

# TAKUMI KUWAHARA

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## RESEARCH INTERESTS

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Particle Physics Phenomenology of Models beyond the Standard Model

[Keywords]: Supersymmetric Models, Grand Unified Theories, CP Violation, Quark Flavor Physics, Lepton Flavor Physics, Dark Matter, Composite Particles, Inflation, Quantum Corrections

## SELECTED PUBLICATIONS

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- [1] M. Ibe, A. Kamada, S. Kobayashi, **Takumi Kuwahara**, and W. Nakano.  
“*Ultraviolet Completion of a Composite Asymmetric Dark Matter Model with a Dark Photon Portal*”  
arXiv:1811.10232, JHEP 1903 (2019) 173
- [2] J. L. Evans, K. Kadota, and **Takumi Kuwahara**.  
“*Revisiting Flavor and CP Violation in Supersymmetric  $SU(5)$  with Right-Handed Neutrinos*”  
arXiv:1807.08234, Phys.Rev. D98 (2018) no.7, 075030
- [3] J. Hisano, **Takumi Kuwahara**, and Y. Omura.  
“*Threshold Corrections to Baryon Number Violating Operators in Supersymmetric  $SU(5)$  GUTs.*”  
arXiv:1503.08561, Nucl.Phys. B898 (2015) 1-29  
and its extension,  
B. Bajc, J. Hisano, **Takumi Kuwahara**, and Y. Omura.  
“*Threshold Corrections to Dimension-six Proton Decay Operators in Non-minimal SUSY  $SU(5)$  GUTs.*”  
arXiv:1603.03568, Nucl.Phys. B910 (2016) 1

## RESEARCH EMPLOYMENT

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### Postdoctoral fellow

Center for High-Energy Physics, Peking University	?? 2020 - ?? 2025 (expected)
Center for Theoretical Physics of the Universe, Particle Theory and Cosmology group, Institute for Basic Science	Sep. 2017-Aug. 2020
University of Tokyo, High Energy Physics Theory Group	Apr. 2017 - Aug. 2017

## EDUCATION

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**Nagoya University**, Nagoya, Japan

Ph.D., Physics, March 2017

- Thesis Title: *Next-Leading Order Corrections for Proton Decay in Supersymmetric Unification*
- Supervisor: Junji Hisano, Ph.D

M.S., Physics, March 2014

- Thesis Title: *Proton Decay in SUSY  $SU(5)$  GUTs Revisited after Discovery of the Higgs Boson*
- Supervisor: Junji Hisano, Ph.D

**Tokyo University of Science**, Tokyo, Japan

B.S., Physics, March 2012

## RESEARCH FELLOWSHIP

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### Research Fellow

Apr. 2016 - Aug. 2018

Japan Society for the Promotion of Science (JSPS)

### Research Assistant

Jul. 2014 - Mar. 2015

Department of Physics, Nagoya University

Supervisors: Junji Hisano, Ph.D

## REFERENCES

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### Junji Hisano

Professor of Theoretical Particle Physics Group, Kobayashi-Maskawa Institute for the Origin of Particles and the Universe (KMI), Nagoya University

hisano@eken.phys.nagoya-u.ac.jp

### Borut Bajc

Professor of Department of Theoretical Physics, Jožef Stefan Institute

borut.bajc@ijs.si

### Masahiro Ibe

Associate Professor of the Theory Group at the Institute for Cosmic Ray Research, University of Tokyo

ibe@icrr.u-tokyo.ac.jp

## TEACHING EXPERIENCE

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### Co-instructor

- Basic Experiments on Physics fall semester 2013–2015  
Aichi Medical University

### Teaching Assistant

- Mathematics for Physics (G30: for students studying abroad) fall semester 2015  
Department of Physics, Nagoya University
- Mathematics for Physics fall semester 2013  
Department of Physics, Nagoya University

## AWARDS

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### Travel Awards

- Overseas Dispatching for Young Scientists, Nagoya, Japan March 2016

### Student Awards

- Exemption from Refund of a Scholar Loan (JASSO) March 2016
- Exemption from Refund of a Scholar Loan (JASSO) March 2014

## PUBLICATIONS

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According to the custom in the particle physics community, the alphabetical authorship is used.

