# Takanobu Amano
# 天野 孝伸 (あまの たかのぶ)

Associate Professor
Department of Earth and Planetary Science,
Graduate School of Science, The University of Tokyo


## PERSONAL DETAILS


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| Affiliation | Department of Earth and Planetary Science,<br>Graduate School of Science, The University of Tokyo |
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## RESEARCH INTERESTS

I am interested in theoretical aspects of space and astrophysical plasma phenomena. My major research interests include physics of collisionless shocks (both non-relativistic and relativistic regimes), high-energy particle acceleration and transport, linear and nonlinear theory for kinetic plasma instabilities, and numerical techniques for advanced kinetic/fluid plasma simulations.

## APPOINTMENTS

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| Aug. 1, 2016 - present | **Associate Professor**<br>Department of Earth and Planetary Science,<br>School of Science, The University of Tokyo |
| Mar. 16, 2012 - Jul. 31, 2016 | **Assistant Professor**<br>Department of Earth and Planetary Science,<br>School of Science, The University of Tokyo |
| Apr. 1, 2009 - Mar. 15, 2012 | **Designated Assistant Professor**<br>Division of Particle and Astrophysical Science,<br>Nagoya University |
| Apr. 1, 2008 - Mar. 31, 2009 | **Postdoctoral Researcher**<br>Solar-Terrestrial Environment Laboratory,<br>Nagoya University |

## EDUCATION

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|---|---|
| Apr. 1, 2005 - Mar. 31, 2008 | **Ph.D degree**<br>Department of Earth and Planetary Science,<br>Graduate School of Science, The University of Tokyo |
| Apr. 1, 2003 - Mar. 31, 2005 | **MS degree**<br>Department of Earth and Planetary Science,<br>Graduate School of Science, The University of Tokyo |
| Apr. 1, 1999 - Mar. 31, 2003 | **BS degree**<br>Department of Earth and Planetary Physics,<br>School of Science, The University of Tokyo |

## AWARDS

- 2018 Young Researcher Award (under 40 yrs. old) from Association of Asia Pacific Physical Societies, Division of Plasma Physics (AAPPS-DPP)
- 2015 Obayashi Early Career Scientist Award from Society of Geomagnetism and Earth, Planetary and Space Sciences (SGEPSS)
- 2005 JSPS (Japan Society for the Promotion of Science) Research Fellowship for Young Scientists (DC1)

## PUBLICATIONS

See also, Google Scholar, or Publons profile pages for the up-to-date list of publications and citation statistics.

### Refereed Articles


[1] **Amano, T.** and M. Hoshino (2022). Theory of electron injection at oblique shock of finite thickness. *Astrophys. J. 927*(1), 132. https://doi.org/10.3847/1538-4357/ac4f49

[2] Jikei, T. and **T. Amano** (2022). Critical comparison of collisionless fluid models: Nonlinear simulations of parallel firehose instability. *Phys. Plasmas 29*(2), 022102. https://doi.org/10.1063/5.0077064

[3] Keika, K., S. Kasahara, S. Yokota, M. Hoshino, K. Seki, **T. Amano**, L. M. Kistler, M. Nosé, Y. Miyoshi, T. Hori, and I. Shinohara (2022). Preferential energization of lower-charge-state heavier ions in the near-earth magnetotail. *J. Geophys. Res. 127*(1), e2021JA029786. https://doi.org/10.1029/2021JA029786

[4] Iwamoto, M., **T. Amano**, Y. Matsumoto, S. Matsukiyo, and M. Hoshino (2022). Particle acceleration by pickup process upstream of relativistic shocks. *Astrophys. J. 924*(2), 108. https://doi.org/10.3847/1538-4357/ac38aa

[5] Kobzar, O., J. Niemiec, **T. Amano**, M. Hoshino, S. Matsukiyo, Y. Matsumoto, and M. Pohl (2021). Electron acceleration at rippled low-Mach-number shocks in high-beta collisionless cosmic plasmas. *Astrophys. J. 919*(2), 97. https://doi.org/10.3847/1538-4357/ac1107

[6] Nishigai, T. and **T. Amano** (2021). Mach number dependence of ion-scale kinetic instability at collisionless perpendicular shock: Condition for Weibel-dominated shock. *Phys. Plasmas 28*(7), 072903. https://doi.org/10.1063/5.0051269 **(Corresponding Author)**

