

Seiji ZENITANI

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Research interests

Magnetic reconnection, astrophysical jets, collisionless shocks, relativistic astrophysics, kinetic plasma instabilities, particle-in-cell (PIC) simulations, magnetohydrodynamic (MHD) simulations

Academic Training

- 2006 Ph.D. in space physics, **University of Tokyo**, Japan
“High-energy particle acceleration and magnetic field dissipation in the plasma sheets of celestial magnetospheres” (advisor: Prof. Masahiro Hoshino)
2001 M.A. in space physics, **University of Tokyo**, Japan
1999 B.S. in Science, **Kyoto University**, Japan

Research Experience

- 2017 – present **Kyoto University**, Uji, Kyoto, Japan
Researcher, Research Institute for Sustainable Humanosphere (2017/04 –)
2011 – 2017 **National Astronomical Observatory of Japan**, Mitaka, Tokyo, Japan
Research Assistant Professor, NAOJ fellow (2012/04 – 2017/03)
Research Assistant Professor for NAOJ-NIFS joint project (2011/09 – 2012/03)
2006 – 2011 **NASA Goddard Space Flight Center**, Greenbelt, MD, USA
Visiting research scientist, University of Maryland Baltimore County (UMBC)
Goddard Planetary Heliophysics Institute (2010/04 – 2011/09),
NASA Postdoctoral Fellow (2007/04 – 2010/04),
Visiting research associate, University of Maryland Baltimore County (UMBC)
Goddard Earth Sciences & Technology Center (2006/11 – 2007/04)
2006 – 2007 Researcher (unpaid), **Institute of Space and Astronautical Science**,
Japan Aerospace Exploration Agency, Sagami-hara, Japan

Fellowships

- 2012 – 2017 NAOJ Fellowship
2010 – 2011 Japan Society for the Promotion of Science, Postdoctoral Fellowship for Research Abroad
2007 – 2010 NASA Postdoctoral Fellowship
2003 – 2005 Japan Society for the Promotion of Science, Research Fellowship for Young Scientists

Award

- 2011/11/5 Ohbayashi Award by *Society of Geomagnetism and Earth, Planetary and Space Sciences*
2015/2/20 Excellent reviewer award in 2014 by *Earth, Planets and Space*
2016/4/21 Young Scientists' Prize by *the Minister of Education, Culture, Sports, Science and Technology*

Professional Membership & Services

- Membership Society of Geomagnetism and Earth, Planetary and Space Sciences (SGEPSS),
Astronomical Society of Japan, American Geophysical Union
Review Astronomy & Astrophysics, Astrophysical Journal, Astrophysical Journal Letters,
Astrophysics and Space Science Library, Earth Planets and Space, Geophysical Research
Letters, Journal of Geophysical Research, Monthly Notices of the Royal Astronomical
Society, Nature Communications, New Journal of Physics, Physica Scripta, Physical Review
E, Physical Review Letters, Physics of Plasmas, Solar Physics, Space Science Reviews
Proposal review National Science Foundation, NASA Earth and Space Science Fellowship (NESSF),
Chilean National Science and Technology Commission (CONICYT)

Publications

Refereed journals (first author)

