

Spacecraft observations of ULF waves

Kazuo Takahashi

The Johns Hopkins University Applied Physics Laboratory, USA

Earth's magnetosphere exhibits a variety of ULF waves. Among these, the most powerful have periods in the range of 10-1000 s and they are known as Pc and Pi waves depending on whether their waveform is continuous or irregular. The period range corresponds to the MHD regime of the magnetospheric plasma, and in fact many properties of the observed ULF waves are successfully explained in terms of Alfvén waves, fast waves, or the combination of the two. Historically, ground observations have played a major role in establishing various statistical properties of the waves. However, spacecraft observations provide crucial information regarding the mode and excitation mechanism of the waves. Both internal (magnetospheric) and external (solar wind) processes excite the ULF waves. An example of externally excited waves is the toroidal Alfvén waves and an example of internally excited waves is Pi2 waves. We use recent spacecraft observations of these wave types to illustrate how spacecraft observations have contributed to our current understanding of MHD waves in the magnetosphere.