Haruhiko Saitoh

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EDUCATION

2000-2005 **The University of Tokyo**, Hongo, Tokyo, Japan
Ph.D. in Advanced Energy (Plasma Physics), March 2005
M.S. in Advanced Energy (Plasma Physics), March 2002

1996-2000 **Kyoto University**, Sakyo-ku, Kyoto, Japan
B.S. in Physics, March 2000

RESEARCH EXPERIENCE

July 2013 – present **Staff scientist, Max Planck Institute for Plasma Physics**
Boltzmannstraße 2, D-85748 Garching, Germany
(Visiting research scientist, The University of Tokyo)

My research field is experimental plasma physics. I am currently a member of the PAX/APEX team at Max Planck Institute for Plasma Physics, which is focusing on the first creation and understanding of electron-positron pair-plasmas at the NEPOMUC positron source. Specifically, I am experimentally researching the effective injection and confinement methods of non-neutral plasmas in a toroidal dipole magnetic field configuration.

April 2006 – June 2013 **Research associate, The University of Tokyo**
Department of Advanced Energy, Graduate School of Frontier Sciences,
The University of Tokyo, Kashiwa, Chiba, Japan

I was a member of the RT-1 experiment, a dipole device generated by a levitated superconducting magnet, at the University of Tokyo. I was researching both fusion-oriented high-temperature plasmas and non-neutral plasmas at RT-1. I was involved in the experimental understanding of the self-organization and long confinement of a toroidal electron plasma in a dipole field configuration. I was also investigating the high-beta dipole plasma especially focusing on the behaviors of hot electrons by using interferometry, x-ray, and magnetic diagnostics.

April 2005 - March 2006 **Postdoctoral research fellow, RIKEN**
Atomic Physics Laboratory, RIKEN, Wako, Saitama, Japan

I was a member of the ASACUSA collaboration and involved in a non-neutral plasma experiment on a cusp (anti-Helmholtz magnetic field) trap for antihydrogen synthesis in CERN. As one of essential techniques for the antihydrogen formation, I worked for the radial compression and generation of high density states of the cusp non-neutral plasmas by using rotating electric fields.

April 2000 – March 2005 **PhD study, JSPS research fellow (DC1), at The University of Tokyo**
Department of Advanced Energy, Graduate School of Frontier Sciences,
The University of Tokyo, Hongo, Tokyo, Japan

My PhD study was to investigate the fundamental properties of flowing plasmas in the Proto-RT device, a prototype normal-conducting dipole machine. I worked for the confinement of toroidal electron plasma and the formation of supersonic toroidal flow in hydrogen plasma.

April 1999 – March 2000 **Undergraduate study at Kyoto University**
Department of Physics, Faculty of Science,
Kyoto University, Sakyo-ku, Kyoto, Japan

Conducted mirror and baseball-coil plasma experiments in the LATE experiment team.

AWARD

15th Technology Innovation Award (2010),
The Japan Society of Plasma Science and Nuclear Fusion Research,
Z. Yoshida, Y. Ogawa, J. Morikawa, H. Saitoh, Y. Yano, S. Mizumaki, T. Tosaka,
"Development of high-T_c superconducting coil and its application to plasma experiments"

RESEARCH GRANTS

AS A PRINCIPAL INVESTIGATOR

2013-2016 JSPS Grant-in-Aid for Young Scientists (A) 24,700,000 JPY
"Formation of electron-positron plasma in a dipole field configuration"

2011-2013 JSPS Challenging Exploratory Research 3,120,000 JPY
"Fundamental study on the formation of toroidal antimatter plasma"

2006-2007 JSPS Grant-in-Aid for Young Scientists (B) 3,600,000 JPY
"Confinement of non-neutral plasma in an inhomogeneous magnetic field"

2005 RIKEN Special Postdoctoral Researchers Program 1,300,000 JPY
"Formation of antimatter plasmas in cusp magnetic field configuration"

2002-2004 Grant-in-Aid for JSPS Fellow 3,500,000 JPY
"Equilibrium and confinement properties in toroidal non-neutral plasma trap"

AS A CO-INVESTIGATOR

2011-2014 JSPS Grant-in-Aid for Scientific Research (S) PI: Prof. Zensho Yoshida
"Self-organization of magnetospheric plasma - Non-linear effects of distorted metric in magnetic field"

2007-2009 JSPS Grant-in-Aid for Scientific Research (B) PI: Prof. Zensho Yoshida
"Waves and instabilities in magnetospheric plasmas"

