Japanese URSI Commission H (Waves in Plasmas)
Activity Report
September 2020 - July 2021

[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 waiting the deployment of electric-field wire antenna (15-m length x 4) just after the Mercury orbit insertion planned in 2025. Limited observation by non-deployed search coils are going in the cruise phase, with the development of the telemetry data pipelines and operation planning. Earth flyby was executed on 10-11 April 2020, and Venus flybys were on 15 Oct 2020 and 11 Aug. 2021. Mercury flybys before the real arrival will be planned in 2021 – 2025.

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 with the launch in 2022 and the arrival at Jupiter in 2029. It will spend at least three years making detailed observations of the Jovian system including Europa, Ganymede, Calisto flybys, 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) are supplied (Co-PI: Y. Kasaba [Tohoku Univ.]) and provides the highly resolved information of Jovian radiation emitted from Jupiter and Galilean moons by the first 3-axis E-field measurement on Jovian orbit. In 2021 summer, the spacecraft is during the final prelaunch test stage 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. After successful operation during the prime mission from March, 2017 to October 2018, the JAXA has approved the mission extension of Arase until end of March, 2022. The Plasma Wave Experiment (PWE, PI: Y. Kasahara [Kanazawa Univ.]) measures 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 DSX satellites in the magnetosphere. We intensively conducted the PWE burst mode operations, by which waveforms were continuously captured. The science data files for wave spectrum and waveform are available from the ERG Science Center http://ergsc.isee.nagoya-u.ac.jp/index.shtml.en
All science instruments are still in good condition and we are planning a further extension of the Arase mission.

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://pparc.gp.tohoku.ac.jp/about-us/observatory/?lang=en
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 six antennas is also operated.

7. SS-520-3 sounding rocket

SS-520-3 sounding rocket aims at the investigation of energy sources that provide outflow energies to escaping ionospheric ions at the Cusp region. Low frequency plasma waves are one of the plausible candidates of the energy sources. The LFAS (Low frequency analyzer system) onboard the rocket observes electric field components of plasma waves including global electric fields in the frequency range below 10kHz. The rocket will be launched at Ny Alesund, Norway in 2021.

8. PWING Project

The ground-based observation of Pc1 geomagnetic pulsations and ELF/VLF waves by the PWING project are automatically carried out at 6 stations at subauroral latitudes at Athabasca and Kapuskasing (Canada), Gakona (Alaska), Zhigansk/Maimaga and Istok (Russia), and Husafell (Iceland). The data in CDF format are available from the ERG Science Center at https://www.isee.nagoya-u.ac.jp/dimr/PWING/en/.

9. Bilateral project between JSPS and CAS

The bilateral project between Japan and Czech has worked for multi-satellite data analysis about various plasma waves and inter-calibrations for receivers using Arase, Van Allen Probes, Cluster etc. The project also studies the tweek atmospherics by investigating the regional lightning activities at Europe and Japan.

10. Japan-Norway Partnership for computing in Space Science

A new six years' program is initiated in the Japan-Norway partnership in 2021. This program aims to enhance activities in research and research-based education for computing in space science. Kobe University and Kyoto University collaborate with the University of Oslo and exchange students under the supervision of the staff members. Students will learn space science and acquire expertise in computational science. Schools and workshops on space science will be held in both countries.

11. A high-speed data file transfer technique

High-speed data transfer is one of the crucial factor to share large-scale plasma data. We have been developing a network transfer protocol named as "HpFP" and an application to use this protocol named as "HCP tools". The performance of them are being examined on the JGN and SINET5 in Japan that provide 10Gbps bandwidth.

[2] Recent Meetings

1. Workshop on Laboratory Astrophysics: Novel Development in Nonlinear Plasma Physics with Lasers, 2-3, Sep. 2020, hybrid.
   http://www.eie.eng.osaka-u.ac.jp/le/tanakaken/workshop-on-laboratory-astrophysics-2020.
2. The Astronomical Society of Japan 2020 Autumn Annual Meeting, online, 8-10 September 2020.
   http://www.asj.or.jp/nenkai/
3. Workshop on Laboratory Astrophysics: Novel Development in Nonlinear Plasma Physics with Lasers, 2-3, Sep. 2020, hybrid
   http://www.eie.eng.osaka-u.ac.jp/le/tanakaken/workshop-on-laboratory-astrophysics-2020.
4. EPSC 2020, virtual, 21 September - 9 October 2020
   https://www.epsc2020.eu/.
5. Opto 2020 Symposium on Photon and Beam Science, 22, Sep. 2020, online
   https://www.qst.go.jp/site/kansai/43216.html.
6. AAPPS-DPP (4th Asia Pacific Conference on Plasma Physics), 26-31, Oct. 2020, online,
   http://aappsdpp.org/DPP2020/registration.html.
7. DPS2020, virtual, 26-30 October 2020.
   https://dps.aas.org/meetings/current.
8. Outer planet moon-magnetosphere interaction workshop, virtual, 5-6 November 2020.
   https://indico.esa.int/event/337/.
9. The Japan Society for Planetary Science Fall meeting 2020, Aizu, online, 12-14 November 2020.
   https://www.wakusei.jp/meetings/fallmeeting/2020/index.html.
10. 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/

11. AGU fall meeting 2020, 1-17 December 2020[Online].
https://www.agu.org/Fall-Meeting-2020
12. COSPAR 2021, Virtual, 28 January - 4 February 2021.
https://www.cospar2020.org/.
13. Symposium on Planetary Sciences (SPS) 2021, online, 17-19 February 2021.
http://pparc.tohoku.ac.jp/sympo/sps/.
14. The 3rd ISEE Symposium "PWING-ERG Conference and School" was held on March 8-12, 2021 via online. This conference was held as the completion of the PWING project and as the 5th year anniversary of the ERG (Arase) mission. The school was held in the first 1.5 days with six lectures and two training courses for graduate-course students. The 264 participants from 37 countries registered in this conference and joined discussion on the dynamics of the inner magnetosphere based on latest ground and satellite measurements and modeling. The conference site with details of the conference and school is at https://is.isee.nagoya-u.ac.jp/pwing-erg/
15. The Astronomical Society of Japan 2020 Autumn Annual Meeting, online, 16-19 March 2021.
http://www.asj.or.jp/nenkai/.
16. JUICE SWT#17, virtual, 8 April 2021.
17. European Geosciences Union (EGU) General Assembly 2021, 19-30 April, 2021[Online].
https://www.egu2021.eu/
18. JpGU Meeting 2021, online, 30 May - 6 June 2021.
http://www.jpgu.org/meeting_e2021/.
19. HEDS2021 (NTERNATIONAL CONFERENCE ON HIGH ENERGY DENSITY SCIENCES 2021), 19-21, Apr. 2021, hybrid
https://www.ile.osaka-u.ac.jp/project/heds2021/program.html.
20. Opto 2021 Symposium on Photon and Beam Science, 22, Jun.. 2021, hybrid,
https://www.qst.go.jp/site/kansai/symposium-opto2021.html.
21. Magnetospheres of Outer Planets (MOP) 2021, Liege, Virtual, 12-16 July 2021.
https://www.mop.uliege.be/.

