

Commission H (Waves in Plasmas) Activity Report

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Research Topics

<Akebono>

Based on the plasma wave data by AKEBONO spacecraft over 15 years, the **mapping of VLF wave activity** in the inner geospace has been elucidated (Kasahara et al., 2004). An example of such time variation of electric wave intensity during the geomagnetic storm time in the frequency range from 1 to 10kHz is shown in Figure 1. The plasma wave data obtained by the instruments PWS and VLF are available on request [for further information: <http://www.stp.isas.jaxa.jp/akebono>].

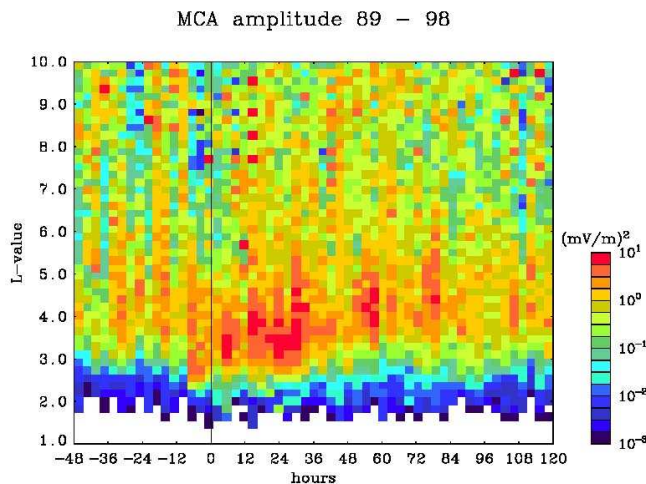


Figure 1

Vertical axis indicates the L-value of the observation point, and the horizontal axis indicates the relative time from the beginning time of the storm recovery (Kasahara et al. 2004).

One of the hot topics in the inner magnetosphere physics is the **origin of relativistic electrons in the outer radiation belt**. One of the plausible mechanisms is **wave-particle resonant diffusion** by whistler mode chorus during recovery phase of magnetic storm is one of hot topics. Using Akebono VLF and RDM data, several works related to the topic are performed and some interesting results were demonstrated so far.

<GEOTAIL>

GEOTAIL spacecraft has been operated since 1992. The Plasma Wave Instrument (PWI) is continuously collecting spectrum data and high time-resolution waveform data. It is expected to be in a good condition at least until the next long eclipse in 2005. The 24 hour plots of the observed wave spectrum data are opened in the PWI web site <http://www.rish.kyoto-u.ac.jp/gtlpwi>, and <http://www.stp.isas.jaxa.jp/geotail>.

<Antenna in space plasma>

The characteristics of dipole antenna or probe antenna have been studied in two ways; one is the construction of **electrical equivalent circuit** using the AKEBONO and GEOTAIL observation data. Figure 2 shows a dependence of antenna impedance to the angle on the geomagnetic field (Higashi et al., 2004). Another approach is the computer simulation using the particle code. Usui et al. have been studying the antenna properties of a dipole antenna immersed in magnetized plasma by performing **PIC (Particle-In-Cell) electromagnetic simulations**. In the simulation, the effect of the plasma temperature and sheath size around the antenna are taken into account.

