



Spacecraft Charging Impacts Particle Measurements



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What is the science question?

Spacecraft are not electrically grounded, so they accumulate electric charge. This creates a sheath of plasma around it. Charged particles traveling through this sheath are altered in both energy and direction, affecting our ability to measure particle quantities. How precisely can we measure the coldest particles in space given this plasma sheath?

What were your findings?

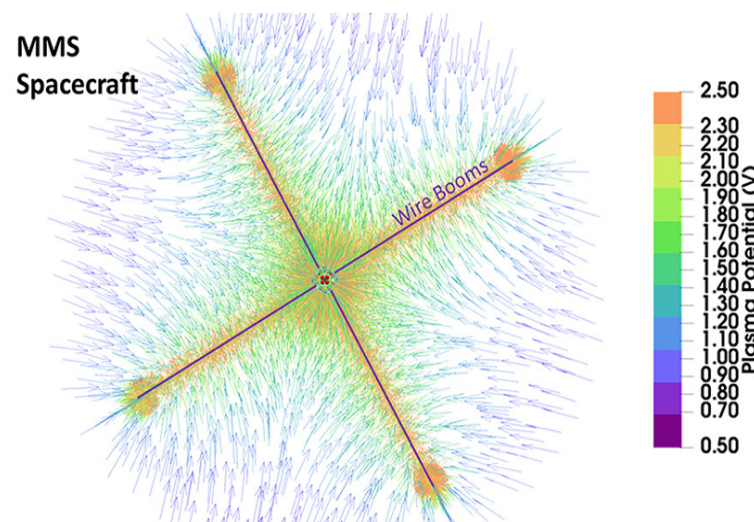
New data from the MMS spacecraft allow the relative effects of the plasma sheath to be explored at high time and spatial resolution. This work presents a method using these measurements to study a model that traces the migration of particles through the sheath and estimates the error in measured velocity.

What was the impact?

To ensure we are making a complete measurement of the electrons and ions involved in space plasma phenomena, it is vitally important to minimize spacecraft charging. Without controlling this source of error, the coldest particles in space are hidden to us.

Why does it matter?

Near Earth, the coldest particles in space originate in the Earth's ionosphere and they represent a small, net loss of our atmosphere. We want to monitor this loss and understand what drives it, especially with regard to changes in the Earth's magnetic field. After all, this is what we think happened to the Martian atmosphere.



This model shows an MMS spacecraft as the tiny square four wire booms cross. The colored arrows show the electric field around the spacecraft due to the plasma sheath and accumulated electric charge, which impacts MMS's ability to accurately measure particles.