[7] 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, B. L. Giles, C. T. Russell, R. J. Strangeway, N. Ahmadi, P. Lindqvist, R. E. Ergun, S. A. Fuselier, and J. L. Burch (2021). Energy transfer between hot protons and electromagnetic ion cyclotron waves in compressional Pc5 Ultra-Low Frequency waves. *J. Geophys. Res. 126*(5), e2020JA028912. https://doi.org/10.1029/2020ja028912

[8] Jikei, T. and **T. Amano** (2021). A non-local fluid closure for modeling cyclotron resonance in collisionless magnetized plasmas. *Phys. Plasmas 28*(4), 042105. https://doi.org/10.1063/5.0045335

[9] Bohdan, A., M. Pohl, J. Niemiec, P. J. Morris, Y. Matsumoto, **T. Amano**, M. Hoshino, and A. Sulaiman (2021). Magnetic field amplification by the Weibel instability at planetary and astrophysical shocks with high Mach number. *Phys. Rev. Lett. 126*(9), 095101. https://doi.org/10.1103/PhysRevLett.126.095101

[10] Ligorini, A., J. Niemiec, O. Kobzar, M. Iwamoto, A. Bohdan, M. Pohl, Y. Matsumoto, **T. Amano**, S. Matsukiyo, and M. Hoshino (2021). Mildly relativistic magnetized shocks in electron-ion plasmas - II. Particle acceleration and heating. *Mon. Not. R. Astron. Soc. 502*(4), 5065–5074. https://doi.org/10.1093/mnras/stab220

[11] Ligorini, A., J. Niemiec, O. Kobzar, M. Iwamoto, A. Bohdan, M. Pohl, Y. Matsumoto, **T. Amano**, S. Matsukiyo, Y. Esaki, and M. Hoshino (2021). Mildly relativistic magnetized shocks in electron-ion plasmas - I. Electromagnetic shock structure. *Mon. Not. R. Astron. Soc. 501*(4), 4837–4849. https://doi.org/10.1093/mnras/staa3901

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

[13] Yamakawa, T., K. Seki, **T. Amano**, N. Takahashi, and Y. Miyoshi (2020). Excitation of internally driven ULF waves by the drift-bounce resonance with ring current ions based on the drift-kinetic simulation. *J. Geophys. Res. 125*(11), e2020JA028231. https://doi.org/10.1029/2020ja028231

[14] Kitamura, N., Y. Omura, S. Nakamura, **T. Amano**, S. A. Boardsen, N. Ahmadi, O. Le Contel, P. A. Lindqvist, R. E. Ergun, Y. Saito, S. Yokota, D. J. Gershman, W. R. Paterson, C. J. Pollock, B. L. Giles, C. T. Russell, R. J. Strangeway, and J. L. Burch (2020). Observations of the source region of whistler mode waves in magnetosheath mirror structures. *J. Geophys. Res. 125*(5). https://doi.org/10.1029/2019JA027488

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

[16] **Amano, T.**, T. Katou, N. Kitamura, M. Oka, Y. Matsumoto, M. Hoshino, Y. Saito, S. Yokota, B. L. Giles, W. R. Paterson, C. T. Russell, O. Le Contel, R. E. Ergun, P.-A. Lindqvist, D. L. Turner, J. F. Fennell, and J. B. Blake (2020). Observational evidence for stochastic shock drift acceleration of electrons at the Earth's bow shock. *Phys. Rev. Lett. 124*(6), 065101. https://doi.org/10.1103/PhysRevLett.124.065101

[17] Oka, M., F. Otsuka, S. Matsukiyo, L. B. Wilson, M. R. Argall, **T. Amano**, T. D. Phan, M. Hoshino, O. L. 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 (2019). Electron scattering by low-frequency whistler waves at Earth's bow shock. *Astrophys. J. 886*(1), 53. https://doi.org/10.3847/1538-4357/ab4a81

[18] Bohdan, A., J. Niemiec, M. Pohl, Y. Matsumoto, **T. Amano**, and M. Hoshino (2019). Kinetic simulations of nonrelativistic perpendicular shocks of young supernova remnants. II. Influence of shock-surfing acceleration on downstream electron spectra. *Astrophys. J. 885*(1), 10. https://doi.org/10.3847/1538-4357/ab43cf

