



On Magnetosheath Jet Kinetic Structure and Plasma Properties



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What is the science question?

Magnetosheath (MSH) jets are dynamic pressure enhancements downstream of Earth's bow shock and are associated to various space magnetospheric phenomena (i.e., reconnection, wave excitation, foreshock dynamics etc.) The main question we address is : Can full (measured) particle moments capture the physics plasma jets in the magnetosheath? Furthermore, we investigate jets' kinetic structure and their interaction with the background MSH.

What were your findings?

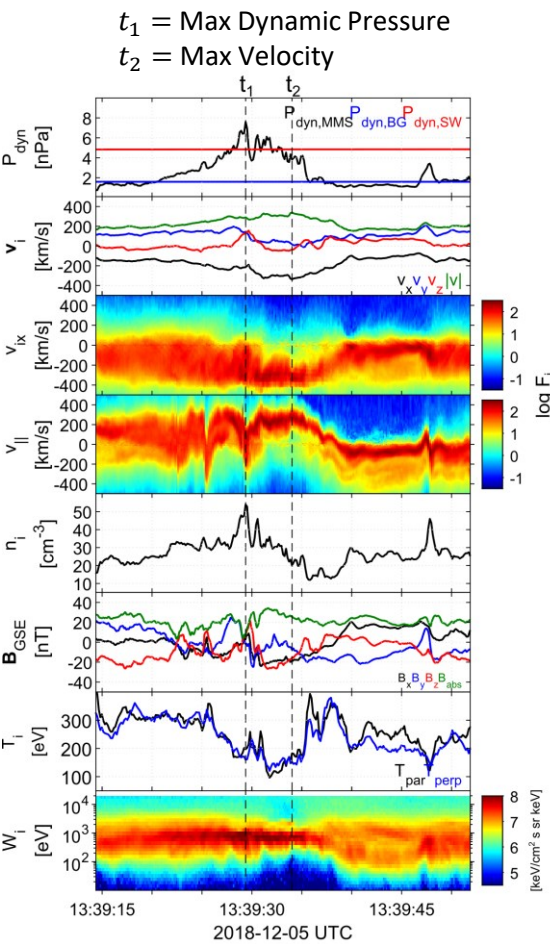
MMS observations highlighted the complex nature of a magnetosheath jet downstream of the quasi-parallel bow shock. The figure on the left shows the burst measurements of a magnetosheath jet. The figure on the right shows a partial moment derivation for the same jet. By either removing parts of the VDF and integrating (cut) or by fitting single and double peak Maxwellians to VDFs (fit), we obtain partial ion moments of the jet population. We show that in the velocity space, the jet can co-exist with the background MSH during its lifetime. The partial moments of the jet population are significantly different compared to the full (raw) ones, indicating a higher velocity and a lower density and temperature.

What was the impact?

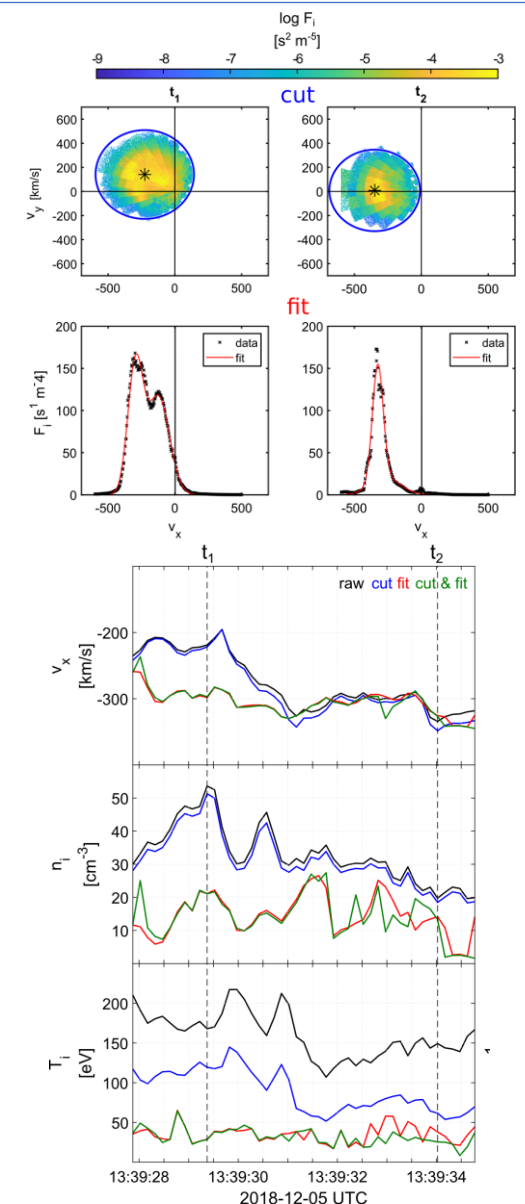
Our results provide evidence that full particle moments may not fully describe transient phenomena such as plasma jets in the magnetosheath region. Partial moments indicate that jets resembles a less heated solar wind beam, associating their generation to collisionless shock processes (e.g., reformation) and foreshock structures (e.g., SLAMS). The interaction of MSH jet with the background MSH population may excite waves and contribute to turbulence.

Why does it matter to non-scientists?

Magnetosheath jets can modulate magnetopause reconnection and have been associated to substorms, and ground magnetometer observations. All these phenomena can be connected to particle energization and to the colorful phenomena of aurora.



Top - bottom: Ion dynamic pressure, ion velocity, reduced x (GSE) and parallel to B velocity distribution function (VDF), ion number density, magnetic field, ion temperature, and ion differential energy spectrum.



Partial moments of a magnetosheath jet