

# Sangjun Cha — CV

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[ADS Library](#) [Google Scholar](#)

## Education

### Yonsei University

*Ph.D. in Astronomy*

2021/03 – 2026/08 (expected)

Thesis: High-Precision Mapping of Dark Matter in Galaxy Clusters Through Strong and Weak Lensing with Deep-Learning Techniques

Supervisor: Prof. Myungkook James Jee

### Yonsei University

*B.S. in Astronomy & Physics (Double majors)*

2015/03 – 2021/02

(Studies were interrupted by compulsory military service, 2016–2017)

## Research Highlights

- Lead developer of the MARS and MrMARTIAN cluster lensing codes, including automatic differentiation, deep learning optimizers, and analytic components for hybrid modeling.
- 6 first-author papers on cluster lensing, JWST Bullet/Abell 2744, and CNN-based weak-lensing mass mapping

## Research Interests

Cosmology, Deep learning, Galaxy clusters, Large-scale structure of the universe, Strong gravitational lensing, Weak gravitational lensing

## Publication Statistics

18 total refereed/under-review papers. **6 first-author papers** (6 refereed),  
**4 second or third author** and **8 co-author papers** (8 refereed, 4 under review)

## Fellowship, Grants, Scholarship, and Awards

**2018 – 2020:** Truth Scholarship (Yonsei University), ~ USD 4500

**2021 – 2023:** Integrated Undergraduate-and-Graduate Program Scholarship (Yonsei University; Three-year full-tuition), ~ USD 23000

**2021 – 2023:** Brain Korea 21 Plus Fellowship (Yonsei University), ~ USD 30000

**2023:** Yonsei Merit Academic Paper Award (Yonsei University)

**2024:** Excellent Academic Paper Award (Yonsei University), ~ USD 400

**2024 – 2026:** Doctoral Student Research Fellowship (National Research Foundation of Korea) - Title: A research on Cosmological Parameter Prediction in Modern Cosmology Combining Strong Gravitational Lensing and Deep-Learning technique, ~ USD 40000

**2024:** International Joint Research Grant by Yonsei Graduate School, ~ USD 1800

**2025:** Academic Research Fellowship (Yonsei University), ~ USD 1400

## Teaching Assistant

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**2021:** UNDERSTANDING OF SPACE (Yonsei University)

**2021:** ASTROPHYSICS (Yonsei University)

**2022:** INTRODUCTION TO ASTROPHYSICS (Yonsei University)

**2022:** SCIENTIFIC IMAGE DATA PROCESSING (Yonsei University)

## Successful Proposals

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### Hubble Space Telescope Cycle 33 (25.8 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

## Presentations

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### Talk.....

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

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

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

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

**2024:** Do Globular Cluster Trace Dark Matter? / 2024 KAS Fall Meeting / South Korea / Contributed

**2024:** Constraining Cosmological Parameters through Strong Lensing / 2024 KAS Spring Meeting / South Korea / Contributed

**2023:** Precision MARS Mass Reconstruction of Abell 2744: Combining Large Strong and Weak Lensing Datasets from JWST / 2023 KAS Fall Meeting / South Korea / Contributed

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

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

### Poster.....

**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 High Redshift / EAS 2025 / Ireland  
**2025:** Lensing Analysis of the Bullet Cluster with JWST / 2025 KAS Spring Meeting / South Korea  
**2024:** Multi-resolution MAXimum-entropy Reconstruction Technique Integrating Analytic Node (Mr.MARTIAN): A New Hybrid Lensing Reconstruction Method for the JWST Era / The 11th KIAS Workshop on Cosmology and Structure Formation / South Korea  
**2024:** Precision MARS Mass Reconstruction of A2744: 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

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**Military Service** (Served as a part of the compulsory military service in South Korea)

**2016 – 2017:** Korea National Police Agency Auxiliary Police

**2023:** Merging Cluster Workshop 2023 at Yonsei – Served as a LOC

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

**2025:** Merging Cluster Workshop 2025 at Yonsei – Served as a LOC

## Publication List

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### Refereed Publications.....

#### First Author

**[6]:** MrMARTIAN: A Multi-resolution Mass Reconstruction Algorithm Combining Free-form and Analytic Components, **Cha, S.**, Jee, M. J., 2025, arXiv:2508.13262, accepted in ApJ

**[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

**[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.-. heng ., Joo, H., Park, H., Morishita, T., Faisst, A., Lee, B., Wang, W., Chary, R.-R., 2025, arXiv:2508.08356, accepted in ApJL

**[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, HyeonHan, K., Jee, M. J., **Cha, S.**, Cho, H., 2024, NatAs, 8, 377
- [3]: Weak-lensing Analysis of the Complex Cluster Merger A746 with Subaru/Hyper Suprime-Cam, HyeonHan, 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.....

- [4]: 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., HyeonHan, K., Li, R., Pei, W., Shan, H., Wang, J., White, S. D. M., 2025, arXiv, arXiv:2510.27291, submitted to MNRAS
- [3]: Cosmology with supernova Encore in the strong lensing cluster MACS J0138-2155: Lens model comparison and H0 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., and Wang, H., 2025, arXiv, arXiv:2509.12319, submitted to A&A
- [2]: Cosmology with supernova Encore in the strong lensing cluster MACS J0138-2155: Time delays & 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., and Zitrin, A., 2025, arXiv, arXiv:2509.12301, submitted to ApJ
- [1]: A dynamical mass measure of an inactive black hole in the distant universe, 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., 2025, arXiv:2503.17478, submitted

### Conference Proceedings.....

- [1]: MAximum-entropy ReconStruction (MARS): A New Strong-lensing Reconstruction Algorithm for the JWST Era, **Cha, S.**, Jee, M. J., Proceedings of the International Astronomical Union , Volume 18 , Symposium S381: Strong Gravitational Lensing in the Era of Big Data , December 2022 , pp. 102 - 105