[3] Future Meetings

1. AOGS2021 18th Annual Meeting, online, 1-6 August 2021.
https://www.asiaoceania.org/aogs2021/public.asp?page=home.html.
2. IAGA-IASPEI 2021, virtual, 21-27 August 2021.
http://iaga-iaspei-india2021.in/.
3. XXXIIIrd International Union of Radio Science: General Assembly & Scientific Symposium (URSI GASS), Sapienza University Campus, Rome, Italy (hybrid), 28 August - 4 September 2021.
https://www.ursi2021.org/.
4. STE simulation workshop, online, 6-8 September 2021.
https://cidas.isee.nagoya-u.ac.jp/simulation/meeting2021./
https://portal.isee.nagoya-u.ac.jp/survey/isee/index.php/11?lang=ja.
5. The Astronomical Society of Japan 2021 Autumn Annual Meeting, virtual, 13-16 September 2021.
https://www.asj.or.jp/jp/activities/nenkai/.
6. Europlanet Science Congress 2021, online, 13-24, September, 2021.
https://www.epsc2021.eu/
https://www.europlanet-society.org/european-planetary-science-congress/.
7. The Japan Society for Planetary Science Fall meeting 2021, Nagoya, 16-18 September 2021.
https://www.wakusei.jp/meetings/fallmeeting/.
https://www.wakusei.jp/meetings/fallmeeting/2021/.
https://www.wakusei.jp/meetings/fallmeeting/2021/entry.html.

8. ISAS Planetary Exploration Workshop, online, 21,22,24 September 2021.
https://www.isas.jaxa.jp/en/researchers/.
9. Division for Planetary Sciences (DPS) of American Astronomical Society (AAS) 53rd meeting, Virtual, 3-8 October 2021.
https://dps.aas.org/meetings/future.
10. The 150th Society of Geomagnetism and Earth, Planetary and Space Sciences (SGEPSS) General Assembly, online, 31 October - 4 November 2021.
http://www.sgepss.org/sgepss/.
https://www.sgepss.org/sgepss/fallmeeting/FM2021/LOC2021/.
11. The Meteorological Society of Japan Autumn Meeting 2021, online & onsite, Mie, 2-8 December 2021.
https://www.metsoc.jp/meetings/2021a.
12. AGU fall meeting 2021, New Orleans, 13-17 December 2021[Hybrid].
https://www.agu.org/Fall-Meeting
13. Space Science Symposium (SPS) 2022, January 2022.
https://www.isas.jaxa.jp/en/researchers/.
14. SCOSTEP 15th Quadrennial Solar-Terrestrial Physics Symposium (STP-15) will be held at Alibag, India, on 21-25 February 2022. The conference website is at https://www.stp15.in/.
15. Symposium on Planetary Sciences 2022, February 2022.
http://pparc.tohoku.ac.jp/sympo/sps/.
16. 53rd Lunar and Planetary Science Conference (LPSC), 7-11 March 2022.
https://www.hou.usra.edu/meetings/.
https://www.hou.usra.edu/meetings/lpsc2022/.
17. The Astronomical Society of Japan 2022 Spring Annual Meeting, Hiroshima, 16-19 March 2022.
https://www.asj.or.jp/jp/activities/nenkai/.
18. European Geosciences Union (EGU) General Assembly 2022, Vienna. Austria, 3-8 April, 2022.
https://www.egu2022.eu/
19. Japan Geoscience Union Meeting (JPGU) 2022, Chiba, Japan, 22-26 May 2022.
20. Mercury 2022 conference, Orleans, France, 7-10 June 2022.
https://mercury2020.ias.u-psud.fr.
21. Mars atmosphere modelling and observers, 14-17 June 2022.
http://www-mars.lmd.jussieu.fr/paris2022/.
22. 7th international workshop on Mars Atmosphere Modelling and Observations, Paris, 14-17 July 2022.
http://www-mars.lmd.jussieu.fr/paris2022/.
23. COSPAR 44th General Assembly, Athens, Greece, 16-24 July, 2020.
https://www.cosparathens2022.org/
24. The 14th International School and Symposium for Space Simulations (ISSS14), Kobe, Japan, Sep. 2022 (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(January 2020-July 2021)

Aizawa, S., D. Delcourt, N. Terada, and N. André (2020), Statistical study of non-adiabatic energization and transport in Kelvin-Helmholtz vortices at mercury, Planetary and Space Science, 193, 105079, https://doi.org/10.1016/j.pss.2020.105079.

The non-adiabatic energization and transport of picked up planetary ions in KH vortices at Mercury were investigated. The field configuration in both of dawn and dusk side can cause non-adiabatic energization but it is larger on the dawnside. Degree of acceleration and transport is controlled by the orientation of the convection electric field in the magnetosheath.

Aizawa, S., J. M. Raines, D. Delcourt, N. Terada, and N. André (2020), MESSENGER observations of planetary ion characteristics in the vicinity of Kelvin-Helmholtz vortices at Mercury, Journal of Geophysical Research: Space Physics, 125, e2020JA027871. https://doi.org/10.1029/2020JA027871.

The statistical characteristics of planetary ions derived from MESS ENGER FIPS observations in the presence of KH waves was investigated. Large counts in FIPS data and a decelerating signature are observed above 2.0 keV/e for KH events. KH waves may play a role in the deceleration of planetary ions in the Hermean magnetosphere.

Aizawa, S., L. S. Griton, S. Fatemi, W. Exner, J. Deca, F. Pantellini, M. Yagi, D. Heyner, V. Génot, N. André, J. Amaya, G. Murakami, L. Beigbeder, M. Gangloff, M. Bouchemit, E. Budnik, H. Usui, Cross-comparison of global simulation models applied to Mercury's dayside magnetosphere, Planetary and Space Science, online 1 February 2021, 105176

First comparison of multiple global simulations of the solar wind interaction with Mercury's dayside magnetosphere has been done. The simulation study was conducted in the framework of the international collaborative project SHOTS - Studies on Hermean magnetosphere Oriented Theories and Simulations. Two 3D magnetohydrodynamic and two 3D hybrid simulation codes are used. The results of four distinct simulation approaches are juxtaposed with MESSENGER observations. In contrast to the magnetosheath thickness, the simulated shock locations depend on the inner boundary condition of the model

Amano, T., Katou, T., Kitamura, N., Oka, M., Matsumoto, Y., Hoshino, M., et al. (2020). Observational evidence for stochastic shock drift acceleration of electrons at the Earth's bow shock. Physical Review Letters, 124(6), 065101. https://doi.org/10.1103/PhysRevLett.124.065101test

This paper has demonstrated that a recently proposed electron acceleration mechanism model called stochastic shock drift acceleration quite well explains MMS observations made at the bow shock.