### Under-Reviewed Manuscripts

- [1] Ayuki Kamada, Hee Jung Kim, and **Takumi Kuwahara**.  
“*Maximally self-interacting dark matter: models and predictions*”  
arXiv:2007.15522
- [2] Ayuki Kamada, and **Takumi Kuwahara**.  
“*Lessons from  $T^\mu_\mu$  on inflation models: two-loop renormalization of  $\eta$  in the scalar QED*”  
arXiv:1909.04229

### Peer-Reviewed Publications

- [1] Ayuki Kamada, and **Takumi Kuwahara**.  
“*Lessons from  $T^\mu_\mu$  on inflation models: two-scalar theory and Yukawa theory*”  
arXiv:1909.04228, doi:10.1103/PhysRevD.101.096012, Phys.Rev. D 101 (2020) no.9, 096012.
- [2] Masahiro Ibe, Ayuki Kamada, Shin Kobayashi, **Takumi Kuwahara**, and Wakutaka Nakano.  
“*Baryon-Dark Matter Coincidence in Mirrored Unification*”  
arXiv:1907.03404, doi:10.1103/PhysRevD.100.075022, Phys.Rev. D 100 (2019) no.7, 075022.
- [3] Wataru Kuramoto, **Takumi Kuwahara**, and Ryo Nagai.  
“*Renormalization Effects on Electric Dipole Moments in Electroweakly Interacting Massive Particle Models*”  
arXiv:1902.05360, doi:10.1103/PhysRevD.99.095024, Phys.Rev. D99 (2019) no.9, 095024
- [4] Masahiro Ibe, Ayuki Kamada, Shin Kobayashi, **Takumi Kuwahara**, and Wakutaka Nakano.  
“*Ultraviolet Completion of a Composite Asymmetric Dark Matter Model with a Dark Photon Portal*”  
arXiv:1811.10232, doi:10.1007/JHEP03(2019)173, JHEP 1903 (2019) 173
- [5] Jason L. Evans, Kenji Kadota, and **Takumi Kuwahara**.  
“*Revisiting Flavor and CP Violation in Supersymmetric  $SU(5)$  with Right-Handed Neutrinos*”  
arXiv:1807.08234, doi:10.1103/PhysRevD.98.075030, Phys.Rev. D98 (2018) no.7, 075030
- [6] Junji Hisano, **Takumi Kuwahara**, Yuji Omura, and Takeki Sato.  
“*Two-loop Anomalous Dimensions for Four-Fermi Operators in Supersymmetric Theories.*”  
arXiv:1703.08329, doi:10.1016/j.nuclphysb.2017.06.021, Nucl.Phys. B922 (2017) 77-93
- [7] Junji Hisano, Wataru Kuramoto, and **Takumi Kuwahara**.  
“*Light Stop, Heavy Higgs, and Heavy Gluino in Supersymmetric Standard Models with Extra Matters.*”  
arXiv:1611.07670, doi:10.1093/ptep/ptx031, PTEP 2017 (0) 033
- [8] Borut Bajc, Junji Hisano, **Takumi Kuwahara**, and Yuji Omura.  
“*Threshold Corrections to Dimension-six Proton Decay Operators in Non-minimal SUSY  $SU(5)$  GUTs.*”  
arXiv:1603.03568, doi:10.1016/j.nuclphysb.2016.06.017, Nucl.Phys. B910 (2016) 1
- [9] Junji Hisano, Daiki Kobayashi, Wataru Kuramoto, and **Takumi Kuwahara**.  
“*Nucleon Electric Dipole Moments in High-Scale Supersymmetric Models.*”  
arXiv:1507.05836, doi:10.1007/JHEP11(2015)085, JHEP 1511 (2015) 085
- [10] Junji Hisano, **Takumi Kuwahara**, and Yuji Omura.  
“*Threshold Corrections to Baryon Number Violating Operators in Supersymmetric  $SU(5)$  GUTs.*”  
arXiv:1503.08561, doi:10.1016/j.nuclphysb.2015.06.022, Nucl.Phys. B898 (2015) 1-29

- [11] Junji Hisano, Daiki Kobayashi, **Takumi Kuwahara**, and Natsumi Nagata.  
*“Decoupling Can Revive Minimal Supersymmetric  $SU(5)$ .”*  
arXiv:1304.3651, doi:10.1007/JHEP07(2013)038, JHEP 1307 (2013) 038
- [12] Junji Hisano, **Takumi Kuwahara**, and Natsumi Nagata.  
*“Grand Unification in High-scale Supersymmetry.”*  
arXiv:1304.0343, doi:10.1016/j.physletb.2013.05.017, Phys.Lett. B723 (2013) 324-329

## Conference Papers

- [1] **Takumi Kuwahara**, *“Renormalization Effects on Electric Dipole Moments in Electroweakly Interacting Massive Particle Models”*, arXiv:1906.08721. (Proceedings of FPCP 2019 Conference)
- [2] **Takumi Kuwahara**, *“Threshold corrections to dimension-six proton decay operators in SUSY  $SU(5)$ ”*, doi:10.1063/1.5010111. (Proceedings of Workshop on Neutrino Physics: Session of CETUP\* 2016)
- [3] **Takumi Kuwahara**, *“GUT Scale Threshold Effect on Proton Decay”*, doi:10.22323/1.248.0085. (Proceedings of FPCP 2015 Conference)
- [4] **Takumi Kuwahara**, *“Decoupling can revive minimal supersymmetric  $SU(5)$ ”*, doi:10.22323/1.208.0034. (Proceedings of KMI2013)