[19] Iwamoto, M., **T. Amano**, M. Hoshino, Y. Matsumoto, J. Niemiec, A. Ligorini, O. Kobzar, and M. Pohl (2019). Precursor wave amplification by ion – electron coupling through wakefield in relativistic shocks. *Astrophys. J. 883*(2), L35. https://doi.org/10.3847/2041-8213/ab4265

[20] Bohdan, A., J. Niemiec, M. Pohl, Y. Matsumoto, **T. Amano**, and M. Hoshino (2019). Kinetic simulations of nonrelativistic perpendicular shocks of young supernova remnants. I. Electron shock-surfing acceleration. *Astrophys. J. 878*(1), 5. https://doi.org/10.3847/1538-4357/ab1b6d

[21] Katou, T. and **T. Amano** (2019). Theory of stochastic shock drift acceleration for electrons in the shock transition region. *Astrophys. J. 874*(2), 119. https://doi.org/10.3847/1538-4357/ab0d8a

[22] Yamakawa, T., K. Seki, **T. Amano**, N. Takahashi, and Y. Miyoshi (2019). Excitation of storm time Pc5 ULF waves by ring current ions based on the drift-kinetic simulation. *Geophys. Res. Lett. 46*(4), 1911–1918. https://doi.org/10.1029/2018GL081573

[23] **Amano, T.**, M. Iwamoto, Y. Matsumoto, and M. Hoshino (2019). The efficiency of coherent radiation from relativistic shocks. In *Prog. Phot. Sci.*, Volume 119, pp. 371–383. Springer, Cham

[24] Seki, K., Y. Miyoshi, Y. Ebihara, Y. Katoh, **T. Amano**, S. Saito, M. Shoji, A. Nakamizo, K. Keika, T. Hori, S. Nakano, S. Watanabe, K. Kamiya, N. Takahashi, Y. Omura, M. Nose, M.-C. Fok, T. Tanaka, A. Ieda, and A. Yoshikawa (2018). Theory, modeling, and integrated studies in the Arase (ERG) project. *Earth, Planets Sp. 70*(1), 17. https://doi.org/10.1186/s40623-018-0785-9

[25] Keika, K., S. Kasahara, S. Yokota, M. Hoshino, K. Seki, M. Nosé, **T. Amano**, Y. Miyoshi, and I. Shinohara (2018). Ion energies dominating energy density in the inner magnetosphere: spatial distributions and composition, observed by Arase/MEP-i. *Geophys. Res. Lett. 45*(22), 12,153–12,162. https://doi.org/10.1029/2018GL080047

[26] **Amano, T.** (2018). A generalized quasi-neutral fluid-particle hybrid plasma model and its application to energetic-particle-magnetohydrodynamics hybrid simulation. *J. Comput. Phys. 366*, 366–385. https://doi.org/10.1016/j.jcp.2018.04.020

[27] Walia, N. K., K. Seki, M. Hoshino, **T. Amano**, N. Kitamura, Y. Saito, S. Yokota, C. J. Pollock, B. L. Giles, T. E. Moore, R. B. Torbert, C. T. Russell, and J. L. Burch (2018). A statistical study of slow-mode shocks observed by MMS in the dayside magnetopause. *Geophys. Res. Lett. 45*(10), 4675–4684. https://doi.org/10.1029/2018GL077580

[28] Iwamoto, M., **T. Amano**, M. Hoshino, and Y. Matsumoto (2018). Precursor wave emission enhanced by Weibel instability in relativistic shocks. *Astrophys. J. 858*(2), 93. https://doi.org/10.3847/1538-4357/aaba7a

[29] Kamiya, K., K. Seki, S. Saito, **T. Amano**, and Y. Miyoshi (2018). Formation of butterfly pitch angle distributions of relativistic electrons in the outer radiation belt with a monochromatic Pc5 wave. *J. Geophys. Res. 123*(6), 4679–4691. https://doi.org/10.1002/2017JA024764

[30] Matsumoto, Y., **T. Amano**, T. N. Kato, and M. Hoshino (2017). Electron Surfing and Drift Accelerations in a Weibel-Dominated High-Mach-Number Shock. *Phys. Rev. Lett. 119*(10), 105101. https://doi.org/10.1103/PhysRevLett.119.105101

