HYUNSU KONG

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ACADEMIC POSITIONS

Rensselaer Polytechnic Institute, Department of Physics, Applied Physics & Astronomy
Postdoctoral Research Associate 2025–

The University of Texas at Austin, Department of Astronomy
Visiting Scholar 2017–2018

EDUCATION

Ph.D. in Physics, *The University of Texas at Austin* 2018–2025
Advisor: Michael Boylan-Kolchin

B.S. in Physics, *The University of Texas at Austin* 2014–2017

A.S. in Physics, Highest Honors *Houston Community College* 2009–2011

RESEARCH EXPERIENCE

Research Interests

- Cosmology, dark matter, galaxy formation/evolution, numerical simulations
- Investigating the statistical properties of dark matter subhalos in Milky Way-mass halos to validate the ΛCDM cosmological model or propose alternative theories
- Predicting the abundance of ultra-faint satellite galaxies around the Milky Way.
- Developer of Bloodhound: a novel subhalo-tracking algorithm designed to efficiently track subhalos in cosmological simulations: improves subhalo tracking by 4 billion years, leading to identification of 30% more subhalos within 50 kpc the host halo
- Managing data for the Phat ELVIS cosmological simulation project, which includes 12 dark matter-only (DMO) simulations of Milky Way-mass dark matter halos and 12 Disk simulations with an embedded galaxy potential

Collaborations

FIRE (Feedback In Realistic Environments)
Phat ELVIS (Exploring the Local Volume in Simulations)

PRESENTATIONS

Invited Workshop — **UPenn, Dept. of Physics and Astronomy** — Oct 2024
Using Bloodhound for Tracking Dark Matter Subhalos in Cosmological Simulations

- Invited by Prof. Robyn Sanderson to lead a workshop on the application of Bloodhound, a next-generation halo tracker, for advanced subhalo analysis in cosmological simulations
- Engaged faculty, postdocs, and graduate students from Caltech, MIT, UC Irvine, and UPenn in hands-on demonstrations and discussions about improving subhalo tracking and testing the ΛCDM model

Invited Talks — **UC Irvine Astrophysics Seminar** — Oct 2024
UC Riverside Astro Seminar — Oct 2024
Carnegie Observatories Dark Matter Group Meeting — Oct 2024
UPenn Astronomy Journal Club — Oct 2024

Conference Talks — **Self-Interacting Dark Matter: Models, Simulations and Signals** — June 2023
Bloodhound: Tracking the Evolution of Substructures — *Pollica, Italy*

Seminar Talks	**Galaxies and Cosmology Seminar, Astronomy Department**	
	Oct 2020, Oct 2022, Feb 2023, April 2024	*UT Austin*
	Weinberg Institute Brown Bag, Physics Department	
	April 2024	*UT Austin*
Posters	**Cosmic Signals of Dark Matter Physics: New Synergies**	June 2024
	Bloodhound: Tracking dark matter subhalo particles in cosmological simulations	*KITP UCSB*

PUBLICATIONS

[1] **H. Kong**, M. Boylan-Kolchin, and J. Bullock, "Bloodhound Unleashed: Particle-based Substructure Tracking for Cosmological Simulations", submitted to MNRAS (arXiv:2503.10766)

MENTORSHIP

Research mentor: UT Austin Undergraduate Student Summer 2024–Present

MJ Cooke

- **Co-Mentorship Role:** Actively co-mentored MJ Cooke with Postdoctoral mentor Jenna Samuel, in the investigation of ultra-diffuse satellite galaxy formation using FIRE simulations, a project inspired by my prior work with the TAURUS mentee, Courtney Reed
- **Guided Research and Skill Development:** Provided hands-on guidance in project development, computational analysis, data interpretation, and scientific communication through structured feedback and collaborative session

Research mentor: UT Austin TAURUS research program 2022–2023

Courtney Reed

- **Collaborative Support:** Assisted Postdoctoral mentor Jenna Samuel in mentoring Courtney Reed, an undergraduate student from a traditionally marginalized background, focusing on a research project investigating ultra-diffuse satellite galaxy formation using FIRE simulations
- **Extended Engagement:** Continued involvement beyond the program, contributing to an AAS research note

