Japanese URSI Commission H (Waves in Plasmas)
Activity Report
April 2019 - August 2020

[1] Status of projects related with plasma wave observation

1. BepiColombo/MMO

http://www.isas.jaxa.jp/en/missions/spacecraft/current/mmo.html

BepiColombo is a Mercury exploration project jointly planned by JAXA and the European Space Agency (ESA). Arrival at Mercury will be in 2025. It consists of two orbiters; the Mercury Planetary Orbiter (MPO) and the Mercury Magnetosphere Orbiter (MMO) whose nickname becomes 'MIO'. JAXA is responsible for the latter.

For the plasma wave, Plasma Wave Investigation (PI: Y. Kasaba [Tohoku Univ.]) is aboard this spacecraft. PWI will first observe electric field, plasma waves, and radio waves around Mercury, which were not covered by past missions. The PWI science team is now shifting to develop the telemetry data pipelines and operation planning for the real science execution which will be realized in 2020s. The next step is the Venus flyby in Oct 2020.

2. JUICE

http://www.isas.jaxa.jp/en/missions/spacecraft/future/juice.html

JUICE (JUpiter ICy moons Explorer) is the L-class mission of ESA, planned for launch in 2022 and arrival at Jupiter in 2029. It will spend at least three years making detailed observations of the Jovian system including Ganymede, Calisto and Europa, and finally be on the orbit around Ganymede. For the plasma wave, Radio and Plasma Wave Investigation (PI: J.-E. Wahlund [IRF Uppsala, Sweden]) is aboard this spacecraft and covers the information of the exospheres, surfaces, and conducting subsurface oceans of icy satellites and their interactions with surrounding Jovian magnetosphere. For the access to the conductive subsurface ocean, RPWI will first observe cold plasma and electric fields, in order to separate the global conductivity and current from the ionospheres. As a byproduct, reflected Jovian radio emission can be expected from the boundary of crust (ice) and subsurface ocean (conductive water). From Japan, High Frequency part (RWI-Preamp and HF-Receiver) will be supplied (Co-PI: Y. Kasaba [Tohoku Univ.]) and provide the highly resolved information of Jovian radiation emitted from Jupiter and Ganymede by the first 3-axis E-field measurement. Our Flight Models are now tested in Europe.

3. Arase (ERG)

http://www.isas.jaxa.jp/en/missions/spacecraft/current/erg.html
http://ergsc.isee.nagoya-u.ac.jp/index.shtml.en

The Arase (ERG; Exploration of energization and Radiation in Geospace) project is a mission to study acceleration and loss mechanisms of relativistic electrons around the Earth. The Arase (ERG) was launched in Dec., 2016, and the prime mission started in March, 2017. The Plasma Wave Experiment (PWE, PI: Y. Kasahara [Kanazawa Univ.]) has measured DC electric field and plasma waves in the inner magnetosphere covering wide frequency range from DC to 10 MHz for electric field and from a few Hz to 100 kHz for magnetic field. The Software-Wave Particle Interaction Analyzer (SWPIA) (PI: H. Kojima, [Kyoto. Univ.]) is equipped to realize direct measurements of interactions between energetic electrons and whistler-mode chorus in the Earth's inner magnetosphere.

Varieties of wave phenomena such as chorus, EMIC, ULF pulsations and lightning whistlers have been successfully observed by the PWE. We have also conducted cooperative observations with the ground-based stations, Van Allen Probes and the other satellites in the magnetosphere. We intensively conducted the PWE burst mode operations, by which waveforms were continuously captured. During the prime mission, all science instruments have operated in good health and the JAXA has approved the mission extension of Arase until end of March, 2022.

4. Hisaki spacecraft

http://www.isas.jaxa.jp/en/missions/spacecraft/current/hisaki.html

Hisaki satellite with the EUV spectrometer (Extreme Ultraviolet Spectroscope for Exospheric Dynamics: EXCEED) is the UV/EUV space telescope dedicated to planetary sciences.

Hisaki has provided continuous observations of Jovian system in UV aurora total flux and EUV Io torus plasma distributions and plasma diagnostics, which connected the solar wind information and ground-based radio (Decameter [aurora] - VHF [radiation belt]) and IR (aurora and airglows) observations. From July 2016, NASA Juno orbiter started the observation around Jupiter. Hisaki's priority is on the support observation for this mission. The Hisaki mission period has extended until the end of Mar. 2022.

5. GEOTAIL

http://www.isas.jaxa.jp/en/missions/spacecraft/current/geotail.html

GEOTAIL spacecraft has been operated since 1992. The Plasma Wave Instrument (PWI) is continuously collecting the high resolution waveform data as well as the spectrum data. The color plots of the observed wave spectrum data have been opened in the PWI web site http://space.rish.kyoto-u.ac.jp/gtlpwi, and http://www.stp.isas.jaxa.jp/geotail. One can easily also make the color spectrum plots in flexible time scales at https://geotail.nict.go.jp/.

6. Ground-based observation of solar and planetary radio waves

http://pparc.gp.tohoku.ac.jp/research/iprt

http://ariel.gp.tohoku.ac.jp/jupiter/

Ground-based observation of solar and planetary radio waves is performed using IPRT (Iitate Planetary Radio Telescope) and HF antenna array developed by Tohoku University. IPRT has been operated at the Iitate observatory in Fukushima Japan since 2000. IPRT measures meter to decimeter natural radio waves at fixed frequencies of 325 and 785 MHz using LNA and also from 150 to 500 MHz using wide-band receiver. Primary purposes of the telescope are to investigate the dynamic behavior of Jupiter's synchrotron radiation and solar radio emissions in the low-frequency range. In addition to this, IPRT has capability to observe weak radio sources in the low frequency range such as pulsars. HF antenna at Iitate observatory has been operated since 1996 for ground-based observation of Jovian decametric radiation (DAM; 15-40MHz). Wide-band spectrum monitor, and waveform receiver with single antenna, and long-baseline interferometer with 3 station's antenna (Kawatabi, Zao, and Yoneyama) are in operation. For observation of weaker non-Io Jovian DAM events, short-baseline interferometer with four antennas is also operated.

7. PWING Project

http://www.isee.nagoya-u.ac.jp/dimr/PWING/en/

The PWING project investigates the process of dynamical variation of the particles and waves in the Earth's inner magnetosphere and clarify the mechanism of the dynamical variation quantitatively. This project has operated eight ground-based stations separately positioned in the longitudinal direction at subauroral latitudes in Canada, Alaska, Russia, Finland, and Iceland, using induction magnetometers, riometers, VLF/ELF receivers, and all-sky airglow/aurora imagers and EMCCD cameras since March 2017. Conjugate measurements of particles and waves with the new ERG (Arase) satellite and the Van Allen Probes has been made extensively in 2017-2020. The budget for PWING will be finished in March 2021. But the ground-based observation will be continued as possible as we can.

8. Bilateral project between JSPS and CAS

This is the joint project between JSPS and CAS (PI: Y. Miyoshi/O. Santolik) for plasma waves as well as lightnings using multi-satellite and ground-based data. The project will be finished in March 2021.

