

SUNAO SUGIYAMA

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CONTACT INFORMATION

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RESEARCH INTERESTS

Theoretical and Observational cosmology: *large-scale structure of the Universe, gravitational weak/micro lensing, primordial black hole*

COLLABORATIONS

Subaru HSC weak lensing working group, member (2021-present, **co-chair** since 2024Nov)
Dark Enrgy Survey (DES), member (2024-present)

POSITIONS

Current	Postdoctoral researcher, University of Pennsylvania, Philadelphia, the United States Mentor: Prof. Bhuvnesh Jain JSPS Overseas Research Fellow, University of Pennsylvania, Philadelphia, the United States	Sep. 2023 – present Sep. 2023 – present
Past	Postdoctoral researcher, Kavli IPMU, Chiba, Japan Mentor: Prof. Masahiro Takada Project Researcher, Beyond AI, Tokyo, Japan JSPS Research Fellowships for Young Scientists, Kavli IPMU, Chiba, Japan	Apr. 2023 – Aug. 2023 Apr. 2023 – Aug. 2023 Apr. 2021 – Mar. 2023
Educations	University of Tokyo, Tokyo, Japan, Ph.D. course in Physics Dissertation: “ <i>Joint cosmology analyses using gravitational weak lensing data from Subaru Hyper Suprime-Cam</i> ” Supervisor: Prof. Masahiro Takada University of Tokyo, Tokyo, Japan, M.S. in Physics Dissertation: “ <i>Validation of cosmological analysis based on perturbation theory for wide-field galaxy survey</i> ” Supervisor: Prof. Masahiro Takada University of Tokyo, Tokyo, Japan, B.A. in Physics	Apr. 2020 – Mar. 2023 Apr. 2018 – Mar. 2020 Apr. 2014 – Mar. 2018

GRANT & AWARDS

Grant-in-Aid for JSPS Research Fellows (DC2), Japan Society for the Promotion of Science, Apr. 2021 – Mar. 2023

The School of Science Encouragement Award (Doctoral program), University of Tokyo, the School of Science, Mar. 2023

WINGS IGPEES, course completion, Sep. 2018 – Mar. 2023

TEACHING

Collaborative coding: git and github, **CD3 symposium** 2023, Kavli IPMU

Coadvised Noriaki Nakasawa, a master student at the University of Nagoya, 2022

PROFESSIONAL ACTIVITIES

Society	The Astronomical Society of Japan (ASJ), 2018 – present The Physical Society of Japan (JPS), 2022 – present
Seminar/Workshop/Conference	IPMU weekly lunch seminar (co-organizer), 2019 – 2021 HSC weaklensing mini workshop (organizer), Aug. 2022 Sesto 2025 - Tracing Cosmic Evolution with Galaxy Clusters V (SOC), 2025
Referee	International Journal of Modern Physics D The Astrophysical Journal American Astronomical Society Journals Journal of Cosmology and Astroparticle Physics
Computing	Developer of fft-extended-source , fastnc , dark emulator as a part of Dark Quest Project I can work with C, C++, Python, HSC pipeline (for image analysis)
Accepted Observation	PI of Definitive search for PBH dark matter in the multiverse cosmology with HSC co-PI of Survey of M31 eclipsing binaries: Toward a 1% distance measurement

PUBLIC ENGAGEMENT AND OUTREACH

Apperence on *Cosmic Front, Primordial Black Hole: the master key of the Universe (title in Japanese)* produced by NHK, 2021

Interviewed by Quanta Magazine on *Clashing Cosmic Numbers Challenge Our Best Theory of the Universe*, 2024

Interviewed by Asahi Shimbun on *Breakdown in the standard model of the Universe? An analysis using precise dark matter “map” (title in Japanese)*, 2024

PUBLICATIONS

The up-to-date list of publication available at [ADS](#).

