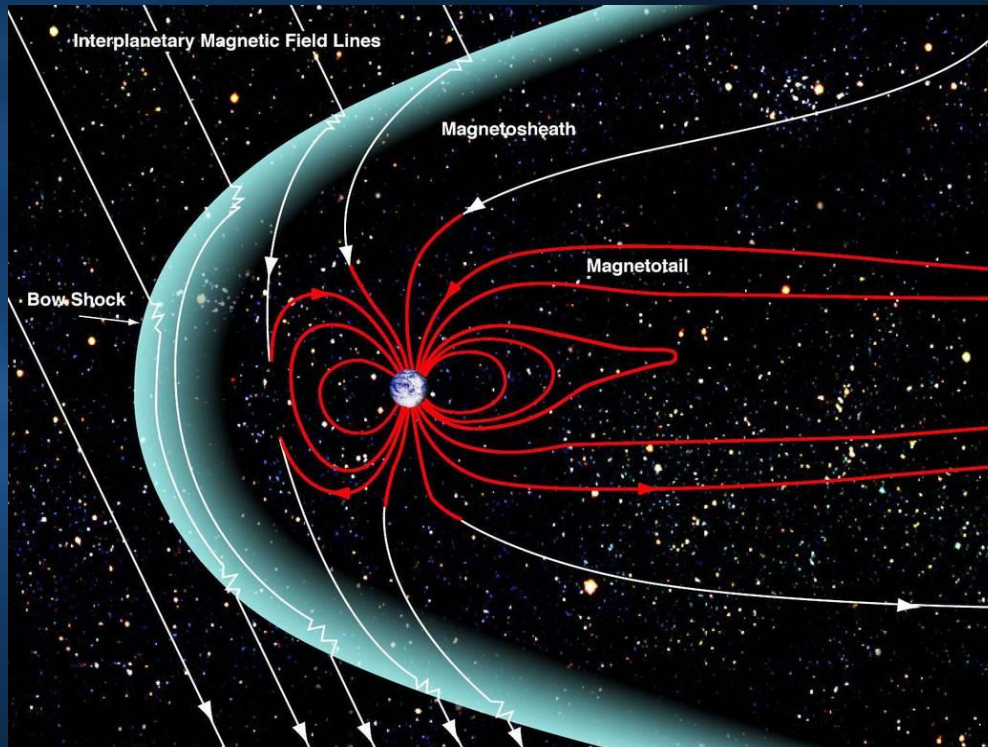


# How the Magnetosphere's Bow Shock Slows the Solar Wind

The magnetosphere shields our home planet from solar and cosmic particle radiation, as well as erosion of the atmosphere by the solar wind - the constant flow of charged particles streaming off the sun. The solar wind impinges on the magnetosphere at supersonic speeds, creating a bow shock. The bow shock slows down the solar wind by converting the streaming energy of the solar wind particles into heat. Though the effects could be seen, the exact process for this conversion had not been observed, owing to the insufficient time resolution of past measurements.

New research published in Physical Review Letters has observed the heating with NASA's Magnetospheric Multiscale Mission (MMS). MMS was able to reveal the process itself due to the 100-times faster plasma measurements when an unexpected burst of solar wind pushed the bow shock closer to Earth.



The fast and precise measurements from MMS gave the researchers a new picture of the solar wind before, during and after its interaction with the bow shock.

The research found that when electrons in the solar wind interact with the magnetosphere at the bow shock, the electrons are accelerated to such a high speed that the electron stream become unstable. This instability converts the streaming energy into heat -- meanwhile, the supersonic winds slows down. By knowing the exact process for the energy conversion, future simulations and studies will be able to better understand how the magnetosphere and bow shock cushions the Earth from solar disturbances.

CHEN, L. J. et al (2018). Electron bulk acceleration and thermalization at Earth's quasi-perpendicular bow shock. *PHYSICAL REVIEW LETTERS*, 120(22).  
doi:<https://doi.org/10.1103/PhysRevLett.120.225101>

*The shape of the Earth's magnetosphere is the result of being blasted by solar wind, compressing the sunward side to a distance of only 6 to 10 times the radius of the Earth.*