[2] Recent Meetings

1. European Geosciences Union (EGU) General Assembly 2019, Vienna, Austria, 7-12 Apr., 2019.
   https://www.egu2019.eu/
   https://meetingorganizer.copernicus.org/EGU2019/sessionprogramme
2. Japan Geoscience Union Meeting (JpGU) 2019, Chiba, Japan, 26-30 May, 2019.
   http://www.jpgu.org/meeting_e2019/
3. Magnetospheres of Outer Planets (MOP) Conference 2019, Sendai, Japan, 2-7 June, 2019.
   http://lasp.colorado.edu/home/mop/resources/mop-conference/
   http://pparc.tohoku.ac.jp/sympo/mop/
4. SuperDARN workshop 2019, Fujiyoshida, Japan, 2-9 June, 2019.
   http://superdarn2019.nict.go.jp/
5. VarSITI completion symposium, Sofia, Bulgaria, 10-14 June, 2019.
   http://newserver.stil.bas.bg/VarSITI2019/
6. 2019 IEEE 11th International Conference on Communication Software and Networks (ICCSN 2019), Chongqing, China, 12-15 June, 2019.
   http://www.iccsn.org/iccsn19.html
7. 32nd International Symposium on Space Technology and Science (ISTS), Fukui, Japan, 15-21 June, 2019.
   https://www.ists.or.jp/
8. The 27th IUGG General Assembly, Montréal, Québec, Canada, 8-18 July, 2019.
   http://iugg2019montreal.com/
9. 16th Meeting of Asia Oceania Geosciences Society (AOGS), Singapore, 28 July-2 Aug., 2019.
   http://www.asiaoceania.org/society/index.asp
10. The 5th IEEE International Conference on Cloud and Big Data Computing (CBDCom 2019), Fukuoka, Japan, 5-8 Aug. 2019.
    http://cyber-science.org/2019/cbdcom/
11. The 21st IEEE International Conferences on High Performance Computing and Communications (HPCC-2019), Zhangjiajie, China, 10-12 Aug. 2019.
    http://csee.hnu.edu.cn/hpcc2019/index.html
12. The 16th IBPSA Conference, Rome, Italy, 2-4 Sep., 2019.
    http://buildingsimulation2019.org/
13. EPSC-DPS Joint Meeting 2019, Geneva, Switzerland, 15-20, September, 2019.
    JUICE-Clipper Science Workshop, Geneva, Switzerland, 16 September, 2019.
    https://www.epsc-dps2019.eu
    https://meetingorganizer.copernicus.org/EPSC-DPS2019/session/34618
14. ERG Mission Science Workshop, Tokyo, Japan, 17-19, September, 2019.
    https://ergsc.isee.nagoya-u.ac.jp/documents/science201909/
15. BepiColombo SWT #19, Noordwijk, Netherlands, 14-18, October, 2019.
16. SGEPSS Fall Meeting, Kumamoto, Japan, 23-26 October, 2019.
    http://sgepss.org/sgepss/sookai/146/
17. The 14th JUICE Science Working Team Meeting, Noordwijk, Netherlands, 30-31, Oct., 2019.
18. The 23rd International Computer Science and Engineering Conference 2019, Phuket, Thailand, 30 Oct.-1 Nov., 2019.
    https://www.icsec2019.org/
19. 13th International Conference, MIWAI 2019 Kuala Lumpur, Malaysia, 17-19 Nov., 2019.
    https://khamreang.msu.ac.th/miwai19/
20. **Workshop on Radio Science and Wave Measurement Technology in Space Plasma, Kanazawa, Japan, 19-20 Nov., 2019.**
    The symposium was held in cooperation with Japanese URSI-H commission and sub-committee on plasma wave in SGEPSS.
    Part 1: Prague-Kanazawa Joint Symposium on Space Science & Technology 2019.
    Part 2: The 415th Symposium on Sustainable Humanosphere
    http://www.rish.kyoto-u.ac.jp/events/symposium-0415/
21. 17th International Conference on ICT and Knowledge Engineering (ICT&KE), Bangkok,

Thailand, 20-22 Nov., 2019.
http://www.ict-ke.org/

22. The Tenth Symposium on Polar Science, Tokyo, Japan, 3-5 Dec., 2019.
https://www.nipr.ac.jp/symposium2019/
23. AGU Fall Meeting 2019, San Francisco, CA., USA, 9-13 Dec., 2019.
https://www.agu.org/fall-meeting-2019
24. 2020 ERG Science and Space Weather Workshop, Taoyuan, Taiwan, Jan. 13-15, 2020.
https://events.asiaa.sinica.edu.tw/workshop/20200113/
25. The 21th Symposium on Planetary Sciences, Sendai, Japan, 17-19 Feb., 2020.
The Moon-Planet System Meeting 2020, Sendai, Japan, 20-21 Feb., 2020.
http://pparc.tohoku.ac.jp/sympo/sps/
https://www.cps-jp.org/~satellite/index2020.html
26. IPSJ Special Interest Group on Information Systems (SIG-IS), 2020-IS-151, Tokyo, Japan, 28 Feb., 2020.
http://www.ipsj.or.jp/kenkyukai/event/is151.html
27. Japanese-Czech Symposium on Space Physics, Prague, Czechia, 2-4 March, 2020.
28. The 15th JUICE Science Working Team Meeting, Noordwijk, Netherlands, 11-12 March, 2020.
29. European Geosciences Union (EGU) General Assembly 2020, online, 4-8 May, 2020.
https://www.egu2020.eu/
30. JpGU - AGU Joint Meeting 2020: Virtual, online, 12-16 Jul., 2020.
http://www.jpgu.org/meeting_j2020v/

[3] Future Meetings

1. ISAS Planetary Exploration Workshop 2020, online, 9-11 Sep., 2020.
https://www.isas.jaxa.jp/en/researchers/info/002406.html
2. Europlanet Science Congress (EPSC) 2020, online, 21 Sep.-9 Oct., 2020.
https://www.epsc2020.eu/
3. Division for Planetary Sciences (DPS) 2020, online, 26-30 Oct., 2020.
https://dps.aas.org/meetings/current
4. SGEPSS Fall Meeting, online, 1-4 Nov., 2020.
http://www.sgepss.org/sgepss/fallmeeting/FM2020/
5. Outer planet moon-magnetosphere interaction workshop, online, 5-6 Nov., 2020.
https://indico.esa.int/event/337/
6. **VERSIM2020, online, 16-20 Nov., 2020 (LOC: RISH, Kyoto Univ.)**
(9th VLF/ELF Remote Sensing of Ionospheres & Magnetospheres)
This workshop is supported by URSI, IAGA, SGEPSS etc.
http://pcwave.rish.kyoto-u.ac.jp/versim/
7. AGU Fall Meeting 2020, online, 1-17 Dec., 2020.
https://www.agu.org/Fall-Meeting
8. COSPAR Scientific Assembly, Sydney, Australia, 28 Jan.-4 Feb., 2021.
https://10times.com/cospar-scientific-assembly-sydney
9. The 22th Symposium on Planetary Sciences, Sendai, Japan, 22-24 February, 2021.
10. **Plasma waves in interplanetary space plasma (2020 Research Meeting of ISEE, Nagoya Univ.), online, 28(TBC) Feb., 2021**
This workshop will be held in cooperation with Japanese URSI-H commission and sub-committee on plasma wave in SGEPSS.
11. PWING/ERG conference, online, 7-12 March, 2021,
https://is.isee.nagoya-u.ac.jp/pwing-erg/
12. Mercury 2021 conference, Orleans, France, 8-11 June, 2021.
https://mercury2020.ias.u-psud.fr
13. IAGA-IASPEI 2021, Hyderabad, India, 22-27 Aug., 2021.
http://iaga-iaspei-india2021.in/
14. The 14th International School and Symposium for Space Simulations (ISSS14), Kobe, Japan,

Sep. 2021 (postponed from 2020).
The program of ISSS is designed for the teaching of space plasma simulation techniques and the sharing of state-of-the-art simulation advances and results with researchers in plasma physics. The most recent observational results, theoretical advances, and numerical simulations will be presented to address the outstanding problems in space physics.

