

# 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

20 total refereed/under-review papers. **6 first-author papers** (6 refereed),  
**4 second or third author** and **10 co-author papers** (8 refereed, 6 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, 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, NatAs, 8, 377

**[3]: Weak-lensing Analysis of the Complex Cluster Merger A746 with Subaru/Hyper Suprime-Cam**, Hyeong-Han, 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.....

**[6]: 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., and Lee, B., 2025, arXiv, arXiv:2512.11022

**[5]: 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., 2025, arXiv, arXiv:2512.03150, submitted to ApJ

**[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., HyeongHan, 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  $H_0$  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., 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, arXiv:2503.17478, submitted

## Conference Proceedings.....

**[1]: MMaximum-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