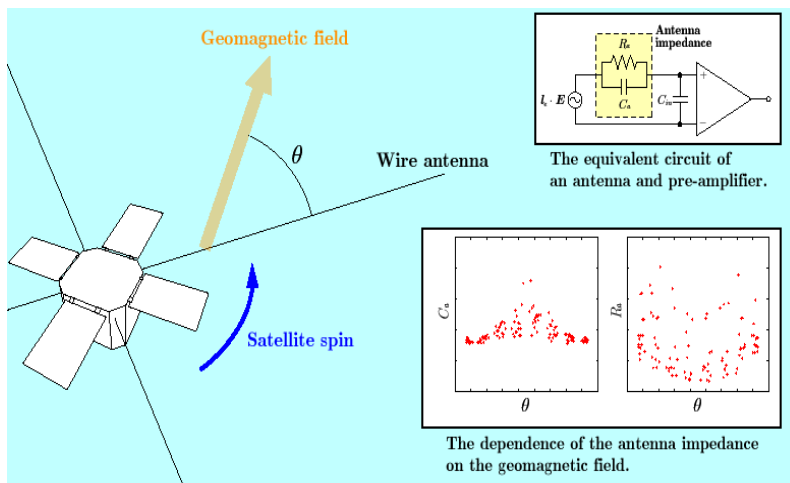
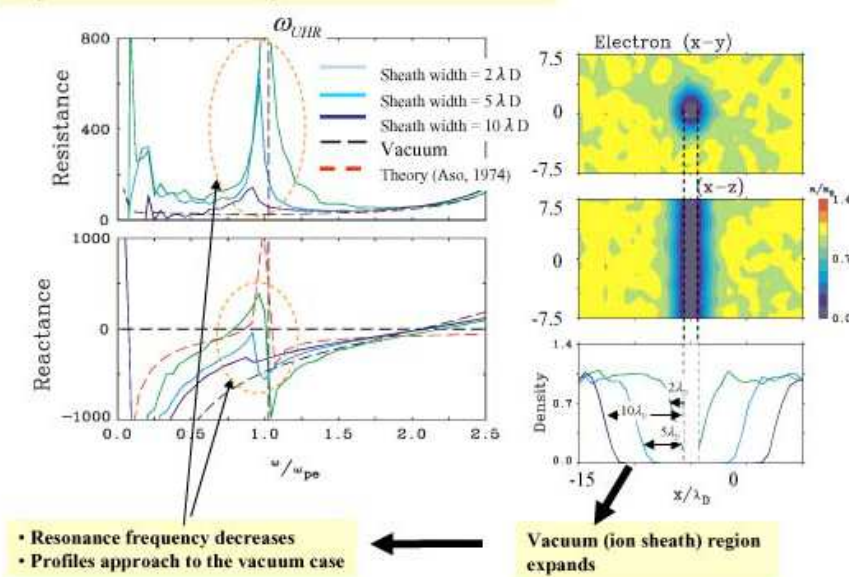


Figure 2
Experimental result showing the dependence of antenna impedance on the geomagnetic field (Higashi et al., 2004).

Dependence of antenna impedance on sheath structure



• Resonance frequency decreases
• Profiles approach to the vacuum case

Vacuum (ion sheath) region expands

Figure 3
Dependence of antenna impedance obtained by Particle-In-Cell simulations (Usui et al., 2004).

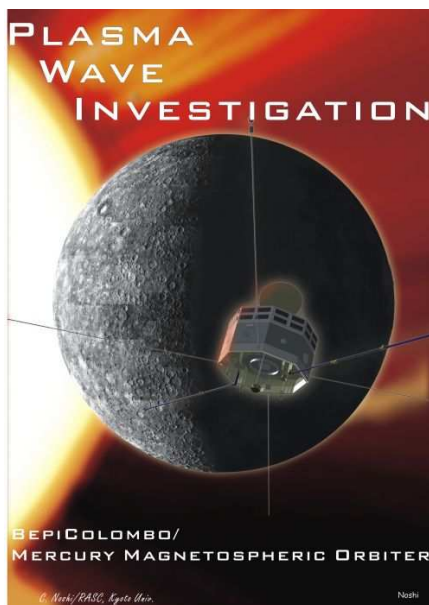
<SELENE>

SELENE spacecraft will be launched in 2006. After the 1st system function and EMC tests performed from August 2003 to January 2004, each scientific instrument is now in the final adjustment stage and next system function test will start in January 2005. For the delivery, onboard software is now under development to install various kinds of intelligent functions, such as data compression and data selection algorithm.

The Lunar Radar Sounder (LRS) experiment onboard the SELENE consists of three subsystems; SDR (sounder), NPW (natural plasma wave) and WFC (waveform capture). SDR will provide subsurface stratification and tectonic features in the shallow part (several km depth) of the lunar crust, by using an FM/CW radar technique in HF frequency range. NPW and WFC will observe natural plasma waves in the frequency range from 20kHz to 30MHz and from 100Hz to 1MHz, respectively.

<BepiColombo>

The BepiColombo is the science mission to Mercury. It is the first collaborative science mission between JAXA and ESA. The BepiColombo mission consists of two individual spacecraft called MPO (Mercury Planetary Orbiter) and MMO (Mercury Magnetospheric Orbiter). The Announce of Opportunity(AO) for the MMO spacecraft was issued by JAXA in April 2004.

