ABSTRACTS

22.05 Solar Transition Region Response to Heating Rate Variations, E.S. ORAN, J.T. MARISKA, J.P. BORIS, T.R. YOUNG, and G.A. DSCHEK, Laboratory for Computational Physics and E.O. Hulbert Center for Space Research, NRL.

The structure of the solar chromosphere-corona transition region is primarily determined by a balance between local radiative losses and the energy provided by thermal conduction from the corona. Changes in the coronal heat source can therefore result in readjustments in density and temperature in both the transition region and the overlying corona. In addition the chromosphere is dynamically coupled to the overlying atmospheric layers and it is also involved in any readjustments. We examine the response of the coupled chromosphere, transition region, and corona to variations in the heating by using a numerical model for these atmospheric layers. The simulations show that the atmosphere responds to both increases and decreases in a spatially uniform energy deposition by smoothly readjusting both the temperature gradient and the amount of material in the region of peak radiating efficiency. Throughout this process the transition region maintains a thin laminar structure. The spectroscopic consequences of these readjustments can be large, however, and the results of both heating and cooling will be discussed in this context.

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22.06 Mass Flows in the Solar Corona as a Diagnostic of the Coronal Heating Function, J.T. MARISKA and J.P. BORIS, E.O. Hulbert Center for Space Research and Laboratory for Computational Physics, NRL.

Using a simple theory and numerical simulations we show that the systematic flow of plasma along a coronal magnetic flux tube is easily produced by asymmetric heating. For small degrees of asymmetry the velocity of the flow is proportional to the heating asymmetry and is directed to the side of the loop away from the bulk of the energy deposition. For larger degrees of asymmetry the flow saturates at the velocity necessary to redistribute the energy evenly via the enthalpy flux. In this model velocity measurements in the solar transition region represent a first order diagnostic of coronal heating and observations of downflows in the chromospheric network support the idea that the heating of coronal magnetic loops occurs away from the bright network elements.

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22.07 Thermoelectric Effects on Coronal Heat Balance, D.L. BOOK, Laboratory for Computational Physics, NRL.

In the transition region, the solar atmosphere changes within a few hundred kilometers from a weakly ionized medium to one which is nearly fully ionized. This establishes a strong positive gradient in the electron pressure $p_e$. Under its influence the electrons shift slightly downward, producing an electric field $E = -\nabla p_e / n_e$, directed toward the Sun. Consequently, the thermoelectric contribution to the heat flow $q = -\nabla T - AE$, which results from distortion of the electron distribution function, is positive. The role of this effect in maintaining the average coronal heat balance is investigated numerically by integrating the time-independent equations for mass, charge, and energy conservation, including radiative cooling and collisional transport processes. It is shown that the thermoelectric effect reduces the rate of upward thermal conduction from the corona by an amount substantially greater than in a fully ionized plasma.


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22.08 Enthalpy Flux Cooling of the Solar Corona, S.G. WANGHORST, M.T. WILSON.

The differential emission measure profile for quiet and flaring solar regions is considered, using a model in which the principal downflow of heat is due to the enthalpy of hot, downflowing material, rather than conduction. It is found that the emission measure profile for quiet solar regions is matched well by a downflow particle number flux which decreases with temperature. This would be expected if this particle flux is due to heated spicular material falling back onto the chromosphere. In flaring regions, however, a particle flux which increases with temperature is required to explain the steep emission measure profile. This could be a result of mass motions downward out of the flaring loops.

22.09 Inhibition of Coronal Transient Loop Formation in Strong Magnetic Field


The occurrence frequency of loop transients, relative to closely associated events such as eruptive prominences, is higher in weak magnetic field than in strong field. Transients that do occur in a strong field have high velocity. This behavior is expected if transient loops are the result of competing processes: the sweeping up and concentration of coronal plasma by ejected mass from below, along with diffusion of the concentration at a rate proportional to the critical speed, which increases with magnetic field strength. This mechanism is consistent with an observation in the low corona of formation of a depletion before formation of a loop top, and also with the failure of the transient occurrence rate to keep pace with the sunspot number.