1. **S. Zenitani** & M. Hoshino, *The Generation of Non-thermal Particles in Relativistic Magnetic Reconnection of Pair Plasmas*, *Astrophys. J.*, 562, L63 (2001)
2. **S. Zenitani** & M. Hoshino, *Relativistic Particle Acceleration in a Folded Current Sheet*, *Astrophys. J.*, 618, L111 (2005)
3. **S. Zenitani** & M. Hoshino, *Three Dimensional Evolution of a Relativistic Current Sheet: Triggering of Magnetic Reconnection by the Guide Field*, *Physical Review Letters*, 95, 095001 (2005)
4. **S. Zenitani** & M. Hoshino, *Particle Acceleration and Magnetic Dissipation in Relativistic Current Sheet of Pair Plasmas*, *Astrophys. J.*, 670, 702 (2007)
5. **S. Zenitani** & M. Hoshino, *The Role of the Guide Field in Relativistic Pair Plasma Reconnection*, *Astrophys. J.*, 677, 530 (2008)
6. **S. Zenitani** & M. Hesse, *The role of the Weibel instability at the reconnection jet front in relativistic pair plasma reconnection*, *Physics of Plasmas*, 15, 022101 (2008)
7. **S. Zenitani** & M. Hesse, *Self-regulation of the Reconnecting Current Layer in Relativistic Pair Plasma Reconnection*, *Astrophys. J.*, 684, 1477 (2008)
8. **S. Zenitani**, M. Hesse, & A. Klimas, *Two-fluid Magnetohydrodynamic Simulations of Relativistic Magnetic Reconnection*, *Astrophys. J.*, 696, 1385 (2009)
9. **S. Zenitani**, M. Hesse, & A. Klimas, *Relativistic Two-fluid Simulations of Guide Field Magnetic Reconnection*, *Astrophys. J.*, 705, 907 (2009)
10. **S. Zenitani**, M. Hesse, & A. Klimas, *Scaling of the Anomalous Boost in Relativistic Jet Boundary Layer*, *Astrophys. J.*, 712, 951 (2010)
11. **S. Zenitani**, M. Hesse, & A. Klimas, *Resistive Magnetohydrodynamic Simulations of Relativistic Magnetic Reconnection*, *Astrophys. J.*, 716, L214 (2010)
12. **S. Zenitani** & T. Miyoshi, *Magnetohydrodynamic structure of a plasmoid in fast reconnection in low beta plasmas*, *Physics of Plasmas*, 18, 022105 (2011)
13. **S. Zenitani**, M. Hesse, A. Klimas, & M. Kuznetsova, *New Measure of the Dissipation Region in Collisionless Magnetic Reconnection*, *Physical Review Letters*, 106, 195003 (2011)
14. **S. Zenitani**, M. Hesse, A. Klimas, C. Brack, & M. Kuznetsova, *The inner structure of collisionless magnetic reconnection: The electron-frame dissipation measure and Hall fields*, *Physics of Plasmas*, 18, 122108 (2011)
15. **S. Zenitani**, I. Shinohara, & T. Nagai, *Evidence for the dissipation region in magnetotail reconnection*, *Geophys. Res. Lett.*, 39, L11102 (2012)
16. **S. Zenitani**, I. Shinohara, T. Nagai, & T. Wada, *Kinetic aspects of the ion current layer in a reconnection outflow exhaust*, *Physics of Plasmas*, 20, 092120 (2013)
17. **S. Zenitani** & T. Umeda, *Some remarks on the diffusion regions in magnetic reconnection*, *Physics of Plasmas*, 21, 034503 (2014)
18. **S. Zenitani**, *Magnetohydrodynamic structure of a plasmoid in fast reconnection in low beta plasmas: Shock-shock interactions*, *Physics of Plasmas*, 22, 032114 (2015)
19. **S. Zenitani**, *Loading Relativistic Maxwell Distributions in Particle Simulations*, *Physics of Plasmas*, 22, 042116 (2015)
20. **S. Zenitani** & T. Nagai, *Particle dynamics in the electron current layer in collisionless magnetic reconnection*, *Physics of Plasmas*, 23, 102102 (2016)

Refereed journals (coauthor)

21. M. Hesse & **S. Zenitani**, *Dissipation in relativistic pair-plasma reconnection*, *Physics of Plasmas*, 14, 112102 (2007)
22. A. Klimas, M. Hesse, & **S. Zenitani**, *Particle-in-cell simulation of collisionless reconnection with open outflow boundaries*, *Physics of Plasmas*, 15, 082102 (2008)
23. M. Hesse, **S. Zenitani**, & A. Klimas, *The structure of the electron outflow jet in collisionless magnetic reconnection*, *Physics of Plasmas*, 15, 112102 (2008)
24. M. Hesse, **S. Zenitani**, M. Kuznetsova, & A. Klimas, *A simple, analytical model of collisionless reconnection in a pair plasma*, *Physics of Plasmas*, 16, 102106 (2009)

