

Takashi Kurumaji

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EDUCATION

University of Tokyo, Department of Applied Physics Sept. 26, 2014
PhD of Engineering
Advisor: Prof. Yoshinori Tokura
Thesis: Magnetoelectric responses in magnetic insulators without inversion symmetry

University of Tokyo, Department of Applied Physics March 2012
M. Eng. Applied Physics
Advisor: Prof. Yoshinori Tokura
Thesis: Magnetoelectric responses in triangular-lattice transition-metal halides MX_2

University of Tokyo, Department of Applied Physics March 2010
B.S. Applied Physics

ACADEMIC POSITIONS

California Institute of Technology, Division of Physics, Mathematics and Astronomy September 2023 - Present
Research Professor

The University of Tokyo, Department of Advanced Materials Science August 2020 – August 2023
LEADER ((Leading Initiative for Excellent Young Researchers program, MEXT Japan) Research Associate

POSTDOCTORAL RESEARCH POSITIONS

Massachusetts Institute of Technology October 2017 – July 2020
Overseas Research Fellow (JSPS), Department of Physics, Checkelsky group

RIKEN Center for Emergent Matter Science April 2015 – October 2017
Special Postdoctoral Researcher, Strong Correlation Physics Research Group

The University of Tokyo October 2014 – March 2015
Research Fellow for Young Science (JSPS), Department of Applied Physics, Tokura group

AWARDS

Inamori Research Grants 2023 April 2023-August 2023

Young Scientist Award of the Physical Society of Japan, Division 8 (Strongly Correlated Electron Systems),
“Development of new skyrmion-hosting materials and relationship with centrosymmetry”
October 2021

Grant-In-Aid for Young Scientists no. 21K13874 April 2021-March 2023

Leading Initiative for Excellent Young Researchers (LEADER), Japan Society for the Promotion Science
October 2020-Present

Overseas Research Fellow, Japan Society for the Promotion of Science May 2018-April 2020

Fellowship for Research Abroad, Yamada Science Foundation October 2017-April 2018

Grant-In-Aid for Young Scientists (B) no. 17K14351 April 2017-October

Research Fellow for Young Science (PD), Japan Society for the Promotion of Science October 2015-March 2015

Research Fellow for Young Science (DC1), Japan Society for the Promotion of Science

April 2012 -September 2015

Shoji Tanaka Prize (Master Thesis Award), Department of Applied Physics, University of Tokyo March 2012

Bachelor Thesis Award, Department of Applied Physics, University of Tokyo March 2010

PUBLICATION

34. “Low-temperature hysteresis broadening emerging from domain-wall creep dynamics in a two-phase competing system”

K. Matsuura, Y. Nishizawa, Y. Kinoshita, **T. Kurumaji**, A. Miyake, H. Oike, M. Tokunaga, Y. Tokura, and F. Kagawa (accepted to Commun. Mater.).

33. “Crucial roles of phase competition and spin-lattice relaxation in gigantic switchable optomagnet effect of $(\text{Fe}_{0.875}\text{Zn}_{0.125})_2\text{Mo}_3\text{O}_8$ ”

Y. H. Zhuang, H. W. Liu, Y. H. Li, Y. M. Chang, **T. Kurumaji**, Y. Tokura, and Y. M. Sheu (Phys. Rev. B 108, 024421 (2023)).

32. “Symmetry-based requirement for the measurement of electrical and thermal Hall conductivity under an in-plane magnetic field”

T. Kurumaji (Phys. Rev. Research 5, 023138 (2023), arXiv:2304.00785 (2023)).

31. “Thermodynamic determination of the equilibrium first-order phase-transition line hidden by hysteresis in a phase diagram”

K. Matsuura, Y. Nishizawa, M. Kriener, **T. Kurumaji**, H. Oike, Y. Tokura, and F. Kagawa (Sci. Rep. 13, 6876 (2023), arXiv:2303.00327 (2023)).

30. “Double dome structure of the Bose-Einstein condensation in diluted $S = 3/2$ quantum magnets”

Y. Watanabe, A. Miyake, M. Gen, Y. Mizukami, K. Hashimoto, T. Shibauchi, A. Ikeda, M. Tokunaga, **T. Kurumaji**, Y. Tokunaga, and T.-h. Arima (Nat. Commun. 14, 1260 (2023)).

29. “Rhombic skyrmion lattice coupled with orthorhombic structural distortion EuAl_4 ”

M. Gen, R. Takagi, Y. Watanabe, S. Kitou, H. Sagayama, N. Matsuyama, Y. Kohama, A. Ikeda, Y. Ōnuki, **T. Kurumaji**, T.-h. Arima, and S. Seki (Physical Review B 107, L020410 (2023), arXiv:2209.12751 (2022)).

