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# Waveguide ULF waves in the Earth magnetosphere and associated magnetopause motion

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## Abstract

We focus our study on the properties of the quasi periodic magnetopause motion and magnetosphere waves with the same frequencies (ULF range) registered by the THEMIS spacecraft Fluxgate Magnetometer (FGM) and Electrostatic Analyzer (ESA). Two different types of magnetopause motion associated to magnetosphere wave activity can be distinguished: surface waves generated by growth of the Kelvin - Helmholtz instability and quasi static one dimensional displacement of the magnetopause surface. Surface waves penetrate to the resonance field line and generate toroidal and poloidal alfven modes with typical FLR properties. One dimensional quasi periodic displacements of the dayside magnetopause are probably caused by cavity modes – standing fast MHD wave between the magnetopause and reflection point near the plasmapause. ULF waves observed in the low latitude magnetopause region manifest themselves as fast MHD modes propagated tailward – waveguide modes. The estimation of phase velocity based on multispacecraft timing technique gives the value about 0.1 – 0.2 of the local Alfvenic velocity estimation. Observed slowing-down waves can be identified as magnetosphere waveguide modes. Simultaneous measurements of magnetic field and plasma parameters inside the magnetosphere and in the magnetosheath demonstrate high correlation of magnetopause displacements with maxima of magnetic field wave perturbation. The results of numerical simulation of fast MHD wave propagation and reflection in the magnetosphere (with the source in the subsolar region) by means of ray-tracing technique are in a good agreement with observed properties of waveguide and cavity modes.