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*

MAJOR INVOLVEMENT IN LARGE PROJECTS

Subaru HSC weak lensing working group, member (2021-present)
Dark Enrgy Survey (DES), member (2024-present)

POSITIONS

Postdoctoral researcher — **Sep. 2023 – Now**
University of Pennsylvania, Philadelphia, the United States
Mentor: Prof. Bhuvnesh Jain

JSPS Overseas Research Fellow — **Sep. 2023 – Now**
University of Pennsylvania, Philadelphia, the United States

Postdoctoral researcher — **Apr. 2023 – Aug. 2023**
Kavli IPMU, Chiba, Japan
Mentor: Prof. Masahiro Takada

Project Researcher — **Apr. 2023 – Aug. 2023**
Beyond AI, Tokyo, Japan

JSPS Research Fellowships for Young Scientists (DC2) — **Apr. 2021 – Mar. 2023**
Kavli IPMU, Chiba, Japan

EDUCATIONS

University of Tokyo, Tokyo, Japan — **Apr. 2020 – Mar. 2023**
Ph.D. course in Physics
Dissertation: *"Joint cosmology analyses using gravitational weak lensing data from Subaru Hyper Suprime-Cam"*
Supervisor: Prof. Masahiro Takada

University of Tokyo, Tokyo, Japan — **Apr. 2018 – Mar. 2020**
M.S. in Physics
Dissertation: *"Validation of cosmological analysis based on perturbation theory for wide-field galaxy survey"*
Supervisor: Prof. Masahiro Takada

University of Tokyo, Tokyo, Japan — **Apr. 2014 – Mar. 2018**
B.A. in Physics

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

OBSERVATIONS

PI, Definitive search for PBH dark matter in the multiverse cosmology with HSC

PROFESSIONAL SOCIETY

The Astronomical Society of Japan (ASJ), 2018 – present

The Physical Society of Japan (JPS), 2022 – present

PUBLICATIONS

For up-to-date list of my papers, please see ADS.

* = Author list alphabeticized
Major author

1. **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.** doi: 10. 1103/PhysRevD.108.123520

2. **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.** doi: 10.1103/PhysRevD.108.123519

3. **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.** doi: 10.1103/PhysRevD.108.123518

4. **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.** doi: 10.1103/PhysRevD.108.123517

5. **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.** doi: 10.1103/PhysRevD.108.123521

6. **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.** doi: 10.1016/j.physletb.2023.137891

7. **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.** doi: 10.1103/PhysRevD.106.083520

8. **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.** doi: 10.1103/PhysRevD. 106.083519

9. **Sugiyama, Sunao. Fast Fourier Transformation Based Evaluation of Microlensing Magnification with Extended Source.** ApJ, **937(2):63, October 2022:63.** doi: 10. 3847/1538-4357/ac8df1

10. **Sugiyama, Sunao, M. Takada, H. Miyatake, et al. HSC Year 1 cosmology results with the minimal bias method: HSC ×BOSS galaxy-galaxy weak lensing and BOSS galaxy clustering.** Phys. Rev. D, **105(12):123537, June 2022:123537.** doi: 10.1103/ PhysRevD.105.123537

11. **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.** doi: 10.1016/j.physletb.2021.136097

12. ***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.** doi: 10.1103/PhysRevLett.125.181304

13. **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. doi: 10.1103/PhysRevD. **102.083520**

14. **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. doi: 10.1093/mnras/staa407

15. 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. doi: 10.1038/s41550-019-0723-1

Contributing author

16. 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. doi: 10.1093/mnras/stae064

17. 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. doi: 10.1093/mnras/stad1801

18. 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. doi: 10.48550/arXiv. **2309.13025**

19. 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. doi: 10.1093/mnras/stac3410

SELECTED TALKS

Listing 11 selected talks among 31 talks.

1. HSC Y3 weak lensing cosmology results, CosmoPalooza, 2023, Oct., *Oral*

2. HSC Year 3 Weak Lensing Cosmology Results, HSC webinar, 2023, Apr., *Oral*

3. HSC Y3 cosmology results, CMB x LSS, 2023, Apr., *Oral* (Invited Talk)

4. Revealing the nature of dark matter with gravitational lensing: weak and microlensing, Colloqium at Osaka theoretical astrophysics group, 2022, Jul., *Oral* (Invited Talk)

5. Exploring Primordial black hole with microlensing observation of Andromeda galaxy, Subaru Users Meeting 2021, 2022, Jan., *Oral*

6. 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*

7. Exploring Dark Matter Candidates with Microlensing, KEK theory seminar, 2021, Apr., *Oral*

8. 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)

9. Observational constraint on PBH scenarios with HSC microlensing, 9th workshop on observational cosmology, 2020, Nov., *Oral*

10. Validation of PT-based method for cosmology analysis with wide field galaxy survey data, Seminar at astro group of Hirosaki University, 2020, Feb., *Oral*

11. Wave effect on PBH micro-lensing and constraintWave effect on PBH micro-lensing and constraint, 7th workshop on observational cosmology, 2018, Dec., *Oral*

PEER REVIEWS

Reviewer of International Journal of Modern Physics D

PRESS RELEASES

Primordial black holes and the search for dark matter from the multiverse

How to see the invisible: Using dark matter distribution to test our cosmological model

PROGRAMMING SKILLS

Computing Language	C, C++, Python, HSC pipeline (for image analysis)
Code developed	`fft-extended-source`
Software Maintenance	`dark emulator` as a part of Dark Quest Project

SEMINARS AND WORKSHOPS ORGANIZED

IPMU weekly lunch seminar (co-organizer), 2019 − 2021

HSC weaklensing mini workshop, Aug. 2022