[31] Oka, M., Wilson, L. B. III, T. D. Phan, A. J. Hull, **T. Amano**, M. Hoshino, M. R. Argall, O. L. Contel, O. Agapitov, D. J. Gershman, Y. V. Khotyaintsev, J. L. Burch, R. B. Torbert, C. Pollock, J. C. Dorelli, B. L. Giles, T. E. Moore, Y. Saito, L. A. Avanov, W. Paterson, R. E. Ergun, R. J. Strangeway, C. T. Russell, and P. A. Lindqvist (2017). Electron scattering by high-frequency whistler waves at Earth's bow shock. *Astrophys. J. 842*(2), L11. https://doi.org/10.3847/2041-8213/aa7759

[32] Iwamoto, M., **T. Amano**, M. Hoshino, and Y. Matsumoto (2017). Persistence of precursor waves in two-dimensional relativistic shocks. *Astrophys. J. 840*(1), 52. https://doi.org/10.3847/1538-4357/aa6d6f

[33] Hirabayashi, K., M. Hoshino, and **T. Amano** (2016). A new framework for magnetohydrodynamic simulations with anisotropic pressure. *J. Comput. Phys. 327*, 851–872. https://doi.org/10.1016/j.jcp.2016.09.064

[34] **Amano, T.** (2016). A second-order divergence-constrained multidimensional numerical scheme for relativistic two-fluid electrodynamics. *Astrophys. J. 831*(1), 100. https://doi.org/10.3847/0004-637X/831/1/100

[35] Balsara, D. S., **T. Amano**, S. Garain, and J. Kim (2016). A high-order relativistic two-fluid electrodynamic scheme with consistent reconstruction of electromagnetic fields and a multidimensional Riemann solver for electromagnetism. *J. Comput. Phys. 318*, 169–200. https://doi.org/10.1016/j.jcp.2016.05.006

[36] **Amano, T.** (2015). Divergence-free approximate Riemann solver for the quasi-neutral two-fluid plasma model. *J. Comput. Phys. 299*, 863–886. https://doi.org/10.1016/j.jcp.2015.07.035

[37] Matsumoto, Y., **T. Amano**, T. N. Kato, and M. Hoshino (2015). Stochastic electron acceleration during spontaneous turbulent reconnection in a strong shock wave. *Science 347*(6225), 974–978. https://doi.org/10.1126/science.1260168

[38] Minoshima, T., Y. Matsumoto, and **T. Amano** (2015). A finite volume formulation of the multi-moment advection scheme for Vlasov simulations of magnetized plasma. *Comput. Phys. Commun. 187*, 137–151. https://doi.org/10.1016/j.cpc.2014.10.023

[39] Itou, H., **T. Amano**, and M. Hoshino (2014). First-principles simulations of electrostatic interactions between dust grains. *Phys. Plasmas 21*(12), 123707. https://doi.org/10.1063/1.4904373

[40] **Amano, T.**, K. Higashimori, and K. Shirakawa (2014). A robust method for handling low density regions in hybrid simulations for collisionless plasmas. *J. Comput. Phys. 275*, 197–212. https://doi.org/10.1016/j.jcp.2014.06.048

[41] Matsumoto, Y., **T. Amano**, and M. Hoshino (2013). Electron acceleration in a non-relativistic shock with very high Alfvén Mach number. *Phys. Rev. Lett. 111*(21), 215003. https://doi.org/10.1103/PhysRevLett.111.215003

[42] Saito, T., M. Hoshino, and **T. Amano** (2013). Stability of cosmic-ray modified shocks: two-fluid approach. *Astrophys. J. 775*(2), 130. https://doi.org/10.1088/0004-637X/775/2/130

[43] **Amano, T.** and J. G. Kirk (2013). The role of superluminal electromagnetic waves in pulsar wind termination shocks. *Astrophys. J. 770*(1), 18. https://doi.org/10.1088/0004-637X/770/1/18

[44] Minoshima, T., Y. Matsumoto, and **T. Amano** (2013). Multi-moment advection scheme in three dimension for Vlasov simulations of magnetized plasma. *J. Comput. Phys. 236*, 81–95. https://doi.org/10.1016/j.jcp.2012.11.024

[45] Matsumoto, Y., **T. Amano**, and M. Hoshino (2012). Electron accelerations at high Mach number shocks: two-dimensional particl-in-cell simulations in various parameter regimes. *Astrophys. J. 755*(2), 109. https://doi.org/10.1088/0004-637X/755/2/109

