Sangjun Cha | Curriculum Vitae

Academia Sinica Institute of Astronomy and Astrophysics (ASIAA)
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Experience

Academia Sinica Institute of Astronomy and Astrophysics (ASIAA) **Taipei, Taiwan**
EACOA Fellow *2026/09 – Present*
PI: Prof. Keiichi Umetsu

Education

Yonsei University **Seoul, Republic of Korea**
Ph.D. in Astronomy *2021/03 – 2026/08*
Thesis: High-Precision Mapping of Dark Matter in Galaxy Clusters Through Strong and Weak Lensing with Deep Learning
Advisor: Prof. Myungkook James Jee

Yonsei University **Seoul, Republic of Korea**
B.S. in Astronomy and Physics *2015/03 – 2021/02*
Leave of absence for compulsory military service, 2016–2017

Research Overview

My research uses gravitational lensing to map dark matter across a broad range of scales, from galaxy cluster cores to the surrounding cosmic web. I develop lensing mass reconstruction algorithms and apply them to deep and wide-field imaging. I use galaxy distributions, intracluster light, X-ray, and radio observations to interpret the resulting mass maps. These analyses probe cluster mass structure, merger geometry, and the connection between cluster cores and their larger-scale environments.

Publication Statistics

25 refereed or under-review papers: **7 first-author papers** (7 refereed), **4 papers as second or third author**, and **14 additional co-authored papers**.

Fellowships, Grants, Scholarships, and Awards

2026 – Present: EACOA Fellowship (East Asian Core Observatories Association), USD 20,000/year in research support

2025, 2026: Excellent Academic Paper Award (Yonsei University)

2025: Academic Research Fellowship (Yonsei University), ∼ USD 1,400

2024 – 2026: Doctoral Student Research Fellowship (National Research Foundation of Korea), ∼ USD 40,000

2024: Merit Academic Paper Award (Yonsei University)

2024: International Joint Research Grant (Yonsei Graduate School), ∼ USD 1,800

2021 – 2023: Integrated Undergraduate-and-Graduate Program Scholarship (Yonsei University; three-year full tuition), ∼ USD 23,000

2021 – 2023: Brain Korea 21 Plus Fellowship (Yonsei University), ∼ USD 30,000

2018 – 2020: Truth Scholarship (Yonsei University), ∼ USD 4,500

Successful Proposals

Gemini 2026B Gemini/Subaru Time Exchange (5.4 hours, PI)
Revealing Anisotropic Accretion from the Surrounding Large-Scale Structure onto MACS J0600.1-2008 with Subaru/PFS

Joint HST Cycle 34 / JWST Cycle 5 GO Program (HST GO-18395; JWST GO-12707; 27 HST orbits + 21.9 JWST hours, co-I)
LensTrove: Unlocking the Cosmological Power of Cluster-lensed Supernovae

JWST Cycle 5 (ID: 10341, 61.9 hours, co-I)
LUCID: Unveiling Galaxies Below the 1% Solar Metallicity Floor through Cosmic Telescopes

Joint HST Cycles 33–34 / JWST Cycles 4–5 GO Program (HST GO-18069/18452; JWST GO-9330/12576; 26 HST orbits + 25.8 JWST hours, co-I)
Requiem's Return: Precision cosmology from a decade-delayed, strongly-lensed supernova and its new sibling

MeerKAT (ID: MKT-25073, 5.5 hours, co-I)
From First Impact to Apocenter: Merger-driven Diffuse Radio Emission from Bullet-like Systems at Distinct Phases

Teaching Assistant

2021: Understanding of Space (Yonsei University)

2021: Astrophysics (Yonsei University)

2022: Introduction to Astrophysics (Yonsei University)

2022: Scientific Image Data Processing (Yonsei University)

Presentations

Talks

2026: Tracing Cluster-connected Filamentary Structures around Abell 2744: A Wide-field Weak-lensing View of the Surrounding Large-scale Structure / Filaments in the Multi-scale Universe: Understanding Their Role and Detectability / Japan / Contributed