Bohdan, A., Pohl, M., Niemiec, J., Vafin, S., Matsumoto, Y., Amano, T., & Hoshino, M. (2020). Kinetic simulations of nonrelativistic perpendicular shocks of young supernova remnants. III. Magnetic reconnection. The Astrophysical Journal, 893(1), 6. https://doi.org/10.3847/1538-4357/ab7cd6

This paper has studied the roles of spontaneous magnetic reconnection resulting from magnetic field amplification at high Mach number supernova remnant shocks using kinetic simulations.

Bohdan, A., Pohl, M., Niemiec, J., Morris, P. J., Matsumoto, Y., Amano, T., et al. (2021). Magnetic Field Amplification by the Weibel Instability at Planetary and Astrophysical Shocks with High Mach Number. Physical Review Letters, 126(9), 095101, https://doi.org/10.1103/PhysRevLett.126.095101

This paper has investigated the amplification of magnetic field via Weibel instability at collisionless shocks using kinetic simulations and discussed applications to planetary bow shocks as well as supernova remnant shocks.

Bohdan, A., Pohl, M., Niemiec, J., Morris, P. J., Matsumoto, Y., Amano, T., & Hoshino, M. (2020). Kinetic simulation of nonrelativistic perpendicular shocks of young supernova remnants. IV. Electron heating. The Astrophysical Journal, 904(1), 12, https://doi.org/10.3847/1538-4357/abbc19

This paper has studied the electron heating mechanisms at high Mach number collisionless shocks using kinetic simulations.

Colpitts, C., Y. Miyoshi, Y. Kasahara, G. L. Delzanno, J. R. Wygant, C. A. Cattell, A.

Breneman, C. Kletzing, G. Cunningham, M. Hikishima, S. Matsuda, Y. Katoh, J.-F. Ripoll, I. Shinohara, and A. Matsuoka, First Direct Observations of Propagation of Discrete Chorus Elements From the Equatorial Source to Higher Latitudes, Using the Van Allen Probes and Arase Satellites, J. Geophys. Res.: Space Physics, 125(10), https://doi.org/10.1029/2020JA028315, 2020.

Colpitts et al. (2020) presented the first direct observations of the same discrete rising tone chorus elements propagating from a near equatorial (Van Allen Probes) to an off-equatorial (Arase) satellite. Ray tracing confirms that the elements are generated parallel to the field at the equator, and propagate through the medium unducted to Van Allen Probes and then to Arase with the observed time delay

Fukizawa, M., T. Sakanoi, Y. Miyoshi, Y. Kazama, Y. Katoh, Y. Kasahara, S. Matsuda, A. Matsuoka, S. Kurita, M. Shoji, M. Teramoto, S. Imajo, I. Sinohara, S.-Y. Wang, S. W.-Y. Tam, T.-F. Chang, B.-J. Wang, C.-W. Jun, Pitch-angle scattering of inner magnetospheric electrons caused by ECH waves obtained with the Arase satellite, Geophys. Res. Lett., 47, e2020GL089926, https://doi.org/10.1029/2020GL089926, 2020.

An event that electron cyclotron harmonic wave intensity correlated with electron flux in a loss cone with ~5 keV energy was found. The pitch-angle diffusion coefficient of 5 keV is larger than those of other energies when the electron temperature is 8 eV and the wave normal angle is 88.5 degree. The electron flux correlated with the ECH wave intensity can cause 557.7 nm auroral emission with ~200 R intensity.

Girgis, K. M., Hada, T., Matsukiyo, S., Solar wind parameter and seasonal variation effects on the south atlantic anomaly using Tsyganenko models Earth, Planet. Space, vol.72, Issue 1, article id.100, 2020

Test particle simulations of radiation belt protons in the virtual magnetosphere produced by using a Tsyganenko model are performed to investigate the dependence of south Atlantic anomaly on the solar wind parameters.

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.

Hosokawa, K., Y. Miyoshi, S.-I. Oyama, Y. Ogawa, S. Kurita, Y. Kasahara, Y. Kasaba, S. Yagitani, S. Matsuda, M. Ozaki, F. Tsuchiya, A. Kumamoto, T. Takashima, I. Shinohara, and R. Fujii, Over-Darkening of Pulsating Aurora, J. Geophys. Res.: Space Physics, 126(4), https://doi.org/10.1029/2020JA028838, 2021.

Hosokawa et al. (2021) studied the over-darkening PsA by using simultaneous observations of PsA with an all-sky camera in Finland and the magnetospheric satellite Arase. They concluded that the over-darkening PsA is not a pure temporal variation of chorus at a fixed point, but a result of compounding effects of spatial structure and dynamical motion of PsA.

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.

Imajo, S., Y. Miyoshi, Y. Kazama, K. Asamura, I. Shinohara, K. Shiokawa, Y. Kasahara, Y. Kasaba, A. Matsuoka, S.-Y. Wang, S. W. Y. Tam, T.-F. Chang, B.-J. Wang, V. Angelopoulos, C.-W. Jun, M. Shoji, S. Nakamura, M. Kitahara, M. Teramoto, S. Kurita, and T. Hori, Active Auroral Arc Powered by Accelerated Electrons from Very High Altitudes, Scientific Reports, 11(1), https://doi.org/10.1038/s41598-020-79665-5, 2021.

Imajo et al. (2021) analyzed the high-angular resolution electron data measured by Arase and optical data from a ground-based all-sky imager. They demonstrated that active auroral arcs are powered by electrons accelerated at altitudes reaching greater than 30,000 km. This suggests that the dominant auroral acceleration region can extend far above a few thousand kilometres by some unknown magnetospheric mechanisms.

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., 125, https://doi.org/10.1029/2020JA028068, 2020.

Inaba et al. (2020) reported plasma and field observations in the magnetospheric source region of a stable auroral red (SAR) arc by the Arase satellite on 28 March 2017 and concluded that the observed SAR arc is likely not caused by waves but by Coulomb collisions of ring current ions with plasmaspheric electrons.