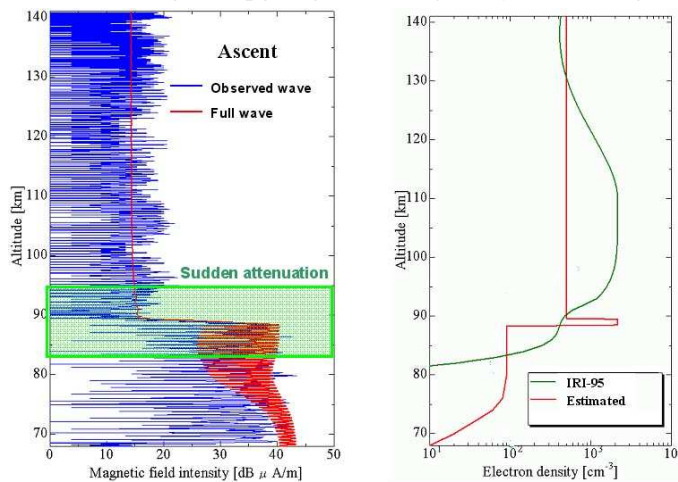


Scientists in Japan and Europe jointly proposed the plasma wave observation system called PWI (Plasma Wave Investigation) in the response to the AO for MMO. The Principal Investigator of PWI is Prof. Hiroshi Matsumoto in Kyoto university, Japan. After reviewing the PWI proposal, the MMO Payload Review Committee in JAXA selected the PWI for the science payload onboard MMO spacecraft. PWI investigates plasma/radio waves and DC electric field in Mercury magnetosphere. The MMO launch is scheduled in 2012.

Illustration of MMO (Mercury Magnetospheric Orbiter)

<Ionospheric sounding by Radio Waves>

The ionospheric sounding S-310-33 rocket experiment was successfully conducted at Kagoshima Space center, JAXA on January 18th. The MF wave (NHK Kumamoto Broadcasting Station; 873 kHz) was observed and using the wave absorption method, the electron number density profile was estimated. An usual enhancement of electron density was found to exist at altitude below 90 km during night time, which cannot be sensed either by the conventional ionosonde nor the MF radar (Ashihara et al., 2004). The left of Figure 4 shows the wave intensity observed along the upgoing rocket trajectory, and the right, the estimated electron number density.



This kind of experiment is important to improve the International Reference Ionosphere (IRI) model at altitudes below 90. For the same aim, a rocket experiment at high latitudes is now under design by the Alaska Student Rocket Project (ASRP) team. The rocket named as SRP-5 will be launched in Fairbanks, Alaska in February 2005.

Figure 4. Observed MF radio wave intensity along the upgoing rocket trajectory (Left), and the estimated electron number density shown by red line (Right).

Conferences

Conferences and Meetings (July 2004 – October 2004)

- 1) The First Asia-Oceania Geophysics Society Meeting , Singapore, July 5-9, 2004
- 2) 35th COSPAR Scientific Assembly, Paris, France, July 8-25, 2004
- 3) NATO Advanced Study Institute on Sprites, Elves and Intense Lightning Discharges Corte in Corsica, July 21-30, 2004
- 4) The 28th Symposium on Space and Atmospheric Science in the Polar Regions, NIPR, Tokyo, August 3-4, 2004
- 5) Western Pacific Geophysics Meeting : Honolulu Hawaii, August 16-20, 2004
- 6) AP-RASC'04, Qingdao, China, August 24-27, 2004
- 7) Society of Geomagnetism and Earth, Planetary and Space Sciences (SGEPSS), Ehime,

September 26-29, 2004

- 8) 2004 STE Simulation Meetings, Chiba, October 28-29, 2004.
- 9) Pittsburgh, USA, November 6-12 2004.

Future Conferences and Meetings

- 1) AGU Fall meeting: December 13-17, San Francisco, 2004.
- 2) Space Weather/Climate Symposium #5, STEL, Nagoya, November 24-26, 2004.
- 3) Symposium on Space Environment, JAXA, Tsukuba, November 25-26, 2004.
- 4) AGU 2004 Fall Meeting, San Francisco U.S.A., December 13-17, 2004.
- 5) Third International Symposium on the Arctic Research and eventh Ny-Alesund Scientific Seminar, Tokyo, Japan, February 22-24, 2005
- 6) Magnetospheric ULF Waves (Chapman), San Diego, CA, USA, March 21-25, 2005
- 7) 7th International School/Symposium for Space Simulations, Kyoto, Japan, March 26-31, 2005
- 8) ISSS-7, Kyoto, March 26-31, 2005 <http://www.rish.kyoto-u.ac.jp/iss7/>
- 9) 9th Spacecraft Charging Technology Conference, April 4-8, 2005, Tsukuba
- 10) European Geosciences Union General Assembly , April 24-29, 2005, Vienna, Austria, 2004
- 11) 9th Spacecraft Charging Technology Conference April 4-8, 2005, Tsukuba, Japan
- 12) European Geosciences Union General Assembly 2005, Vienna, April 24-29, 2005
- 13) AGU 2005 Joint Assembly, Louisiana, USA, May 23-27, 2005
- 14) Asia Oceania Geosciences Society's 2nd Annual Meeting (AOGS 2005), June 20-24, 2005, Singaporean (<http://www.asiaoceania-conference.org/>)