HYBRID MODELS OF SOLAR WIND PLASMA HEATING

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Remote sensing and in-situ observations show that solar wind ions are hotter than electrons, and the heavy ions flow faster than protons by an Alfvén speed. Turbulent spectrum of Alfvénic fluctuations and shocks were detected in solar wind plasma. Cross-field inhomogeneities in the corona were observed to extend to several tens of solar radii from the Sun. The acceleration and heating of solar wind plasma is studied via 1D and 2D hybrid simulations. The models describe the kinetics of protons and heavy ions, and electrons are treated as neutralizing fluid. The velocity distribution of protons in shocks is also investigated. A spectrum of Alfvénic fluctuations was injected at the simulation boundary, or produced by drift instability, and the parametric dependence of the perpendicular heating by the spectrum of waves in H^+-He^{++} solar wind plasma was investigated. It was found that He^{++} ions are heated efficiently by the spectrum below the proton gyroperiod. Efficient heating of both, protons and He^{++} can be achieved by super-Alfvénic drift. Parametric studies show that inhomogeneities across the magnetic field in the background plasma structure can lead to more efficient heating than in homogeneous plasma.