Inaba, Y., K. Shiokawa, S. Oyama, Y. Otsuka, M. Connors, I. Schofield, Y. Miyoshi, S. Imajo, A. Shinbori, A. Y. Gololobov, Y. Kazama, S.-Y. Wang, S. W. Y. Tam, T. F. Chang, B.-J. Wang, K. Asamura, S. Yokota, S. Kasahara, K. Keika, T. Hori, A. Matsuoka, Y. Kasahara, A. Kumamoto, S. Matsuda, Y. Kasaba, F. Tsuchiya, M. Shoji, M. Kitahara, S. Nakamura, I. Shinohara, H. E. Spence, G. D. Reeves, R. J. Macdowall, C. W. Smith, J. R. Wygant, J. W. Bonnell, Multi-event Analysis of Plasma and Field Variations in Source of Stable Auroral Red (SAR) Arcs in Inner Magnetosphere during Non-storm-time Substorms, J. Geophys. Res., 126, https://doi.org/10.1029/2020JA029081, 2021.

Inaba et al. (2021) reported three events of plasma and field variations in source of Stable Auroral Red (SAR) Arcs in the inner magnetosphere during non-storm-time substorms and concluded that the observed SAR arcs are mainly not caused by waves but by Coulomb collisions of ring current ions with plasmaspheric electrons with one exceptional case.

Jikei, T., & Amano, T. (2021). A non-local fluid closure for modeling cyclotron resonance in collisionless magnetized plasmas. Physics of Plasmas, 28(4), 042105. https://doi.org/10.1063/5.0045335

This paper has proposed a new scheme for taking into account the effect of cyclotron resonance into a fluid model.

Jun, C.-W., Y. Miyoshi, S. Kurita, C. Yue, J. Bortnik, L. Lyons, S. Nakamura, M. Shoji, S. Imajo, C. Kletzing, Y. Kasahara, Y. Kasaba, S. Matsuda, F. Tsuchiya, A. Kumamoto, A. Matsuoka, and I. Shinohara, The Characteristics of EMIC Waves in the Magnetosphere Based

on the Van Allen Probes and Arase Observations, J. Geophys. Res.: Space Physics, https://doi.org/10.1029/2020JA029001, 2021.

Jun et al. (2021) performed a comprehensive statistical study of electromagnetic ion cyclotron (EMIC) waves observed by the Van Allen Probes and Arase. They categorized EMIC wave events with respect to wavebands and relative locations from the plasmasphere. Finally, they suggest that EMIC waves in the magnetosphere can be generated by different free energy sources.

Kalaee, M. J. and Y. Katoh, Plasma frequency demand for mode conversion processes from slow Z-mode to LO-mode waves in an inhomogeneous plasma, Earth Planets Space, 72:95, https://doi.org/10.1186/s40623-020-01226-x, 2020.

The condition required for the efficient mode conversion can be satisfied by waves propagating first toward the high-density region and then returning toward the low-density region before reaching the region where the wave frequency matches the cutoff frequency without a large plasma inhomogeneity. The angle between the background magnetic field and the density gradient has a significant effect on the plasma frequency demand.

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, 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, 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.

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).

Kawai, K., K. Shiokawa, Y. Otsuka, S. Oyama, Y. Kasaba, Y. Kasahara, F. Tsuchiya, A. Kumamoto, S. Nakamura, A. Matsuoka, S. Imajo, Y. Kazama, Shiang-Yu, Wang, Sunny W. Y. Tam, T. F. Chang, B. J. Wang, K. Asamura, S. Kasahara, S. Yokota, K. Keika, T. Hori, Y. Miyoshi, C. Jun, M. Shoji, and I. Shinohara, First simultaneous observation of a nighttime

medium-scale traveling ionospheric disturbance from the ground and a magnetospheric satellite, J. Geophys. Res., 126, https://doi.org/10.1029/2020JA029086, 2021.

Kawai et al. (2021) reported the first simultaneous observation of a nighttime medium-scale traveling ionospheric disturbance (MSTID) from the ground and a magnetospheric satellite using the Arase satellite and a ground-based airglow imager at Gakona, Alaska, and concluded that the fluctuations of electric field and plasma density in the magnetosphere occur in the magnetosphere associated with the MSTID.

Kawazura, Y., A. A. Schekochihin, M. Barnes, J. M. TenBarge, Y. Tong, K. G. Klein, and W. Dorland, Ion versus Electron Heating in Compressively Driven Astrophysical Gyrokinetic Turbulence, Phys. Rev. X, 10, 041050, 2020.

The partition of irreversible heating between ions and electrons in compressively driven (but subsonic) collisionless turbulence is investigated by means of nonlinear hybrid gyrokinetic simulations. The results show that ions are preferentially heated when compressive driving is large or when plasma pressure dominates magnetic pressure. Preferential electron heating can happen only in fairly special cases.

Kazama, Y., H. Kojima, Y. Miyoshi, Y. Kasahara, S. Kasahara, H. Usui, B.-J. Wang, S.-Y. Wang, S. W. Y. Tam, T.-F. Chang, K. Asamura, Y. Kasaba, S. Matsuda, M. Shoji, A. Matsuoka, M. Teramoto, T. Takashima, and I. Shinohara, Extremely Collimated Electron Beams in the High Latitude Magnetosphere Observed by Arase, Geophys. Res. Lett., 48(5), https://doi.org/10.1029/2020GL090522, 2021.

Kanaza et al. (2021) reported electron beams observed at high latitudes in the magnetosphere by Arase. The beam electrons are mainly flowing away from the Earth and are well collimated to within a few degrees. The statistical properties are consistent with the interpretation that ionospheric electrons are accelerated by a parallel electric field of an auroral potential structure and are streaming upward to the high latitude magnetosphere.

Kazama, Y., Y. Miyoshi, H. Kojima, Y. Kasahara, S. Kasahara, H. Usui, B.-J. Wang, S.-Y. Wang, S. W. Y. Tam, T. F. Chang, K. Asamura, S. Matsuda, A. Kumamoto, F. Tsuchiya, Y. Kasaba, M. Shoji, A. Matsuoka, M. Teramoto, T. Takashima, and I.Shinohara, Arase observation of simultaneous electron scatterings by upper-band and lower-band chorus emissions, Geophys. Res. Lett., 48, e2021GL093708, https://doi.org/10.1029/2021GL093708, 2021.

Kazama et al. (2021) investigated the modulation of electron distribution function caused by lower- and upper-band chorus waves using the Arase satellite data.

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., 125, https://doi.org/10.1029/2020JA028074, 2020.

