ULF Waves – What can they tell us about the Earth's Magnetosphere?

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Ultra-low frequency (ULF) waves in the 1–100 mHz band are ubiquitous in the magnetosphere. They are a manifestation of hydromagnetic wave activity generated by physical processes resulting from the interaction of the solar wind with the Earth's magnetosphere. The almost pure sinusoidal signature of ULF waves when seen on the ground and in space by satellites suggests a resonance phenomenon. This is not unexpected since the size of the magnetospheric cavity is of the same order as the wavelength of the ULF waves. The magnetopause, plasmapause and ionosphere provide convenient boundaries for wave reflection and transmission. Within the cavities bounded by these surfaces resonances may be established from propagating modes. These include the Alfven wave mode which is field aligned, resulting in field line resonance (FLR) and the fast mode wave which propagates isotropically and may establish cavity or waveguide resonances in the magnetosphere and the ionosphere. It will be shown how the propagation and resonance characteristics of ULF waves can be used as diagnostic tools to determine important information on the topology of the dynamic magnetosphere and its plasma, from both spatial and temporal perspectives. These primarily employ simple and inexpensive ground based instrumentation. Finally, some plans for future research using ULF wave diagnostics during the IPY and IHY will be outlined.