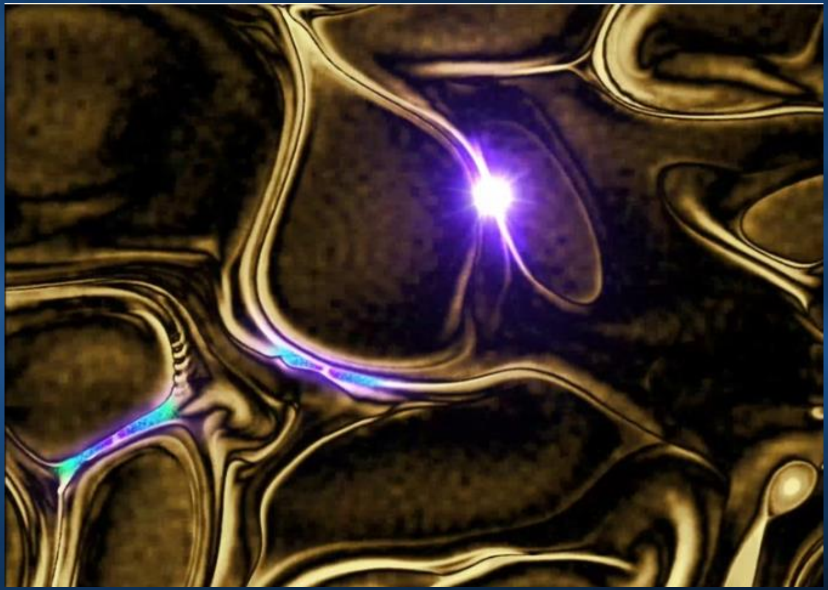
Electron Magnetic Reconnection without Ion Coupling in Earth's Turbulent Magnetospheath

Magnetic reconnection is one of the most important processes in near-Earth space, which is filled with charged particles known as plasma. This fundamental process dissipates magnetic energy and propels charged particles — both of which contribute to a dynamic space weather system that scientists want to better understand, and even someday predict, as we do terrestrial weather. Reconnection occurs when crossed magnetic field lines snap, explosively flinging away nearby particles at high speeds. The new discovery found reconnection where it has never been seen before — in turbulent plasma.

In a surprising new discovery published in Nature, scientists working with NASA's Magnetospheric Multiscale (MMS) spacecraft, and an innovative technique have uncovered a completely new type of magnetic event in our near-Earth space environment. This technique increased the resolution of the plasma measurements, allowing MMS to detect narrow electron jets that had previously been missed.



With the new method, the MMS scientists are hopeful they can comb back through existing datasets to find more of these events, and potentially other unexpected discoveries as well.

The new event occurred in a region called the magnetosheath, just outside the outer boundary of the magnetosphere, where the solar wind is extremely turbulent. Previously, scientists didn't know if reconnection could occur there, as the plasma is highly chaotic in that region. MMS found it does, but on scales much smaller than previous spacecraft could study. Compared to standard reconnection, in which broad jets of ions stream out from the site of reconnection, turbulent reconnection ejects narrow jets of electrons only a couple miles wide.

Magnetic reconnection occurs throughout the universe, so when we learn about it around our planet — where it's easiest for scientists to examine it — we can apply that information to other events farther away. The finding of reconnection in turbulence has implications for studies on the Sun, which has similarly turbulent environments. It may help scientists understand the role magnetic reconnection plays in heating the inexplicably hot solar corona — the Sun's outer atmosphere — and accelerating the supersonic solar wind.

More information:https://www.nasa.gov/feature/goddard/2018/nasa-spacecraft-discovers-new-magnetic-process-in-turbulent-space