* = Author list alphabetized

Major author

1. R. C. H. Gomes, **Sugiyama, S.**, B. Jain, et al. Cosmology with second and third-order shear statistics for the Dark Energy Survey: Methods and simulated analysis. *arXiv e-prints*, arXiv:2503.03964, [March 2025:arXiv:2503.03964](#)
2. **Sugiyama, Sunao**, R. C. H. Gomes, and M. Jarvis. Fast modeling of the shear three-point correlation function. *arXiv e-prints*, arXiv:2407.01798, [July 2024:arXiv:2407.01798](#)
3. **Sugiyama, Sunao**, H. Miyatake, S. More, et al. Hyper Suprime-Cam Year 3 results: Cosmology from galaxy clustering and weak lensing with HSC and SDSS using the minimal bias model. *Phys. Rev. D*, 108(12):123521, [December 2023:123521](#)
4. S. More, **Sugiyama, Sunao**, H. Miyatake, et al. Hyper Suprime-Cam Year 3 results: Measurements of clustering of SDSS-BOSS galaxies, galaxy-galaxy lensing, and cosmic shear. *Phys. Rev. D*, 108(12):123520, [December 2023:123520](#)
5. R. Dalal, X. Li, A. Nicola, et al. Hyper Suprime-Cam Year 3 results: Cosmology from cosmic shear power spectra. *Phys. Rev. D*, 108(12):123519, [December 2023:123519](#)
6. X. Li, T. Zhang, **Sugiyama, Sunao**, et al. Hyper Suprime-Cam Year 3 results: Cosmology from cosmic shear two-point correlation functions. *Phys. Rev. D*, 108(12):123518, [December 2023:123518](#)
7. H. Miyatake, **Sugiyama, Sunao**, M. Takada, et al. Hyper Suprime-Cam Year 3 results: Cosmology from galaxy clustering and weak lensing with HSC and SDSS using the emulator based halo model. *Phys. Rev. D*, 108(12):123517, [December 2023:123517](#)
8. **Sugiyama, Sunao**, M. Takada, and A. Kusenko. Possible evidence of axion stars in HSC and OGLE microlensing events. *Physics Letters B*, 840:137891, [May 2023:137891](#)
9. H. Miyatake, **Sugiyama, Sunao**, M. Takada, et al. Cosmological inference from an emulator based halo model. II. Joint analysis of galaxy-galaxy weak lensing and galaxy clustering from HSC-Y1 and SDSS. *Phys. Rev. D*, 106(8):083520, [October 2022:083520](#)
10. H. Miyatake, Y. Kobayashi, M. Takada, et al. Cosmological inference from an emulator based halo model. I. Validation tests with HSC and SDSS mock catalogs. *Phys. Rev. D*, 106(8):083519, [October 2022:083519](#)
11. **Sugiyama, Sunao**. Fast Fourier Transformation Based Evaluation of Microlensing Magnification with Extended Source. *ApJ*, 937(2):63, [October 2022:63](#)
12. **Sugiyama, Sunao**, M. Takada, H. Miyatake, et al. HSC Year 1 cosmology results with the minimal bias method: HSC \times BOSS galaxy-galaxy weak lensing and BOSS galaxy clustering. *Phys. Rev. D*, 105(12):123537, [June 2022:123537](#)

13. **Sugiyama, Sunao**, V. Takhistov, E. Vitagliano, et al. Testing stochastic gravitational wave signals from primordial black holes with optical telescopes. *Physics Letters B*, 814:136097, [March 2021:136097](#)
14. *A. Kusenko, M. Sasaki, **Sugiyama, Sunao**, et al. Exploring Primordial Black Holes from the Multiverse with Optical Telescopes. *Phys. Rev. Lett.*, 125(18):181304, [October 2020:181304](#)
15. **Sugiyama, Sunao**, M. Takada, Y. Kobayashi, et al. Validating a minimal galaxy bias method for cosmological parameter inference using HSC-SDSS mock catalogs. *Phys. Rev. D*, 102(8):083520, [October 2020:083520](#)
16. **Sugiyama, Sunao**, T. Kurita, and M. Takada. On the wave optics effect on primordial black hole constraints from optical microlensing search. *MNRAS*, 493(3):3632–3641, [April 2020:3632–3641](#)
17. H. Niikura, M. Takada, N. Yasuda, et al. Microlensing constraints on primordial black holes with Subaru/HSC Andromeda observations. *Nature Astronomy*, 3:524–534, [April 2019:524–534](#)