[4] Recently Published Papers

Ali Ahmad, U., Y. Kasahara, S. Matsuda, M. Ozaki, and Y. Goto, Automatic Detection of Lightning Whistlers Observed by the Plasma Wave Experiment Onboard the Arase Satellite Using the OpenCV Library. Remote Sensing, 11(15), 1785, https://doi.org/10.3390/rs11151785, 2019.

✓ Ali Ahmad et al. (2019) proposed an image analysis approach to process the datasets of plasma wave observation by the Arase satellite. They implemented an automatic detection system to classify the various types of lightning whistlers.

Bolouki, N., K. Sakai,, T. Y. Huang, S. Isayama, Y. L. Liu, C. W. Peng, C. H. Chen, N. Khasanah, H. H. Chu, T. Moritaka, K. Tomita, Y. Sato, K. Uchino, T. Morita, S. Matsukiyo, Y. Hara, H. Shimogawara, Y. Sakawa, S. Sakata, S. Kojima, S. Fujioka, Y. Shoji, S. Tomiya, R. Yamazaki, M. Koenig, and Y. Kuramitsu, Collective Thomson scattering measurements of electron feature using stimulated Brillouin scattering in laser-produced plasmas, High Energy Density Physics, Volume 32, pp.82-88, https://doi.org/10.1016/j.hedp.2019.06.002, 2019.

✓ Collective Thomson scattering (CTS) has been applied to laser-produced plasmas with Gekko XII HIPER laser facility. A scheme of stimulated Brillouin scattering (SBS) has been used in CTS measurements for the first time.

Darian, D., W. J. Miloch, M. Mortensen, Y. Miyake, and H. Usui, Numerical simulations of a dust grain in a flowing magnetized plasma, Physics of Plasmas, Volume 26, issue 4, 043701, https://doi.org/10.1063/1.5089631, 2019.

✓ The effect of an external magnetic field on the formation of the wake in the potential distribution behind a dust grain is studied with self-consistent Particle-In-Cell numerical simulations. The topology of the wakefield is significantly affected by the magnetization degree of plasma and by the ion flow speed. The external magnetic field acts to reduce the potential enhancements in the wake and leads to the splitting of the wake pattern.

Harada, Y., S. Ruhunusiri, J. S. Halekas, J. Espley, G. A. DiBraccio, J. P. McFadden, D. L. Mitchell, C. Mazelle, G. Collinson, D. A. Brain, T. Hara, M. Nosé, S. Oimatsu, K. Yamamoto, and B. M. Jakosky, Locally generated ULF waves in the Martian magnetosphere: MAVEN observations, J. Geophys. Res.: Space Physics, 124, https://doi.org/10.1029/2019JA027312, 2019.

✓ This study investigated Martian ultralow frequency (ULF) electromagnetic waves generated by local plasma instabilities below the Martian bow shock. The observed properties of the waves are generally consistent with a proton Bernstein mode instability driven by a positive perpendicular slope in proton velocity distribution functions. The excited waves can cause perpendicular heating of thermal protons, thereby transferring energy from precipitating hot protons to cold ionospheric protons.

Hasegawa, T., S. Matsuda, A. Kumamoto, F. Tsuchiya, Y. Kasahara, Y. Miyoshi, Y. Kasaba, A. Matsuoka, and I. Shinohara, Automatic Electron Density Determination by Using a Convolutional Neural Network, IEEE Access, 7, 163384-163394, https://doi.org/10.1109/ACCESS.2019.2951916, 2019.

✓ Hasegawa et al. (2019) developed a technique for automatically determining upper hybrid resonance (UHR) frequencies using a convolutional neural network (CNN) to derive the electron density along the orbit of the Arase satellite.

Hendry, A. T., O. Santolik, C. A. Kletzing, C. J. Rodger, K. Shiokawa, and D. Baishev, Multi-instrument observation of nonlinear EMIC-driven electron precipitation at sub-MeV energies, Geophys. Res. Lett., 46, https://doi.org/10.1029/2019GL082401, 2019.

✓ They reported multi-instrument observation of nonlinear EMIC-driven electron precipitation at sub-MeV energies based on ground and satellite measurements of electrons and waves.

Hikishima, M., Y. Omura, and D. Summers, Particle simulation of the generation of plasmaspheric hiss, J. Geophys. Res.: Space Physics, 125, e2020JA027973, https://doi.org/10.1029/2020JA027973, 2020.

✓ We have conducted a one-dimensional electromagnetic particle simulation with a parabolic magnetic field to reproduce whistler-mode hiss emissions in the plasmasphere. The simulation demonstrates that hiss emissions are generated locally near the magnetic equator through linear and nonlinear interactions with energetic electrons with temperature anisotropy.

Hosokawa, K., Y. Miyoshi, M. Ozaki, S.-I. Oyama, Y. Ogawa, S. Kurita, Y. Kasahara, Y. Kasaba, S. Yagitani, S. Matsuda, F. Tsuchiya, A. Kumamoto, R. Kataoka, K. Shiokawa, T. Raita, E. Turunen, T. Takashima, I. Shinohara, and R. Fujii, Multiple time-scale beats in aurora: precise orchestration via magnetospheric chorus waves, Scientific Reports, 10, 3380, https://doi.org/10.1038/s41598-020-59642-8, 2020.

✓ The first direct correspondence between the main/internal modulations of the pulsating aurora and chorus burst and rising tone elements from simultaneous satellite-ground based observations.

Hsieh Y.-K., Y. Kubota, and Y. Omura, Nonlinear evolution of radiation belt electron fluxes interacting with oblique whistler mode chorus emissions, J. Geophys. Res.: Space Physics, 125, e2019JA027465, https://doi.org/10.1029/2019JA027465, 2020.

✓ The Green's functions and convolution integrals for oblique chorus are computed to simulate evolution of electron fluxes in the radiation belt. An electron can undergo both cyclotron and Landau resonances with different subpackets of one oblique chorus emission. Oblique chorus energizes keV electrons to about 2 MeV rapidly within several emissions, and then the acceleration slows down after reaching 2MeV.

Inaba Y., K. Shiokawa, S. Oyama, Y. Otsuka, A. Oksanen, A. Shinbori, A. Yu. Gololobov, Y. Miyoshi, Y. Kazama, S.-Y. Wang, S. W. Y. Tam, T.-F. Chang, B.-J. Wang, S. Yokota, S. Kasahara, K. Keika, T. Hori, A. Matsuoka, Y. Kasahara, A. Kumamoto, Y. Kasaba, M. Shoji, I. Shinohara, and C. Stolle, Plasma and field observations in the magnetospheric source region of a stable auroral red (SAR) arc by the Arase satellite on 28 March 2017, J. Geophys. Res: Space Physics., 125, https://doi.org/10.1029/2020JA028068, 2020.

