Yu Saito, Ph.D.

Contact Information

California NanoSystems Institute University of California, Santa Barbara
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Personal Web: http://yusaito.com, LinkedIn, Google Scholar Profile

Research Experience

Elings Prize Fellow October 2018 – present
California NanoSystems Institute, University of California at Santa Barbara, CA, USA
Advisor: Prof. Andrea Young
Experimental research on quantum phenomena in twisted bilayer graphene and flat band physics

Postdoctoral Researcher April 2018 – September 2018
Center for Advanced Intelligence Project, RIKEN, Tokyo, Japan
Advisor: Prof. Koji Tsuda
Research on deep learning based classification of optical microscope images of 2D materials

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

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

Teaching Experience

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

Supervision/Training of Students

- ▷ Two undergraduate/master students at the University of Tokyo for their research projects
- ▷ Intern master student from Harvard University for the summer project
- ▷ Two undergraduate students at UC Santa Barbara for their research projects
- ▷ Two undergraduate students from Peking University for their summer projects

Skills

Experimental skills

- ▷ Nanofabrication Techniques: Scanning Electron Microscope, Atomic Force Microscope, Photo-lithography, Electron-beam lithography, Electron-beam deposition, Basic semiconductor process, Stacking of van der Waals heterostructure

▷ Low-Temperature Transport Measurements: general cryogenic electrical measurement techniques , dilution refrigerator

Computer skills

▷ Programming
– Languages: Python (Advanced), C/C++ (basic)
– Measurement program implemented with Python-based LabRAD platform
- Data analysis (numpy/pandas/scikit-learn), Kaggle Expert

Honors, Awards and Fellowships

▷ **37th Inoue Research Award for Young Scientists**
Inoue Foundation for Science, February 2021

▷ **13th Young Scientist Award of the Physical Society of Japan (Division 6)**
Physical Society of Japan, March 2019

▷ **Elings Prize Fellowship in Science 2018 (Postdoctoral Fellowship)**
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 (Graduate Student Fellowship)**
Japan Society for the Promotion of Science (JSPS), April 2015- March 2018

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)

Synergistic Activities

Reviewer Experience

▷ Science, Science Advances, Nature Physics, Nature Communications, Scientific reports Physical Review X, Physical Review Letters, Nano Letters, Chemistry of Materials, ACS Applied Materials & Interfaces, Nanoscale, npj Quantum Materials, Communication Physics, Communication Materials

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) from the University of Tokyo

List of Publications (Google Scholar Citations, Publons, ORCID)

Peer-reviewed Papers

(*equal contribution)

1. **Isospin Pomeranchuk effect in twisted bilayer graphene**
   Y. Saito*, F. Wang*, J. Ge, X. Liu, T. Taniguchi, K. Watanabe, J.I.A. Li, E. Berg, A. F. Young
   Nature **592**, 220-224 (2021).
   DOI: 10.1038/s41586-021-03409-2
   Highlighted in "**News and Views**" in Nature, "**Research Update**" in Physics World, "**Report**" in PHYS ORG and **Journal club for condensed matter physics**.

2. **Hofstadter subband ferromagnetism and symmetry broken Chern insulators in twisted bilayer graphene**
   Y. Saito, J. Ge, L. Rademaker, K. Watanabe, T. Taniguchi, D. A. Abanin, A. F. Young
   Nature Physics **17**, 478-481 (2021).
   DOI: 10.1038/s41567-020-01129-4

3. **Independent superconductors and correlated insulators in twisted bilayer graphene**
   Y. Saito, J. Ge, K. Watanabe, T. Taniguchi, A. F. Young
   Nature Physics **16**, 926-930 (2020).
   DOI: 10.1038/s41567-020-0928-3
   Highlighted in **Journal club for condensed matter physics**.

4. **Dynamical vortex phase diagram of two-dimensional superconductivity in gated MoS_2**
   Y. Saito, Y. M. Itahashi, T. Nojima and Y. Iwasa
   Physical Review Materials **4**, 074003 (2020).
   DOI: 10.1103/PhysRevMaterials.4.074003
   Selected as **Editor's Suggestion**

5. **Quantum and classical ratchet motions of vortices in a 2D trigonal superconductor**
   Y. M. Itahashi*, **Y. Saito***, T. Nojima, T. Ideue and Y. Iwasa
   Physical Review Research **2**, 023127 (2020).
   DOI: 10.1103/PhysRevResearch.2.023127

6. **Nonreciprocal transport in gate-induced polar superconductor $SrTiO_3$**
   Y. M. Itahashi, T. Ideue, **Y. Saito**, S. Shimizu, T. Ouchi, T. Nojima and Y. Iwasa
   Science Advances **6**, eaay9120 (2020).
   DOI: 10.1126/sciadv.aay9120

