heat coronal loops.

44.07 Convective Overshoot and Magnetic Flux Storage at the Bottom of the Solar Convection Zone, J. H. Schmitt, Harvard-Smithsonian Center for Astrophysics - Recent numerical computations of compressible convection (Hurlburt et al. 1981) show that the flow from convectively unstable into convectively stable regions occurs in predominantly plume-like features. We use an empirical theory for plumes to predict the extent of an overshoot zone (where \( \nu_{\text{rad}} < \nu_{\text{ad}} \)) underneath the convection zone proper (where \( \nu_{\text{rad}} > \nu_{\text{ad}} \)), and to calculate the temperature stratification in this region. We find typical values of the extent of the overshoot zone of a few tenths of a pressure scale height, mainly dependent on the assumed entrainment and initial velocity, and typical values of the subadiabatic gradient \( \nu_{\text{ad}} \) of the order \( 10^{-6} - 10^{-7} \). Radiative and convective regions are separated by a thin boundary layer, with a thickness of

© American Astronomical Society • Provided by the NASA Astrophysics Data System