Joohyun Lee

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RESEARCH INTEREST

Theoretical & Computational Astrophysics
numerical cosmological simulation of the epoch of reionization;
role of dark matter models in the growth of structures;
general galaxy formation & evolution; usage of machine learning in simulation data analysis

EDUCATION

Ph.D. in Astronomy, The University of Texas at Austin 09/2021 - present
Supervisor: Paul Shapiro

B.Sc. in Physics & B.Eng. in Electrical and Computer, Seoul National University 03/2014 - 08/2021

RESEARCH EXPERIENCE

Graduate Student Fellow, The University of Texas at Austin 09/2021 -
(Supervisor: Prof. Paul Shapiro)

- Multiple Beads-on-a-string Dark-Matter-Deficient Galaxies Produced in a Mini-Bullet (Cluster) Galaxy Collision
  - Ran a suite of N-body/hydro simulations of Satellite-satellite galaxy collisions with the presence of a massive host
  - Performed orbit integration of the produced dark-matter-deficient galaxies to compare with observations
- The Inhomogeneous Rise of Metallicity During the Epoch of Reionization
  - Analyzed the Cosmic Dawn (CoDa) III simulation to study the metal enrichment process in the IGM/CGM during the EoR

Research Associate, Computational Cosmology Group, Seoul National University 09/2019 - 08/2021
(Supervisor: Prof. Ji-hoon Kim)

- Estimating Galactic Baryonic Properties from Their Dark Matter Using Machine Learning
  - Applied trained machine to the cosmological simulation halo catalog (IllustrisTNG simulation)
  - Computed and compared two-point correlation function in IllustrisTNG halo catalog and machine-predicted halo catalog
- Dark-Matter-Deficient Galaxies Produced Via High-velocity Galaxy Collision in Cosmological Simulation
  - Studied IllustrisTNG catalog to find high-speed collision events of dwarf galaxies to compare with idealized simulation
- pc-scale Simulation of Simultaneous Formation of Dark-Matter-Deficient Galaxies and Star Clusters
  - Ran a suite of 1.25 pc-resolution galaxy collision simulations with different merger configuration and feedback schemes
  - Resolved and tracked the formation process of dark-matter-deficient galaxies and massive star clusters

Research Associate, AGN Research Group, Seoul National University 09/2020 - 02/2021
(Supervisor: Prof. Jong-Hak Woo)

- Calibrated and Applied Novel Method of Measuring SFR in AGNs
  - Tested Oxygen emission line flux as SFR indicator by statistically analyzing SDSS spectroscopy data and IR surveys
  - Investigated correlation between gas outflow strength from AGNs and star formation of host galaxies

AWARDED FELLOWSHIPS & SCHOLARSHIPS

FINESST Fellowship (**$150k**), NASA 09/2022 - 08/2025
Dean's Excellence Fellowship, University of Texas at Austin 09/2021 - 08/2022
Presidential Science Scholarship (∼ **$40k**), Korea Student Aid Foundation 03/2014 - 08/2020

AWARDED COMPUTING TIME

Stampede3 (∼ **5k** CPU hours), NSF ACCESS 03/2024 - 08/2025

PUBLICATIONS (ADS Library)

- **Lee, J.**, Shin, E. -j., Kim, J. -h., Shapiro, P. R., & Chung, E., "Multiple Beads-on-a-string: Dark Matter-Deficient Galaxy Formation in a Mini-Bullet Satellite-satellite Galaxy Collision", *ApJ 966 (2024) 72*, *astro-ph:2312.11350*
- **Lee, J.**, Shin, E. -j., & Kim, J. -h., "Dark Matter Deficient Galaxies And Their Member Star Clusters Form Simultaneously During High-velocity Galaxy Collisions In 1.25 pc Resolution Simulations", *ApJL 917 (2021) L15*, *astro-ph:2108.01102*
- Shin, E. -j., Jung, M., Kwon, G., Kim, J. -h, **Lee, J.**, Jo, Y., & Oh, B. K., "Dark Matter Deficient Galaxies Produced Via High-velocity Galaxy Collisions In High-resolution Numerical Simulations", *ApJ 899 (2020) 25*, *astro-ph:2007.09889*

CONTRIBUTED TALKS & PRESENTATIONS

- Cosmic Dawn at High Latitudes Conference 06/2024
- First Stars Conference 05/2024
- UT Austin Extragalactic/Cosmology Seminar 11/2023
- FirstLight Conference (poster) 06/2023
- UT Austin Extragalactic/Cosmology Seminar 05/2023
- IAUGA 2022 (poster) 08/2022
- APS April Meeting 2022 04/2022
- Galaxy Evolution Workshop 2021, ASIAA 02/2022
- Numerical Galaxy Formation Mini-Workshop, SNU 01/2022
- SAZERAC-SIPS Early Galaxy Formation Near and Far — Preparing for a Long Journey with JWST 12/2021
- The 1st KIAA Forum on Gas in Galaxies for Early Career Scientists (KooGiG-Junior workshop) 10/2021
- UT Austin Extragalactic/Cosmology Seminar 09/2021
- AGORA WORKSHOP 2021 08/2021

ADVISING & RESEARCH MENTORING

Eugene Lee, as a research mentor 05/2024 -
Jany Esquivel, as an NSF REU informal research mentor 06/2024 - 07/2024
Eunwoo Chung, as a research mentor, co-authored a paper 01/2023 - 12/2023

COMPUTING SKILLS & EXPERIENCES

Languages: Python, C, C++, LaTex (skilled); Fortran, MATLAB, Mathematica, HTML, Markdown (familiar); IDL, RISC-V assembly language (basic)

Astrophysical Simulation Codes: Enzo, Ramses, Gadget, MUSIC, DICE, yt

Machine Learning: JAX, PyTorch (familiar); TensorFlow (basic)

High performance computing experience:

- Local cluster of Computational Cosmology Group, Seoul National University (CentOS)
- Nurion, Korea Institute of Science and Technology Information (CentOS)
- Frontera (CentOS), Stampede3, Stampede2 (Red Hat), Texas Advanced Computing Center
- Andes, Oak Ridge National Laboratory (Linux)

MENTORING, OUTREACH & TEACHING EXPERIENCES

GUMMY Mentor in UT Astro. Dept.	08/2023 -
Informal Mentor for Summer NSF REU Scholars	2022, 2023, & 2024
Korea Student Aid Foundation Science Teaching Service Organization	01 - 02/2015
Habitat for Humanity in Cebu, Phillippines	02/2016
Military Service at Korean Air Force 5th Air Mobility Wing	05/2017 - 04/2019

OTHER SKILLS

Languages: Korean (native), English, Japanese (fluent)