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Fluid Plasma Specific Entropy in the Magnetosphere: Properties and Questions

Joachim Raeder (1), Doug Cramer (1), Kai Germaschewski (1), and Andrei Runov (2)

(1) University of New Hampshire, Space Science Center, Durham, NH, United States (j.raeder@unh.edu), (2) University of California, Los Angeles, CA, USA

The specific entropy of the plasma in the magnetosphere is an important
marker of its origins and heating history. In principle, the entropy of a collisionless
plasma should remain conserved along its transport path, except at shocks and where heat conduction is present.
However, statistical analysis shows that the plasma sheet entropy is larger than the
magnetosheath entropy by orders of magnitude.
Within the plasma sheet specific entropy is mostly constant,
which is in line with our findings from global simulations that plasma sheet reconnection does
not create substantial dissipation.
Here, we use THEMIS/MMS data and simulations to investigate where and how the heating occurs.
In particular, we trace fluid elements to both find the sources of plasma sheet plasma,
and the locations where violations of adiabaticity occur.
We also investigate if, and how, these processes are controlled by the solar wind and/or by the IMF.