2008-2010 JSPS Grant-in-Aid for Scientific Research (B) PI: Prof. Yuichi Ogawa
"Study on over-dense plasmas by electron Bernstein waves in a dipole magnetic confinement device"

2002-2006 JSPS Grant-in-Aid for Scientific Research (S) PI: Prof. Zensho Yoshida
"Experimental studies on the high-beta equilibrium and stability of rapidly flowing plasma produced in toroidal non-neutral plasma trap"

REFERENCES

Professor Thomas Sunn Pedersen, Max Planck Institute for Plasma Physics
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Professor Yasunori Yamazaki, RIKEN
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Professor Takashi Maekawa, Kyoto University
Kitashirakawa Oiwake-cho, Sakyo-ku, Kyoto 606-8502, JAPAN
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PERSONAL INFORMATION

Family name	Saitoh
First name	Haruhiko
Gender	Male
Date of Birth	11 February 1977
Birth place	Hiroshima Prefecture, Japan
Nationality	Japanese
Marital Status	Married, one child
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PUBLICATION LIST

REVIWED JOURNAL PAPERS

1. H. Saitoh, Y. Yano, Z. Yoshida, M. Nishiura, J. Morikawa, Y. Kawazura, T. Nogami, M. Yamasaki, "Measurement of a density profile of a hot-electron plasma in RT-1 with three-chord interferometry" Physics of Plasmas **22** ,024503 (2015).

2. H. Saitoh, T. Sunn Pedersen, U. Hergenhahn, E. V. Stenson, N. Paschkowski, C. Hugenschmidt, "Recent status of A Positron-Electron Experiment (APEX)" Journal of Physics: Conference Series **505**, 012045 (2014).

3. H. Saitoh, Y. Yano, Z. Yoshida, M. Nishiura, J. Morikawa, Y. Kawazura, T. Nogami, M. Yamasaki, "Observation of a new high-beta and high-density state of a magnetospheric plasma in RT-1" Physics of Plasmas **21**, 064502 1-4 (2014).

4. Z. Yoshida, H. Saitoh, Y. Yano, H. Mikami, N. Kasaoka, W. Sakamoto, J. Morikawa, M. Furukawa, S. M. Mahajan, "Self-organized confinement by magnetic dipole: recent results from RT-1 and theoretical modeling" Plasma Physics and Controlled Fusion 55, 014018 (2013).

5. H. Saitoh, Z. Yoshida, J. Morikawa, Y. Yano, H. Mikami, N. Kasaoka, W. Sakamoto, "Observation of magnetic fluctuations and rapid density decay of magnetospheric plasma in RT-1" Physics of Plasmas **19**, 064502 1-4 (2012).

6. H. Saitoh, Z. Yoshida, Y. Ogawa, J. Morikawa, Y. Yano, T. Mizushima, S. Mizumaki, T. Tosaka, "Demagnetization of a Bi-2223 high-temperature superconducting coil in RT-1 by spontaneous temperature rise" Cryogenics **52**, 82-85 (2012). Japanese translation is published in Teion Kogaku **45**, 107-110 (2010).

7. Z. Yoshida, Y. Yano, J. Morikawa, H. Saitoh, "Thermo-magneto coupling in a dipole plasma" Physics of Plasmas **19**, 072303 1-5 (2012).

8. N. Kuroda, H. A. Torii, Y. Nagata, M. Shibata, Y. Enomoto, H. Imao, Y. Kanai, M. Hori, H. Saitoh, H. Higaki, A. Mohri, K. Fujii, C. H. Kim, Y. Matsuda, K. Michishio, Y. Nagashima, M. Ohtsuka, K. Tanaka, Y. Yamazaki, "Development of a monoenergetic ultraslow antiproton beam source for high-precision investigation" Physical Review Special Topics - Accelerators and Beams **15**, 024702 1-10 (2012).

9. H. Saitoh, Z. Yoshida, J. Morikawa, Y. Yano, T. Mizushima, Y. Ogawa, M. Furukawa, Y. Kawai, K. Harima, Y. Kawazura, Y. Kaneko, K. Tadachi, S. Emoto, M. Kobayashi, T. Sugiura, G. Vogel, "High-β plasma formation and observation of peaked density profile in RT-1" Nuclear Fusion **51**, 063034 1-6 (2011).

10. H. Saitoh, Z. Yoshida, J. Morikawa, M. Furukawa, Y. Yano, Y. Kawai, M. Kobayashi, G.Vogel, H. Mikami, "Formation of high-β plasma and stable confinement of toroidal electron plasma in RT-1" Physics of Plasmas **18**, 056102 1-9 (2011).

