

Yu Saito

Contact Information

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Research Interests

Condensed Matter Physics:

2D materials (including 2D superconductors, 2D magnets),
Van der Waals heterostructure, Quantum Transport, Functional Devices

Materials Informatics:

Optimization/Exploration/Design of interface structure and materials properties, especially in 2D materials (Bayesian Optimization, Feature Selection)

Education

Doctor of Philosophy in Engineering Expected March 2018
Department of Applied Physics, The University of Tokyo — Tokyo, Japan
Advisor: Prof. Yoshihiro Iwasa

Master of Engineering (with Distinguished Master's Thesis Award) March 2015
Department of Applied Physics, The University of Tokyo — Tokyo, Japan
Thesis title: "Superconductivity in Ion-gated Two-dimensional Materials"
Advisor: Prof. Yoshihiro Iwasa

Bachelor of Engineering (with Distinguished Bachelor's Thesis Award) March 2013
Department of Applied Physics, The University of Tokyo — Tokyo, Japan
Thesis title: "Nano Interface Phase Transition Device with Layered Thin Films"
Advisor: Prof. Yoshihiro Iwasa & Dr. Jianting Ye

Professional Experience

Research Fellow April 2015 – present
The University of Tokyo — Tokyo, Japan
Mentor: Prof. Yoshihiro Iwasa

Experimental research on condensed matter physics and quantum nanoelectronics

- ▷ Quantum transport in 2D materials (semiconductor/metal/superconductors).
- ▷ Gate-control of 2D materials properties by using a FET structure and ionic liquid.
- ▷ Nonlinear response in noncentrosymmetric materials

Grants from Grant-in-Aid for JSPS Research Fellow (DC1, No.JP15J07681)

Teaching Experience

Teaching Assistant October 2013 – March 2015
The University of Tokyo — Tokyo, Japan

- ▷ Statistical Thermodynamics
- ▷ Physical Mathematics

Skills

Experimental skills

- ▷ Nanofabrication Techniques: Scanning Electron Microscope (SEM), Atomic Force Microscope (AFM), Photolithography, E-beam lithography, vacuum deposition of metals, Basic semiconductor process
- ▷ Low-Temperature Measurements: general cryogenic techniques (esp. operation of PPMS, Quantum Design) combined with AC lock-in amplifier
- ▷ Electronics Techniques: low noise DC and AC measurements on electronic devices using analytic tools.
- ▷ Deep knowledge of superconductivity and 2D materials, Extensive knowledge of quantum nanoelectronics and device physics, Broad knowledge of quantum mechanics and statistical physics

Computer skills

- ▷ Software
 - Pattern designs using AutoCAD
 - Data visualization with Igor Pro and tableau etc.
 - Designs of schematic images with Adobe Photoshop and Illustrator.
- ▷ Programming – Languages: C/C++, Python
 - Applied machine learning and statistics for the real-world problems.
 - Numerical calculations for the physical problems.

Soft skills

- ▷ Distinguished problem setting and solving ability
- ▷ High self-learning ability in unexplored territory
- ▷ Experienced team player and strong leadership

Honors and Awards

- ▷ Silver medal at Kaggle competition "Santa's uncertain bags"
 - 13th place out of 600+ teams (Top 2%)
- ▷ Tanaka Shouji Award (Distinguished Master's Thesis Award) in 2015
 - Top 10% of the graduating class (50+ students) at the department
- ▷ Distinguished Bachelor's Thesis Award in 2013
 - Top 10% of the graduating class (60+ 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 (Research fund of JPY3400000)

Services

Reviewer Experience

- ▷ Nature Communications, Scientific Reports Nano Letters, Chemistry of Materials, Physical Review B, Nanoscale

Supervisor Experience

- ▷ Two undergraduate students and one master student at the University of Tokyo

Professional Memberships

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

Publication List ([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](https://doi.org/10.1038/natrevmats.2016.94)
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](https://doi.org/10.1088/0953-2048/29/9/093001)

Original Papers (refereed)

1. **Nonreciprocal charge transport in noncentrosymmetric superconductors**
R. Wakatsuki*, Y. Saito*, S. Hoshino, Y. M. Itahashi, T. Ideue, M. Ezawa, Y. Iwasa and N. Nagaosaa
(*equal contribution)
Science Advances **3**, e1602390 (2017).
DOI: [10.1126/sciadv.1602390](https://doi.org/10.1126/sciadv.1602390)
2. **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](https://doi.org/10.1021/acs.nanolett.6b00999)
3. **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](https://doi.org/10.1021/acs.nanolett.6b00075)
4. **Superconductivity protected by spin-valley locking in ion-gated MoS₂**
Y. Saito, Y. Nakamura, M. S. Bahramy, 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](https://doi.org/10.1038/nphys3580)
See also "[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)
5. **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](#)
6. **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)
7. **Ambipolar insulator-to-metal transition in black phosphorus by ionic-liquid gating**
Y. Saito and Y. Iwasa
ACS Nano **9**, 3192-3198 (2015).