2026: Testing BCG-Halo Offsets in Cluster Strong Lensing: Impact on Time-Delay Predictions / Precision Cosmology with Strong Lensing Time Delays / Japan / Contributed

2026: Stepwise 2D Tracing and Matched-filter Scans for the Analysis of Intracluster Filaments in Abell 2744: A Two-track Strategy for Wide-field Surveys / EAS 2026 / Switzerland / Contributed

2026: Tracing Dark Matter Morphology with Intracluster Light in the Bullet Cluster / EAS 2026 / Switzerland / Contributed

2026: BCG-Halo Offset Freedom and Time-delay Predictions in Cluster Strong Lensing: A Free-form Perspective / Cluster Time-Delay Cosmography Workshop (Spring Edition) / USA / Contributed

2026: High-Precision Mapping of Dark Matter in Galaxy Clusters Through Strong and Weak Lensing with Deep Learning / 2026 KAS Spring Meeting / Republic of Korea / Contributed

2025: Probing Dark Matter and Cluster Mergers with JWST Strong and Weak Lensing: Case Studies of the Bullet Cluster and Abell 2744 / 33rd Texas Symposium on Relativistic Astrophysics / USA / Contributed

2025: Weak-lensing Detection and Reconstruction of Filamentary Structures in the Rubin Era: A Case Study of Abell 2744 / Korean Rubin Science Workshop 2025 / Republic of Korea / Contributed

2025: Detection and Reconstruction of Filamentary Structures around Abell 2744 from Weak Lensing Alone / 2025 KAS Fall Meeting / Republic of Korea / Contributed

2025: From Cluster Cores to Filaments: Gravitational Lensing Studies of Galaxy Clusters / CfA Galaxy Clusters Group Meeting / USA

2025: Lensing Analysis of Merging Clusters in the JWST Era: The Bullet Cluster and Abell 2744 / 2025 Merging Cluster Workshop / Republic of Korea / Contributed

2025: JWST Lensing Analysis of Merging Galaxy Clusters: The Bullet Cluster and Abell 2744 / CL2025: Entering a Golden Age of Galaxy Cluster Studies / Taiwan / Contributed

2025: Probing Galaxy Cluster Mergers by Combining Strong and Weak Gravitational Lensing in the JWST Era / MPA Cosmology Seminar / Germany

2024: Probing Galaxy Clusters by Combining Strong and Weak Gravitational Lensing in the JWST Era / NOIRLab, University of Arizona / USA

2024: Probing Galaxy Clusters by Combining Strong and Weak Lensing in the JWST Era: Mass Reconstruction of Abell 2744 / The 11th KIAS Workshop on Cosmology and Structure Formation / Republic of Korea / Contributed

2024: Do Globular Clusters Trace Dark Matter? / 2024 KAS Fall Meeting / Republic of Korea / Contributed

2024: Constraining Cosmological Parameters through Strong Lensing / 2024 KAS Spring Meeting / Republic of Korea / Contributed

2023: Precision MARS Mass Reconstruction of Abell 2744: Combining Large Strong- and Weak-lensing Data Sets from JWST / 2023 KAS Fall Meeting / Republic of Korea / Contributed

2022: Wide-field Weak-lensing Mass Reconstruction with an Improved Convolutional Neural Network / 2022 KAS Fall Meeting / Republic of Korea / Contributed

2022: MARS Probe of Hubble Frontier Fields Clusters / IAUGA 2022 / Republic of Korea / Contributed

Posters

2025: Probing Galaxy Clusters from Cores to the Outskirts in the JWST Era: Mass Reconstruction of the Galaxy Cluster Abell 2744 by Combining Strong and Weak Lensing / Tracing Cosmic Evolution with Galaxy Clusters V / Italy

2025: Lensing through JWST: Greater Detail Nearby, New Perspectives at High Redshift / EAS 2025 / Ireland

2025: Lensing Analysis of the Bullet Cluster with JWST / 2025 KAS Spring Meeting / Republic of Korea