✓ They reported the first plasma and field observation in the magnetospheric source region of a stable auroral red (SAR) arc by the Arase satellite on 28 March 2017. They concluded that EMIC and kinetic Alfven waves are not likely to cause the SAR arc, while Coulomb collision can be a candidate of the cause.

Kasaba, Y., T. Takashima, M. N. Nishino, and M. Fujimoto, Science operation concept of BepiColombo/MMO based on the MDP scheme, Proc. International Symposium Planetary Science 2011, ed. by S. Okano, Y. Kasaba, and H. Misawa, 1-11. TERRAPUB, Tokyo, https://doi.org/10.5047/pisps.001, 2019.

✓ Science Payloads of BepiColombo MMO is operated through the MDP, and act as an integrated measurement system observing charged and energetic neutral particles, magnetic and electric fields, plasma waves, radio waves, dust, and exospheric constituents with a coordinated manner within our limited telemetry resource.

Kasaba, Y., H. Kojima, M. Moncuquet, J.-E. Wahlund, S. Yagitani, F. Sahraoui, P. Henri, T. Karlsson, Y. Kasahara, A. Kumamoto, K. Ishisaka, K. Issautier, T. Imachi, S. Matsuda, J. Lichtenberger, and H. Usui, Plasma Wave Investigation (PWI) aboard Mio/BepiColombo

Mercury Magnetospheric Orbiter (MMO) on the trip to the first measurement of electric fields, electromagnetic waves, and radio waves around Mercury. Space Sci. Rev. 216:65., https://doi.org/10.1007/s11214-020-00692-9, 2020.

- ✓ The PWI aboard the BepiColombo Mio (MMO) will enable the first observations of electric fields, plasma waves, and radio waves in and around the Hermean magnetosphere and exosphere. The PWI has receivers (EWO with AM2P, SORBET) connected to electromagnetic sensors (MEFISTO, WPT, and SCM: LF-SC and DB-SC) for measurements of (1) electron density and temperature, (2) the electron and ion scale waves, (3) radio waves, and (4) dust impacts.

Kasaba, Y., T. Takashima, S. Matsuda, S. Eguchi, M. Endo, T. Miyabara, M. Taeda, Y. Kuroda, Y. Kasahara, T. Imachi, H. Kojima, S. Yagitani, M. Moncuquet, J.-E. Wahlund, A. Kumamoto, A. Matsuoka, W. Baumjohann, S. Yokota, K. Asamura, Y. Saito, D. Delcourt, M. Hirahara, S. Barabash, N. Andre, M. Kobayashi, I. Yoshikawa, G. Murakami, and H. Hayakawa, Mission Data Processor aboard the BepiColombo Mio spacecraft: Design and science operation concept, Space Sci. Rev. 216:34. https://doi.org/10.1007/s11214-020-00658-x, 2020.

- ✓ The MDP with other payloads aboard the BepiColombo Mio (MMO) acts as an integrated system for Hermean environmental studies by in situ observation of charged and energetic neutral particles, magnetic and electric fields, plasma waves, dust, and the remote sensing of radio waves and exospheric emissions. To utilize the limited telemetry bandwidth, Nominal(M)- and Burst(H)-mode data sets are partially downlinked after the selections based on Survey(L)- or L/M-mode data.

Kasahara, S., Y. Miyoshi, S. Kurita, S. Yokota, K. Keika, T. Hori, Y. Kasahara, S. Matsuda, A. Kumamoto, A. Matsuoka, K. Seki, and I. Shinohara, Strong diffusion of energetic electrons by equatorial chorus waves in the midnight-to-dawn sector, Geophys. Res. Lett., 46, https://doi.org/10.1029/2019GL085499, 2019.

- ✓ In-situ measurements of loss-cone filling of energetic electrons and related chorus wave activities and evidence of strong diffusions are presented.

Kataoka, R., T. Nishiyama, Y. Tanaka, A. Kadokura, H. A. Uchida, Y. Ebihara, M. K Ejiri, Y. Tomikawa, M. Tsutsumi, K. Sato, Y. Miyoshi, K. Shiokawa, S. Kurita, Y. Kasahara, M. Ozaki, K. Hosokawa, S. Matsuda, I. Shinohara, T. Takashima, T. Sato, T. Mitani, T. Hori, and N. Higashio, Transient ionization of the mesosphere during auroral breakup: Arase satellite and ground-based conjugate observations at Syowa Station, Earth, Planets and Space, 71, 1, 9, https://doi.org/10.1186/s40623-019-0989-7, 2019.

- ✓ Simultaneous measurements between ground-based observations at Antarctica and Arase satellite and transient ionization of the mesosphere is presented.

Kataoka, R., K. Murase, H. A. Uchida, Y. Asaoka, S. Torii, S. Matsuda, A. Matsuoka, S. Nakahira, I. Shinohara, H. Ueno, S. Miyake, Y. Miyoshi, M. Shoji, S. Kurita, Y. Kasahara, M. Ozaki, Y. Kasaba, K. Hosokawa, and Y.-M. Tanaka, Plasma waves causing relativistic electron precipitation events at International Space Station: Lessons from conjunction observations with Arase satellite, J. Geophys. Res.: Space Physics, 125, e2020JA027875., https://doi.org/10.1029/2020JA027875, 2020.

- ✓ Several different kinds of plasma waves were identified in the magnetosphere as the possible cause of relativistic electron precipitation (REP) events at International Space Station (ISS).

Kawamura, S., K. Hosokawa, S. Kurita, S. Oyama, Y. Miyoshi, Y. Kasahara, M. Ozaki, S. Matsuda, A. Matsuoka B. Kozelov, Y. Kawamura, and I. Shinohara, Tracking the region of high correlation between pulsating aurora and chorus: Simultaneous observations with Arase satellite and ground-based all-sky imager in Russia, J. Geophys. Res.: Space Physics, 124, 2769-2778, https://doi.org/10.1029/2019JA026496, 2019.

- ✓ Observations between ground-based pulsating aurora and chorus waves detected by Arase are presented, and high-correlation between pulsating aurora and chorus is reported.

Kim, H., K. Shiokawa, J. Park, Y. Miyoshi, Y. Miyashita, C. Stolle, K.-H. Kim, J. Matzka, S. Buchert, T. Fromm and J. Hwang, Ionospheric plasma density oscillation related to EMIC Pc1 waves, Geophys. Res. Lett., 47, https://doi.org/10.1029/2020GL089000, 2020.

✓ Kim et al. (2020) newly found ionospheric plasma density oscillation in association with EMIC Pc1 waves based on measurements by the Swarm satellites in the ionosphere.

Kim, G.-J., K. Kim, H. Kwon, K. Shiokawa, K. Takahashi, and J. Hwang, Long-lasting ground-satellite high coherence of compressional dayside Pc3-Pc4 pulsations, J. Geophys. Res.: Space Physics, 125, https://doi.org/10.1029/2020JA028074, 2020.

