

Keisuke Harigaya

Curriculum Vitae

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Area of Research

Theoretical particle physics and cosmology with focus on constructing theories to solve the problems and mysteries in the standard model of particle physics

Professional Career

Assistant professor	Sep. 2022 -	Department of Physics, Enrico Fermi Institute, and Kavli Institute for Cosmological Physics, University of Chicago
Visiting Associate Scientist	Sep. 2022 -	Kavli Institute for the Physics and Mathematics of the Universe
Fellow	Aug. 2021 - Aug. 2022	CERN
Member	Sep. 2018 - July 2021	Institute for Advanced Study
Postdoctoral Scholar	Sep. 2015 - Aug. 2018	UC Berkeley and Lawrence Berkeley National Laboratory
Postdoctoral Scholar	Apr. 2015 - Aug. 2015	Institute for Cosmic Ray Research, JSPS Research Fellowships for Young Scientists

Fellowships/Scholarships

Aug. 2021 - Aug. 2022	CERN, Non-Member State Postdoc Fellowship
Sep. 2018 - July 2021	Institute for Advanced Study, Membership
Apr. 2015 - Aug. 2015	JSPS Research Fellowships for Young Scientists
Apr. 2012 - Mar. 2015	JSPS Research Fellowships for Young Scientists
Apr. 2010 - Mar. 2011	Iwaware Scholarship

Education

Apr. 2012 - Mar. 2015	Ph.D, The University of Tokyo
Apr. 2010 - Mar. 2012	M.S. Physics, The University of Tokyo
Apr. 2006 - Mar. 2010	B.S. Physics, The University of Tokyo

Media Coverage of Research

- “Axions Would Solve Another Major Problem in Physics” by Natalie Wolchover, Quanta Magazine, Mar. 17, 2020
<https://www.quantamagazine.org/axions-would-solve-another-major-blem-in-physics-20200317/>
- “Particles called axions could reveal how matter conquered the universe” by Emily Conover, Science News, Mar. 24, 2020
<https://www.sciencenews.org/article/particles-axions-how-matter-conquered-universe>
- “Pikkuruinen hiukkanen voisi ratkaista kolme arvoitusta (A tiny particle could solve three puzzles)” by Laura Koponen, Tähdet ja avaruus (Stars and Space), 24, Apr. 2020
- Mentioning of baryogenesis by axions in Nihon Keizai Shimbun (Japan Economics Newspaper) by Shoji Yano, 26, morning of Aug. 23, 2020

Service/Leadership

- Co-editor of the white paper on “Early Universe Model-building” submitted for Snowmass 2021
<https://arxiv.org/abs/2203.06680>
- Facilitator of a session on “Cosmic Probes of Dark Matter Physics” at the Snowmass Community Planning meeting (Oct. 2020)
- Referee of The Review of Particle Physics (2024), Physical Review Letter (2018, 2020, 2021), Physical Review D (2015, 2016, 2017, 2019, 2020, 2021,2022), Journal of High Energy Physics (2016, 2018, 2019, 2020, 2022, 2023), Journal of Cosmology and Astroparticle Physics (2022), Physics Letters B (2012, 2015, 2016, 2018, 2019,2022), and European Physical Journal C (2020)
- Chairs of sessions at KEK-PH, KEK, Tsukuba, Japan, Oct. 2014; Phenomenology Symposium, University of Pittsburgh, Pittsburgh (online), US, May 2020; International Conference From the Planck Scale to the Electroweak Scale, the old Ecole Polytechnique, France, June 2022; International Symposium on Particles, Strings and Cosmology, Max Planck Institute for Nuclear Physics, Germany, July 2022
- Co-organizer of Particle Seminar at UC Berkeley/LBNL (2016, 2017)

Outreach

- Oral presentation on “Dark matter wanted” at Berkeley Japanese Academic Network (Oct. 2016)
- Poster presentation on the research activities of the Kavli IPMU at the opening of the Kavli IPMU to the public (Oct. 2010, 2011, 2012, 2013, 2014)

- Counseling for freshman and sophomore students as prospective physics majors at the opening of the physics department to the public (Oct. 2009)
- Poster presentation on entropy, heat capacity, and phase transition to the public at the campus festival of the University of Tokyo (May 2009)

Teaching

Spring 2023 Quantum Field Theory III
Autumn 2023 Advanced Classical Mechanics

Colloquia

1. **Parity symmetry breaking scale and Standard Model parameters**
University of Chicago, Enrico Fermi Institute, Oct. 2022
2. **Rotating scalar fields in the early universe**
University of Chicago, Kavli Institute for Cosmological Physics, Oct. 2022
3. **New axion cosmology and three mysteries of the universe**
University of Chicago, Department of Physics, Jan. 2021