28. “Single crystal growths and magnetic properties of hexagonal polar semimetals RAuGe ($R = \text{Y, Gd-Tm, and Lu}$)”

T. Kurumaji, M. Gen, S. Kitou, K. Ikeuchi, M. Nakamura, A. Ikeda, and T.-h. Arima (J. Alloys Compd. 947, 169475 (2023), arXiv:2301.02794 (2023))

27. “Polarized neutron scattering study on the centrosymmetric skyrmion host material Gd_2PdSi_3 ”

J. Ju, H. Saito, **T. Kurumaji**, M. Hirschberger, A. Kikkawa, Y. Taguchi, T.-h. Arima, Y. Tokura, and T. Nakajima (Physical Review B 107, 024405 (2023), arXiv:2208.08188 (2022)).

26. “Magnetic-field-induced antiferromagnetic-antiferromagnetic phase transition in quasi-two-dimensional multiferroic material $\text{Ba}_2\text{FeSi}_2\text{O}_7$ ”

Y. Watanabe, M. Gen, **T. Kurumaji**, Y. Tokunaga, and T.-h. Arima (Journal of the Physical Society of Japan, 92, 014701 (2023)), selected as JPSJ Hot Topics (doi.org/10.7566/JPSHT.3.005).

25. “Anisotropic magnetotransport properties coupled with spiral spin modulation in a magnetic semimetal EuZnGe ”

T. Kurumaji, M. Gen, S. Kitou, H. Sagayama, A. Ikeda, and T.-h. Arima (Physical Review Materials, 6, 094410 (2022), arXiv:2208.02385, (2022)).

24. “Complex magnetic phase diagram with a small phase pocket in a three-dimensional frustrated magnet $\text{CuInCr}_4\text{S}_8$ ”
M. Gen, H. Ishikawa, A. Ikeda, A. Miyake, Z. Yang, Y. Okamoto, M. Mori, K. Takenaka, **T. Kurumaji**, Y. Tokunaga, T. Arima, M. Tokunaga, K. Kindo, Y. H. Matsuda, and Y. Kohama (Physical Review Research, **4**, 033148 (2022), arXiv:2112.08990, (2022)).
23. “Néel-type skyrmions detected through polarized small-angle neutron scattering”
T. Kurumaji (Neutron News **32**, 20 (2021)).
22. “Direct observation of cycloidal spin modulation and field-induced transition in Néel-type Skyrmion-hosting VOSe_2O_5 ”
T. Kurumaji, T. Nakajima, A. Feoktystov, V. Ukleev, T. Arima, K. Kakurai, and Y. Tokura (Journal of the Physical Society of Japan **90**, 024705-pp1-7 (2021), arXiv:1912.06309).
21. “Signatures of ultrafast reversal of excitonic order in Ta_2NiSe_5 ”
H. Ning, O. Mehio, M. Buchhold, **T. Kurumaji**, G. Refael, J. G. Checkelsky, and D. Hsieh (Physical Review Letters **125**, 267602-pp1-6 (2020), arXiv:2012.12912).
20. “Topological Nernst effect of the two-dimensional skyrmion lattice”
M. Hirschberger, L. Spitz, T. Nomoto, **T. Kurumaji**, S. Gao, J. Masell, T. Nakajima, A. Kikkawa, Y. Yamasaki, H. Sagayama, H. Nakao, Y. Taguchi, R. Arita, T.-h. Arima, and Y. Tokura (Phys. Rev. Lett. **125**, 076602 (2020), arXiv:1910.06027).
19. “High-field depinned phase and planar Hall effect in the skyrmion host Gd_2PdSi_3 ”
M. Hirschberger, T. Nakajima, M. Kriener, **T. Kurumaji**, L. Spitz, S. Gao, A. Kikkawa, Y. Yamasaki, H. Sagayama, H. Nakao, S. Ohira-Kawamura, Y. Taguchi, T.-h. Arima, and Y. Tokura (Phys. Rev. B **101**, 220401(R) (2020)).
18. “Ordering phenomena of spin trimers accompanied by large geometrical Hall effect”
S. Gao, M. Hirschberger, O. Zaharko, T. Nakajima, **T. Kurumaji**, A. Kikkawa, J. Shiogai, A. Tsukazaki, S. Kimura, S. Awaji, Y. Taguchi, T.-h. Arima, and Y. Tokura (Phys. Rev. B **100**, 241115(R) (2019)).
17. “Skyrmion phase and competing magnetic orders on a breathing kagomé lattice”
M. Hirschberger, T. Nakajima, S. Gao, L. Peng, A. Kikkawa, **T. Kurumaji**, M. Kriener, Y. Yamasaki, H. Sagayama, H. Nakao, K. Ohishi, K. Kakurai, Y. Taguchi, X.-Z. Yu, T.-h. Arima, and Y. Tokura (Nature Communications **10**, 5831 (2019)).
16. “Spiral spin structures and skyrmions in multiferroics”
T. Kurumaji (Physical Sciences Reviews, 20190016 (2019)).
15. “Picosecond creation of switchable optomagnets from a polar antiferromagnet with giant photoinduced Kerr rotations”
Y. M. Sheu, Y. M. Chang, C. P. Chang, Y. H. Li, K. R. Babu, G. Y. Guo, **T. Kurumaji**, and Y. Tokura (Phys. Rev. X **9**, 031038 (2019)).
14. “Skyrmion lattice with a giant topological Hall effect in a frustrated triangular-lattice magnet”
T. Kurumaji, T. Nakajima, M. Hirschberger, A. Kikkawa, Y. Yamasaki, H. Sagayama, H. Nakao, Y. Taguchi, T.-h. Arima, and Y. Tokura (Science, **365**, 914 (2019)).
13. “Néel-type skyrmion lattice in the tetragonal polar magnet VOSe_2O_5 ”
T. Kurumaji, T. Nakajima, V. Ukleev, A. Feoktystov, T. Arima, K. Kakurai, and Y. Tokura (Physical Review Letters, **119**, 237201 (2017)).
12. “Optical magnetoelectric resonance in a polar magnet $(\text{Fe}, \text{Zn})_2\text{Mo}_3\text{O}_8$ with axion-type coupling”
T. Kurumaji, Y. Takahashi, J. Fujioka, R. Masuda, H. Shishikura, S. Ishiwata, and Y. Tokura (Physical Review Letters, **119**, 077206, (2017)).
11. “Shift current photovoltaic effect in a ferroelectric charge-transfer complex”