✓ Kim et al. (2020) reported characteristics of compressional dayside Pc3-Pc4 pulsations which show high coherence over a long time between ground and magnetospheric satellites.

Kim, H., K. Shiokawa, J. Park, Y. Miyoshi, J. Hwang, and A. Kadokura, Modulation of Pc1 wave ducting by equatorial plasma bubble, Geophys. Res. Lett., 47, https://doi.org/10.1029/2020GL088054, 2020.

✓ Kim et al. (2020) reported modulation of Pc1/EMIC wave ducting by equatorial plasma bubbles based on measurements by the Swarm satellites in the low-latitude ionosphere.

Kimura, T., A. Yamazaki, K. Yoshioka, G. Murakami, F. Tsuchiya, H. Kita, C. Tao, I. Yoshikawa, and C. Yamauchi, Development of ground pipeline system for high-level scientific data products of the Hisaki satellite mission and its application to planetary space weather, J. Space Weather Space Clim., 9, A8, https://doi.org/10.1051/swsc/2019005, 2019.

✓ This paper describes a data pipeline system developed for processing high-level scientific and ancillary data products from the Hisaki mission. Continuous monitoring with Hisaki will contribute considerably to our understanding of space weather relating to planets in our solar system.

Kita, H., H. Misawa, A. Bhardwaj, F. Tsuchiya, G. Murakami, C. Tao, T. Kimura, K. Yoshioka, A. Yamazaki, Y. Kasaba, I. Yoshikawa, and M. Fujimoto, Short-term variation in the dawn-dusk asymmetry of the Jovian radiation belt obtained from GMRT and Hisaki EXCEED observations, Astrophys. J. Lett., 872:L24, https://doi.org/10.3847/2041-8213/ab0427, 2019.

✓ In order to reveal variations of days to weeks in the brightness distribution of Jovian Synchrotron Radiation (JSR), this paper reported analysis results of simultaneous radio and ultraviolet observations using the Giant Metrewave Radio Telescope (GMRT) and the Hisaki EXCEED. The statistical analysis indicates that JSR and IPT do not have a significant correlation.

Kitahara, M. and Katoh, Y., Anomalous Trapping of Low Pitch Angle Electrons by Coherent Whistler Mode Waves, J. Geophys. Res.: Space Physics, 124, 5568-5583, https://doi.org/10.1029/2019JA026493, 2019.

✓ We examined the mechanism of anomalous trapping at low pitch angles, which could be caused by coherent whistler mode waves and could have contributions on energetic electron precipitation to the atmosphere. A particle equation with low pitch angle assumption was derived. In addition, test particle simulations demonstrate the theoretically predicted motion of electrons.

Koga, R., F. Tsuchiya, M. Kagitani, T. Sakanoi, K. Yoshioka, I. Yoshikawa, T. Kimura, G. Murakami, A. Yamazaki, H. T. Smith, and F. Bagenal, Transient change of Io's neutral oxygen cloud and plasma torus observed by Hisaki, J. Geophys. Res.: Space Physics, 124, 10318-10331, https://doi.org/10.1029/2019JA026877, 2019.

✓ The spatial distribution of OI 130.4 nm emissions around Io's orbit during transient strong density enhancement in the torus in 2015 has been analyzed based on Hisaki observations. The lifetime of O+ was estimated from time variations of O and O+, and it shortened during the density enhancement in 2015. Io's neutral oxygen cloud spread outward from Jupiter during the high density period.

Kwon J.-W, K.-H. Kim, H. Jin, H.-J. Kwon, G. Jee, K. Shiokawa, and M. Connors, Statistical Study of EMIC Pc1-Pc2 Waves Observed at Subauroral Latitudes, J. Atmos. Solar-Terr. Phys., https://doi.org/10.1016/j.jastp.2020.105292, 2020.

- ✓ Pc1-Pc2 waves observed at subauroral latitudes mostly appear to be in the He-band. Their frequencies are higher in the postmidnight-to-dawn sector and lower in the late afternoon sector. The subauroral latitude Pc1-Pc2 waves are associated with EMIC waves generated near the plasmapause.

Li, L., Y. Omura, X.-Z. Zhou, Q.-G. Zong, S.-Y. Fu, R. Rankin, and A. W. Degeling, Roles of magnetospheric convection on nonlinear drift resonance between electrons and ULF waves, J. Geophys. Res.: Space Physics, 125, e2020JA027787, https://doi.org/10.1029/2020JA027787, 2020.

- ✓ We derive nonlinear-driven pendulum equation for drift resonant interaction of particles and ULF waves under the convection electric field. Under strong convection, resonant electrons remain phase trapped by low-m ULF waves but can be quickly untrapped for high-m cases. The convection electric field causes particle diffusion when its trapping frequency is close to the drift frequency for intermediate-m case.

Liu, N., Z. Su, Z. Gao, H. Zheng, Y. Wang, S. Wang, Y. Miyoshi, I. Shinohara, Y. Kasahara, F. Tsuchiya, A. Kumamoto, S. Matsuda, M. Shoji, T. Mitani, T. Takashima, Y. Kazama, B-J. Wang, S-Y. Wang, C-W Jun, T-F Chang, S.W.Y Tam, S. Kasahara, S. Yokota, K. Keika, T. Hori, and A. Matsuoka, Comprehensive Observations of Substorm-Enhanced Plasmaspheric Hiss Generation, Propagation, and Dissipation, Geophys. Res. Lett., 47, e2019GL086, https://doi.org/10.1029/2019GL086040, 2020.

- ✓ Comparative study about hiss evolutions from Van Allen Probes and Arase and propagation effects of hiss waves are discussed.

Martinez-Calderon, C., Y. Katoh, J. Manninen, Y. Kasahara, S. Matsuda, A. Kumamoto, F. Tsuchiya A. Matsuoka M. Shoji M. Teramoto I. Shinohara K. Shiokawa and Y. Miyoshi., Conjugate observations of dayside and nightside VLF chorus and QP emissions between Arase (ERG) and Kannuslehto, Finland. J. Geophys. Res.: Space Physics, 125, e2019JA026663, https://doi.org/10.1029/2019JA026663, 2019.

- ✓ Two conjugate events during storm recovery phase and quiet time showing simultaneous very low frequency (VLF) waves observations between the same ground station (Kannuslehto, MLAT = 64.4°N, L=5.46) and Arase (ERG) spacecraft were the first time compared focusing on coherence and spatial extent of the waves, electron density, and magnetic field variations.

Martinez-Calderon, C., F. Nemec, Y. Katoh, K. Shiokawa, C. Kletzing, G. Hospodarsky, O. Santolik, Y. Kasahara, S. Matsuda, A. Kumamoto, F. Tsuchiya, A. Matsuoka, M. Shoji, M. Teramoto, S. Kurita, Y. Miyoshi, M. Ozaki, N. Nishitani, A. V. Oinats, and V. I. Kurkin, Spatial extent of quasi-periodic emissions simultaneously observed by Arase and Van Allen Probes on November 29, 2018, J. Geophys. Res. : Space Physics, 125, https://doi.org/10.1029/2020JA028126, 2020.

- ✓ Martinez-Caldron et al. (2020) reported spatial extent of quasi-periodic ELF/VLF emissions which are simultaneously observed by Arase and Van Allen Probes on November 29, 2018.

