Honggeun Kim

Cambridge, MA | hgkim@mit.edu | (617) 955-9764 | website: https://honggeunkim.github.io/

SUMMARY

Extensive experience with applying statistical methods including power spectrum analysis (Fourier transform), Principal Component Analysis (PCA), Singular Value Decomposition (SVD), Gaussian Process Regression (GPR), and the Fisher Information Matrix. Research experience using deep learning techniques, such as U-net, for segmenting radio interferometric images. Conducted research projects in collaboration with over 100 people as part of the Hydrogen Epoch of Reionization Array (HERA), working in a team environment on multi-disciplinary projects.

EDUCATION

Massachusetts Institute of Technology (MIT), Cambridge, MA, USA

Ph.D. Department of Physics Expected 2024

Dissertation: "Instrumental effects in 21 cm Cosmology: Power spectrum and One-point statistics with the HERA Interferometer" under the supervision of Prof. Hewitt

GPA: 4.6/5.0

Yonsei University, Seoul, South Korea

M.S. Astronomy Department *2016*

Thesis: "Research on the Structure of the AGN Torus through the Fraction of Optically-Selected Type 1 AGNs based on the SDSS DR7" under the supervision of Prof. Yi

GPA: 4.3/4.3

Yonsei University, Seoul, South Korea

B.S. Astronomy Department *2013*

GPA: 4.26/4.3 (graduate as rank 1st out of 220 (College of Science))

SKILLS

Programming Languages: python (fluent): built a code for fast calculation of radio interferometric measurements (https://github.com/vispb/vispb/tree/main).
Basic experience on C++ and JAVA.
Software: CST (3D electromagnetic fields simulation software)
Courses: Coursework covering the curriculum of physics including Quantum Computation and Machine Learning (course number 6.7900)
Languages: English (proficient), Korean (native), Japanese (basic)

EXPERIENCE

Department of Physics, MIT, Cambridge, MA, USA *Spring 2024 – current*

Research Assistant

- *Processed a substantial volume of radio interferometric data to generate image data cubes, effectively reducing the data volume using an optimal mapping technique.*
- *Conducted comprehensive analyses of one-point statistics in radio interferometric images using the deepest existing observation data targeting the distant universe for the first time.*
- *Forecasted future observation by using Fisher information matrix to explore non-Gaussianity in early universe.*
- *Researched the tomography of early universe by using U-net with pyTorch (convolutional neural network).*

Department of Physics, MIT, Cambridge, MA, USA Fall 2023

Teaching Assistant, "Junior Lab"

- Prepared and helped lab experiments every week, consulted student's lab projects, and graded student's reports, term project papers, and presentations.

Department of Physics, MIT, Cambridge, MA, USA *Spring 2019 - Spring 2023*

Research Assistant

- *Created 3D models of radio beams accounting for potential perturbations in our antenna system, and analyzed how these perturbations impact power spectrum analysis.*
- *Devised a rapid simulator of radio interferometric measurements by streamlining redundant calculations and parallelizing computationally extensive tasks.*

- *Identified and specified strategies for mitigating systematics and unwanted signals in radio observations through the application of Fourier filtering, PCA, and GPR.*

Department of Physics, MIT, Cambridge, MA, USA *Fall 2018*
Teaching Assistant, "Early Universe"
- Conducted weekly recitation, helped students with course materials, and graded homework and exams.

Department of Astronomy, Yonsei University, Seoul, South Korea *Fall 2014*
Teaching Assistant, "Galaxy and Universe"

Department of Astronomy, Yonsei University, Seoul, South Korea *Fall 2013*
Teaching Assistant, "Cosmology "

PUBLICATIONS

Kim et al., 2024, "Exploring One-point Statistics in HERA Phase I Data: Effects of Foregrounds and Systematics on Measuring One-Point Statistics", in preparation

Kim et al., 2023, "The Impact of Beam Variations on Power Spectrum Estimation for 21 cm Cosmology. II. Mitigation of Foreground Systematics for HERA", The Astrophysical Journal, 953, 136

Kim et al., 2022, "The Impact of Beam Variations on Power Spectrum Estimation for 21 cm Cosmology. I. Simulations of Foreground Contamination for HERA", The Astrophysical Journal, 941, 207

Khim and Yi, 2017, "On the Structure of the AGN Torus through the Fraction of Optically Selected Type 1 AGNs", The Astrophysical Journal, 846, 155

Khim et al., 2015, "Demographics of Isolated Galaxies Along The Hubble Sequence", The Astrophysical Journal, 220, 3

HONORS AND ACHIEVEMENTS

Fellowship of Physics Department, MIT (2017)
The Highest Honors at Graduation, Yonsei University (2012)
The Highest Honors, Yonsei University (2009, 2010, 2011)
The National Scholarship for Science and Engineering (South Korea, 2009-2010)