M. Nakamura, S. Horiuchi, F. Kagawa, N. Ogawa, **T. Kurumaji**, S. Ishibashi, Y. Tokura, and M. Kawasaki (Nature Communications, **8**, 281, (2017)).

10. “Giant thermal Hall effect in multiferroics”

T. Ideue, **T. Kurumaji**, S. Ishiwata, and Y. Tokura (Nature Materials, **16**, 797, (2017)).

9. “Current-induced nucleation and annihilation of magnetic skyrmions at room temperature in a chiral magnet”

X. Z. Yu, D. Morikawa, Y. Tokunaga, M. Kubota, **T. Kurumaji**, H. Oike, M. Nakamura, F. Kagawa, Y. Taguchi, T. Arima, M. Kawasaki, and Y. Tokura (Advanced Materials, **29**, 1606178, (2017)).

8. “Diagonal magnetoelectric susceptibility and effect of Fe doping in the polar ferrimagnetic $\text{Mn}_2\text{Mo}_3\text{O}_8$ ”

T. Kurumaji, S. Ishiwata, and Y. Tokura (Physical Review B, **95**, 045142 (2017)).

7. “Electromagnon resonance in a collinear spin state of the polar antiferromagnet $\text{Fe}_2\text{Mo}_3\text{O}_8$ ”

T. Kurumaji, Y. Takahashi, J. Fujioka, R. Masuda, H. Shishikura, S. Ishiwata, and Y. Tokura (Physical Review B, **95**, 020405(R) (2017)).

6. “Doping-tunable ferrimagnetic phase with large magnetoelectric effect in a polar magnet $\text{Fe}_2\text{Mo}_3\text{O}_8$ ”

T. Kurumaji, S. Ishiwata, and Y. Tokura (Physical Review X **5**, 031034 (2015)).

5. “Magnetoelectric responses from the respective magnetic R and Fe subsystems in noncentrosymmetric antiferromagnets $R\text{Fe}_3(\text{BO}_3)_4$ ($R = \text{Eu}, \text{Gd}, \text{and Tb}$)”

T. Kurumaji, K. Ohgushi, and Y. Tokura (Physical Review B **89**, 195126 (2014)).

4. “Magnetoelectric responses induced by domain rearrangement and spin structural change in triangular-lattice helimagnets NiI_2 and CoI_2 ”

T. Kurumaji, S. Seki, S. Ishiwata, H. Murakawa, Y. Kaneko, and Y. Tokura (Physical Review B **87**, 014429 (2013)).

3. “Multiferroicity in NiBr_2 with long-wavelength cycloidal spin structure on a triangular lattice”

Y. Tokunaga, D. Okuyama, **T. Kurumaji**, T. Arima, H. Nakao, Y. Murakami, Y. Taguchi, and Y. Tokura (Physical Review B **84**, 060406 (2011)).

