Geophysical Research Abstracts
Vol. 21, EGU2019-1732, 2019
EGU General Assembly 2019

First Direct Observations of a Surface Eigenmode of the Dayside Magnetopause: Excitation by a Magnetosheath Jet

Martin Archer (1), Heli Hietala (2), Michael Hartinger (3), Ferdinand Plaschke (4), and Vassilis Angelopoulos (5)

(1) School of Physics and Astronomy, Queen Mary University of London, London, United Kingdom (m.archer@qmul.ac.uk), (2) Space Research Laboratory, University of Turku, Turku, Finland (heli.hietala@utu.fi), (3) Space Science Institute, Boulder, USA, (4) Space Research Institute, Austrian Academy of Sciences, Graz, Austria (Ferdinand.Plaschke@oeaw.ac.at), (5) Department of Earth, Planetary and Space Sciences, University of California, Los Angeles, USA (vassilis@ucla.edu)

The abrupt boundary between a magnetosphere and the surrounding plasma, the magnetopause, has long been known to support surface waves. It was proposed that impulses acting on the boundary might lead to a trapping of these waves on the dayside by the ionosphere, resulting in a standing wave or eigenmode of the magnetopause surface. While many potential impulsive drivers exist, no direct observational evidence of this mechanism has been found to date and searches for indirect evidence have proved inconclusive, leading to speculation that it might not occur.

Magnetosheath jets ($\sim$ $1\mathrm{R_E}$-scale transient enhancements in the antisunward velocity and density immediately upstream of the magnetopause) are known to impinge on the boundary causing localised motion/indentations due to their elevated dynamic pressure and have been suggested as a possible driver of these surface eigenmodes. By using fortuitous multipoint spacecraft observations during a rare isolated jet, we show that the broadband impulsive driver excited narrowband oscillations of the magnetopause location as well as magnetospheric ultra-low frequency waves.

Through comparing the observations with theoretical expectations for several possible mechanisms, we conclude that the isolated jet excited the magnetopause surface eigenmode – like how hitting a drum once reveals the sounds of its normal modes. We therefore present the first observations of this long-proposed mechanism, which should act as a global source of magnetopause dynamics and ultra-low frequency waves that can then drive radiation belt / auroral interactions and ionospheric Joule dissipation.