

Yu Saito, Ph.D.

Contact Information

Date/place of birth: November 10, 1990 in Fukushima (Japan) Nationality: Japanese
RIKEN Center for Advanced Intelligence Project Phone: +81-3-6225-2373
Nihonbashi 1-4-1, Cyuo-ku, Tokyo 103-0027, Japan E-mail: yu.saito.zk@riken.jp
Web: <http://yusaito.com>

Research Interests

Condensed Matter Physics:

2D materials, van der Waals heterostructures, Superconductivity, Quantum transport, Energy dissipation, Nanomagnetometry and nanothermometry, Functional devices

Education

Doctor of Philosophy in Applied Physics (with Dean's Award) March 2018
Department of Applied Physics, The University of Tokyo
Thesis title: "Study on Electric-Field-Induced 2D Superconductivity"
Advisor: Prof. Yoshihiro Iwasa

Master of Engineering (with Distinguished Master's Thesis Award) March 2015
Department of Applied Physics, The University of Tokyo

Bachelor of Engineering (with Distinguished Bachelor's Thesis Award) March 2013
Department of Applied Physics, The University of Tokyo

Professional Experience

Postdoctoral Researcher April 2018 – present
Center for Advanced Intelligence Project, RIKEN
Advisor: Prof. Koji Tsuda
Theoretical research on 2D materials informatics using machine learning and Bayesian optimization

JSPS Research Fellow April 2015 – March 2018
Department of Applied Physics, The University of Tokyo
Advisor: Prof. Yoshihiro Iwasa
Experimental research on transport properties in ion-gated 2D materials and 2D superconductivity

Teaching Experience

Teaching Assistant October 2013 – March 2015
Department of Applied Physics, The University of Tokyo
▷ Statistical Thermodynamics
▷ Physical Mathematics

Supervision of Students

▷ Two undergraduate students and two master students at the University of Tokyo

Skills

Experimental skills

- ▷ Nanofabrication Techniques: Scanning Electron Microscope, Atomic Force Microscope, Photo-lithography, Electron-beam lithography, Electron-beam deposition, Basic semiconductor process, Fabrication of van der Waals heterostructure
- ▷ Low-Temperature Transport Measurements: general cryogenic electrical measurement, techniques (especially, operation of PPMS) combined with AC lock-in amplifier, dilution refrigerator

Computer skills

- ▷ Programming
 - Languages: C/C++, Python
 - Optimization, machine learning and statistics.
 - Basic numerical calculations.

Honors, Awards and Fellowships

- ▷ **Elings Prize Fellowship in Science**
California NanoSystems Institute, University of California, Santa Barbara
- ▷ **JSPS Ikushi Prize**
Japan Society for the Promotion of Science (JSPS), March 2018
- ▷ **Dean's Award**
Graduate School of Engineering, The University of Tokyo, March 2018
-Top of the PhD students at the department
- ▷ **JSPS Research Fellowship**
Japan Society for the Promotion of Science (JSPS), April 2015- March 2018
- ▷ **Tanaka Shouji Award (Distinguished Master's Thesis Award)**
Department of Applied Physics, The University of Tokyo, March 2015
-Top 10% of the graduating class (50+ students) at the department
- ▷ **Distinguished Bachelor's Thesis Award**
Department of Applied Physics, The University of Tokyo, March 2013
-Top 10% of the graduating class (50+ students) at the department

Grants

1. **Grant-in-Aid for JSPS Research Fellow (DC1)** April 2015 – March 2018
(No.JP15J07681)
from Japan Society for the Promotion of Science (JSPS) (Research fund of JPY3400000)

Services

Reviewer Experience

- ▷ Nature Communications, Nano Letters, Chemistry of Materials, ACS Applied Materials & Interfaces, Nanoscale, npj Quantum Materials

Outreach Activity

- ▷ Seminars and talks at Asaka high school in Fukushima, Japan, 2012-2014
- ▷ Press releases of the contents published in (Science 2015, Nature Physics 2016, Science Advances 2017)

Professional Memberships

- ▷ The Physical Society of Japan
- ▷ American Physical Society

List of Publications ([Google Scholar Citations](#), [Researcher ID](#))

Review Articles (refereed)

1. **Highly crystalline 2D superconductors**
Y. Saito, T. Nojima and Y. Iwasa
Nature Reviews Materials **2**, 16094 (2016).
[DOI: 10.1038/natrevmats.2016.94](#)
Top 1% highly cited paper in the Web of Science (2017/5-6)
2. **Gate-induced superconductivity in two-dimensional atomic crystals**
Y. Saito, T. Nojima and Y. Iwasa
Superconductor Science and Technology (SUST) **29**, 093001 (2016).
[DOI: 10.1088/0953-2048/29/9/093001](#)