11. H. Saitoh, Z. Yoshida, J. Morikawa, Y. Yano, H. Hayashi, T. Mizushima, Y. Kawai, M. Kobayashi, H. Mikami, "Confinement of electron plasma by levitating dipole magnet" Physics of Plasmas **17**, 112111 1-11 (2010).

12. H. Saitoh, Z. Yoshida, J. Morikawa, Y. Yano, T. Mizushima, M. Kobayashi, "Formation of high-β ECH plasma and inward particle diffusion in RT-1" Journal of Fusion Energy **29**, 553-557 (2010).

13. Z. Yoshida, H. Saitoh, J. Morikawa, Y. Yano, S. Watanabe, Y. Ogawa, "Magnetospheric vortex formation: Self-organized confinement of charged particles" Physical Review Letters **104**, 235004 1-4 (2010).

14. Z. Yoshida, S. M. Mahajan, T. Mizushima, Y. Yano, H. Saitoh, J. Morikawa, "Generalized two-fluid equilibria ---Understanding RT-1 experiments and beyond" Physics of Plasmas **17**, 112507 1-7 (2010).

15. Y. Yano, Z. Yoshida, Y. Ogawa, J. Morikawa, H. Saitoh,

"Feedback control of the position of the levitated superconducting magnet in the RT-1 device"
Fusion Engineering and Design **85**, 641-648 (2010).

16. H. Saitoh, Y. Yano, T. Mizushima, J. Morikawa, Z. Yoshida,
"Measurement of the density profile of a toroidal non-neutral plasma by a wall-Probe Array"
Plasma and Fusion Research **4**, 054 1-7 (2009).

17. H. Saitoh, Y. Yano, T. Mizushima, J. Morikawa, Z. Yoshida,
"Initial results of x-ray imaging and energy spectrum measurements of hot electron plasmas in RT-1"
Plasma and Fusion Research **4**, 050 1-3 (2009).

18. Y. Yano, Z. Yoshida, J. Morikawa, H. Saitoh, H. Hayashi, T. Mizushima,
"Improvement of field accuracy and plasma performance in the RT-1 device"
Plasma and Fusion Research **4**, 039 1-3 (2009).

19. Y. Ogawa, Z. Yoshida, J. Morikawa, H. Saitoh, S. Watanabe, Y, Yano, S. Mizumaki, T. Tosaka,
"Construction and operation of an internal coil device, RT-1, with a high-temperature superconductor"
Plasma and Fusion Research **4**, 020 1-8 (2009).

20. H. Imao, M. Tarek, K. Michishio, Y. Enomoto, T. Shimoyama, Y. Kanai, N. Kuroda, A. Mohri,
H. Higaki, H. Saitoh, H. A. Torii, Y. Nagata, H. Toyoda, Y. Matsuda, Y. Nagashima, Y. Yamazaki
"ASACUSA MUSASHI: New progress with intense ultra slow antiproton beam"
Hyperfine Interactions **194**, 71-76 (2009).

21. H. Saitoh, A. Mohri, Y. Enomoto, Y. Kanai, Y. Yamazaki,
"Radial compression of a non-neutral plasma in a cusp-trap for antihydrogen synthesis"
Physical Review A **77**, 051403 1-4(R) (2008).

22. S. Watanabe, H. Saitoh, Z. Yoshida,
"Modified probe characteristics in a supersonic plasma flow"
Plasma and Fusion Research **3**, 019 1-3 (2008).

23. H. Saitoh, Z. Yoshida, J. Morikawa, S. Watanabe, Y. Yano, J. Suzuki,
"Long-lived pure electron plasma in RT-1"
Plasma and Fusion Research **2**, 045 1-2 (2007).

24. Z. Yoshida, Y. Ogawa, J. Morikawa, M. Furukawa, H. Saitoh, M. Hirota, D. Hori, J. Shiraishi,
S. Watanabe, S. Numazawa, Y. Yano, J. Suzuki
"RT-1 project: Magnetosphere-like plasma experiment"
Fusion Science and Technology **51**, 2T 29-33 (2007).

25. H. Saitoh, Z. Yoshida, S. Watanabe,
"Stable confinement of toroidal electron plasma in an internal conductor device Proto-RT"
Physics of Plasmas **12**, 092102 1-7 (2005).