2024: Multi-resolution MAximum-entropy Reconstruction Technique Integrating Analytic Node (MrMARTIAN): A New Hybrid Lensing Reconstruction Method for the JWST Era / The 11th KIAS Workshop on Cosmology and Structure Formation / Republic of Korea

2024: Precision MARS Mass Reconstruction of Abell 2744: Synergizing the Largest Strong-lensing and Densest Weak-lensing Data Sets from JWST / EAS 2024 / Italy

2024: Constraining Cosmological Parameters through Strong Lensing / EAS 2024 / Italy

2023: MAximum-entropy ReconStruction (MARS): A New Strong-lensing Reconstruction Algorithm for the JWST Era / IAUS 381: Strong Gravitational Lensing in the Era of Big Data / Italy

2022: A New Maximum-entropy-regularized Strong-lensing Mass Reconstruction Method / 240th AAS Meeting / USA

Service and Outreach

2025: Local Organizing Committee member, Merging Cluster Workshop 2025 at Yonsei University

2023: Local Organizing Committee member, Merging Cluster Workshop 2023 at Yonsei University

Military Service (Completed compulsory military service in the Republic of Korea)

2016 – 2017: Korea National Police Agency Auxiliary Police

Selected Media Coverage

2025: First-author paper on the Bullet Cluster (ApJL, 987, L15), featured in a NASA press release

Publication List

Refereed Publications

First Author

[7]: Weak-lensing Analysis of Intracluster Filaments in Abell 2744: Matched-filter Scans and Stepwise 2D Tracing, **Cha, S.**, Finner, K., Jee, M. J., Grazian, A., 2026, arXiv:2604.07445, accepted for publication in ApJ

[6]: MrMARTIAN: A Multi-resolution Mass Reconstruction Algorithm Combining Free-form and Analytic Components, **Cha, S.**, Jee, M. J., 2026, ApJ, 997, 18

[5]: A High-Caliber View of the Bullet Cluster Through JWST Strong and Weak Lensing Analyses, **Cha, S.**, Cho, B. Y., Joo, H., Lee, W., HyeongHan, K., Scofield, Z. P., Finner, K., Jee, M. J., 2025, ApJL, 987, L15

[4]: Weak-lensing Mass Reconstruction of Galaxy Clusters with a Convolutional Neural Network. II. Application to Next-Generation Wide-Field Surveys, **Cha, S.**, Jee, M. J., Hong, S. E., Park, S., Bak, D., Kim, T., 2025, ApJ, 981, 52

[3]: Precision MARS Mass Reconstruction of A2744: Synergizing the Largest Strong-lensing and Densest Weak-lensing Data Sets from JWST, **Cha, S.**, HyeongHan, K., Scofield, Z. P., Joo, H., Jee, M. J., 2024, ApJ, 961, 186

[2]: Model-independent Mass Reconstruction of the Hubble Frontier Field Clusters with MARS Based on Self-consistent Strong-lensing Data, **Cha, S.**, Jee, M. J., 2023, ApJ, 951, 140

[1]: MARS: A New Maximum-entropy-regularized Strong Lensing Mass Reconstruction Method, **Cha, S.**, Jee, M. J., 2022, ApJ, 931, 127

Co-Author

[16]: The baryonic mass budgets in the central regions of the Bullet Cluster and their consistency with MONDian strong lensing, Zhang, D., Haghi, H., Asencio, E., Banik, I., Zonoozi, A. H., **Cha, S.**, Cho, B. Y., Joo, H., Kroupa, P., Lazutkina, A., Gjergo, E., 2026, PRD, 114, 023001

[15]: A stellar dynamical mass measurement of an inactive black hole at redshift 2, Newman, A. B., Gu, M., Belli, S., Ellis, R. S., Gangula, S., Greene, J. E., Walsh, J. L., Suyu, S. H., Ertl, S., Caminha, G., Granata, G., Grillo, C., Schuldt, S., Barone, T. M., Bird, S., Glazebrook, K., Jafariyazani, M., Kriek, M., Matthews, A., Morishita, T., Nanayakkara, T., Pierel, J. D. R., Acebron, A., Bergamini, P., **Cha, S.**, Diego, J. M., Foo, N., Frye, B., Fudamoto, Y., Jee, M. J., Kamieneski, P. S., Koekemoer, A. M., Meena, A. K., Nishida, S., Oguri, M., Rosati, P., Zitrin, A., 2026, Science, 392, 1065–1068