Original Papers (refereed)

1. **Electric-field-control of electronic states in WS₂ nanodevices by electrolyte gating**
F. Qin, T. Ideue, W. Shi, Y. Zhang, R. Suzuki, M. Yoshida, Y. Saito and Y. Iwasa
Journal of Applied Physics **134**, e56862 (2018).
[DOI: 10.3791/56862](#)
2. **Quantum phase transitions in highly crystalline two-dimensional superconductors**
Y. Saito, T. Nojima and Y. Iwasa
Nature Communications **9**, 778 (2018).
[DOI: 10.1038/s41467-018-03275-z](#)
3. **Nonreciprocal charge transport in noncentrosymmetric superconductors**
R. Wakatsuki*, Y. Saito*(co-first), S. Hoshino, Y. M. Itahashi, T. Ideue, M. Ezawa, Y. Iwasa and N. Nagaosa
(*equal contribution)
Science Advances **3**, e1602390 (2017).
[DOI: 10.1126/sciadv.1602390](#)
See also [UTokyo Research](#)
4. **Gate-tuned thermoelectric power in black phosphorus**
Y. Saito*, T. Iizuka*, T. Koretsune, R. Arita, S. Shimizu and Y. Iwasa
(*equal contribution)
Nano Letters **16**, 4819-4824 (2016).
[DOI: 10.1021/acs.nanolett.6b00999](#)
5. **Gate-optimized thermoelectric power factor in ultrathin WSe₂ single crystals**
M. Yoshida, T. Iizuka, Y. Saito, M. Onga, R. Suzuki, Y. J. Zhang, Y. Iwasa and S. Shimizu
Nano Letters **16**, 2061-2065 (2016).
[DOI: 10.1021/acs.nanolett.6b00075](#)
6. **Superconductivity protected by spin-valley locking in ion-gated MoS₂**
Y. Saito, Y. Nakamura, M. S. Bahrany, Y. Kohama, J. T. Ye, Y. Kasahara, Y. Nakagawa, M. Onga, M. Tokunaga, T. Nojima, Y. Yanase and Y. Iwasa
Nature Physics **12**, 144-149 (2016).
[DOI: 10.1038/nphys3580](#)
Highlighted in "[Perspective](#)" in Science, "[News and Views](#)" in Nature Physics and [UTokyo Research](#)
Top 1% highly cited paper in the Web of Science (2016/5-6)

7. **Metallic ground state in an ion-gated two-dimensional superconductor**
Y. Saito, Y. Kasahara, J. T. Ye, Y. Iwasa and T. Nojima
 Science **350**, 409-413 (2015).
[DOI: 10.1126/science.1259440](https://doi.org/10.1126/science.1259440)
 See also [UTokyo Research](#)
8. **Superconductivity series in transition metal dichalcogenides by ionic gating**
 W. Shi, J. T. Ye, Y. J. Zhang, R. Suzuki, M. Yoshida, J. Miyazaki, N. Inoue, Y. Saito
 and Y. Iwasa
 Scientific Reports **5**, 12534 (2015).
[DOI: 10.1038/srep12534](https://doi.org/10.1038/srep12534)
 Top 1% highly cited paper in the Web of Science (2017/5-6)
9. **Ambipolar insulator-to-metal transition in black phosphorus by ionic-liquid gating**
Y. Saito and Y. Iwasa
 ACS Nano **9**, 3192-3198 (2015).
[DOI: 10.1021/acsnano.5b00497](https://doi.org/10.1021/acsnano.5b00497)
 Top 1% highly cited paper in the Web of Science (2016/1-2)

Japanese Articles (refereed)

1. **2D superconducting state maintained in 50 Tesla magnetic fields**
Y. Saito, Y. Iwasa, Y. Kohama and M. Tokunaga
 BUSSEIKEN DAYORI **56**(3), 20-22 (2016).
2. **Electric-double-layer transistor and two-dimensional superconductivity**
Y. Saito, T. Nojima and Y. Iwasa
 KOTBA (Solid State Physics) **51**, 775-788 (2016).

