HELLENIC REPUBLIC
National and Kapodistrian University of Athens

DEPARTMENT OF PHYSICS

SECTOR OF ASTROPHYSICS

52nd SpaceCoffee

Wednesday 29 January 2020, 16:00, Lecture Room

Magnetosheath Jets: Data analysis, Simulations & Machine Learning

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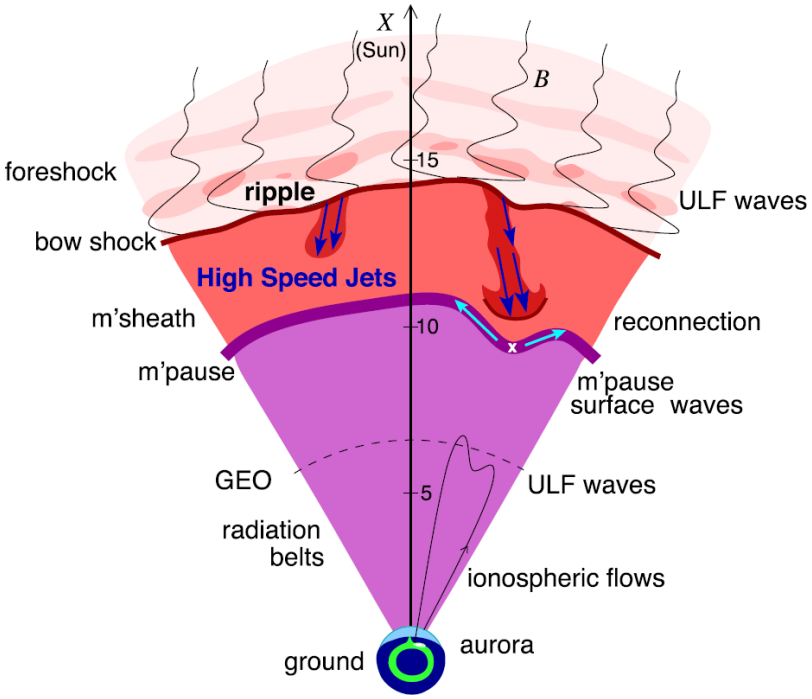

Magnetosheath jets are fast plasma flows originating from the solar wind interaction with the Earth's bow shock. They are local enhancements of dynamic pressure above the surrounding background level, reaching values even higher than the upstream solar wind. Their increased momentum can create local deformation of the magnetopause and trigger local magnetic reconnection, drive compressional waves or even cause direct plasma penetration in the magnetosphere.

In this seminar, three complementary works are presented. The first work consists of a comparison between the global hybrid-Vlasov simulations (Vlasiator) and the MMS observations regarding magnetosheath jets. The goal of this project is to validate simulation results and investigate properties of jets that are impossible to do when using measurements exclusively. In the second project, using Magnetospheric Multiscale (MMS) data, we find, classify and analyze magnetosheath jets from May 2015 until May 2019. The classification is being done according to their associated angle between IMF and the bow shock normal vector (θ_{Bn}). Jets appearing for $\theta_{Bn} < 45$ are referred to as quasi-parallel, while jets appearing for $\theta_{Bn} > 45$ as quasi-perpendicular jets.In this work, we present the first statistical results of such a classification and provide comparative statistics for each class. In the third part, we investigate a link between the different classes of jets and their associated solar wind measurements. We do that by applying a neural network, connecting the solar wind measurements of ACE to the magnetosheath jet class measured by MMS. Finally, we compare the result derived from the machine learning technique to some physical modeling estimations.