7. **Deep learning-based quality filtering of mechanically exfoliated 2D crystals**
   Y. Saito*, Kento Shin*, Kei Terayama, Shaan Desai, Masaru Onga, Yuji Nakagawa, Yuki M. Itahashi, Yoshihiro Iwasa, Makoto Yamada, Koji Tsuda
   npj Computational Materials **5**, 124 (2019).
   DOI: 10.1038/s41524-019-0262-4

8. **Gate-controlled low carrier density superconductors: Toward the two-dimensional BCS-BEC crossover**
   Y. Nakagawa, **Y. Saito**, T. Nojima, K. Inumaru, S. Yamanakaand, Y. Kasahara and Y. Iwasa
   Physical Review B **98**, 064512 (2018).
   DOI: 10.1103/PhysRevB.98.064512

9. **Electric-field-control of electronic states in WS_2 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

10. **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
Selected as **Editors' Highlights**
See also **UTokyo Research**

11. **Nonreciprocal charge transport in noncentrosymmetric superconductors**
R. Wakatsuki*, **Y. Saito***, S. Hoshino, Y. M. Itahashi, T. Ideue, M. Ezawa, Y. Iwasa and N. Nagaosa
Science Advances **3**, e1602390 (2017).
DOI: 10.1126/sciadv.1602390
See also **UTokyo Research**

12. **Highly crystalline 2D superconductors**
Y. Saito, T. Nojima and Y. Iwasa
Nature Reviews Materials **2**, 16094 (2016).
DOI: 10.1038/natrevmats.2016.94

13. **Gate-induced superconductivity in two-dimensional atomic crystals**
Y. Saito, T. Nojima and Y. Iwasa
Superconductor Science and Technology **29**, 093001 (2016).
DOI: 10.1088/0953-2048/29/9/093001

14. **Gate-tuned thermoelectric power in black phosphorus**
Y. Saito*, T. Iizuka*, T. Koretsune, R. Arita, S. Shimizu and Y. Iwasa
Nano Letters **16**, 4819-4824 (2016).
DOI: 10.1021/acs.nanolett.6b00999

15. **Gate-optimized thermoelectric power factor in ultrathin WSe_2 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

16. **Superconductivity protected by spin-valley locking in ion-gated MoS_2**
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
Highlighted in "**Perspective**" in Science, "**News and Views**" in Nature Physics and **UTokyo Research**

17. **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
See also **UTokyo Research**

18. **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

19. **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

Japanese Articles

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 and Seminars

1. **Isospin analogue of the Pomeranchuk effect in twisted bilayer graphene**
APS March Meeting 2021, March 2021 (via Zoom)

2. **Strongly correlated phenomena in twisted bilayer graphene**
The 68th JSAP Spring Meeting 2021, March 2021 (via Zoom)

3. **Isospin Pomeranchuk effect in twisted bilayer graphene**
The 60th Fullerenes, Nanotubes and Graphene Research General Symposium, March 2021 (via Zoom)

4. **Superconductivity and Chern insualtors in twisted bilayer graphene**
The University of Tokyo, Tokyo, May 4th, 2020 (via Zoom)
Hosted by Prof. Yoshihiro Iwasa

5. **Ion-Gated 2D Crystalline Superconductors**
Seminar at ICFO, Barcerona, Spain, July 9th, 2019
Hosted by Prof. Dimitri Efetov

6. **Study on Electric-field-induced 2D superconductivity**
JSPS 74th Annual Meeting, Fukuoka, March 2019

7. **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

8. **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

9. **2D crystalline superconductors with broken inversion symmetry.**
28th International Conference on Low Temperature Physics (LT28), Gothenburg, Sweden, August 11th, 2017

10. **2D crystalline superconductors based on transition metal dichalcogenides.**
EMN Lyon meeting on 2D materials, Lyon, France, August 8th, 2017

11. **Highly crystalline 2D superconductors.**
    CEMS Topical Meeting on Emergent 2D Materials 2017, Tokyo, Japan, July 21th, 2017
12. **Highly crystalline 2D superconductors.**
    YITP Workshop: Cutting-edge of superconductivity, Kyoto, Japan, June 19th, 2017
13. **Highly crystalline 2D superconductors protected by spin-valley locking.**
    IEEE International Magnetics Conference INTERMAG Europe 2017, Dublin, Ireland, April 28th, 2017
14. **2D superconductors without inversion symmetry.**
    CEMS Topical Meeting on Emergent Superconductivity under Extreme Condition, Tokyo, Japan, January 17th, 2017
15. **Highly-crystalline 2D superconductors and beyond.**
    29th International Symposium on Superconductivity (ISS 2016), Tokyo, Japan, December 15th, 2016
16. **Ion-gated interface superconductivity in two-dimensional layered materials.**
    NORDITA program : Physics of Interfaces and Layered Structures (PILS 2015), Stockholm, Sweden, September 11th, 2015

References

Yoshihiro Iwasa (PhD supervisor)
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Koji Tsuda (Postdoc supervisor)
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Youichi Yanase (Collaborator)
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