Matsukiyo, S., T. Akamizu, and T. Hada, Heavy Ion Acceleration by Super-Alfvénic Waves, The Astrophysical Journal Letters, 887(1), article id. L2, https://doi.org/10.3847/2041-8213/ab58cf, 2019.

- ✓ A generation mechanism of super-Alfvénic (SPA) waves in multi-ion species plasma is proposed, and the associated heavy ion acceleration process is discussed.

Matsukiyo, S., T. Noumi, G. P. Zank, H. Washimi, and T. Hada, PIC Simulation of a Shock Tube: Implications for Wave Transmission in the Heliospheric Boundary Region, The Astrophysical

Journal, 888(1), article id. 11, https://doi.org/10.3847/1538-4357/ab54c9, 2020.

- ✓ A shock tube problem is solved numerically by using one-dimensional full particle-in-cell simulations under the condition that a relatively tenuous and weakly magnetized plasma is continuously pushed by a relatively dense and strongly magnetized plasma having supersonic relative velocity. The results are discussed in the context of the heliospheric boundary region or heliopause.

Miyake, Y., W. J. Miloch, S. H. Solveig, and H. L. Pecseli, Electron wing-like structures formed at a negatively charged spacecraft moving in a magnetized plasma, J. Geophys. Res.: Space Physics, 125, 2, e2019JA027379, https://doi.org/10.1029/2019JA027379, 2020.

- ✓ Particle simulations identify wing-like density structures formed by electrons reflected at a negatively-charged moving spacecraft in a magnetized plasma. Such structures are characterized by the trail of field-aligned propagation of Langmuir waves. Reflected electrons cause spurious electric fields that can be measured by double probes on a satellite.

Miyashita T., H. Ohya, F. Tsuchiya, A. Hirai, M. Ozaki, K. Shiokawa, Y. Miyoshi, N. Nishitani, M. Teramoto, M. Connors, S. G. Shepherd, Y. Kasahara, A. Kumamoto, M. Shoji, I. Shinohara, H. Nakata, and T. Takano, ULF modulation of energetic electron precipitation observed by VLF/LF radio propagation, URSI Radio Science Bulletin, in press, 2020.

- ✓ Miyashita et al. (2019) reported modulation of energetic electron precipitation by ULF pulsations based on observation by VLF/LF standard radio wave propagation at Athabasca, Canada.

Miyoshi Y., S. Matsuda, S. Kurita, K. Nomura, K. Keika, M. Shoji, N. Kitamura, Y. Kasahara, A. Matsuoka, I. Shinohara, K. Shiokawa, S. Machida, O. Santolik, S. A. Boardsen, R. B. Horne, and J. F. Wygant, EMIC waves converted from equatorial noise due 1 to M/Q=2 ions in the plasmasphere: Observations from Van Allen Probes and Arase, Geophys. Res. Lett., 46, https://doi.org/10.1029/2019GL083024, 2019.

- ✓ Miyoshi et al. (2019) have reported EMIC waves converted from equatorial noise due to M/Q=2 ions in the plasmasphere based on observations from Van Allen Probes and Arase satellites.

Morita, T., K. Nagashima, M. Edamoto, K. Tomita, T. Sano, Y. Itadani, R. Kumar, M. Ota, S. Egashira, R. Yamazaki, S. J. Tanaka, S. Tomita, S. Tomiya, H. Toda, I. Miyata, S. Kakuchi, S. Sei, N. Ishizaka, S. Matsukiyo, Y. Kuramitsu, Y. Ohira, M. Hoshino, and Y. Sakawa, Anomalous plasma acceleration in colliding high-power laser-produced plasmas, Physics of Plasmas, 26(9), id.090702, https://doi.org/10.1063/1.5100197, 2019.

- ✓ An experimental platform for studying magnetic reconnection in an external magnetic field with simultaneous measurements of plasma imaging, flow velocity, and magnetic-field variation is developed.

Murata, K. T., K. Mizutani, Y. Muroyama, K. Yamamoto, K. Muranaga, T. Mizuhara, P. Pavarangkoon, and K. Kobayashi, LoRa Communication Maps of Medium-Sized Rural City in Japan via Community Bus Services, in 2019 IEEE Int. Conf. Dependable, Autonomic and Secure Computing, Int. Conf. Pervasive Intelligence and Computing, Int. Conf. Cloud and Big Data Computing, Int. Conf. Cyber Science and Technology Congress (DASC/PiCom/CBDCom/CyberSciTech), Fukuoka, Japan, Aug. 5-8, 1054-1059, https://doi.org/10.1109/DASC/PiCom/CBDCom/CyberSciTech.2019.00189, 2019.

- ✓ In this experiment, we set up LoRa relay stations at three locations in a city. Experimental results are summarized in an area map, indicating that we succeed in communicating in 61.3% of data points on the bus routes and confirm the possibility of covering the entire city by the LPWA.

Murata, K. T., P. Pavarangkoon, K. Inoue, T. Mizuhara, Y. Kagebayashi, K. Yamamoto, K. Muranaga, E. Kimura and Y. Nagaya, Development of High-performance and Flexible Protocol Handler for International Web Accesses, in The 21st IEEE Int. Conf. High Performance Computing and Communications (HPCC-2019), Zhangjiajie, China, Aug. 10-12, 1958-1963,

https://doi.org/10.1109/HPCC/SmartCity/DSS.2019.00270, 2019.

✓ In this paper, we propose a novel protocol handler for international web accesses based on a high-speed data transfer protocol, namely high-performance and flexible protocol (HpFP). We first design our protocol handler on the basis of HTTP, and then implement it for the Internet Explorer browser in Windows operating system (OS).

Murata, K. T., P. Pavarangkoon, S. Phon-Amnuaisuk, T. Mizuhara, K. Yamamoto, K. Muranaga and T. Aoki, A Programming Environment for Visual IoT on Raspberry Pi, in 2019 IEEE Int. Conf. Dependable, Autonomic and Secure Computing, Int. Conf. Pervasive Intelligence and Computing, Int. Conf. Cloud and Big Data Computing, Int. Conf. Cyber Science and Technology Congress (DASC/PiCom/CBDCom/CyberSciTech), Fukuoka, Japan, Aug. 5-8, 987-992, https://doi.org/10.1109/DASC/PiCom/CBDCom/CyberSciTech.2019.00180, 2019.

✓ In this paper, we first introduce a programming environment for visual IoT on Raspberry Pi camera system, and then discuss a couple of sample applications.

Nakamura, Y., Y. Kasaba, T, Kimura, L. Lamy, B. Cecconi, G. Fischer, A. Sasaki, C. Tao, F. Tsuchiya, H. Misawa, A. Kumamoto, and A. Morioka, Seasonal variation of north-south asymmetry in the intensity of Saturn Kilometric Radiation from 2004 to 2017, https://doi.org/10.1016/j.pss.2019.104711, 2019.

✓ This study investigates the long-term variation of Saturn Kilometric Radiation (SKR) intensity observed by the Radio and Plasma Wave Science (RPWS) instrument on board the Cassini spacecraft from 2004 (southern summer) to 2017 (northern summer). The results show that the SKR intensity was brighter in the summer hemisphere than in the winter hemisphere. The dependence on solar EUV flux and solar wind dynamic pressure were less than that on rotational axis tilt.

