

Yu Saito, Ph.D.

Personal and Contact Information

Date/place of birth: November 10, 1990 in Fukushima (Japan) Nationality: Japanese
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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 in Applied Physics (with Distinguished Master's Thesis Award)
Department of Applied Physics, The University of Tokyo March 2015

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

Research Experience

Elings Prize Fellow October 2018 – present
California NanoSystems Institute, University of California, Santa Barbara
Advisor: Prof. Andrea Young
Experimental research on quantum phenomena in 2D materials using transport measurements and nanoSQUID-on-tip microscopy

Postdoctoral Researcher April 2018 – September 2018
Center for Advanced Intelligence Project, RIKEN
Advisor: Prof. Koji Tsuda
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 superconductors

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 for their undergraduate/graduate research project
- ▷ Intern master student from Harvard University for short-period project

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, statics and basic numerical calculations.

Honors, Awards and Fellowships

- ▷ **Elings Prize Fellowship in Science 2018**
California NanoSystems Institute, University of California, Santa Barbara
March 2018
- ▷ **8th JSPS Ikushi Prize**
Japan Society for the Promotion of Science (JSPS), March 2018
- ▷ **Dean's Award in the Graduate School of Engineering**
Graduate School of Engineering, The University of Tokyo, March 2018
- ▷ **JSPS Research Fellowship for Young Scientists DC1**
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
- ▷ **Distinguished Bachelor's Thesis Award**
Department of Applied Physics, The University of Tokyo, March 2013

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

- ▷ Science Advances, Nature Communications, Nano Letters, Chemistry of Materials, ACS Applied Materials & Interfaces, Nanoscale, npj Quantum Materials, Communication Physics, Journal of Materials Chemistry C

Outreach Activity

- ▷ Seminars and talks at Asaka high school in Fukushima, Japan, 2012-2014
- ▷ Press releases of the researches published in (Science 2015, Nature Physics 2016, Science Advances 2017, Nature Communications 2018)

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

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)
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](https://doi.org/10.1088/0953-2048/29/9/093001)

Original Papers (refereed)

1. **Gate-controlled low carrier density superconductors: Toward the two-dimensional BCS-BEC crossover**
Y. Nakagawa, Y. Saito, T. Nojima, K. Inumaru, S. Yamanaka and Y. Kasahara and Y. Iwasa
Physical Review B **98**, 064512 (2018).
DOI: [10.1103/PhysRevB.98.064512](https://doi.org/10.1103/PhysRevB.98.064512)
2. **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 Visualized Experiments **134**, e56862 (2018).
DOI: [10.3791/56862](https://doi.org/10.3791/56862)
3. **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](https://doi.org/10.1038/s41467-018-03275-z)
4. **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](https://doi.org/10.1126/sciadv.1602390)
See also [UTokyo Research](#)
5. **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)
6. **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)

7. **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)
 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)
8. **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**
9. **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)
10. **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/acs.nano.5b00497](https://doi.org/10.1021/acs.nano.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. **Highly crystalline 2D superconductors produced by ionic-liquid gating**
 EMRS 2018 Fall meeting - Recent progress in superconductivity of two-dimensional layered system, Warszawa, Poland, September 18th, 2018
2. **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
3. **2D crystalline superconductors with broken inversion symmetry.**
 28th International Conference on Low Temperature Physics (LT28), Gothenburg, Sweden, August 11th, 2017
4. **2D crystalline superconductors based on transition metal dichalcogenides.**
 EMN Lyon meeting on 2D materials, Lyon, France, August 8th, 2017
5. **Highly crystalline 2D superconductors.**

- CEMS Topical Meeting on Emergent 2D Materials 2017, Tokyo, Japan, July 21th, 2017
6. **Highly crystalline 2D superconductors.**
YITP Workshop: Cutting-edge of superconductivity, Kyoto, Japan, June 19th, 2017
 7. **Highly crystalline 2D superconductors protected by spin-valley locking.**
IEEE International Magnetics Conference INTERMAG Europe 2017, Dublin, Ireland, April 28th, 2017
 8. **2D superconductors without inversion symmetry.**
CEMS Topical Meeting on Emergent Superconductivity under Extreme Condition, Tokyo, Japan, January 17th, 2017
 9. **Highly-crystalline 2D superconductors and beyond.**
29th International Symposium on Superconductivity (ISS 2016), Tokyo, Japan, December 15th, 2016
 10. **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. **Quantum phase transitions in highly crystalline 2D superconductors**
Y. Saito, T. Nojima and Y. Iwasa
American Physical Society (APS) March Meeting 2018, L35-00010, Los Angeles, CA, USA, March 2018
2. **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
3. **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
4. **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
5. **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
6. **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
7. **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

References

Yoshihiro Iwasa (PhD supervisor)

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