26. H. Saitoh, Z. Yoshida, C. Nakashima, H. Himura, J. Morikawa, M. Fukao,
"Confinement of pure electron plasmas in a toroidal magnetic-surface configuration"
Physical Review Letters **92**, 255005 1-4 (2004).

27. H. Saitoh, Z. Yoshida, H. Himura, J. Morikawa, M. Fukao,
"Potential structure of a plasma in an internal conductor device under the influence of a biased electrode"
Physics of Plasmas **11**, 3331-3334 (2004).

28. H. Saitoh, Z. Yoshida, H. Himura, J. Morikawa, M. Fukao, H. Wakabayashi,
"Formation of toroidal plasma flow in an internal conductor trap"
Journal of Plasma and Fusion Research **SERIES 6**, 179-182 (2004).

29. H. Saitoh, Z. Yoshida, C. Nakashima,
"Equilibrium of a non-neutral plasma in a toroidal magnetic shear configuration"
Review of Scientific Instruments **73**, 87-90 (2002).

30. C. Nakashima, Z. Yoshida, H. Himura, M. Fukao, J. Morikawa, H. Saitoh,
"Injection of electron beam into a toroidal trap using chaotic orbits near magnetic null"

Physical Review E **65**, 036409 1-6 (2002).

31. Y. Ogawa, H. Himura, M. Hirota, D. Hori, A. Ito, S. Kondoh, J. Morikawa, C. Nakashima, H. Nihei, R. Numata M. Ohhashi, K. Ohkuni, S. Ohsaki, H. Saitoh, N. Shatashvili, F. Volponi, H. Wakabayashi, Z. Yoshida, "Research on high-beta plasmas based on two-fluid relaxation theory" Journal of Plasma and Fusion Research SERIES **5**, 100-105 (2002).

32. H. Himura, C. Nakashima, H. Saitoh, Z. Yoshida, "Probing of flowing electron plasmas" Physics of Plasmas **8**, 4651-4658 (2001).

33. K. Yagi, Z. Yoshida, H. Himura, J. Morikawa, C. Nakashima, H. Saitoh, S. Tahara, M. Fukao, T. Uchida, "Measurement of anomalous resistance induced by chaotic motion of electrons in a magnetic null point" Journal of Plasma and Fusion Research SERIES **4**, 595-599 (2001).

34. C. Nakashima, Z. Yoshida, H. Himura, J. Morikawa, K. Yagi, H. Saitoh, "Steady state formation of an electron plasma in a toroidal geometry" Journal of Plasma and Fusion Research SERIES **4**, 368-372 (2001).

SELECTED CONFERENCE CONTRIBUTIONS (including six invited talks)

1. H. Saitoh, H. Saitoh, J. Stanja, T. Sunn Pedersen, U. Hergenhahn, E. V. Stenson, H. Niemann, N. Paschkowski, C. Hugenschmidt, G. H. Marx, L. Schweikhard, J. R. Danielson, C. M. Surko, "Status of A Positron-Electron Experiment (APEX) towards the formation of pair plasmas" (**invited talk**) 11th International Workshop on Non-neutral Plasmas, 1-4 December 2014, Takamatsu, Japan.

2. H. Saitoh, T. Sunn Pedersen, U. Hergenhahn, E. V. Stenson, J. Stanja, N. Paschkowski, C. Hugenschmidt, "Injection and trapping of electrons in a dipole magnetic field: towards the formation of an electron-positron plasma" 41st EPS Conference on Plasma Physics, 23-27 June 2014, Berlin, Germany

3. H. Saitoh, T. S. Pedersen, U. Hergenhahn, E. V. Stenson, N. Paschkowski, C. Hugenschmidt, "Recent status of A Positron-Electron Experiment (APEX)" 13th International Workshop on Slow Positron Beam Techniques and Applications, 15-20 September 2013, Technical University Munich, Germany

4. H. Saitoh, Z. Yoshida, Y. Yano, J. Morikawa, M. Furukawa, H. Mikami, N. Kasaoka, W. Sakamoto, T. Harima, Y. Kawazura, Y. Kaneko, S. Emoto, K. Tadachi, S. Emoto, S. Iizuka, Y. Goto, "Observation of magnetic fluctuations and disruption of magnetospheric plasma in RT-1" 24th IAEA Fusion Energy Conference, 8-13 October 2012, San Diego, USA.