Invited Seminars in 2021-2023

1. **Rotating Scalar Fields in the Early Universe**
International Center for Quantum-field Measurement Systems for Studies of the Universe and Particles, Aug. 2023
2. **Parity symmetry breaking scale and Standard Model parameters**
KEK theory center, Aug. 2023
3. **Cosmology of Axion Rotation**
Kavli IPMU, Aug. 2023
4. **Cosmology of Axion Rotation**
University of Pittsburgh, Mar. 2023
5. **QCD axion dark matter with a small decay constant**
Fermilab, Feb. 2023
6. **Parity symmetry breaking scale and Standard Model parameters**
Harvard University, Feb. 2023

7. **Cosmology of Axion Rotation**
University of Sydney (online), Feb. 2023
8. **Rotating scalar fields in the early universe**
Rutgers University, Nov. 2022
9. **Rotating scalar fields in the early universe**
University of Florida, Nov. 2022
10. **Cosmology of Axion Rotation**
University of Delaware (online), Nov. 2022
11. **Cosmology of Axion Rotation**
California Institute of Technology, Oct. 2022
12. **Parity symmetry breaking scale and Standard Model parameters**
University of California Davis (online), Oct. 2022
13. **Parity symmetry breaking scale and Standard Model parameters**
University of Michigan, Sep. 2022
14. **Cosmology of Axion Rotation**
Weizmann Institute of Science, July 2022
15. **Cosmology of Axion Rotation**
Warsaw University, April 2022
16. **Naturalness and muon anomalous magnetic moment**
Indian Institute of Science (online), Mar. 2022
17. **Parity symmetry breaking scale and Standard Model parameters**
University of Maryland (online), Feb. 2022
18. **Cosmology with Axion Rotation**
KEK (online), Dec. 2021
19. **Cosmology with Axion Rotation**
University of Geneva, Dec. 2021
20. **Cosmology with Axion Rotation**
DESY, Nov. 2021
21. **Axion Kinetic Misalignment and Baryogenesis**
EPFL, Oct. 2021
22. **Naturalness and muon anomalous magnetic moment**
Harvard University (online), Sep. 2021

23. **Axion Kinetic Misalignment and Baryogenesis**
Institute for Basic Science (online), Mar. 2021
24. **Axion Kinetic Misalignment and Baryogenesis**
Florida State University (online), Jan. 2021
25. **Axion Kinetic Misalignment and Axiogenesis**
University California Los Angeles (online), Jan. 2021

Invited Oral Presentations at International Conferences/Workshops

1. **Axion rotation in the early universe**
Planck, University of Warsaw, May 2023
2. **Cosmology of Axion Rotation**
UCLA Dark Matter, UCLA, March 2023
3. **Rotating scalar fields in the early universe**
KEK Theory Meeting on Particle Physics Phenomenology, KEK, Dec. 2022
4. **Supersymmetric scenarios at FCC**
FCC BSM Physics Programme Workshop, CERN, Sep. 2022
5. **New Ideas on Axion and ALPs**
PASCOS, Heidelberg, July 2022
6. **Axion rotation**
CAU BSM workshop, Chung-Ang University (online), Feb. 2022
7. **Sterile Neutrino Dark Matter and Leptogenesis in Left-Right symmetric theory**
Rencontres de Moriond (online), March 2021
8. **Axion kinetic misalignment and baryogenesis**
Dark Matter as a Portal to New Physics, APCTP (online), Feb. 2021
9. **Axion kinetic misalignment, axiogenesis, and IAXO**
12th IAXO Collaboration meeting, Heidelberg (online), Oct. 2020
10. **Axion kinetic misalignment and baryogenesis**
Zooming in on Axions in the Early Universe, CERN (online), June 2020
11. **Axion model-building**
Axions in the Lab and in the Cosmos, CERN, July 2019
12. **Implications of Higgs Discovery for the Strong CP Problem and Unification**
PASCOS 2018, Case Western Univ., June 2018

13. **QCD Axion Dark Matter with a Small Decay Constant**
Ultralight Dark Matter and Axions, Univ. of Michigan, Feb. 2018
14. **Dark matter production in late time reheating**
Beyond the Standard Model 2014, KEK, Mar. 2014

