

# HYUNSU KONG

PMA 16.212, Weinberg Institute, Department of Physics  
The University of Texas at Austin  
2515 Speedway, C1600, Austin, TX, 78712

Web: <https://hyunsukong.github.io/>  
Email: [hyunsukong@utexas.edu](mailto:hyunsukong@utexas.edu)

## EDUCATION

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<b>The University of Texas at Austin</b> , Austin, TX <i>Ph.D. in Physics</i> Advisor: Michael Boylan-Kolchin	2018–Present
<b>The University of Texas at Austin</b> , Austin, TX <i>B.S. in Physics</i>	2014–2017
<b>Houston Community College</b> , Houston, TX <i>A.S. in Physics, Highest Honors</i>	2009–2011

## RESEARCH EXPERIENCE

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### 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  $\Lambda$ CDM cosmological model or propose alternative theories
- Predicting the abundance of ultra-faint satellite galaxies around the Milky Way.
- Lead 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

### Visiting Scholar

Aug 2017–Aug 2018

*The University of Texas at Austin*

- Investigated the mutual influence of Milky Way and M31 analogues within the Cosmic Dawn (CoDa) simulation, exploring their role in accelerating reionization and galaxy formation in the local universe
- Supervisor: Paul Shapiro

### Collaborations

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

## PRESENTATIONS

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Invited Workshop	<b>UPenn, Dept. of Physics and Astronomy</b> <i>Using Bloodhound for Tracking Dark Matter Subhalos in Cosmological Simulations</i> <ul style="list-style-type: none"><li>• 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</li><li>• 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 <math>\Lambda</math>CDM model</li></ul>	Oct 2024
Invited Talks	<b>UC Irvine Astrophysics Seminar</b> <i>Bloodhound Unleashed: Unveiling Dark Matter Subhalos to Test <math>\Lambda</math>CDM</i>	Oct 2024
	<b>UC Riverside Astro Seminar</b> <i>Bloodhound Unleashed: Unveiling Dark Matter Subhalos to Test <math>\Lambda</math>CDM</i>	Oct 2024

	<b>Carnegie Observatories Dark Matter Group Meeting</b>	Oct 2024
	<i>Bloodhound Unleashed: Unveiling Dark Matter Subhalos to Test <math>\Lambda</math>CDM</i>	
	<b>UPenn Astronomy Journal Club</b>	Oct 2024
	<i>Bloodhound Unleashed: Unveiling Dark Matter Subhalos to Test <math>\Lambda</math>CDM</i>	
Conference Talks	<b>Self-Interacting Dark Matter: Models, Simulations and Signals</b>	June 2023
	<i>Bloodhound: Tracking the Evolution of Substructures</i>	Pollica, Italy
Seminar Talks	<b>Galaxies and Cosmology Seminar, Astronomy Department</b>	
	Oct 2020, Oct 2022, Feb 2023, April 2024	UT Austin
	<b>Weinberg Institute Brown Bag, Physics Department</b>	
	April 2024	UT Austin
Posters	<b>Cosmic Signals of Dark Matter Physics: New Synergies</b>	June 2024
	<i>Bloodhound: Tracking dark matter subhalo particles in cosmological simulations</i>	KITP UCSB

## PUBLICATIONS

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- [2] **H. Kong**, J. Samuel, M. Cooke, C. Reed, M. Boylan-Kolchin, “Formation and Evolution of Ultra-Diffuse Satellite Galaxies in FIRE”, arXiv: 25XX. (to appear)
- [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

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**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  $\Lambda$ CDM, 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

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### 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

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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  $\Lambda$ CDM 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

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**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

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**Republic of Korea Army, Sergeant**      Jan 2012–Oct 2013  
*23rd Infantry Division*