ABSTRACTS

For typical parameters required in gamma-ray burst models of $v = 4.4 \times 10^4 \text{ cm s}^{-1}$ ($10 \text{ keV}$), $v_g = 1.3 \times 10^7 \text{ cm s}^{-1}$ and $v_g = 2.3 \times 10^7 \text{ cm}$, which is a small fraction of typical loop dimensions. As a result the protons propagate down the loop of length $L$ diffusively with an effective velocity $v_{eff} = 4v_g/L^{0.5}$, where $L$ is distance along the loop. The typical value of $v_{eff} \sim 10^6 \text{ cm s}^{-1}$, but it varies along the loop since $v_g$ is a function of $z$ and it is the gradient in $v_g$ which drives the diffusive transport. Thus, $v_g$ is a minimum at the footpoints of the loop and a maximum at the apex. These results are illustrated with the 1980 June 7 flare using numerical results including Coulomb losses and place important constraints on the rates with which fast protons can be transported toward the photosphere to produce gamma-ray bursts.

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21.13

Field Aligned Anomalous Resistivity and Double Layers as Potential Flux Mechanisms

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Magnetic field aligned anomalous resistivity or double layers are mechanisms that have been out of favor as potential mechanisms for explaining the solar flare process, reconnection being the "vogue" mechanism. This unfortunate state of affairs is to be contrasted with research developments within the space physics community where current research strongly suggests that field aligned anomalous resistivity or double layers are mechanisms that can explain particle acceleration in auroral arcs, which are undoubtedly generated by magnetotail dynamics. As both field aligned anomalous resistivity or double layers require high current densities, much greater than are believed prevalent in the solar atmosphere, two questions naturally arise: how could such high current densities be generated and what are the physical manifestations of such mechanisms in a realistic model of the solar atmosphere. In this paper, we will present results using our field aligned multi-fluid multi-moment code to model the physical manifestations of the onset of three potential field aligned instabilities: the electrostatic ion-cyclotron instability, the ion acoustic stability, and the Buneman instability. We will summarize our results to date and discuss the physical implications of these results in the context of our present understanding of flare observations, particularly X-ray emissions. In addition we will contrast the solar situation with that found in auroral arcs.

21.15

Particle Acceleration in Steady-State Magnetic Reconnection Regions: Applications to Astrophysical Sites

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Numerical simulations of the path and energization of charged particles (electrons and protons) in an X-type magnetic reconnection region have been performed. The geometry of the magnetic field is considered to be a steady state, i.e. in the time a particle moves through the magnetic field, its geometry does not change significantly. The dependancies of the accelerated particle's properties on various system parameters are investigated. This mechanism promises to be applicable to a wide variety of Astrophysical sites: a model of a reconnection region in the Earth's magnetotail is investigated, where protons infalling from the solar wind obtain energies coinciding with the energy distribution measured by space probes. In the case of galaxies moving through an intracluster magnetic field, a similar type of reconnection might occur in their trail. Our simulations indicate the generation of low to medium energy cosmic rays. Spiral Galaxies with a bisymmetrical magnetic field configuration (observed in M81 and M51) have a neutral line between their spiral arms. The possibility of the generation of energized particles in the low B-field region and the local enhancement of synchrotron emission is discussed.

21.14

Impact Line Polarization in Hot Solar Plasmas with non-Maxwellian Electron Distributions

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We have evaluated lower bounds on the degree of Impact Polarization which is expected to be present in the line radiation from the transition region and low corona. We have computed the linear polarization of the dipole radiation emitted from a two-level atomic system collisionally excited by electrons with non-Maxwellian velocity distributions using the results of an Impact Polarization theoretical scheme, based on the formalism of the irreducible tensorial operators. In this scheme the Stokes Parameters' dependence on the pitch angle of the incoming electrons (also in the presence of a magnetic field) can be expressed in analytical formulae, assuming the Born approximation, and in the limiting case of the completely depolarized atomic ground level (conditions fulfilled in the solar atmosphere environment). Two

21.16

An Equation For the Evolution of Solar and Stellar Flare Loops

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An ordinary differential equation describing the evolution of a coronal loop subjected to a spatially uniform but time-varying heating rate is discussed. We assume that the duration of heating is long compared to the sound transit time through the loop, which is assumed to have a uniform cross section. The form of the equation changes as the loop evolves through three stages: "strong evaporation", "scaling law behavior", and "strong condensation". Solutions to the equation may be used to compute the time dependence of the average coronal temperature and the assumed temporal variation of the flare heating rate. The results computed with our model agree reasonably well with recent published numerical simulations and may be obtained with far less computationally intensive methods.