25. A. Klimas, M. Hesse, **S. Zenitani**, & M. Kuznetsova, *Particle-in-cell simulation of collisionless driven reconnection with open boundaries*, Physics of Plasmas, 17, 112904 (2010)
26. M. Hesse, T. Neukirch, K. Schindler, M. Kuznetsova, & **S. Zenitani**, *The Diffusion Region in Collisionless Magnetic Reconnection*, Space Science Reviews, 106, 3 (2011)
27. M. Hesse, J. Birn, & **S. Zenitani**, *Magnetic reconnection in a compressible MHD plasma*, Physics of Plasmas, 18, 042104 (2011)
28. J. Birn, M. Hesse, & **S. Zenitani**, *Reconnection in compressible plasmas: Extended conversion region*, Physics of Plasmas, 18, 111202 (2011)
29. A. Klimas, M. Hesse, & **S. Zenitani**, *Particle-in-cell simulation of collisionless undriven reconnection with open boundaries*, Physics of Plasmas, 19, 042901 (2012)
30. N. Aunai, M. Hesse, **S. Zenitani**, M. Kuznetsova, C. Black, R. Evans, & R. Smets, *Comparison between hybrid and fully kinetic models of asymmetric magnetic reconnection: coplanar and guide field configurations*, Physics of Plasmas, 20, 022902 (2013)
31. T. Nagai, I. Shinohara, **S. Zenitani**, R. Nakamura, T. Nakamura, M. Fujimoto, Y. Saito, & T. Mukai, *Three-dimensional structure of magnetic reconnection in the magnetotail from Geotail observations*, Journal of Geophysical Research, 118, 1667 (2013)
32. M. Hesse, N. Aunai, **S. Zenitani**, M. Kuznetsova, & J. Birn, *Aspects of collisionless magnetic reconnection in asymmetric systems*, Physics of Plasmas, 20, 061210 (2013)
33. H. Baty, J. Pétri, & **S. Zenitani**, *Explosive reconnection of double tearing modes in relativistic plasmas: application to the Crab flares*, MNRAS Letters, 436, L20 (2013)
34. T. Nagai, **S. Zenitani**, I. Shinohara, R. Nakamura, M. Fujimoto, Y. Saito, & T. Mukai, *Ion and electron dynamics in the ion-electron decoupling region of magnetic reconnection with Geotail observations*, Journal of Geophysical Research, 118, 7703 (2013)
35. J. Pétri, M. Takamoto, H. Baty, & **S. Zenitani**, *Explosive reconnection of the double tearing mode in relativistic plasmas with application to the Crab flares*, Plasma Physics and Controlled Fusion, 57, 014034 (2015)
36. T. Nagai, I. Shinohara, & **S. Zenitani**, *Ion acceleration processes in magnetic reconnection: Geotail observations in the magnetotail*, Journal of Geophysical Research, 120, 1766 (2015)
37. T. Nagai, I. Shinohara, & **S. Zenitani**, *The dawn-dusk length of the X line in the near-Earth magnetotail: Geotail survey in 1994-2014*, Journal of Geophysical Research, 120, 8762 (2015)
38. M. Hesse, N. Aunai, J. Birn, P. Cassak, R. E. Denton, J. F. Drake, T. Gombosi, M. Hoshino, W. Matthaeus, D. Sibeck, & **S. Zenitani**, *Theory and Modeling for the Magnetospheric Multiscale Mission*, Space Science Reviews, 199, 577 (2016)
39. H. Hasegawa, N. Kitamura, Y. Saito, T. Nagai, I. Shinohara, S. Yokota, C. Pollock, B. Giles, J. Dorelli, D. Gershman, L. Avanov, S. Kreisler, W. Paterson, M. Chandler, V. Coffey, J. Burch, R. Torbert, T. Moore, C. T. Russell, R. Strangeway, G. Le, M. Oka, T.-D. Phan, B. Lavraud, **S. Zenitani**, and M. Hesse (25th/26 author), *Decay of mesoscale flux transfer events during quasi-continuous spatially-extended reconnection at the magnetopause*, Geophysical Research Letters, 43, 4755 (2016)