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).

Invited Talks

1. **2D crystalline superconductors with broken inversion symmetry.**
28th International Conference on Low Temperature Physics (LT28), Gothenburg, Sweden, August 11th, 2017
2. **2D crystalline superconductors based on transition metal dichalcogenides.**
EMN Lyon meeting on 2D materials, Lyon, France, August 8th, 2017
3. **Highly crystalline 2D superconductors.**
CEMS Topical Meeting on Emergent 2D Materials 2017, Tokyo, Japan, July 21th, 2017
4. **Highly crystalline 2D superconductors.**
YITP Workshop: Cutting-edge of superconductivity, Kyoto, Japan, June 19th, 2017
5. **Highly crystalline 2D superconductors protected by spin-valley locking.**
IEEE International Magnetics Conference INTERMAG Europe 2017, Dublin, Ireland, April 28th, 2017
6. **2D superconductors without inversion symmetry.**
CEMS Topical Meeting on Emergent Superconductivity under Extreme Condition, Tokyo, Japan, January 17th, 2017
7. **Highly-crystalline 2D superconductors and beyond.**
29th International Symposium on Superconductivity (ISS 2015), Tokyo, Japan, December 15th, 2016
8. **Ion-gated interface superconductivity in two-dimensional layered materials.**
NORDITA program : Physics of Interfaces and Layered Structures (PILS 2015), Stockholm, Sweden, September 11th, 2015

Presentations

(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. Bahramy, 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. Bahramy, 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

Domestic Conferences (in Japanese)

(Oral)

1. **Quantum phase transition in highly-crystalline 2D superconductors**
Y. Saito, T.Nojima and Y. Iwasa
JSPS 2017 Autumn Meeting, 24aA29-3, Iwate, September 2017
2. **Quantum phase transition in highly-crystalline 2D superconductors**
Y. Saito, T.Nojima and Y. Iwasa
24th Vortex physics domestic conference, 27p1-3, Akita, November 2016
3. **Nonreciprocal superconducting current in ion-gated MoS₂**
Y. Saito, T.Ideue and Y. Iwasa
JSPS 2016 Autumn Meeting, 14aBH-3, Ishikawa, September 2016
4. **Quantum Griffiths Phase in ion-gated ZrNCl**
Y. Saito, T.Nojima and Y. Iwasa
JSPS 2016 Autumn Meeting, 13aAC-8, Ishikawa, September 2016
5. **Ambipolar insulator-to-metal transition in black phosphorus**
Y. Saito and Y. Iwasa
JSPS 2015 Autumn Meeting, 14aBH-3, Osaka, September 2014
6. **Large upper critical field in ion-gated MoS₂**
Y. Saito, Y. Kohama, J. T. Ye, Y. Kasahara, M. Tokunaga, T. Nojima and Y. Iwasa
JSPS 70th Annual Meeting, 21aAA-5, Tokyo, March 2015
7. **Two-dimensional vortex dynamic in ion-gated**
Y. Saito, J. T. Ye, Y. Kasahara, T. Nojima and Y. Iwasa
JSPS 69th Annual Meeting, 27aCA-4, Kanagawa, March 2014
8. **Two-dimensionality in electric-field-induced superconductivity**
Y. Saito, J. T. Ye, Y. Kasahara, T. Nojima and Y. Iwasa
JSPS 2013 Autumn Meeting, 25pEA-8, Tokushima, September 2013

(Poster)

1. **Ratchet effect and nonlinear-Hall effect in 2D noncentrosymmetric superconductors**
Y. Saito, Y. Itahahsi, T. Ideue, and Y. Iwasa
YITP Workshop: Cutting-edge of superconductivity, Kyoto, Japan, June 20th, 2017
2. **Quantum phase in gate-induced superconductivity**
Y. Saito, T. Nojima and N. Nagaosa
YITP Workshop: Cutting-edge of superconductivity, Kyoto, Japan, June 20th, 2017
3. **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
The 8th Research Meeting in Cryogenic Research Center, Tokyo, February 2017
4. **Superconductivity 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 7th Research Meeting in Cryogenic Research Center, Tokyo, February 2016
5. **Exotic properties of superconductivity 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
JSPS 2015 Autumn Meeting, 14aBH-3, Osaka, September 2014

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

Y. Saito

2013 Summer School for Students Researching Condensed Matter Physics, P-01,
Shiga, August 2013

References

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