## PRESENTATIONS

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(P): Poster presentation

### International Conference Talks

- [1] KEK Theory Meeting on Particle Physics Phenomenology (KEK-PH2020), *“Baryon-Dark Matter Coincidence in Mirrored Unification”*, KEK, Japan, Feb. 2020
- [2] International joint workshop on the Standard Model and beyond (KEK-KIAS-NCTS-ITP CAS joint workshop), *“Electric Dipole Moments in Electroweakly Interacting Massive Particle Models”*, Beijing, China, Oct. 2019
- [3] New physics beyond the Standard Model (research program by Peng Huanwu Innovation Research Center for Theoretical Physics), *“Baryon-Dark Matter Coincidence and Composite Asymmetric Dark Matter”*, Beijing, China, Oct. 2019
- [4] Summer Institute 2019, *“UV Completions of Composite Asymmetric Dark Matter Model with Dark Photon Portal”*, Gangneung, Republic of Korea, July 2019
- [5] Conference on Flavor Physics and CP violation (FPCP) 2019, *“Renormalization Effects on Electric Dipole Moments in Electroweakly Interacting Massive Particle Models”*, Victoria, Canada, May 2019
- [6] KEK Theory Meeting (KEK-PH 2018 Winter), *“Revisiting Flavor and CP Violation in Supersymmetric  $SU(5)$  with Right-Handed Neutrinos”*, KEK, Japan, Dec. 2018
- [7] SUSY 2018, *“Revisiting Flavor and CP Violation in Supersymmetric  $SU(5)$  with Right-Handed Neutrinos”*, Barcelona, Spain, July 2018
- [8] Dark Side of the Universe, *“Two-loop Anomalous Dimensions for Four-Fermi Operators in Supersymmetric Theories”*, Daejeon, Republic of Korea, July 2017
- [9] (P) Gordon research Seminar/Conference (**short talk selected**), *“Light Stop, Heavy Higgs, and Heavy Gluino in Supersymmetric Standard Models with Extra Matters”*, HKUST, Hong-Kong, Jun. 2017

- [10] ECT\* Baryon over antibaryon (**invited talk**), “*Proton Decay in SUSY GUTs*”, ECT\*, Italy, July 2016
- [11] SUSY 2016, “*GUT Scale Threshold Effects on Proton Decay*”, Melbourne, Australia, July 2016
- [12] CETUP\* Workshop on Neutrino Physics/Unification Session, “*Threshold Corrections to Dimension-Six Proton Decay Operators in SUSY  $SU(5)$* ”, Lead-Deadwood South-Dakota, USA, June -July 2016
- [13] (P) KEK Theory Meeting (KEK-PH 2016), “*GUT Scale Threshold Effect on Proton Decay*”, KEK, Japan, Feb. 2016
- [14] Flavors of New Physics, “*GUT Scale Threshold Effect on Proton Decay*”, IQBRC/KEK Tokai Campus, Japan, Mar. 2015
- [15] (P) Flavor Physics and CP Violation (FPCP 2015), “*GUT Scale Threshold Effect on Proton Decay*”, Nagoya, Japan, Mar. 2015
- [16] (P) Sakata Memorial KMI Workshop on “Origin of Mass and Strong Coupling Gauge Theories” (SCGT15), “*GUT Scale Threshold Effect on Proton Decay*”, Nagoya, Japan, Mar. 2015
- [17] (P) Summer Institute 2014, “*Grand Unified Theory in High-scale Supersymmetry*”, Fuji-Yoshida, Japan, Aug. 2014
- [18] (P) KMI International Symposium 2013 on “Quest for the Origin of Particles and the Universe”, “*Decoupling Can Revive Minimal Supersymmetric  $SU(5)$* ”, Nagoya, Japan, Dec. 2013
- [19] (P) International Workshop on Next generation Nucleon Decay and Neutrino Detectors (NNN 2013), “*Decoupling Can Revive Minimal Supersymmetric  $SU(5)$* ”, Kavli IPMU, Japan, Nov. 2013
- [20] KEK Theory Meeting (KEK-PH2013 FALL), “*Decoupling Can Revive Minimal Supersymmetric  $SU(5)$* ”, KEK, Japan, Oct. 2013

## SEMINAR TALKS

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- [1] “*Supersymmetric Standard Models with Extra Matters*”, IBS, Oct. 2017
- [2] “*Next-Leading Order Corrections to Four-Fermi Operators in Supersymmetric Theories*”, University of Tokyo, Mar. 2017
- [3] “*Threshold Corrections to Dimension-Six Proton Decay Operators in SUSY  $SU(5)$  GUTs.*”, **invited talk**, Osaka University, Nov. 2016
- [4] “*Nucleon Electric Dipole Moments in High-Scale Supersymmetric Models.*”, Jožef Stefan Institute, Mar. 2016
- [5] “*Threshold Corrections to Baryon Number Violating Operators in Supersymmetric  $SU(5)$  GUTs.*”, **invited talk**, Tohoku University, Nov. 2015