Conference proceedings and other articles

1. **S. Zenitani** & M. Hoshino, *A plasma sheet as a source of non-thermal particles --- relativistic magnetic reconnection and relativistic drift kink instability in e^\pm plasmas*, Proceedings of 28th International Cosmic Ray Conference, p. 2043 (2003)
2. M. Hoshino, **S. Zenitani**, K. Nagata, & Y. Takagi, *Particle Acceleration in Kinetic Plasma Processes*, Proceedings of Energy Budget in the High Energy Universe, p. 108 (2006)
3. **S. Zenitani**, M. Hesse, & A. Klimas, *Fluid and Magnetofluid Modeling of Relativistic Magnetic Reconnection*, AIP Conference Proceedings, 1366, 138 (2011)
4. **S. Zenitani** & H. R. Takahashi, *New trends of reconnection research: Relativistic Magnetic Reconnection*, J. Plasma Fusion Res., 89, 845 (2013) [in Japanese]
5. M. Hesse, N. Aunai, M. Kuznetsova, **S. Zenitani**, & J. Birn, *Magnetic Reconnection in Different Environments: Similarities and Differences*, AGU Geophysical Monograph, 207, 259 (2015)
6. I. Shinohara, M. Fujimoto, T. Nagai, **S. Zenitani**, & H. Kojima, *Low-frequency Waves in the Tail Reconnection Region*, AGU Geophysical Monograph, 216, 181 (2016)

7. M. Yamada, J. Yoo, & **S. Zenitani**, *Energy conversion and inventory of a prototypical magnetic reconnection layer*, Astrophysics and Space Science Library, 427, 143 (2016)

Invited talks (international)

1. Particle acceleration and magnetic dissipation processes in the plasma sheets of relativistic pair plasmas, US-Japan Workshop on Magnetic Reconnection MR2007, Maryland, March 2007
2. On the current sheet thickness in relativistic pair plasma reconnection, Cambridge Workshop on Magnetic Reconnection, Maryland, September 2007
3. On the outflow region of relativistic pair plasma reconnection, Cambridge Workshop on Magnetic Reconnection, Maryland, September 2007
4. The role of the Weibel instability at the reconnection jet front in relativistic pair plasma reconnection, US-Japan Workshop on Magnetic Reconnection MR2008, Okinawa, Japan, March 2008
5. Current sheet expanding processes in relativistic pair plasma reconnection, Cambridge conference 2008, Bohn, Germany, August 2008
6. Relativistic current sheets in electron-positron plasmas, Cracow conference 2008, Krakow, Poland, October 2008
7. Relativistic two-fluid simulations of pair plasma reconnection, International Cambridge workshop on magnetic reconnection 2009, Fairbanks, Alaska, USA, August 2009
8. Two-fluid simulations of relativistic magnetic reconnection in pair plasmas, US-Japan Workshop on Reconnection MR2009, Madison, Wisconsin, USA, October 2009
9. Two-Fluid Simulations of Relativistic Magnetic Reconnection in Electron-Positron Plasmas, Yosemite Workshop on Magnetic Reconnection, Yosemite, California, USA, February 2010
10. Resistive Magnetohydrodynamic Simulations of Relativistic Magnetic Reconnection, International Cambridge Workshop on Magnetic Reconnection 2010, St. Andrews, UK, August 2010
11. Fluid and Magnetofluid Modeling of Relativistic Magnetic Reconnection, UAH (University of Alabama Huntsville) Workshop 2010, Nashville, Tennessee, USA, October 2010
12. Resistive Magnetohydrodynamic Simulations of Relativistic Magnetic Reconnection, US-Japan Workshop on Magnetic Reconnection MR2010, Nara, Japan, December 2010
13. Numerical Simulations of Relativistic Magnetic Reconnection, Magnetic Reconnection in Relativistic Wind Workshop, SLAC National Accelerator Laboratory, CA, USA, April 2011
14. The electron-frame dissipation measure in collisionless magnetic reconnection, International Cambridge Workshop on Magnetic Reconnection 2011, Durham, New Hampshire, USA, August 2011
15. A new measure of the dissipation region in collisionless magnetic reconnection, Computational Methods in High Energy Density Plasmas - Workshop II: Computational Challenges in Magnetized Plasma, Los Angeles, USA, April 2012
16. A new measure of the dissipation region in collisionless magnetic reconnection: Theory, simulation, and observation, US-Japan Workshop on Reconnection MR2012, Princeton, USA, May 2012
17. Geotail observation of the dissipation region in collisionless magnetic reconnection, AOGS - AGU (WPGM) Joint Assembly, Singapore, August 2012
18. Evidence for the dissipation region in magnetotail reconnection, International Cambridge Workshop on Magnetic Reconnection 2012, Copenhagen, Denmark, August 2012
19. The structure of the dissipation region in collisionless magnetic reconnection: Theory, Simulation, and Observation, GEOTAIL 20th Anniversary Workshop 2012, Tokyo, November 2012
20. Identification of the dissipation region in collisionless magnetic reconnection: Theory and Simulations, AGU Fall meeting 2012, San Francisco, USA, December 2012
21. Magnetic diffusion and ion nonlinear dynamics in magnetic reconnection, The 11th International School / Symposium for Space Simulations (ISSS-11), National Central University, Taiwan, July 2013
22. Magnetic diffusion and ion nonlinear dynamics in magnetic reconnection, ISAS Workshop: Magnetospheric Plasmas, Tokyo, Japan, November 2013
23. The structure of the diffusion region in collisionless reconnection: Theory, simulation, and observation, Parker reconnection Workshop, Sao Jose dos Campos, Brazil, March 2014