[46] Umeda, T., S. Matsukiyo, **T. Amano**, and Y. Miyoshi (2012). A numerical electromagnetic linear dispersion relation for Maxwellian ring-beam velocity d istributions. *Phys. Plasmas 19*(7), 072107. https://doi.org/10.1063/1.4736848

[47] Hayakawa, T., K. Torii, R. Enokiya, **T. Amano**, and Y. Fukui (2012). Molecular and Atomic Gas toward HESS J1745 − 303 in the Galactic Center: Further Support for the Hadronic Scenario. *Publ. Astron. Soc. Japan 64*(1), 8. https://doi.org/10.1093/pasj/64.1.8

[48] Minoshima, T., Y. Matsumoto, and **T. Amano** (2012). Multi-moment advection scheme for Vlasov simulations. *ASP Conf. Ser. 459*(17), 277–282

[49] **Amano, T.** and M. Hoshino (2012). Recent progress in the theory of electron injection in collisionless shocks. In M. P. Leubner and Z. Vörös (Eds.), *Astrophys. Sp. Sci. Proc.*, Volume 33 of *Astrophysics and Space Science Proceedings*, Berlin, Heidelberg, pp. 143–152. Springer Berlin Heidelberg

[50] **Amano, T.**, K. Torii, T. Hayakawa, and Y. Fukui (2011). Stochastic acceleration of cosmic rays in the central molecular zone of the Galaxy. *Publ. Astron. Soc. Japan 63*(6), L63–L66. https://doi.org/10.1093/pasj/63.6.L63

[51] Minoshima, T., Y. Matsumoto, and **T. Amano** (2011). Multi-moment advection scheme for Vlasov simulations. *J. Comput. Phys. 230*(17), 6800–6823. https://doi.org/10.1016/j.jcp.2011.05.010

[52] **Amano, T.**, K. Seki, Y. Miyoshi, T. Umeda, Y. Matsumoto, Y. Ebihara, and S. Saito (2011). Self-consistent kinetic numerical simulation model for ring current particles in the Earth's inner magnetosphere. *J. Geophys. Res. 116*, A02216. https://doi.org/10.1029/2010JA015682

[53] **Amano, T.** and M. Hoshino (2010). A critical mach number for electron injection in collisionless shocks. *Phys. Rev. Lett. 104*(18), 181102. https://doi.org/10.1103/PhysRevLett.104.181102

[54] Shimada, N., M. Hoshino, and **T. Amano** (2010). Structure of a strong supernova shock wave and rapid electron acceleration confined in its transition region. *Phys. Plasmas 17*(3), 032902. https://doi.org/10.1063/1.3322828

[55] **Amano, T.** and M. Hoshino (2009). Effect of shock angle on fast and direct acceleration of electrons in high Mach number quasi-perpendicular shocks. In M. Hirahara, Y. Miyoshi, N. Terada, I. Shinohara, and T. Mukai (Eds.), *AIP Conf. Proc.*, Volume 1144, pp. 36–39. AIP

[56] **Amano, T.** and M. Hoshino (2009). Nonlinear evolution of Buneman instability and its implication for electron acceleration in high Mach number collisionless perpendicular shocks. *Phys. Plasmas 16*(10), 102901. https://doi.org/10.1063/1.3240336

[57] **Amano, T.** and M. Hoshino (2009). Electron shock surfing acceleration in multidimensions: two-dimensional particle-in-cell simulation of collisionless perpendicular shock. *Astrophys. J. 690*(1), 244–251. https://doi.org/10.1088/0004-637X/690/1/244

[58] **Amano, T.** and M. Hoshino (2007). Electron injection at high Mach number quasi-perpendicular shocks: surfing and drift acceleration. *Astrophys. J. 661*(1), 190–202. https://doi.org/10.1086/513599

## Non-Refereed Articles

[1] **Amano, T.** (2016). Inside a plasma shock. *Physics (College. Park. Md). 9*, 117. https://doi.org/10.1103/Physics.9.117

## Non-refereed Articles in Japanese

[1] 星野真弘, **天野孝伸** (2009), 宇宙における衝撃波粒子加速機構の新展開, 日本物理学会誌, 64(6), 421

[2] **天野孝伸** (2009), 超新星残骸衝撃波における電子注入, 天文月報, 102(1), 9

## INVITED TALKS (INTERNATIONAL CONFERENCES)

[1] Electron injection at shocks: Transition from stochastic shock drift acceleration to diffusive shock acceleration, *XXVIII Cracow EPIPHANY Conference on Recent Advances in Astroparticle Physics*, Online, Jan. 12, 2022.