Directed Reading Program (DRP) - Physics 2022–Present

Ashley Garcia, Ananya Gupta

- **Personalized Guidance:** Provided tailored mentorship to undergraduate students lacking prior research experience, guiding them through a directed reading project focused on mutually selected topics
- **Comprehensive Support:** Developed extensive project materials to facilitate a deep understanding of the latest developments and tests of ΛCDM, enabling mentees to deliver impactful end-of-program presentations

UT Austin GUMMY mentor 2022–Present

Rutajit Bharadwaj, Ananya Gupta, Mahan Mirza Khanlari, Sabiha Younus

- **Academic and Personal Support:** Offered guidance and support to undergraduate mentees, assisting in their academic and personal development at UT Austin
- **Career Mentorship:** Provided advice on course selection, research opportunities, and career aspirations, serving as a mentor and resource for their success in academia and preparation for graduate studies

NSF REU & UT Austin TAURUS informal mentor Summer 2022, 2023

Jaden Levine, Alfonso Melendez

- **Summer Mentorship:** Provided weekly mentorship to undergraduate mentees throughout the summer, guiding them in research projects, graduate school applications, and departmental engagement

TEACHING

Teaching Assistant Fall 2018, Spring 2019

The University of Texas at Austin

- PHY 103M: Physics Laboratory I-Mechanics
- Sole instructor for three 2-hour introductory mechanics laboratory classes each semester
- Prepared and conducted lectures at the beginning of each lab session, designed quizzes to help/assess student understanding, and provided thorough feedback on graded lab reports
- Offered support and guidance during office hours
- Gained experience as both a course instructor and a traditional graduate teaching assistant

Undergraduate Learning Assistant 2015-2017

The University of Texas at Austin

- Courses within Department of Physics: Waves and Optics, Modern Physics, Modern Physics Laboratory
- Courses within Department of Mathematics: Differential Calculus, Integral Calculus, Differential & Integral Calculus for Sciences
- Conducted office hours and led weekly discussion sections to aid students with course material and assignments
- Assisted the course instructor and students during class sessions

OUTREACH AND SERVICE

Reviewer & Judge **Capital of Texas Undergraduate Research Conference (CTURC)** March 2024

Presentation judge at annual CTURC event for researchers from all majors/universities in Texas and surrounding states *UT Austin*

Outreach Talks **NSF REU Seminar** July 2023, 2024

What are cosmological simulations? *UT Austin*

Physics Concerto: peer to peer seminar series, Physics Dept. Oct 2023

Testing ΛCDM with Dark Matter Subhalos *UT Austin*

Invited Panelist **Undergraduate Gender Minorities in Physics** Nov 2022

Graduate student panelist for Undergraduate GMiP's graduate school Q&A event *UT Austin*

Python Bootcamp **NSF REU Research Scholars** June 2024

Co-led sessions for a 3-week Python Bootcamp and developed instructional materials *UT Austin*

Korean Journal Club 2018-2022

Organized a journal club for Korean-speaking students from both the Astronomy and Physics departments *UT Austin*

- Organized and led a journal club for Korean-speaking students from both the Astronomy and Physics departments
- Fostered a sense of community among individuals with diverse scientific interests, including theoretical and observational cosmology, galaxy formation, and particle phenomenology

AWARDS & HONORS

ACCESS Explore project, PI, Stampede3-2817 SU, Ranch-20038 GB Feb 2024–Aug 2025

PHY240063: Testing Lambda-CDM with dark matter subhalos of Milky Way-mass halos

Carol May and James C. Thompson Scholarship in Physics Spring 2017

for Distinguished Academic Achievements *UT Austin*

Walter E. Millet Undergraduate Scholarship in Physics Fall 2015 & Spring 2016

for Distinguished Academic Achievements *UT Austin*

OTHER WORK EXPERIENCE

Republic of Korea Army, Sergeant Jan 2012–Oct 2013

23rd Infantry Division