2. “Magnetic-field Induced competition of two multiferroic orders in a triangular-lattice helimagnet MnI_2 ”

T. Kurumaji, S. Seki, S. Ishiwata, H. Murakawa, Y. Tokunaga, Y. Kaneko, and Y. Tokura (Physical Review Letters **106**, 167206 (2011)).

1. “Cupric chloride CuCl_2 as an $S = 1/2$ chain multiferroic”

S. Seki, **T. Kurumaji**, S. Ishiwata, H. Matsui, H. Murakawa, Y. Tokunaga, Y. Kaneko, T. Hasegawa, and Y. Tokura (Physical Review B **82**, 064424 (2010)).

UNDER REVIEW.

“Breathing pyrochlore magnet $\text{CuGaCr}_4\text{S}_8$: magnetic, thermodynamic, and dielectric properties”

M. Gen, H. Ishikawa, A. Miyake, T. Yajima, H. O. Jeschke, H. Sagayama, A. Ikeda, Y. H. Matsuda, K. Kindo, M. Tokunaga, Y. Kohama, **T. Kurumaji**, Y. Tokunaga, and T. Arima (arXiv:2303.10671 (2023)).

“Magnetoelectrocaloric effect of multiferroics GdFeO_3 ”

R. Ikeda, **T. Kurumaji**, Y. Tokunaga, and T.-h. Arima (arXiv:2303.01146 (2023)).

INVITED TALKS.

3. “Direct observation of cycloidal spin modulation in Néel-type skyrmion-hosting VOSe_2O_5 ”

(13th international conference on Polarized Neutrons for Condensed Matter Investigation (PNCMI), NIST Center for Neutron Research, 2021, online,

<https://www.nist.gov/news-events/events/2021/07/polarized-neutrons-condensed-matter-investigations-pncmi-2021-online>)

2. “Inversion symmetry and Skyrmion lattice”

(JPS 76th annual meeting, Symposium on Recent developments of chirality in material science, the Physical Society of Japan, 2021, online)

1. “Skyrmion lattice in a frustrated magnet”

(Center for Integrated Quantum Materials (CIQM) Quantum Materials and Devices Seminars, Harvard University, 2020, Massachusetts, Boston, <https://www.youtube.com/channel/UCBz9hE9jt4pIGK78Tnfiqow/featured>)

ORAL PRESENTATIONS.

8. “Broken helix and anisotropic magnetotransport properties of a Eu-based semimetal EuZnGe”

(22-0561, The International Conference on Strongly Correlated Electron Systems 2023, Incheon, Korea)

7. “Skyrmion lattice with a giant topological Hall effect in a frustrated triangular-lattice magnet”

(V41.00003, American Physical Society, March Meeting 2019, Massachusetts, Boston).

6. “Néel-type skyrmion lattice on the tetragonal polar magnet”

(B22.00007, American Physical Society, March Meeting 2018, California, Los Angeles).

4. “Néel-type skyrmion lattice formation in a new class of polar magnet”

(IV international workshop Dzyaloshinskii-Moriya interaction and exotic spin structures, 2017, Peterhof, Russia).

3. “Electromagnon resonance and optical magnetoelectric effect in a polar magnet (Zn, Fe)₂Mo₃O₈”

(R37a.00005, American Physical Society, March Meeting 2017, New Orleans, Louisiana).

2. “Doping-tunable ferrimagnetic phase with large magnetoelectric effect in a polar magnet Fe₂Mo₃O₈”

(V6.00006, American Physical Society March Meeting 2016, Baltimore, Maryland).

1. “Origin of Magnetoelectric Responses Induced by Respective Magnetic Ions R^{3+}/Fe^{3+} in a Chiral Antiferromagnet $RFe_3(BO_3)_4$ ”

(B6.00011, American Physical Society March Meeting 2014, Denver, Colorado).

PROFESSIONAL ACTIVITIES

1. Reviewer for Nature Communications, Physical Review Letters, Physical Review B, Journal of Physical Society of Japan, Physical Review Applied, Physical Review Materials, Scientific Reports, npj Quantum Materials

Since 2014

2. The Physical Society of Japan March 2021 Autumn Meeting, Session 23pH2 chair

2021

TEACHING, MENTORING and OUTREACH

5. Lecturer of 68th Condensed Matter Physics Summer School, Shiga, Japan

2023

4. Instructor of Applied Physics Experiment I, Department of Applied Physics, the University of Tokyo

2020-2023

3. Mentor of 2 MIT graduate students, 1 visiting student from Osaka University, 3 undergraduate students and 6 graduate students at the University of Tokyo, 2 postdoctoral scholars at RIKEN

2017-present

2. Instructor of RIKEN Open Day, crystal mini-museum

2015-2016

1. Teaching Assistant, Solid State Physics, Department of Applied Physics, the University of Tokyo

2010