5. H. Saitoh, Z. Yoshida, J. Morikawa, Y. Yano, N. Kasaoka, W. Sakamoto, "Confinement of a toroidal non-neutral plasma in magnetic dipole" (**invited talk**) 10th International Workshop on Non-neutral Plasmas, 27-30 August 2012, Greifswald, Germany.

6. H. Saitoh, Z. Yoshida, J. Morikawa, Y. Yano, N. Kasaoka, W. Sakamoto, "Spontaneous formation of peaked density profile in a dipole plasma" 2nd Asian Pacific Transport Working Group Meeting, 15-18 May 2012, Chengdu, China.

7. H. Saitoh, Z. Yoshida, J. Morikawa, Y. Yano, "Initial results on positron confinement in a magnetospheric configuration" 53rd Annual Meeting of the APS Division of Plasma Physics, 14-18 November 2011, Salt Lake City, USA.

8. H. Saitoh, Z. Yoshida, J. Morikawa, M. Furukawa, Y. Yano, Y. Kawai, M. Kobayashi, G.Vogel, H. Mikami, "Formation of high-beta plasma and stable confinement of toroidal electron plasma in RT-1" (**invited talk**) 52nd Annual Meeting of the APS Division of Plasma Physics, 8-12 November 2010, Chicago, USA.

9. H. Saitoh, Z. Yoshida, J. Morikawa, Y. Yano, T. Mizushima, Y. Ogawa, M. Furukawa, K. Harima, Y. Kawazura, K. Tadachi, S. Emoto, M. Kobayashi, T. Sugiura, G. Vogel "High-beta plasma confinement and inward particle diffusion in the magnetospheric device RT-1" 23rd IAEA Fusion Energy Conference, 11-16 October 2010, Daejon, Korea.

10. H. Saitoh, Z. Yoshida, J. Morikawa, Y. Yano, T. Mizushima, M. Kobayashi (RT-1),
"Overview of the recent results of the RT-1 with levitated superconducting coil" (**invited talk**)
Innovative Confinement Concepts (ICC) 2010 Workshop, 16-19 Feb 2010, Princeton, USA.

11. H. Saitoh, A. Mohri, Y. Enomoto, Y. Kanai, Y. Yamazaki (MUSASHI ASACUSA),
"Radial compression of a non-neutral plasma in a non-uniform magnetic field of a cusp trap" (**invited talk**)
9th International Workshop on Non-neutral Plasmas, 16-20 June 2008, New York, USA.
Published as AIP Conf. Proc. **1114** (*Non-Neutral Plasma Physics VII*), 163-170.

12. H. Saitoh, Z. Yoshida, Y. Ogawa, J. Morikawa, S. Watanabe, Y. Yano, J. Suzuki,
"Improved plasma properties in RT-1 with a levitated coil"
49th Annual Meeting of the APS Division of Plasma Physics, November 14 (12-16), 2007 Orlando, Florida, USA.

13. H. Saitoh, Z. Yoshida, Y. Ogawa, J. Morikawa, S. Watanabe, Y. Yano, J. Suzuki,
"Initial plasma experiment in the levitated ring trap RT-1"
48th Annual Meeting of the APS Division of Plasma Physics, November 2, 2006; Philadelphia, USA.

14. H. Saitoh, Z. Yoshida, S. Watanabe,
"Confinement of toroidal non-neutral plasma in Proto-RT" (**invited talk**)
Workshop on Physics with Ultra Slow Antiproton Beams March 15 2005 RIKEN, Saitama, Japan.
Published as AIP Conf. Proc. **793** (*Physics with Ultra Slow Antiproton Beams*), 372-390.

15. H. Saitoh, Z. Yoshida, H. Himura, J. Morikawa, M. Fukao, H. Wakabayashi,
"Formation of toroidal plasma flow in an internal conductor trap"
13th International Toki Conference December 9 2003, Toki, Japan.

16. H. Saitoh, Z. Yoshida, H. Himura, J. Morikawa, M. Fukao, H. Wakabayashi,
"Long time confinement of toroidal electron plasmas in Proto-RT"
Workshop on non-neutral plasmas 2003 July 10 2003, Santa Fe, US.
Published as AIP Conf. Proc. **692** (*Non-neutral Plasma Physics V*), 326-331.

17. H. Saitoh, Z. Yoshida, H. Himura, C. Nakashima, J. Morikawa, M. Fukao,
"Control of equilibrium structure of a toroidal non-neutral plasma in Proto-RT"
11th International Congress on Plasma Physics July 17 2002, Sydney, Australia.
Published as AIP Conf. Proc. **669** (*Plasma Physics*), 553-556.