[2] Connecting Injection and Subsequent Acceleration of Nonthermal Electrons at Collisionless Oblique Shocks, *The 30th International Toki Conference on Plasma and Fusion Research (ITC30)*, Online, Nov. 16, 2021. **(Plenary Talk)**

[3] Stochastic Shock Drift Acceleration as the Mechanism for Electron Injection into Diffusive Shock Acceleration at Collisionless Shocks, *5th Asia-Pacific Conference on Plasma Physics (AAPPS-DPP2021)*, Online, Sep. 28, 2021.

[4] Particle Acceleration at Collisionless Shocks, *10th East-Asia Workshop on Laboratory, Space, Astrophysical Plasmas (EASW-10)*, Online, Aug. 16, 2021.

[5] Perspectives for Electron Heating and Acceleration at Collisionless Shocks, *MMS Spring 2021 Science Working Team Meeting*, Online, Apr. 8, 2021.

[6] Non-thermal Particle Acceleration at Collisionless Shocks, *Max Planck Princeton Center Workshop*, Göttingen, Germany, Jan. 22, 2020.

[7] Three-dimensional Particle-In-Cell Simulations for High Mach Number Collisionless Shocks, *The 2nd Asia-Pacific Conference on Plasma Physics*, Kanazawa, Japan, Nov. 15, 2018.

[8] Nonthermal Electron Acceleration at Earth's Bow Shock: Theory, Simulation and Observation, *The 13th International School/Symposium for Space Simulations (ISSS-13)*, Los Angeles, USA, Sep. 13, 2018.

[9] Stochastic Shock Drift Acceleration for Electrons, *8th East-Asia Workshop on Laboratory, Space, Astrophysical Plasmas*, Daejeon, Korea, Aug. 1, 2018.

[10] Cosmic-Ray Acceleration via Astrophysical Coherent Radiation, *20th International Symposium on Very High Energy Cosmic Ray Interactions (ISVHECRI)*, Nagoya, Japan, May 24, 2018.

[11] Particle Acceleration in Relativistic Plasmas, *Dawn of a New Era for Black Hole Jets in Active Galaxies*, Sendai, Japan, Jan. 26, 2018.

[12] Nonthermal Electrons at Quasi-perpendicular Collisionless Shocks, *7th East-Asia Workshop on Laboratory, Space, Astrophysical Plasmas*, Weihai, China, Jul. 25, 2017.

[13] Coherent and Stochastic Acceleration in Quasi-perpendicular Collisionless Shocks, *Workshop on Plasma Astrophysics from the Laboratory to the Non-thermal Universe*, Oxford, UK, Jul. 4, 2017.

[14] Kinetic Simulations of Particle Acceleration and Transport around Collisionless Shocks, *AOGS 13th Annual Meeting*, Beijing, China, Aug. 1, 2016.

[15] Particle Acceleration and Transport at Collisionless Shocks, *6th East-Asia Workshop on Laboratory, Space, Astrophysical Plasmas*, Tsukuba, Japan, Jul. 11, 2016.

[16] Key Issues in Particle Acceleration Theory at Collisionless Shocks, *18th International Congress on Plasma Physics*, Kaohsiung, Taiwan, Jun. 29, 2016.

[17] Energetic Particle Hybrid Code and Its Application, *11th International Conference on Numerical Modeling of Space Plasma Flows (ASTRONUM2016)*, Monterey, USA, Jun. 9, 2016.

[18] Superluminal Electromagnetic Waves in Highly Magnetized Relativistic Shocks, *5th East-Asia School and Workshop on Laboratory, Space, Astrophysical Plasmas*, Pohang, Korea, Aug. 21, 2015.

[19] Quasi-neutral Two-fluid Plasma Simulation Model, *10th International Conference on Numerical Modeling of Space Plasma Flows (ASTRONUM 2015)*, Avignon, France, Jun. 10, 2015.

[20] Physics of Very High Mach Number Collisionless Shocks, *The Many Facets of Supernova Remnants*, Rikkyo University, Japan, Nov. 10, 2014.