Niemiec, J., O. Kobzar, T. Amano, M. Hoshino S. Matsukiyo, Y. Matsumoto, and M. Pohl, Electron Acceleration at Rippled Low Mach Number Shocks in Merging Galaxy Clusters, Proceedings of 36th International Cosmic Ray Conference (ICRC2019), article id: 368, 2019.

✓ The effects of the shock rippling on electron acceleration at large-scale merger shocks in galaxy clusters is investigated by using 2D PIC simulation. It is shown that the electron acceleration rate increases considerably after the appearance of wave-rippling modes.

Nishitani, N., J. M. Ruohoniemi, M. Lester, J. B. H. Baker, A. V. Koustov, S. G. Shepherd, G. Chisham, T. Hori, E. G. Thomas, R. A. Makarevich, A. Marchaudon, P. Ponomarenko, J. A. Wild, S. E. Milan, W. A. Bristow, J. Devlin, E. Miller, R. A. Greenwald, T. Ogawa, and T. Kikuchi, Review of the accomplishments of Mid-latitude Super Dual Auroral Radar Network (SuperDARN) HF Radars, Progress in Earth and Planetary Science, https://doi.org/10.1186/s40645-019-0270-5, 6:27, 2019.

✓ The accomplishments made with mid-latitude SuperDARN radars are reviewed in five specified scientific and technical areas: convection, ionospheric irregularities, HF propagation analysis, ion-neutral interactions and magnetohydrodynamic (MHD) waves.

Nosé, M., A. Matsuoka, A. Kumamoto, Y. Kasahara, M. Teramoto, S. Kurita, J. Goldstein, L. M. Kistler, S. Singh, A. Gololobov, K. Shiokawa, S. Imajo, S. Oimatsu, K. Yamamoto, Y. Obana. M. Shoji, F. Tsuchiya, I. Shinohara, Y. Miyoshi, W. S. Kurth, C. A. Kletzing, C. W. Smith, R. J. MacDowall, H. Spence, and G. D. Reeves, Oxygen torus and its coincidence with EMIC wave in the deep inner magnetosphere: Van Allen Probe B and Arase observations, Earth, Planets and Space, 72:111, https://doi.org/10.1186/s40623-020-01235-w, 2020.

✓ Simultaneous observations from the Van Allen Probe B and Arase satellites showed that the oxygen torus does not extend over all MLT but is skewed toward the dawn and an electromagnetic ion cyclotron (EMIC) wave in the H+ band appeared coincidently with the oxygen torus.

Obana, Y., N. Maruyama, A. Shinbori, K. K. Hashimoto, M. Fedrizzi, M., M. Nosé, Y. Otsuka,

N. Nishitani, T. Hori, A. Kumamoto, F. Tsuchiya, S. Matsuda, A. Matsuoka, Y. Kasahara, A. Yoshikawa, Y. Miyoshi, and I. Shinohara, Response of the ionosphere‐plasmasphere coupling to the September 2017 storm: What erodes the plasmasphere so severely?, Space Weather, 17, 861-876, https://doi.org/10.1029/2019SW002168, 2019.

- ✓ Obana et al. (2019) reported that a magnetic storm during 7-10 September 2017 dramatically displaced the outer boundary of the plasmasphere inwards, to only ~4,000 km from Earth's surface. The study suggests that the remarkable deformation is caused by the unusually long-lasting leakage of the convection electric field deep within the plasmasphere.

Oimatsu, S., M. Nosé, G. Le, S. A. Fuselier, R. E. Ergun, P.-A. Lindqvist, and D. Sormakov, Selective acceleration of O+ by drift-bounce resonance in the Earth's magnetosphere: MMS observations, J. Geophys. Res., 125, e2019JA027686, https://doi.org/10.1029/2019JA027686, 2020.

- ✓ A case study of an event on 17 February 2016 shows that O+ flux oscillations at ~10–30 keV occurred at MLT ~ 5 hr and L ~ 8–9 during a storm recovery phase. These flux oscillations were accompanied by a toroidal Pc5 wave. Statistical result supports the selective acceleration of O+ due to the N = 2 drift-bounce resonance.

Oka, M., F. Otsuka, S. Matsukiyo, L. B. III Wilson, M. R. Argall, T. Amano, T. D. Phan, M. Hoshino, O. Le Contel, D. J. Gershman, J. L. Burch, R. B. Torbert, J. C. Dorelli, B. L. Giles, R. E. Ergun, C. T. Russell, and P. A. Lindqvist, Electron Scattering by Low-frequency Whistler Waves at Earth's Bow Shock, The Astrophysical Journal, 886(1), article id. 53, https://doi.org/10.3847/1538-4357/ab4a81, 2019.

- ✓ Using MMS (Magnetospheric Multiscale mission) data, it is shown that mildly energetic (~0.5 keV) electrons are locally scattered (and accelerated while being confined) by magnetosonic-whistler waves within the shock transition layer of the earth's bow shock, especially when the shock angle is large (theta>70 deg).

Omura, Y., Y.-K. Hsieh, J. C. Foster, P. J. Erickson, C. A. Kletzing, and D. N. Baker, Cyclotron acceleration of relativistic electrons through Landau resonance with obliquely propagating whistler-mode chorus emissions, J. Geophys. Res.: Space Physics, 124, 2795-2810. https://doi.org/10.1029/2018JA026374, 2019.

- ✓ Efficient acceleration of relativistic electrons at Landau resonance with obliquely propagating whistler-mode chorus emissions is confirmed by theory, simulation, and observation. The acceleration is due to the perpendicular component of the wave electric field.

Otsuka, F., S. Matsukiyo, and T. Hada, PIC Simulation of a quasi-parallel collisionless shock: Interaction between upstream waves and backstreaming ions, High Energy Density Physics, Volume 33, article id. 100709, https://doi.org/10.1016/j.hedp.2019.100709, 2019.

- ✓ A one-dimensional full particle-in-cell (PIC) simulation of a quasi-parallel collisionless shock with the Alfvén Mach number 6.6 and a shock angle of 20 degrees is performed to investigate the interactions between self-consistently produced backstreaming ions and upstream waves.

Paulsson, J. J. P., Y. Miyake, W. J. Miloch, and H. Usui, Effects of booms of sounding rockets in flowing plasmas, Physics of Plasmas 26, 032902, https://doi.org/10.1063/1.5051414, 2019.

- ✓ Effects of booms of a sounding rocket on rocket charging and on the local plasma conditions are studied with numerical and analytical models accounting for flowing, ionospheric plasmas. Simulations are carried out with a first-principles self-consistent Particle-In-Cell numerical code. It is shown that the booms can affect the charging of the payload and disturb the local plasma to a high degree.

Shiokawa, K., M. Nosé, S. Imajo, Y.-M. Tanaka, Y. Miyoshi, K. Hosokawa, M. Connors, M. Engebretson, Y. Kazama, S.-Y. Wang, S. W. Y. Tam, Tzu-Fang Chang, Bo-Jhou Wang, K. Asamura, S. Kasahara, S. Yokota, T. Hori, K. Keika, Y. Kasaba, M. Shoji, Y. Kasahara, A.