List of Invited Talks

1. **Quantum phase transitions and symmetry-breaking physics in ion-gated 2D crystalline superconductors**
 Superthin 2017 Superconductivity in atomically thin materials and heterostructures, Rugano, Switzerland, November 22nd, 2017
2. **2D crystalline superconductors with broken inversion symmetry.**
 28th International Conference on Low Temperature Physics (LT28), Gothenburg, Sweden, August 11th, 2017
3. **2D crystalline superconductors based on transition metal dichalcogenides.**
 EMN Lyon meeting on 2D materials, Lyon, France, August 8th, 2017
4. **Highly crystalline 2D superconductors.**
 CEMS Topical Meeting on Emergent 2D Materials 2017, Tokyo, Japan, July 21th, 2017
5. **Highly crystalline 2D superconductors.**
 YITP Workshop: Cutting-edge of superconductivity, Kyoto, Japan, June 19th, 2017
6. **Highly crystalline 2D superconductors protected by spin-valley locking.**
 IEEE International Magnetism Conference INTERMAG Europe 2017, Dublin, Ireland, April 28th, 2017
7. **2D superconductors without inversion symmetry.**
 CEMS Topical Meeting on Emergent Superconductivity under Extreme Condition, Tokyo, Japan, January 17th, 2017
8. **Highly-crystalline 2D superconductors and beyond.**

29th International Symposium on Superconductivity (ISS 2015), Tokyo, Japan, December 15th, 2016

9. **Ion-gated interface superconductivity in two-dimensional layered materials.**

NORDITA program : Physics of Interfaces and Layered Structures (PILS 2015), Stockholm, Sweden, September 11th, 2015

List of Contributed Talks

(First/presenting author only)

International Conferences

(Oral)

1. **Ion-gated 2D crystalline superconductors with broken inversion symmetry**

Y. Saito, Y. Itahashi, T. Ideue and Y. Iwasa

XXVI International Materials Research Congress 2017: Inorganic Analogues to Graphene, SA.5-0007, Cancun, Mexico, August 24th, 2017

2. **Nonreciprocal transport in superconducting MoS₂**

Y. Saito, R. Wakatsuki, S. Hoshino, T. Ideue, M. Ezawa, Y. Iwasa and N. Nagaosa
American Physical Society (APS) March Meeting 2017, L31-00010, New Orleans, LA, USA, March 2017

3. **Griffiths singularity of quantum phase transition in ion-gated ZrNCl**

Y. Saito, T. Nojima and Y. Iwasa

American Physical Society (APS) March Meeting 2016, S15-00003, Baltimore, MD, USA, March 2016

4. **Metallic ground state in an ion-gate two-dimensional superconductor.**

Y. Iwasa, Y. Saito Y. Kasahara, J. T. Ye and T. Nojima (as a presenter)

American Physical Society (APS) March Meeting 2015, Q20-00011, San Antonio, TX, USA, March 2015

5. **Large upper critical field in ion-gated MoS₂ superconductivity.**

Y. Saito, Y. Kohama, J. T. Ye, Y. Kasahara, M. Tokunaga and Y. Iwasa

American Physical Society (APS) March Meeting 2015, G11-00011, San Antonio, TX, USA, March 2015

6. **Two-dimensionality in electric-field-induced superconductivity.**

Y. Saito, J. T. Ye, Y. J. Zhang, Y. Kasahara, T. Nojima and Y. Iwasa

American Physical Society (APS) March Meeting 2014, T52-00008, Denver, CO, USA, March 2014

(Poster)

1. **Electric and thermoelectric properties in ion-gated black phosphorus**

Y. Saito, T. Iizuka, T. Koretsune, R. Arita and Y. Iwasa

XXVI International Materials Research Congress 2017: Inorganic Analogues to Graphene, P010, Cancun, Mexico, August 23th, 2017

2. **Cooper pairing protected by spin-valley locking in two-dimensional superconductivity on MoS₂**

Y. Saito, Y. Nakamura, M. S. Bahrany, Y. Kohama, J. T. Ye, Y. Kasahara, M. Tokunaga, T. Nojima, Y. Yanase and Y. Iwasa

American Physical Society (APS) March Meeting 2016, T1-00037, Baltimore, MD, USA, March 2016

3. **Quantum creep in a highly crystalline two-dimensional superconductor.**

Y. Saito, Y. Nakamura, M. S. Bahrany, Y. Kohama, J. T. Ye, Y. Kasahara, M. Tokunaga, T. Nojima, Y. Yanase and Y. Iwasa

American Physical Society (APS) March Meeting 2016, T1-00206, Baltimore, MD, USA, March 2016