[14]: Joint JWST-DECam Lensing Reveals That the Bullet Cluster Is a Minor Merger, Cho, B. Y., Jee, M. J., Joo, H., **Cha, S.**, HyeongHan, K., 2026, ApJ, 1005, 28

[13]: Mature but Still Growing: JWST Detection of the Earliest Intracluster Light at $z \sim 2$, Joo, H., Jee, M. J., Finner, K., Scofield, Z. P., **Cha, S.**, Kim, J., Chary, R.-R., Faisst, A., Lee, B., 2026, ApJL, 1002, L17

[12]: Reproducing Abell 2744 with the HyperMillennium Simulation, Wang, Q., Li, M., Gao, L., Guo, Q., Angulo, R. E., **Cha, S.**, Cole, S., Frenk, C. S., HyeongHan, K., Li, R., Pei, W., Shan, H., Wang, J., White, S. D. M., 2026, MNRAS, 548, 1

[11]: Cosmology with supernova Encore in the strong-lensing cluster MACS J0138-2155: Lens model comparison and H_0 measurement, Suyu, S. H., Acebron, A., Grillo, C., Bergamini, P., Caminha, G. B., **Cha, S.**, Diego, J. M., Ertl, S., Foo, N., Frye, B. L., Fudamoto, Y., Granata, G., Halkola, A., Jee, M. J., Kamieneski, P. S., Koekemoer, A. M., Meena, A. K., Newman, A. B., Nishida, S., Oguri, M., Rosati, P., Schuldt, S., Zitrin, A., Cañameras, R., Hayes, E. E., Larison, C., Mamuzic, E., Millon, M., Pierel, J. D. R., Tortorelli, L., Wang, H., 2026, A&A, 708, A291

[10]: An Active Galaxy Cluster Merger at Cosmic Noon Revealed by JWST Weak Lensing and Multiwavelength Probes, Scofield, Z. P., Finner, K., Joo, H., Jee, M. J., Lee, W., **Cha, S.**, Kim, J., Lin, Y.-H., Chary, R.-R., Faisst, A., Lee, B., 2026, ApJL, 999, L1

[9]: Cosmology with supernova Encore in the strong-lensing cluster MACS J0138-2155: Time delays and Hubble constant measurement, Pierel, J. D. R., Hayes, E. E., Millon, M., Larison, C., Mamuzic, E., Acebron, A., Agrawal, A., Bergamini, P., **Cha, S.**, Dhawan, S., Diego, J. M., Frye, B. L., Gilman, D., Granata, G., Grillo, C., Jee, M. J., Kamieneski, P. S., Koekemoer, A. M., Meena, A. K., Newman, A. B., Oguri, M., Padilla-Gonzalez, E., Poidevin, F., Rosati, P., Schuldt, S., Strolger, L. G., Suyu, S. H., Thorp, S., Zitrin, A., 2026, ApJ, 998, 219

[8]: JWST Discovery of Strong Lensing from a Galaxy Cluster at Cosmic Noon: Giant Arcs and a Highly Concentrated Core of XLSSC 122, Finner, K., **Cha, S.**, Scofield, Z. P., Jee, M. J., Lin, Y.-H., Joo, H., Park, H., Morishita, T., Faisst, A., Lee, B., Wang, W., Chary, R.-R., 2025, ApJL, 994, L35

[7]: Is Earendel a Star? Investigating the Sunrise Arc Using JWST Strong and Weak Gravitational Lensing Analyses, Scofield, Z. P., Jee, M. J., **Cha, S.**, Park, H., 2025, ApJ, 993, 226