Matsuoka, and I. Shinohara, Arase observation of the source region of auroral arcs and diffuse auroras in the inner magnetosphere, J. Geophys. Res.: Space Physics, 125, e2019JA027310, https://doi.org/10.1029/2019JA027310, 2020.

- ✓ Campaign observations were carried out between Arase satellite and ground station at Nain, Canada, in September 2018. Discrete and diffuse auroras were observed from the ground, while in space electrons and ions were observed, whose characteristics changed depending on whether the spacecraft was lined up with discrete auroras, or later, with diffuse auroras. The observations suggest mechanisms by which the particles may be energized during substorms, with direct measurements in the source region.

Shue, J.-H., Y. Nariyuki, Y. Katoh, S. Saito, Y. Kasahara, Y.-K. Hsieh, Y. Matsuda, and Y. Goto, A systematic study in characteristics of lower band rising-tone chorus elements, J. Geophys. Res. Space Physics, 124, 9003–9016, https://doi.org/10.1029/2019JA027368, 2019.

- ✓ We carried out a systematic study of whistler-mode chorus emissions observed by THEMIS probes using the random forest method of machine learning and Pearson's correlation analysis. We found that the temperature is the most important parameter that controls the lasting time of chorus elements and showed that our results can be well explained by the threshold and optimum wave amplitudes for the nonlinear generation of chorus emissions.

Takeshita Y., K. Shiokawa, M. Ozaki, J. Manninen, S. Oyama, M. Connors, D. Baishev, V. Kurkin, and A. Oinats, Longitudinal extent of magnetospheric ELF/VLF waves using multipoint PWING ground stations at subauroral latitudes, J. Geophys. Res.: Space Physics, 124, https://doi.org/10.1029/2019JA026810, 2019.

- ✓ Takeshita et al. (2019) reported longitudinal extent of magnetospheric ELF/VLF waves using six-point PWING ground stations at subauroral latitudes at L~4 and concluded that the most typical extent is ~76 degree in longitudes.

Tanaka, Y.-M., T. Nishiyama, A. Kadokura, M. Ozaki, Y. Miyoshi, K. Shiokawa, S. Oyama, R. Kataoka, M. Tsutsumi, K. Nishimura, K. Sato, Y. Kasahara, A. Kumamoto, F. Tsuchiya, M. Fukizawa, M. Hikishima, S. Matsuda, A. Matsuoka, I. Shinohara, M. Nose, T. Nagatsuma, M. Shinohara, A. Fujimoto, M. Teramoto, R. Nomura, A. Sessai Yukimatu, K. Hosokawa, M. Shoji, and R. Latteck, Direct comparison between magnetospheric plasma waves and polar mesosphere winter echoes in both hemispheres, J. Geophys. Res.: Space Physics, 124, https://doi.org/10.1029/2019JA026891, 2019.

- ✓ Tanaka et al. (2019) reported direct comparison between magnetospheric plasma waves and polar mesosphere winter echoes in both hemispheres based on measurements by the Arase satellite and the PANSY radar at Antarctic Syowa station.

Teramoto, M., T. Hori, S. Saito, Y. Miyoshi, S. Kurita, N. Higashio, A. Matsuoka, Y. Kasahara, Y. Kasaba, T. Takashima, R. Nomura, M. Nosé, A. Fujimoto, Y. M. Tanaka, M. Shoji, Y. Tsugawa, M. Shinohara, I. Shinohara, J. B. Blake, J. F. Fennell, S. G. Claudepierre, D. L. Turner, C. A. Kletzing, D. Sormakov and O. Troshichev, Remote Detection of Drift Resonance Between Energetic Electrons and Ultralow Frequency Waves: Multisatellite Coordinated Observation by Arase and Van Allen Probes, Geophys. Res. Lett., 46, https://doi.org/10.1029/2019GL084379, 2019.

- ✓ Multi-satellite measurements about drift resonance between Pc5 ULF waves and drifted electrons by Arase and Van Allen Probes, and the modulation region of the drift resonance are identified.

Tsuchiya, F., R. Arakawa, H. Misawa, M. Kagitani, R. Koga, F. Suzuki, R. Hikida, K. Yoshioka, A. Steffl, F. Begenal, P. Delamere, T. Kimura, Y. Kasaba, G. Murakami, I. Yoshikawa, and A. Yamazaki, Azimuthal variation in the Io plasma torus observed by the Hisaki satellite from 2013 to 2016, J. Geophys. Res.: Space Physics, 124, 3236-3254, https://doi.org/10.1029/2018JA026038, 2019.

- ✓ Persistent azimuthal variations in the Io plasma torus were confirmed from three years of Hisaki observations. The characteristics of the azimuthal variation were consistent with the dual hot electron model but different behaviors were also found. The System IV period decreased 3 times. Two of these decreases were associated with increased volcanic activity on Io.

Usui, H., Y. Miyake, W. J. Miloch, and K. Ito, Numerical Study of Plasma Depletion Region in a Satellite Wake, IEEE Transaction Plasma Science, 47(8), 3717-3723, https://doi.org/10.1109/TPS.2019.2918789, 2019.

✓ We demonstrated the existence of a distorted plasma depletion region in a satellite wake through three-dimensional electrostatic particle-in-cell (PIC) plasma simulations. This distortion is asymmetric with respect to the plasma flow direction in the satellite rest frame of reference. The asymmetric structure of the plasma depletion region is caused by the non-uniform local drift motion of electrons around the depletion region.

Xu, H. and K. Shiokawa, Severe magnetic fluctuations in the near-Earth magnetotail: spectral analysis and dependence on solar activity, J. Geophys. Res.: Space Physics, 125, https://doi.org/10.1029/2020JA027834, 2020.

✓ Xu and Shiokawa (2020) reported statistical study of spectral characteristics and solar activity dependence for severe magnetic fluctuations in the near-Earth magnetotail based on the THEMIS satellite measurements.

Yamamoto, K., M. Nosé, K. Keika, D. P. Hartley, C. W. Smith, R. J. MacDowall, L. J. Lanzerotti, D. G. Mitchell, H. E. Spence, G. D. Reeves, J. R. Wygant, J. W. Bonnell, and S. Oimatsu, Eastward propagating second harmonic poloidal waves triggered by temporary outward gradient of proton phase space density: Van Allen Probe A observation, J. Geophys. Res.: Space Physics, 124, https://doi.org/10.1029/2019JA027158, 2019.

✓ Two wave packets of second harmonic poloidal Pc 4 waves with a wave frequency of ~7 mHz were detected by Van Allen Probe A at a radial distance of ~5.8 Re and magnetic local time of 13 hr near the magnetic equator. Using the ion sounding technique, we find that the Pc 4 waves propagated eastward with an azimuthal wave number of ~250. The condition of drift-bounce resonance is well satisfied for the estimated m numbers in both events.

Yamazaki, R., A. Shinoda, T. Umeda, and S. Matsukiyo, Mach number and plasma beta dependence of the ion temperature perpendicular to the external magnetic field in the transition region of perpendicular collisionless shocks, AIP Advances, Volume 9, Issue 12, id.125010, https://doi.org/10.1063/1.5129067, 2019.

✓ By using two-dimensional full particle simulations, it is shown that the ion temperature component perpendicular to the shock magnetic field at the shock foot region is proportional to the square of the Alfvén Mach number divided by the plasma beta.