Kim et al. (2020) reported a long-lasting ground-satellite high coherence of compressional dayside Pc3-Pc4 pulsations based on measurements by ground magnetometers and the RBSP 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 wave ducting by equatorial plasma bubble based on measurements of Pc1 waves by ground magnetometers and the Swarm satellites.

Kim, H., K. Shiokawa, J. Park, Y. Miyoshi, C. Stolle and S. Buchert, Statistical analysis of Pc1 wave ducting deduced from Swarm satellites, J. Geophys. Res., 125, https://doi.org/10.1029/2020JA029016, 2021.

Kim et al. (2021) reported statistical analysis of Pc1 wave ducting based on long-term measurements of Pc1 waves by the Swarm satellites.

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) reported ionospheric plasma density oscillation related to EMIC Pc1 waves based on measurements by ground magnetometers and the Swarm satellites.

Kitamura, N., M. Shoji, S. Nakamura, M. Kitahara, T. Amano, Y. Omura, H. Hasegawa, S. A. Boardsen, Y. Miyoshi, Y. Katoh, M. Teramoto, Y. Saito, S. Yokota, M. Hirahara, D. J. Gershman, A. F. Viñas, B. L. Giles, W. R. Paterson, C. J. Pollock, C. T. Russell, R. J. Strangeway, N. Ahmadi, P.-A. Lindqvist, R. E. Ergun, S. A. Fuselier, and J. L. Burch, Energy transfer between hot protons and electromagnetic ion cyclotron waves in compressional Pc5 ultra-low frequency waves, J. Geophys. Res., 126, e2020JA028912, https://doi.org/10.1029/2020JA028912, 2021.

Kitamura et al. (2021) applied the Wave-Particle Interaction Analyzer method, which can quantitatively investigate the energy transfer between hot anisotropic protons and EMIC waves, to burst-mode data obtained by the four MMS spacecraft. The energy transfer near the cyclotron resonance velocity was identified in the vicinity of the center of troughs of magnetic field intensity, which corresponds to the maxima of ion pressure in the compressional ULF wave.

Kobzar O., Niemiec J., Amano T., Hoshino M., Matsukiyo S., Matsumoto Y., Pohl M., Electron Acceleration at Rippled Low-Mach-number Shocks in High-beta Collisionless Cosmic Plasmas, Astrophys. J., accepted.

The effect of shock surface rippling in electron acceleration is investigated by using 2d full PIC simulation to show that the rate of electron acceleration is enhanced by the presence of the ripple.

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.

Ligorini, A., Niemiec, J., Kobzar, O., Iwamoto, M. Bohdan, A., Pohl, M., Matsumoto, Y., Amano, T., Matsukiyo, S., Esaki, Y., Hoshino, M. Month. Not. Roy., Mildly relativistic magnetized shocks in electron-ion plasmas - I. Electromagnetic shock structure Astr., vol.501, Issue 4, pp.4837-4839, 2021

Micro-structure of a mildly relativistic collisionless perpendicular shock and the associated particle acceleration process are investigated by using 2d full PIC simulation.

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., F. Němec, 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 quasiperiodic emissions simultaneously observed by Arase and Van Allen Probes on 29 November 2018, J. Geophys. Res. Space Physics, 125, e2020JA028126, https://doi.org/10.1029/2020JA028126, 2020.

Martinez-Calderon et al. (2020) studied a quasiperiodic (QP) emission, showing one-to-one correspondence, observed by three satellites in space (Arase and the Van Allen Probes) and a ground station in Istok, Russia. The probable source location of these waves and its spatial extent were also discussed using simple ray tracing calculations.

Martinez-Calderon, C., Y. Katoh, J. Manninen, O. Santolik, Y. Kasahara, S. Matsuda, A. Kumamoto, F. Tsuchiya, A. Matsuoka, M. Shoji, M. Teramoto, I. Shinohara, K. Shiokawa, and Y. Miyoshi, Multi-event study of characteristics and propagation of naturally occurring ELF/VLF waves using high-latitude ground observations and conjunctions with the Arase satellite, J. Geophys. Res., 126, e2020JA028682, https://doi.org/10.1029/2020JA028682, 2021.

By analyzing 13 cases showing one-to-one correspondence of wave spectra between Kannuslehto, Finland, and Arase, Martinez-Calderon et al. (2021) revealed the properties of the ionospheric exit point and characteristics of several types of very low frequency waves, including chorus and quasi-periodic emissions.

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 Y. Miyoshi., Conjugate observations of dayside and nightside VLF chorus and QP emissions between Arase (ERG) and Kannuslehto, Finland. J. Geophys. Res. 125, e2019JA026663. https://doi.org/10.1029/2019JA026663, 2020.

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.

Matsuda, S., H. Kojima, Y. Kasahara, Y. Kasaba, A. Kumamoto, F. Tsuchiya, A. Matsuoka, Y. Miyoshi, and I. Shinohara, Direct Antenna Impedance Measurement for Quantitative AC Electric Field Measurement by Arase, J. Geophys. Res.: Space Physics, https://doi.org/10.1029/2021JA029111, 2021.

Matsuda et al. (2021) demonstrated the significance of the antenna impedance measurement technique implemented to the plasma wave receiver onboard the Arase satellite. The antenna impedance derived from the data show the dependence of local plasma densities that are well explained by the antenna capacitance and the resistance of plasmas.

Matsuda, S., T. Hasegawa, A. Kumamoto, F. Tsuchiya, Y. Kasahara, Y. Miyoshi, Y. Kasaba, A. Matsuoka, and I. Shinohara, Detection of UHR Frequencies by a Convolutional Neural Network From Arase/PWE Data, J. Geophys. Res.: Space Physics, 125(10), https://doi.org/10.1029/2020JA028075, 2020.

Determining the UHR frequency by visual inspection requires huge resources for researchers. Matsuda et al. (2020) evaluated the accuracy of UHR frequency determination by convolutional neural networks (CNN) and concluded that the proposed method is reliable enough to estimate the electron density.

Matsuda, S., Y. Miyoshi, S. Nakamura, M. Kitahara, M. Shoji, T. Hori, S. Imajo, C.-W. Jun, S. Kurita, Y. Kasahara, A. Matsuoka, and I. Shinohara, ISEE_Wave: interactive plasma wave analysis tool, Earth Planets Space, https://doi.org/10.1186/s40623-021-01430-3, 2021.

Matsuda et al. (2021) developed "ISEE_Wave" which is an interactive plasma wave analysis tool for the data observed by the plasma wave experiment (PWE) aboard Arase. ISEE_Wave provides an integrated wave analysis environment, where users can visualize wave properties, such as wave power spectra, wave normal angle, polarization, planarity, and Poynting vector angle.