[6]: Cosmology with Supernova Encore in the strong-lensing cluster MACS J0138-2155: Photometry, cluster members, and lens mass model, Ertl, S., Suyu, S. H., Schuldt, S., Granata, G., Grillo, C., Caminha, G. B., Acebron, A., Bergamini, P., Cañameras, R., **Cha, S.**, Diego, J. M., Foo, N., Frye, B. L., Fudamoto, Y., Halkola, A., Jee, M. J., Kamieneski, P. S., Koekemoer, A. M., Meena, A. K., Nishida, S., Oguri, M., Pierel, J. D. R., Rosati, P., Tortorelli, L., Wang, H., Zitrin, A., 2025, A&A, 702, A157

[5]: SN H0pe: The First Measurement of H_0 from a Multiply Imaged Type Ia Supernova, Discovered by JWST, Pascale, M., Frye, B. L., Pierel, J. D. R., Chen, W., Kelly, P. L., Cohen, S. H., Windhorst, R. A., Riess, A. G., Kamieneski, P. S., Diego, J. M., Meena, A. K., **Cha, S.**, Oguri, M., Zitrin, A., Jee, M. J., Foo, N., Leimbach, R., Koekemoer, A. M., Conselice, C. J., Dai, L., Goobar, A., Siebert, M. R., Strolger, L., Willner, S. P., 2025, ApJ, 979, 13

[4]: Weak-lensing detection of intracluster filaments in the Coma cluster, HyeongHan, K., Jee, M. J., **Cha, S.**, Cho, H., 2024, Nature Astronomy, 8, 377

[3]: Weak-lensing Analysis of the Complex Cluster Merger A746 with Subaru/Hyper Suprime-Cam, HyeongHan, K., Cho, H., Jee, M. J., Wittman, D., **Cha, S.**, Lee, W., Finner, K., Rajpurohit, K., Brüggen, M., Forman, W., Jones, C., van Weeren, R., Botteon, A., Lovisari, L., Stroe, A., Domínguez-Fernández, P., O'Sullivan, E., Vrtilek, J., 2024, ApJ, 962, 100

[2]: Weak-lensing Mass Bias in Merging Galaxy Clusters, Lee, W., **Cha, S.**, Jee, M. J., Nagai, D., King, L., ZuHone, J., Chadayammuri, U., Felix, S., Finner, K., 2023, ApJ, 945, 71

[1]: Weak-lensing Mass Reconstruction of Galaxy Clusters with a Convolutional Neural Network, Hong, S. E., Park, S., Jee, M. J., Bak, D., **Cha, S.**, 2021, ApJ, 923, 266

Submitted Publications

[2]: A new H_0 measurement with SNe Requiem and Encore using Gravity.jl, Bazzanini, L., Di Rosa, G., Acebron, A., Bergamini, P., Lombardi, M., Rosati, P., Angora, G., Caminha, G. B., Ertl, S., Granata, G., Koekemoer, A. M., Suyu, S. H., Pierel, J., Newman, A. B., Grillo, C., Schuldt, S., Bulla, M., **Cha, S.**, D'Addona, M., Diego, J. M., Fogliardi, M., Frye, B. L., Jee, M. J., Kamieneski, P. S., Meneghetti, M., Mercurio, A., Vanzella, E., 2026, arXiv:2606.25205, submitted to A&A

[1]: Dark and Luminous Matter in the Coma Cluster: Probing Galaxy Cluster Assembly Through Filaments with Weak Lensing and Multiwavelength Observations, HyeongHan, K., Finner, K., Jee, M. J., Lee, W., Jiménez-Teja, Y., **Cha, S.**, Kang, W., Hwang, H. S., Cho, H., Churazov, E., Khabibullin, I., Lyskova, N., Sunyaev, R., Bykov, A. M., 2026, arXiv:2606.12523, submitted to A&A

Conference Proceedings

[1]: MAximum-entropy ReconStruction (MARS): A New Strong-lensing Reconstruction Algorithm for the JWST Era, **Cha, S.**, Jee, M. J., 2024, Proceedings of the International Astronomical Union, Vol. 18, Symp. 381, 102–105