[21] Relativistic Electromagnetic Two-fluid Simulations of Pulsar Wind Termination Shocks, *The 6th East-Asian Numerical Astrophysics Meeting (EANAM6)*, Suwon, Korea, Sep. 18, 2014.

[22] Robust Handling of Low Density Regions in Hybrid Simulations, *9th International Conference on Numerical Modeling of Space Plasma Flows (ASTRONUM 2014)*, Long Beach, USA, Jun. 25, 2014.

[23] Relativistic Pulsar Wind Termination Shocks Modified by Superluminal Electromagnetic Waves, *8th International Conference on Numerical Modeling of Space Plasma Flows (ASTRONUM 2013)*, Biarritz, France, Jul. 1, 2013.

[24] Structure of Relativistic Shock Modified by Nonlinear Superluminal Waves, *Nonlinear Waves and Chaos Workshop 9*, La Jolla, USA, Mar. 7, 2013.

[25] Self-consistent Drift-kinetic Numerical Ring-current Modeling : Five-dimensional Vlasov-Maxwell Approach, *Inner Magnetosphere Coupling II (IMC II)*, Los Angeles, USA, Mar. 20, 2012.

[26] Nonthermal Electron Acceleration and Injection in Collisionless Shocks, *International Astrophysics Forum Alpbach (IAFA) 2011*, Alpbach, Austria, Jun. 24, 2011.

[27] Kinetic and Self-consistent Numerical Modeling of the Terrestrial Inner Magnetosphere, *6th International Conference on Numerical Modeling of Space Plasma Flows (ASTRONUM 2011)*, Valencia, Spain, Jun. 17, 2011.

[28] Electron Acceleration and Injection by Whistler Waves in Collisionless Shocks, *2010 International Space Plasma Symposium*, Tinan, Taiwan, Jun. 28, 2010.

[29] Surfing and Drift Acceleration of Electrons at High Mach Number Quasi-perpendicular Shocks, *Kinetic Modeling of Astrophysical Plasmas*, Crakow, Poland, Oct. 6, 2008.

[30] Nonthermal Electron Acceleration in High Mach Number Collisionless Shocks, *The 9th International Workshop on the Interrelationship between Plasma Experiments in Laboratory and Space (IPELS)*, Palm Cove, Australia, Aug. 10, 2007.

## INVITED TALKS (DOMESTIC CONFERENCES)

[1] ミクロなプラズマ素過程に基づく衝撃波粒子加速機構, *高エネルギー現象で探る宇宙の多様性 I*, 東京大学宇宙線研究所, 2021 年 10 月 19 日.

[2] 衝撃波電子加速におけるホイッスラー波の役割, *第 37 回プラズマ・核融合学会年会シンポジウム*, オンライン, 2020 年 12 月 1 日.

[3] 内部磁気圏における ULF 波動励起機構, *実験室・宇宙プラズマ研究集会*, 東京大学本郷キャンパス, 2019 年 9 月 17 日.

[4] 宇宙空間衝撃波の遷移層, *日本物理学会 春季年会*, 東京理科大学野田キャンパス, 2018 年 3 月 24 日.

[5] 内部磁気圏 RC モデリングの新しい試み, *太陽地球圏環境予測のためのモデル研究の展望*, 名古屋大学東山キャンパス, 2017 年 1 月 27 日.

[6] MMS 衛星で見る無衝突衝撃波と電子加速, *高エネルギー宇宙物理学研究会*, 青山学院大学相模原キャンパス, 2016 年 12 月 2 日.

[7] 宇宙プラズマのハイブリッドシミュレーション, *日本物理学会 2016 秋季年会*, 金沢大学角間キャンパス, 2016 年 9 月 14 日.

[8] Theory and Simulations of Particle Acceleration in Collisionless Shocks, *高エネルギーガンマ線でみる極限宇宙 2015*, 2016 年 1 月 14 日.

[9] パルサー風衝撃波と電磁波の相互作用, *高エネルギー宇宙物理学研究会*, 九州大学西新プラザ, 2014 年 11 月 25 日.

[10] 相対論的電磁変性衝撃波の構造と電磁エネルギー散逸, *日本物理学会 2013 春季年会*, 広島大学, 2013 年 3 月 27 日.

[11] 無衝突衝撃波の数値シミュレーションと粒子加速, *宇宙流体力学のフロンティア*, 京都大学, 2009 年 11 月 16 日.