Matsukiyo, S., Parametric instabilities in a two ion species plasma as a driver of super Alfvenic waves, J. Phys. Conf. Ser., vol.1620, Issue 1, article id.012013, 2020

The linear analysis of parametric instabilities of an Alfven wave in a two ion species plasma reveals that there is a channel of the instability where super Alfvenic waves are generated.

Matsukiyo, S., Noumi, T., Zank, G. P., Washimi, H., Hada, T., PIC simulation of a shock tube: Implications for wave transmission in the heliospheric boundary region Astrophys. J., vol.888, Issue 1, article id.11(9pp), 2020

One-dimensional shock tube problem was solved by using a full particle simulation. The results are compared with the heliospheric boundary structures such as heliopause and waves propagating inside and outside of the 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, No. 372, p.29-40, ISSN 1024-4530, 2020.

Miyashita et al. (2020) reported ULF modulation of energetic electron precipitation observed by VLF/LF radio propagation based on VLF/LF radio wave measurements at Athabasca, Canada.

Miyoshi, Y., K. Hosokawa, S. Kurita, S.-I. Oyama, Y. Ogawa, S. Saito, I. Shinohara, A. Kero, E. Turunen, P. T. Verronen, S. Kasahara, S. Yokota, T. Mitani, T. Takashima, N. Higashio, Y. Kasahara, S. Masuda, F. Tsuchiya, A. Kumamoto, A. Matsuoka, T. Hori, K. Keika, M. Shoji, M. Teramoto, S. Imajo, C. Jun, and S. Nakamura, Penetration of MeV electrons into the mesosphere accompanying pulsating aurorae, Scientific Reports, 11, 13724, https://doi.org/10.1038/s41598-021-92611-3, 2021.

Miyoshi et al. (2021) discovered penetration of MeV electrons associated with the pulsating aurora and resultant ozone depression at the mesosphere, and they demonstrated that chorus waves cause wide energy electron precipitations by chorus waves.

Miyoshi, Y., S. Saito, S. Kurita, K. Asamura, K. Hosokawa, T. Sakanoi, T. Mitani, Y. Ogawa, S. Oyama, F. Tsuchiya, S. L. Jones, A. N. Jaynes, and J. B. Blake, Relativistic Electron Microbursts as High Energy Tail of Pulsating Aurora Electrons, Geophys. Res. Lett., 47 https://doi.org/10.1029/2020GL090360, 2020.

Miyoshi et al. (2020) has proposed the new model that the relativistic electron microbursts are a high-energy tail of the pulsating aurora electrons caused by chorus waves.

Morita, T., Tomita, K., Sakai, K., Takagi, M., Aihara, K., Edamoto, M., Egashira, S., Higuchi, T., Ishizaka, N., Izumi, T., Kakuchi, S., Kojima, T., Kuramitsu, Y., Matsukiyo, S., Nakagawa, Y., Minami, T., Murakami, H., Nishioka, Y., Ota, M., Sano, T. Sei, S., Sugiyama, K., Tanaka, S. J., Yamazaki, R., Sakawa, Y., High Local plasma parameter measurements in colliding laser-produced plasmas for studying magnetic reconnection, High Ene. Dens. Phys., vol.36, pp.100754, 2020

High power laser experiment of magnetic reconnection was conducted and the parameters of local plasma were estimated by using Thomson scattering data.

Nakamura, K., K. Shiokawa, Y. Otsuka, A. Shinbori, Y. Miyoshi, M. Connors, H. Spence, G. Reeves, H. O. Funsten, R. MacDowall, C. Smith, J. Wygant, and J. Bonnell, Simultaneous observation of two isolated proton auroras at subauroral latitudes by a highly sensitive all-sky camera and Van Allen Probes, J. Geophys. Res., 126, https://doi.org/10.1029/2020JA029078, 2021.

Nakamura et al. (2021) reported simultaneous observation of two isolated proton auroras (IPAs) at subauroral latitudes by a highly sensitive all-sky camera and Van Allen Probes and found that the source of the IPAs are associated with EMIC waves in the equatorial plane of the magnetosphere.

Nariyuki, Y., A non-equilibrium Alfvenic state of the Langevin system for single particles reproduces the linear relation between the cross helicity and the residual energy in the solar wind, AIP Advances 11, 055005, https://doi.org/10.1063/5.0049849, 2021.

In this paper, a minimal phenomenological model of the non-equilibrium Alfvenic state is reported. It is shown that the present model reproduces the linear relationship between the cross helicity and the residual energy in the solar wind MHD fluctuation.

Nishigai, T., & Amano, T. (2021). Mach number dependence of ion-scale kinetic instability at collisionless perpendicular shock: Condition for Weibel-dominated shock. Physics of Plasmas, 28(7), 072903. https://doi.org/10.1063/5.0051269

This paper has investigated how the ion-scale kinetic plasma instability at collisionless perpendicular shocks depends on Mach numbers using linear analysis and Particle-In-Cell simulations.

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.

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.

Oyama, S., A. Shinbori, Y. Ogawa, M. Kellinsalmi, T. Raita, A. Aikio, H. Vanhamäki, K. Shiokawa, I. Virtanen, L. Cai, A. B. Workayehu, M. Pedersen, K. Kauristie, T. T. Tsuda, B.

Kozelov, A. Demekhov, A. Yahnin, F. Tsuchiya, A. Kumamoto, Y. Kasahara, A. Matsuoka, M. Shoji, M. Teramoto, and M. Lester, An Ephemeral Red Arc Appeared at 68° MLat at a Pseudo Breakup During Geomagnetically Quiet Conditions, J. Geophys. Res.: Space Physics, 125(10), https://doi.org/10.1029/2020ja028468, 2020.

Oyama et al. (2020) studied a red arc event found at geomagnetic 68° north (L ≈ 7.1) during a geomagnetically quiet period and suggested that the ephemeral red arc may represent the moment of SAR arc birth associated with substorm particle injection.

Ozaki, M., K. Shiokawa, R. B. Horne, M. J. Engebretson, M. Lessard, Y. Ogawa, K. Hosokawa, M. Nose, Y. Ebihara, A. Kadokura, S. Yagitani, Y. Miyoshi, S. Hashimoto, S. Sinha, A. K. Sinha, G. K. Seemala, and C.-W. Jun, Magnetic conjugacy of Pc1 waves and isolated proton precipitation at subauroral latitudes: Importance of ionosphere as intensity modulation region, Geophys. Res. Lett., 48, https://doi.org/10.1029/2020GL091384, 2021.

Ozaki et al. (2021) reported the similarities and differences of the magnetic conjugacy between Pc1 waves and isolated proton precipitation at subauroral latitudes.