Contributing author

18. I.-N. Chiu, K.-F. Chen, M. Oguri, et al. Weak-lensing Shear-selected Galaxy Clusters from the Hyper Suprime-Cam Subaru Strategic Program: II. Cosmological Constraints from the Cluster Abundance. *arXiv e-prints*, arXiv:2406.11970, [June 2024:arXiv:2406.11970](#)
19. K.-F. Chen, I.-N. Chiu, M. Oguri, et al. Weak-Lensing Shear-Selected Galaxy Clusters from the Hyper Suprime-Cam Subaru Strategic Program: I. Cluster Catalog, Selection Function and Mass–Observable Relation. *arXiv e-prints*, arXiv:2406.11966, [June 2024:arXiv:2406.11966](#)
20. R. Terasawa, X. Li, M. Takada, et al. Exploring the baryonic effect signature in the Hyper Suprime-Cam Year 3 cosmic shear two-point correlations on small scales: the S_8 tension remains present. *arXiv e-prints*, arXiv:2403.20323, [March 2024:arXiv:2403.20323](#)
21. J. Shi, T. Sunayama, T. Kurita, et al. The intrinsic alignment of galaxy clusters and impact of projection effects. *MNRAS*, 528(2):1487–1499, [February 2024:1487–1499](#)
22. T. Zhang, X. Li, R. Dalal, et al. A general framework for removing point-spread function additive systematics in cosmological weak lensing analysis. *MNRAS*, 525(2):2441–2471, [October 2023:2441–2471](#)
23. T. Sunayama, H. Miyatake, **Sugiyama, Sunao**, et al. Optical Cluster Cosmology with SDSS redMaPPer clusters and HSC-Y3 lensing measurements. *arXiv e-prints*, arXiv:2309.13025, [September 2023:arXiv:2309.13025](#)
24. Y. Park, T. Sunayama, M. Takada, et al. Cluster cosmology with anisotropic boosts: validation of a novel forward modelling analysis and application on SDSS redMaPPer clusters. *MNRAS*, 518(4):5171–5189, [February 2023:5171–5189](#)

Other Articles

1. S. Sugiyama, M. Takada, and H. Miyatake. Weak lensing cosmology with subaru hsc data. *ASJ EUREKA*, 117(1):304–314, [May 2024:304–314](#)

TALKS

Listing 19 selected talks out of 41 talks. See [here](#) for the full list of talks.

1. **Exploring Primordial Black Hole with Microlensing Data: Updates on Analysis Pipeline**, UPenn CfPC workshop, 2024, Nov., *Oral*
2. **Exploring Primordial Black Hole with Microlensing Data: Updates on Analysis Pipeline**, [Focus week on primordial black holes 2024](#), 2024, Nov., *Oral (Invited Talk)*
3. **Cosmology with third-order shear statistics**, Roman F2F meeting, 2024, Oct., *Oral*

4. **Exploring Primordial Black Hole with Microlensing Data**, [Pacific conference](#), 2024, Aug., *Oral (Invited Talk)*
5. **Cosmology from Subaru HSC weak lensing Year 3 data**, [MIFA colloquium](#), 2024, May., *Oral (Invited Talk)*
6. **Cosmology from weak lensing three-point correlation function**, astro/cosmo seminar at CMU, 2024, Feb., *Oral*
7. **Cosmology from Subaru HSC weak lensing Year 3 data**, [Subaru Users Meeting FY2023](#), 2024, Jan., *Oral*
8. **HSC Y3 weak lensing cosmology results**, [CosmoPalooza](#), 2023, Oct., *Oral*
9. **HSC Year 3 Weak Lensing Cosmology Results**, [HSC webinar](#), 2023, Apr., *Oral*
10. **HSC Y3 cosmology results**, [CMB x LSS](#), 2023, Apr., *Oral (Invited Talk)*
11. **Collaborative coding: git and github**, [CD3 Opening Symposium](#), 2023, Apr., *Oral*
12. **Revealing the nature of dark matter with gravitational lensing: weak and microlensing**, [Colloquium at Osaka theoretical astrophysics group](#), 2022, Jul., *Oral (Invited Talk)*
13. **Exploring Primordial black hole with microlensing observation of Andromeda galaxy**, [Subaru Users Meeting 2021](#), 2022, Jan., *Oral*
14. **Joint analysis of galaxy-galaxy lensing and clustering at large scales from Subaru HSC and SDSS data**, [2021 Autumn Annual Meeting of ASJ](#), 2021, Sep., *Oral*
15. **Exploring Dark Matter Candidates with Microlensing**, [KEK theory seminar](#), 2021, Apr., *Oral*
16. **Testing stochastic gravitational wave signals by PBH microlensing**, [4th KEK-PH + KEK-Cosmo Joint Lectures and Workshop on "Gravitational Wave"](#), 2020, Nov., *Oral (Invited Talk)*
17. **Observational constraint on PBH scenarios with HSC microlensing**, [9th workshop on observational cosmology](#), 2020, Nov., *Oral*
18. **Validation of PT-based method for cosmology analysis with wide field galaxy survey data**, Seminar at astro group of Hirosaki University, 2020, Feb., *Oral*
19. **Wave effect on PBH micro-lensing and constraint**, [7th workshop on observational cosmology](#), 2018, Dec., *Oral*

PRESS RELEASES

[Primordial black holes and the search for dark matter from the multiverse](#), IPMU, 2020 Dec

[How to see the invisible: Using dark matter distribution to test our cosmological model](#), IPMU, 2024 Apr