Contributed Oral Presentations at International Conferences/Workshops

1. **Parity symmetry breaking scale and Standard Model parameters**
Mainz Institute for Theoretical Physics, Mainz, July 2022
2. **Cosmology of axion rotation**
Planck, Paris, June 2022
3. **Parity solution to the strong CP problem and sterile neutrino dark matter**
Extended Workshop Neutrino Theories, IFT Madrid, May 2022
4. **Top quark mass and physics beyond the Standard Model from Higgs Parity**
International Workshop on Future Linear Colliders 2021, online, March 2021
5. **Higgs Parity, strong CP problem, GUT**
SUSY 2019, Texas A&M, May 2019
6. **Higgs Parity GUT**
Prospects of Neutrino Physics, Kavli IPMU, April 2019
7. **QCD axion dark matter from parametric resonance**
Planck, Bonn Univ., May 2018
8. **Minimal Mirror Twin Higgs**
Planck, Univ. of Warsaw, May 2017
9. **Light chiral dark sector**
COSMO, Univ. of Michigan, Aug. 2016
10. **R-symmetric Axion/Natural Inflation via Deformed Moduli Dynamics**
CosPa, Univ. of Auckland, Dec. 2014
11. **Lower bound on the tensor-to-scalar ratio in a nearly quadratic chaotic inflation model in supergravity**
The 24th Workshop on General Relativity and Gravitation, Kavli IPMU, Nov. 2014
12. **R-symmetric Axion/Natural Inflation via Deformed Moduli Dynamics**
KEK-PH 2014, KEK, Oct. 2014
13. **Lower bound on the gravitino mass in R breaking new inflation model**
SUSY: Model-building and Phenomenology, IPMU, Dec. 2013

14. **Large scale cosmic perturbation from evaporation of primordial black hole**
PASCOS 2013, Taiwan Univ., Nov. 2013
15. **Non-Gaussianity from Attractor Curvaton**
KEK-PH 2013, KEK, Mar. 2013
16. **Search for the Top Partner at the LHC using Multi-b-Jet Channels**
SUSY 2012, Peking University, Aug. 2012
17. **Vector-like quark search at LHC using multi b-jet channel**
Toyama in Winter 2012 Phenomenology and Cosmology Workshop, Toyama Univ., Feb. 2012
18. **Testing the Little Higgs mechanism at the LHC and the ILC**
ILC Kick-Off Meeting 2011, Tohoku Univ., Sep. 2011

Invited Oral Presentations at Domestic Conferences/Workshops

1. **Parity solution to the strong CP problem**
Phenomenology in Indiana, Kentucky, Illinois, Michigan, and Ohio 2023, Indiana University, Nov. 2023
2. **Physics beyond the standard model from Higgs Parity**
Progress in Particle Physics 2020, YITP (online), Sep 2020
3. **Overview of models and TF/CF coordination**
Snowmass 2021 CF1 meeting: theory motivation and targets for GeV+ dark matter, Aug. 2020
4. **Chiral dark sector**
Lattice for BSM Physics, Boston Univ., April 2017
5. **Light chiral dark sector**
Santa Fe 2016 Summer Workshop, LANL, July 2016
6. **Higgs mass of 125 GeV and g-2 of muon g-2 in gaugino mediation model**
LHC Physics Monthly Meeting, KIAS, June 2015

Contributed Oral Presentations at Domestic Conferences/Workshops

1. **More Implications of Axion Rotations**
The Center for Theoretical Underground Physics and Related Areas, the Institute for Underground Science at SURF, June 2023
2. **QCD axion dark matter in high-mass range**
BREAD Collaboration meeting, University of Chicago, Aug. 2022

3. **Implications of Higgs Discovery for the Strong CP Problem and Unification**
Santa Fe Summer Workshop in Particle Physics, Santa Fe, July 2018
4. **Gaugino coannihilations in high scale SUSY breaking scenario**
Basis of the Universe with Revolutionary Ideas 2014, Toyama Univ., Feb. 2014
5. **Phase locked inflation**
Progress in Particle Physics 2014, YITP, Jul. 2013
6. **Search for the Top Partner at the LHC using Multi-b-Jet Channels**
Progress in Particle Physics 2012, YITP, Jul. 2012
7. **Experimental constraints on the dark matter which couples to the third generation quark**
JPS the 67th Annual Meeting, Kwansei Gakuin Univ., Mar. 2012
8. **Vector-like quark search at LHC using multi b-jet channel**
Physics opportunities with LHC at 7 TeV, KEK, Feb. 2012
9. **Testing the Little Higgs Mechanism**
The 20th General Meeting of the ILC Physics Subgroup, KEK, May 2011