Ozaki, M. T. Inoue, Y. Tanaka, S. Yagitani, Y. Kasahara, K. Shiokawa, Y. Miyoshi, K. Imamura, K. Hosokawa, S. Oyama, R. Kataoka, Y. Ebihara, Y. Ogawa, and A. Kadokura, Spatial evolution of wave-particle interaction region deduced from flash-type auroras and chorus-ray tracing, J. Geophys. Res., 126, e2021JA029254, https://doi.org/10.1029/2021JA029254, 2021.

Ozaki et al. (2021) reported that the spatial expansion of the wave-particle interaction region depends on chorus wave propagation characterized by the refractive index.

Pavarangkoon, P., K. T. Murata, K. Yamamoto, K. Muranaga, A. Higuchi, T. Mizuhara, Y. Kagebayashi, C. Charnsripinyo, N. Nupairoj, T. Ikeda, J. Tanaka and K. Fukazawa, "Development of international mirroring system for real-time web of meteorological satellite data," Earth Science Informatics, vol. 13, no. 4, pp. 1461-1476, https://doi.org/10.1007/s12145-020-00488-z, 2020.

The HpFP protocol, which is an original protocol on the layer 4 (transport layer), is adopted to the high-speed data transfer of satellite observation data for real-time monitoring the Earth. We succeeded in data transfer even on the International networks between Japan, Thailand, Philippines and Taiwan.

Pavarangkoon, P., K. T. Murata, K. Yamamoto, N. Fujita, H. Ohkawa, H. Mikai, Y. Ikehata, K. Muranaga, T. Mizuhara, A. Takaki and Y. Kakizawa, "Performance Evaluation of High-Performance and Flexible Protocol on Data Mover Challenge," in 2020-5th International Conference on Information Technology (InCIT), ChonBuri, Thailand, Oct. 21-22, pp. 265-269, 2020, https://doi.org/10.1109/InCIT50588.2020.9310956.

Performance Evaluation of High-Performance and Flexible Protocol on Data Mover Challenge (2020) that was held in 2020. This challenge events request us to perform high-speed data file transfer on international networks in 100 Gpbs. We could achieve 20-40 Gbps using our original protocol: HpFP.

Saito, S., S. Kurita, Y. Miyoshi, S. Kasahara, S. Yokota, K. Keika, T. Hori, Y. Kasahara, S. Matsuda, M. Shoji, S. Nakamura, A. Matsuoka, S. Imajo and I. Shinohara, Data-driven simulation of rapid flux enhancement of energetic electrons with an upper-band whistler burst,126, e2020JA028979, https://doi.org/10.1029/2020JA028979, 2021.

Saito et al. (2021) conducted a computer simulation using the Arase observed wave and particle data and they successfully reproduced the rapid accelerations of tens keV electrons observed by Arase.

Sakai, K., Isayama, S., Bolouki, N., Habibi, M. S., Liu, Y. L., Hsieh, Y. H., Chu, H. H., Wang, J., Chen, S. H., Morita, T., Tomita, K., Yamazaki, R., Sakawa, Y., Matsukiyo, S., Kuramitsu, Y.Collective Thomson scattering in non-equilibrium laser produced two-stream plasmas

Phys. Plasmas, vol.27, Issue 10, article id.103104, 2020

Characteristics of collective Thomson scattering occurring in a counter propagating plasma produced by high power laser experiment is investigated by using theory, experimental and numerical simulation data.

Sakai, S., K. Seki, N. Terada, H. Shinagawa, R. Sakata, T. Tanaka, and Y. Ebihara (2021), Effects of the IMF direction on atmospheric escape from a Mars-like planet under weak intrinsic magnetic field conditions, J. Geophys. Res. Space Physics, 126, e2020JA028485, https://doi.org/10.1029/2020JA028485.

The ion escape rate is the lowest in northward (parallel) interplanetary magnetic field (IMF) case and comparable in Parker-spiral and southward (antiparallel) IMF cases. In the northward IMF case, ionospheric ions escape from limited regions of the high-latitude lobe reconnection with a draped IMF. In the southward IMF case, IMF penetration into the dayside ionosphere and its subsequent transport to tail flanks cause efficient ion loss.

Sakata, R., K. Seki, S. Sakai, N. Terada, H. Shinagawa, and T. Tanaka (2020), Effects of an intrinsic magnetic field on ion loss from ancient Mars based on multispecies MHD simulations, Journal of Geophysical Research, Vol. 125, e2019JA026945, https://doi.org/10.1029/2019JA026945.

A weak intrinsic magnetic field increases ion loss rates when the solar wind dynamic pressure exceeds the magnetic pressure (overpressure). The existence of intrinsic magnetic field facilitates cusp outflows enabling more escape of molecular ions (O2+ and CO2+) by a factor of 6. In nonoverpressure cases, the ion loss rates decrease by 2 orders for molecular ions, but the effect is mild for O+ with extended corona

Sawaguchi, W., Harada, Y., & Kurita, S. (2021). Discrete rising tone elements of whistler-mode waves in the vicinity of the Moon: ARTEMIS observations. Geophysical Research Letters, 48, e2020GL091100. https://doi.org/10.1029/2020GL091100.

Observation of discrete rising tone elements of whistler mode waves near the moon is presented for the first time, and the property of the wave can be well explained by the nonlinear growth theory of rising tone chorus emissions. This paper demonstrates that the chorus emissions can be generated near the airless bodies without magnetospheres.

Shinbori, A., Y. Otsuka, T. Tsugawa, M. Nishioka, A. Kumamoto, F. Tsuchiya, S. Matsuda, Y. Kasahara, and A. Matsuoka, Relationship Between the Locations of the Midlatitude Trough and Plasmapause Using GNSS-TEC and Arase Satellite Observation Data, J. Geophys. Res.: Space Physics, https://doi.org/10.1029/2020ja028943, 2021.

Shinbori et al. (2021) statistically investigated the relationship between the locations of the midlatitude trough minimum in the ionosphere and plasmapause in the inner magnetosphere using global navigation satellite system-total electron content and electron density data obtained from the Arase satellite from March 23, 2017 to May 31, 2020.

Shoji, M., Y. Miyoshi, L. M. Kistler, K. Asamura, A. Matsuoka, Y. Kasaba, S. Matsuda, Y. Kasahara, and I. Shinohara, Discovery of proton hill in the phase space during interactions between ions and electromagnetic ion cyclotron waves, Scientific Reports, https://doi.org/10.1038/s41598-021-92541-0, 2021.