4. **Exotic superconducting states in ion-gated two-dimensional materials.**
Y. Saito, Y. Nakamura, M. S. Bahramy, Y. Kohama, Y. Kasahara, M. Tokunaga, T. Nojima, Y. Yanase and Y. Iwasa
The 11th International Conference on Materials and Mechanism of Superconductivity (M2S), J005, Geneva, Switzerland, August 2015
5. **Interface superconductivity protected by valley-spin polarization in gate-tuned MoS₂.**
Y. Saito, Y. Nakamura, M. S. Bahramy, Y. Kohama, Y. Kasahara, M. Tokunaga, T. Nojima, Y. Yanase and Y. Iwasa
EP2DS21/MSS-17 Joint conference: 21st International Conference on Electronic Properties of Two-Dimensional Systems/17th International Conference on Modulated Semiconductor Structures, Th-PE-LN5, Sendai, Japan, July 2015
6. **Ambipolar insulator-to-metal transition and electric-field-control thermoelectric properties in black phosphorus**
Y. Saito, T. Iizuka and Y. Iwasa
NT15 The 16th International Conference on the Science and Application of Nanotubes, P110, Nagoya, Japan, June 2015
7. **Asymmetric capacitance and ambipolar metal insulator transition in black phosphorus.**
Y. Saito, and Y. Iwasa
American Physical Society (APS) March Meeting 2015, H1-00234, San Antonio, TX, USA, March 2015

International Workshops/Symposiums

(Poster)

1. **Enhanced upper critical field and nonreciprocal transport in superconducting MoS₂.**
Y. Saito, R. Wakatsuki, S. Hoshino, T. Ideue, M. Ezawa, Y. Iwasa and N. Nagaosa
CEMS-QPEC Symposium on Emergent Quantum Materials, Tokyo, Japan, January 2017
2. **Quantum Griffiths singularity and associated quantum metal in highly-crystalline two-dimensional superconductors.**
Y. Saito, T. Nojima and Y. Iwasa
FET2016, International Workshop on Field-Effect Transistors and Functional Interfaces, Minneapolis, MN, USA, August 2016
3. **Noncentrosymmetric quasi-single-layer superconductivity in electrolyte-gated MoS₂.**
Y. Saito, Y. Nakamura, M. S. Bahramy, Y. Kohama, Y. Kasahara, M. Tokunaga, T. Nojima, Y. Yanase and Y. Iwasa
CEMS International Symposium on Supramolecular Chemistry and Functional Materials 2016, P-05, Tokyo, Japan, January 2016
4. **Two-dimensional superconductivity protected by spin-valley locking in ion-gated MoS₂**
Y. Saito, Y. Nakamura, M. S. Bahramy, Y. Kohama, Y. Kasahara, M. Tokunaga, T. Nojima, Y. Yanase and Y. Iwasa
CEMS Topical Meeting on Emergent 2D Materials, P-01, Wako, Japan, December 2015
5. **Electron transport in ion-gated black phosphorus.**
Y. Saito, T. Iizuka, T. Koretsune, R. Arita and Y. Iwasa
CEMS Topical Meeting on Emergent 2D Materials, P-02, Wako, Japan, December

2015

6. **Exotic phenomena in ion-gated two-dimensional superconductors.**
Y. Saito, Y. Nakamura, M. S. Bahramy, Y. Kohama, Y. Kasahara, M. Tokunaga, T. Nojima, Y. Yanase and Y. Iwasa
PILS 2015, Physics of Interfaces and Layered Structures, Stockholm, Sweden, August 2015
7. **Exploratory novel properties and materials of electric-field-induced superconductors.**
Y. Saito, J. T. Ye, Y. Kasahara, T. Nojima and Y. Iwasa
FET2014, International Workshop on Field-Effect Transistors and Functional Interfaces, Poster10, Kashiwa, Japan, October 2014
8. **Two dimensional superconducting phase in gate induced superconductivity with quantum dynamics.**
Y. Saito, T. Nojima and Y. Iwasa
The 6th Indo-Japan Seminar Physics and Design of Multi-Functional Correlated Materials, P28, Tokyo, Japan, March 2014
9. **Two-dimensionality in electric-field-induced superconductivity.**
Y. Saito, J. T. Ye, Y. J. Zhang, Y. Kasahara, T. Nojima and Y. Iwasa
FIRST International Symposium on “ Topological Quantum Technology ”, P23, Tokyo, Japan, January 2014
10. **Two-dimensionality in electric-field-induced superconductivity.**
Y. Saito, J. T. Ye, Y. J. Zhang, Y. Kasahara, T. Nojima and Y. Iwasa
RIKEN-APW joint workshop “Highlights in condensed matter physics”, P29, Wako, Japan, January 2014

References

Yoshihiro Iwasa

Professor

Department of Applied Physics, The University of Tokyo

Phone: +81-3-5841-6828

E-mail: iwasa@ap.t.u-tokyo.ac.jp

Youichi Yanase

Associate Professor

Department of Physics, Kyoto University

Phone: +81-75-753-3771

E-mail: yanase@scphys.kyoto-u.ac.jp

Yuanbo Zhang

Professor

Department of Physics, Fudan University

Phone: +86-21-51630268

E-mail: zhyb@fudan.edu.cn