

Minjae Kim

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RESEARCH INTERESTS

I study how gas flows and black hole growth shape galaxies across cosmic time, using the circumgalactic medium and high-redshift quasars as complementary probes. I am particularly interested in connecting multi-wavelength observations, from X-ray to radio, with theoretical predictions to constrain feedback and the baryon cycle.

EDUCATION

Korea Advanced Institute of Science and Technology (KAIST) 2020 – Feb. 2027 (Expected)

- B.S. in Physics, Minor in Electrical Engineering.
- GPA: 3.95/4.30; Upper-division GPA: 4.14/4.30.
- Major coursework: Quantum Mechanics I & II, Mathematical Physics I & II, Statistical Physics, Theory of Relativity and Cosmology, Astrophysics, Radio Astronomy, Computational Physics.

UC Berkeley Summer Exchange Student: Completed Introduction to Astrophysics Summer 2024

PUBLICATION

1. **Minjae Kim** and Junhan Kim, “Intrinsic Soft X-ray Emission from the Hot Circumgalactic Medium in IllustrisTNG,” *Submitted to The Astrophysical Journal* (Oct. 2026), [arXiv:2610.16200](#).
2. **Minjae Kim** and Bomee Lee, “SPHEREx Near-Infrared Spectrophotometric View of Luminous Quasars at $4 < z < 6.6$: Rest-Frame Optical Properties and Physical Implications,” *In preparation*.

RESEARCH EXPERIENCE

ObsCAL Group, KAIST (Prof. [Junhan Kim](#)) Aug. 2024 – **Present**

- Modeled soft X-ray luminosity (L_X) from the hot circumgalactic medium (CGM) of IllustrisTNG galaxies. [1]
- Fitted L_X scaling relations with MCMC and tested the L_X -SFR link via partial correlations.
- Found that quiescent galaxies retain as much hot gas and thermal energy as star-forming galaxies; the gas is redistributed to larger radii rather than expelled, lowering their L_X by an order of magnitude.
- Explored an ML-based causal inference approach to the CGM.

Korea Astronomy and Space Science Institute (Dr. Bomee Lee) Jan. 2026 – **Present**

- Assembled $\sim 1,040$ quasars at $z > 5$ and matched them to SPHEREx spectra. [2]
- Built an SED-fitting pipeline that forward-models SPHEREx’s low spectral resolution ($R \sim 35\text{--}130$) and measured rest-frame optical properties.
- Found that these quasars already host massive black holes accreting near the Eddington limit.

International Summer Research Program, UCSC (Prof. [Raja GuhaThakurta](#)) Summer – Winter 2025

- Led a Bayesian mixture-model analysis of Keck/DEIMOS stellar velocities in M32, finding that serendipitously detected stars contain a higher fraction of M32 members than targeted stars.
- Supervised three high school interns on this project as a Science Internship Program (SIP) mentor; one presented the analysis as a poster at the 247th AAS Meeting.

ACADEMIC PRESENTATIONS

Slides, materials, and recorded presentations available [here](#).

KAS Fall Meeting (Poster) Fall 2026

- Presented final results on CGM X-ray signatures in IllustrisTNG.

SPHEREx Regional Meeting (Oral) & KAIST-KASI Network Meeting (Oral) May & Aug. 2026

- Presented “SPHEREx Near-Infrared Spectrophotometric View of Luminous Quasars at $z > 5$.”

KPS Spring Meeting (Oral) & APRIM 2026, Hong Kong (Poster) Spring 2026

- Presented “Probing Hot Gas Components of the Circumgalactic Medium through X-ray Signatures.”

KASI Winter Internship Seminar (Oral) / KAS Spring Meeting (Poster) Spring 2026

- Presented “Spectral Analysis for High-Redshift Quasars using SPHEREx Data.”
- Korea Astronomy Machine Learning (KAML) Meeting** (*Oral*) Spring 2026
- Presented a preliminary machine learning–based causal inference approach for CGM research.
- KPS Undergraduate Physics Research Competition** (*Poster*) / **KAIST URP Final** (*Oral*) Fall 2025
- Presented CGM X-ray research; awarded the Excellent Award for both presentations.
- KPS Spring Meeting / KAS Spring Meeting** (*Poster*) Spring 2025
- Presented early results on CGM X-ray signatures in IllustrisTNG.

AWARDS & HONORS

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- Best Tutor Award**, KAIST Freshmen Tutoring Spring 2026
- Tech Innovator Recognition**, NASA Space Apps Challenge, Seoul Fall 2025
- [SARchive](#): Interactive 3D web platform that visualizes global mountain ranges through SAR data.
- Excellent Award (2nd place)**, [Undergraduate Research Program \(URP\)](#), KAIST Fall 2025
- Selected for follow-up research funding (USD 3.7K, Dec. 2025 – Jun. 2026).
- Excellent Award**, Undergraduate Physics Research Competition, Korea Physical Society (KPS) Fall 2025
- Dean’s List**, Department of Physics, KAIST Spring & Fall 2025
- Outstanding Presentation Award**, Korea Physical Society (KPS) Spring 2025
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- Department Honors Scholarship**, Department of Physics, KAIST Spring & Fall 2025
- KAIST Presidential Fellowship** (KPF Honor Society) 2020
- National Science & Technology Scholarship**, Korean Government 2020
- Merit-based national scholarship covering full tuition and a semester stipend.
- Hansung Sonjaehan Scholarship** 2019
- Awarded by the Hansung Sonjaehan Scholarship Foundation, with a stipend of USD 4K per year.

TEACHING EXPERIENCE

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- Undergraduate Tutor, General Physics I & II**, KAIST Freshman Tutoring Fall, 2025 – **present**
- Led weekly review and Q&A sessions on core physics concepts for KAIST freshmen.
- Research Mentor, [Science Internship Program \(SIP\)](#)**, UC Santa Cruz Summer 2025
- Supervised a research group of three high school interns under Prof. Raja GuhaThakurta.
 - Tutoring: Fundamentals of astronomical data analysis, Python coding, and scientific presentation.
 - Guided one intern to present our M32 analysis as a poster at the [247th Meeting of AAS](#).

Trainings

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- CERN Korean Summer Student Program**, Korean Physical Society Jun. – Jul. 2026
- Project: WIMP freeze-out and FIMP freeze-in within the Higgs Portal Scalar Singlet model.
- SKA Korea Summer Workshop 2026**, KASI/KAIST, Daejeon Aug. 19–21, 2026
- Radio Summer School & Radio Telescope Users’ Meeting**, KASI Aug. 2025 & 2026
- KASI-UST Winter Internship Program**, KASI Jan. – Feb. 2026
- NUPS – Exoplanet Exploration Club**, KAIST Jan. – Dec. 2025
- Presented paper reviews and participated in observation practice sessions.
- Republic of Korea Army**, Honorable Discharge (Sergeant) Jan. 2022 – Jul. 2023

SKILLS & LANGUAGES

Programming: Python (NumPy, SciPy, Astropy, Matplotlib), L^AT_EX (AASTeX), Git/GitHub.

Statistics: Bayesian inference with MCMC ([emcee](#)) and nested sampling ([dynesty](#)); Gaussian mixture models.

Simulations & Data: IllustrisTNG, pyatomdb/APEC, micrOMEGAs; SPHEREx, Keck/DEIMOS, HST.

Languages: Korean (native), English (TOEFL iBT 5.5/6.0; 110/120).