Shoji et al. (2021) introduced the first observational evidence that the frequency drift of electromagnetic ion cyclotron (EMIC) waves is caused by cyclotron trapping. They analyzed the best falling tone emission event, which showed a direct evidence of the formation of a proton hill in phase space indicating cyclotron trapping. The associated resonance currents and the wave growth of a falling tone EMIC wave were observed coincident with the hill, as theoretically predicted.

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.

Takeshita Y., K. Shiokawa, Y. Miyoshi, M. Ozaki, Y. Kasahara, S. Oyama, M. Connors, J. Manninen, V. K. Jordanova, D. Baishev, A. Oinats, and V. Kurkin, Study of spatiotemporal development of global distribution of magnetospheric ELF/VLF waves using ground-based and satellite observations, and RAM-SCB simulations, for the March and November 2017 storms, J. Geophys. Res., 126, https://doi.org/10.1029/2020JA028216, 2021.

Takeshita et al. (2021) reported spatiotemporal development of global distribution of magnetospheric ELF/VLF waves using ground-based and satellite observations, and RAM-SCB simulations, for the March and November 2017 storms.

Thomas, N., K. Shiokawa, Y. Miyoshi, Y. Kasahara, I. Shinohara, A. Kumamoto, F. Tsuchiya, A. Matsuoka, S. Kasahara, S. Yokota, K. Keika, T. Hori, K. Asamura, S.-Y. Wang, Y. Kazama, S. W. Y. Tam, T. F. Chang, B. J. Wang, J. Wygant, A. Breneman, and G. Reeves, Investigation of small-scale electron density irregularities observed by the Arase and Van Allen Probes satellites inside and outside the plasmasphere. Journal of Geophysical Research: Space Physics, 126, e2020JA027917. https://doi.org/10.1029/2020JA027917, 2021.

Thomas et al. (2021) reported statistical investigation of small-scale electron density irregularities observed by the Arase and Van Allen Probes satellites inside and outside the plasmasphere.

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.

Yagitani, S., M. Ozaki, F. Sahraoui, L. Mirioni, M. Mansour, G. Chanteur, C. Coillot, S. Ruocco, V. Leray, M. Hikishima, D. Alison, O. Le Contel, H. Kojima, Y. Kasahara, Y. Kasaba, T. Sasaki, T. Yumoto, Y. Takeuchi (2020). Measurements of magnetic field fluctuations for plasma wave investigation by the Search Coil Magnetometers (SCM) onboard Bepicolombo Mio (Mercury Magnetospheric Orbiter). Space Sci. Rev. 216:111. https://doi.org/10.1007/s11214-020-00734-2

Yagitani et al. (2020) reported the design and performance of the search coil magnetometers, which are part of the Plasma Wave Investigation instrument onboard the BepiColombo/Mio spacecraft (Mercury Magnetospheric Orbiter).

Yahnin, A. G., T. A. Popova, A. G. Demekhov, A. A. Lubchich, A. Matsuoka, K. Asamura, Y. Miyoshi, S. Yokota, S. Kasahara, K. Keika, T. Hori, F. Tsuchiya, A. Kumamoto, Y. Kasahara, M. Shoji, Y. Kasaba, S. Nakamura, I. Shinohara, H. Kim, S. Noh, and T. Raita, Evening Side EMIC Waves and Related Proton Precipitation Induced by a Substorm, J. Geophys. Res.: Space Physics, https://doi.org/10.1029/2020JA029091, 2021.

Yahnin et al. (2021) presented the results of a multi-point and multi-instrument study of

electromagnetic ion cyclotron (EMIC) waves and related energetic proton precipitation during a substorm analyzing the data from Arase and Van Allen Probes. Analyzing parameters of the wave generation obtained from in situ measured proton distribution function, they concluded that the waves could be generated within the substorm area, sometimes close to, but not necessary at the spacecraft location.

Yamakawa, T., Seki, K., Amano, T., Takahashi, N., & Miyoshi, Y. (2020). Excitation of internally driven ULF waves by the drift-bounce resonance with ring current ions based on the drift-kinetic simulation. Journal of Geophysical Research: Space Physics, 125(11), e2020JA028231. https://doi.org/10.1029/2020ja028231

This paper has investigated an internal excitation mechanism of ultra-low-frequency waves in earth's inner magnetosphere using drift-kinetic simulations.

Yang, Z., Liu, Y. D., Matsukiyo, S., Lu, Q., Guo, F., Liu, M., Xie, H., Gao, X., Guo, PIC simulations of microinstabilities and waves at near-sun solar wind perpendicular shocks: Predictions for Parker Solar Probe and Solar Orbiter J. Astrophys. J. Lett., vol.900, Issue 2, article id.L24(8pp), 2020

The characteristics of micro-instabilities generated in the transition region of a quasi-perpendicular shock propagating in the solar wind near the sun by using 2d full PIC simulation.

Yoshida, K., Matsukiyo, S. Shimokawa, K. Washimi, H. Hada, T. Trajectory, Analysis of Galactic Cosmic Rays Invading into the Heliosphere Astrophys. J., vol.916, Issue 1, article id.29, 2021

The behavior of galactic cosmic rays invading into the heliosphere is investigated by using test particle simulations in the virtual heliosphere reproduced by a global MHD simulation.

Zhang, Z., R. T. Desai, Y. Miyake, H. Usui, and O. Shebanits, Particle-in-Cell Simulations of the Cassini Spacecraft's Interaction with Saturn's Ionosphere during the Grand Finale, Monthly Notices of the Royal Astronomical Society, 504, pp.964-973, https://doi.org/10.1093/mnras/stab750, 2021.

A positive spacecraft charging, unexpectedly observed during Cassini's Grand Finale, has been addressed by performing three-dimensional Particle-In-Cell simulations of a model spacecraft immersed in plasma representative of Saturn's ionosphere. The simulations reveal complex interaction features such as electron wings and a highly structured wake containing spacecraft-scale vortices. The results show how a large negative ion concentration combined with a large negative to positive ion mass ratio is able to drive the spacecraft to the observed positive potentials.

Zhang, S., S. Liu, W. Li, Y. He, Q. Yang, F. Xiao, A. Kumamoto, Y. Miyoshi, Y. Nakamura, F. Tsuchiya, Y. Kasahara, and I. Shinohara, A Concise Empirical Formula for the Field-Aligned Distribution of Auroral Kilometeric Radiation Based on Arase Satellite and Van Allen Probes, Geophys. Res. Lett., https://doi.org/10.1029/2021gl092805, 2021.

Zhang et al. (2021) statistically studied the AKR electric field amplitude in the radiation belts using the data from Arase and Van Allen Probes and proposed a concise formula which represents the AKR electric field amplitude decreases with decreasing latitude.