24. Magnetic diffusion and ion nonlinear dynamics in magnetic reconnection, US-Japan Workshop on Reconnection MR2014, Tokyo, Japan, May 2014
25. The structure of the diffusion region in magnetic reconnection, AOGS 11th Annual Meeting, Sapporo, Japan, July 2014
26. A new picture of the central engine of kinetic magnetic reconnection, The 6th East-Asian Numerical Astrophysicists Meeting, Kyoung-Hee University, Suwon, Korea, September 2014
27. Numerical Modeling of Relativistic Reconnection: Kinetic, Two-fluid, and MHD Simulations, The Evolving Blazar Paradigm meeting, Krakow, Poland, April 2015
28. Particle acceleration in relativistic magnetic reconnection, AOGS 12th Annual Meeting, Singapore, August 2015
29. High-speed fluid dynamics in magnetic reconnection in a low-beta plasma, Chapman Conference on Magnetospheric Dynamics, Fairbanks, Alaska, USA, September 2015
30. Particle dynamics and nongyrotropic distribution functions in collisionless magnetic reconnection, International GEMSIS and ASINACTR-G2602 Workshop, Nagoya, March 2016
31. The structure of the diffusion region in collisionless magnetic reconnection: Theory, simulation, and observation, Dynamical Processes in Space Plasmas, Dead Sea, Israel, April 2016
32. Dissipation in relativistic pair-plasma reconnection: revisited, Purdue Workshop on Relativistic Plasma Astrophysics, Purdue, USA, May 2016
33. Electron particle dynamics in collisionless magnetic reconnection, US Japan Workshop and School on Magnetic Reconnection (MR2017), Matsuyama, Japan, Mar 2017

Invited talks (domestic/Japanese)

1. 電子・陽電子プラズマシート中の高エネルギー粒子加速過程、STE シミュレーション研究会、名古屋大学、名古屋、2002/10
2. 相対論磁気リコネクションのシミュレーション研究、STEL 研究会『磁気リコネクション研究の現状と展望 ---素過程から現象まで---』、名古屋大学、名古屋、2011/03
3. 相対論プラズマシミュレーション入門、SGEPSS 波動分科会研究会「一般相対論と MHD プラズマ」府中町屋倶楽部、武生、福井、2011/12
4. 磁気リコネクションのシミュレーション研究、日本天文学会春季年会、龍谷大学、京都、2012/03
5. 磁気拡散領域のジオテイル衛星観測、STEL/NINS 研究会「磁気リコネクション研究の現状と展望 2」、愛媛大学、松山、2013/02
6. 無衝突磁気リコネクションの散逸領域、宇宙惑星プラズマ物理学研究の最前線 研究集会、東京大学、東京、2013/02
7. 相対論磁気リコネクション研究の現状、ブラックホール磁気圏勉強会、熊本大学、熊本、2014/03
8. Our present understanding of the diffusion region in collisionless magnetic reconnection、磁気リコネクションと太陽プラズマ研究会、京都大学東京オフィス、東京、2014/03
9. 相対論磁気リコネクション、宇宙プラズマ理論研究会、東北大学、仙台、2014/08
10. 磁気圏リコネクション研究の現状と MMS ミッションへの期待、GEMSIS ワークショップ 2014、名古屋大学、名古屋、2014/09
11. 無衝突磁気リコネクションの中心領域問題：理論・シミュレーション・観測、STE 研究集会「波動粒子相互作用による粒子加速・輸送及び乱流」、名古屋大学、名古屋、2015/03
12. Particle acceleration in magnetic reconnection、CTA 研究会「高エネルギーガンマ線でみる極限宇宙 2015」、宇宙線研究所、柏、2016/01
13. Particle dynamics in the electron current layer in collisionless magnetic reconnection、磁気リコネクション研究の最前線と今後の展望、国立天文台、三鷹、2016/03
14. 磁気リコネクションの理論・シミュレーション研究の現状と展望、磁気圏・電離圏シンポジウム、宇宙科学研究所、相模原、2016/10

