EGU21-15180
https://doi.org/10.5194/egusphere-egu21-15180
EGU General Assembly 2021

Decomposition of the switchback boundary on MHD wave modes.

Vladimir Krasnoselskikh[1,2], Andrea Larosa[3], Thierry Dudok de Wit[1,3], Oleksiy Agapitov[2], Clara Froment[1], Matthieu Kretzschmar[1,3], Vamsee Jagarlamudi[1], Marco Velli[4], Stuart D. Bale[2,5,6], Keith Goetz[7], Peter Harvey[2], Justin Kasper[8,9,10], Kelly Korreck[9], Davin Larson[2], Robert MacDowall[11], David Malaspina[12], Forrest Mozer[2], Marc Pulupa[2], Claire Reveillet[1], and Michael Stevens[9]

[1]CNRS-University of Orleans, LPCE, Orleans CEDEX 2, France (vkrasnos@cnrs-orleans.fr)
[2]Space Science Laboratory, University of California at Berkeley, 94720, Berkeley, CA, USA
[3]University of Orleans, Orleans, Cedex 2, France
[4]Institute of Geophysics & Planetary Physics, Department of Earth, Planetary & Space Sciences, University of California, Los Angeles, CA 90095-1567, USA
[5]Physics Department, University of California, Berkeley, CA 94720-7300, USA
[6]The Blackett Laboratory, Imperial College London, London, SW7 2AZ, UK
[7]School of Physics and Astronomy, University of Minnesota, Minneapolis, MN 55455, USA
[8]BWX Technologies, Inc., Washington, DC 20002, USA
[9]Smithsonian Astrophysical Observatory, Cambridge, MA, 02138, USA
[10]Climate and Space Sciences and Engineering, University of Michigan, Ann Arbor, MI 48109, USA
[11]Solar System Exploration Division, NASA/Goddard Space Flight Center, Greenbelt, MD 20771, USA
[12]Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder, CO 80303, USA

Switchback boundaries separate two plasmas moving with different velocities, that may have different temperatures and densities and typically manifest sharp magnetic field deflections through the boundary. They may be analyzed similarly to MHD discontinuities. The first step of their characterization consists of analysis in terms of MHD discontinuities. Such an analysis was performed by Larosa et al., (2021) who has found that 32% of them may be attributed to rotational discontinuities, 17% to tangential, about 42% to the group of discontinuities that are difficult to unambiguously define whether they are tangential or rotational, and 9% that do not belong to any of these two groups. We describe and apply hereafter for two events another approach for the characterization of the boundaries based on classification of the general type discontinuity in MHD approximation. It is based on the problem of the decay of the general type of discontinuity. It is well known [Kulikovsky and Lyubimov, 1962, Gogosov, 1959} that general type MHD discontinuity decays on 7 separate discontinuities belonging to different types of MHD waves, namely, entropic wave, two slow mode waves, two Alfvenic waves, and two fast mode waves. Entropic wave is standing in the reference frame of the discontinuity; other wave modes are supposed to run in the opposite directions from the initial discontinuity with their characteristic velocities. Making use of plasma parameters from two sides of the boundary one can evaluate the fraction of each wave mode present in the discontinuity. We apply this method to two boundary crossings. This repartition of the discontinuity allows characterizing the deviation from Alfvenicity quantitatively.

References

Larosa, A., et al., A&A, 2021, (accepted)

Kulikovsky, Lyubimov, Magnetohydrodynamics, (1962)

Gogosov, V.V., Decay of the MHD discontinuity, (1959)