Meetings (Chair/SOC or LOC; in Japan)

1. 自然科学研究機構「自然科学における階層と全体」シンポジウム、安保ホール、名古屋、2012/02/10-11 (SOC/LOC)
2. NINS/UT Workshop on Magnetic Reconnection 2012、学術総合センター、東京都千代田区、2012/02/19-20 (Chair/SOC/LOC)
3. プラズマ研究会、多摩スポーツセンター、神奈川県川崎市、2013/01/13-15 (LOC)
4. 12th International Workshop on the Interrelationship between Plasma Experiments in Laboratory and Space (IPELS), Hakuba Tokyu Hotel, Nagano, Japan, 2013/07/01-05 (LOC)
5. 第2回 DTA シンポジウム「コンパクト天体の活動性と磁氣的性質」、国立天文台、東京都三鷹市、2014/10/27-29 (世話人)
6. 理論天文学研究会 2014、休暇村館山、千葉県館山市、2014/11/10-12 (世話人)
7. STE 研究集会「宇宙プラズマのフロンティア～太陽圏を超えて」、2016/03/02-04 (世話人)
8. Japan Geoscience Union Meeting 2016, MMS international session, 2016/05/22-26 (Main convener)
9. 地球電磁気・地球惑星圏学会 講演会、磁気圏セッションコンビーナ、2016-2019 年度
10. JpGU-AGU Joint Meeting 2017, MMS international session, 2017/05/20-25 (Convener)

Teaching experience

1. 2000 Apr. – 2002 Mar., Teaching assistant, *Seminar on Earth and Planetary Science*, University of Tokyo, undergraduate students
2. 2012 Aug., 2014 Aug., Teaching assistant, *Plasma simulation summer school*, Chiba University, graduate students
3. 2015 Jan. – Feb., Lecturer, *Introduction to Simulation Astronomy*, Graduate University for Advanced Studies, graduate students
4. 2016 Aug., Hosted 1 intern student (undergraduate), *MHD simulation of magnetic reconnection*

Public outreach (in Japanese)

1. 「宇宙プラズマ物理入門：磁気リコネクション研究の現状」朝日カルチャーセンター横浜教室、2015/4/20
2. 「大切なものは目に見えない～地球の裏庭で診る爆発現象」全国同時七夕講演会、筑波技術大学、2015/8/9
3. 「太陽活動と磁力線」星と宇宙の日、国立天文台、2015/10/24

Contribution to broader society: Software development

1. OpenMHD, a Godunov-type code for ideal/resistive magnetohydrodynamics (MHD) (2010-)
<http://th.nao.ac.jp/MEMBER/zenitani/openmhd-e.html>
2. TeXShop, a TeX editor/previewer for Mac OS X (2002-2007)
<http://pages.uoregon.edu/koch/texshop/texshop.html>
3. Carbon Emacs Package, a binary distribution of GNU Emacs for Mac OS X (2003-2010)
<http://th.nao.ac.jp/MEMBER/zenitani/emacs-e.html>
4. GNU Emacs, a UNIX text editor (2008-)
<http://www.gnu.org/software/emacs/>

References

Prof. Masahiro Hoshino

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