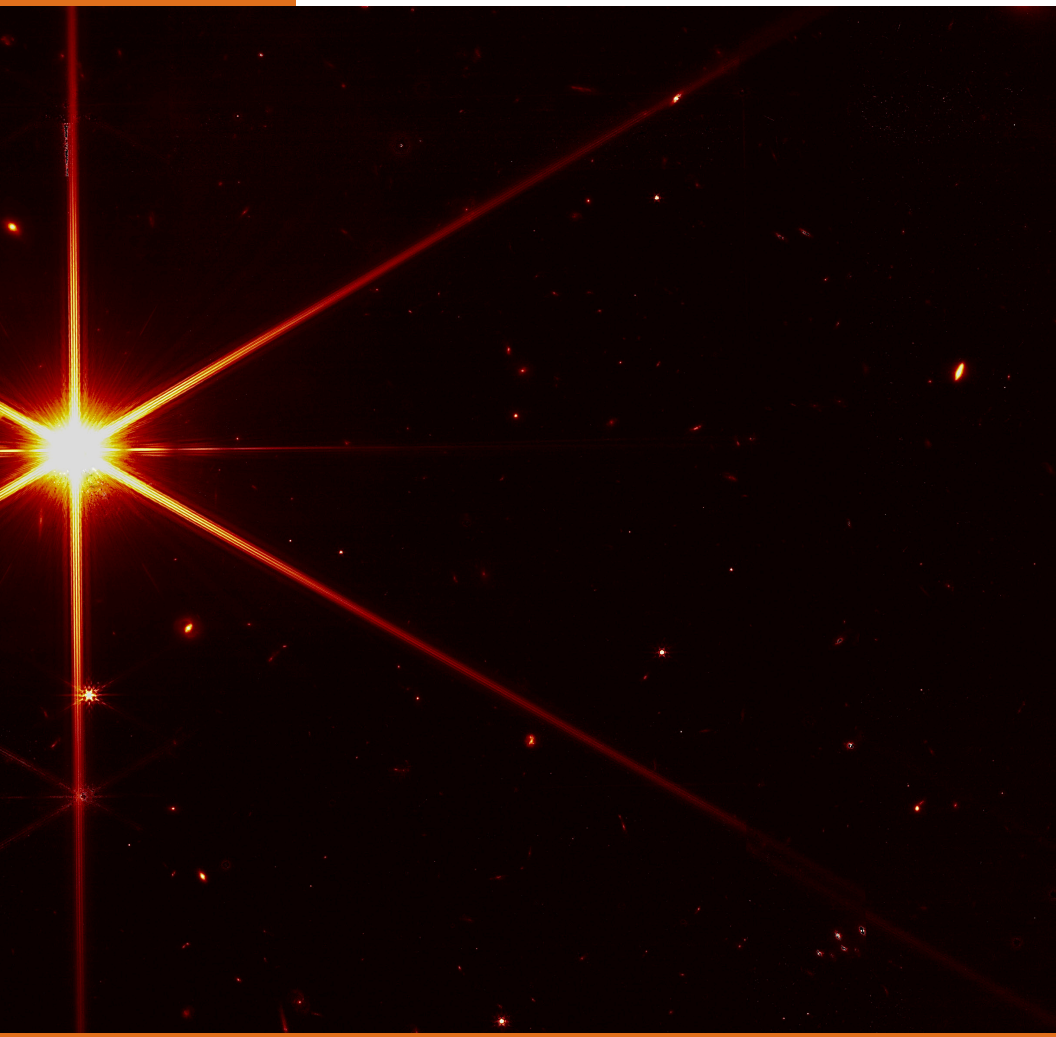
MAY

2022

AUSTIN, TEXAS

BOARD OF VISITORS

— SPRING MEETING —



The University of Texas at Austin
Department of Astronomy
College of Natural Sciences

McDonald Observatory
The University of Texas at Austin

COVER IMAGE

Telescope Alignment Evaluation Image from the James Webb Space Telescope (JWST)

Earlier this year, the JSWT completed the final phase of aligning its primary imaging instrument, the Near-Infrared Camera (or NIRCam).

"While the purpose of this image was to focus on the bright star at the center for alignment evaluation, Webb's optics and NIRCam are so sensitive that the galaxies and stars seen in the background show up. At this stage of Webb's mirror alignment, known as "fine phasing," each of the primary mirror segments have been adjusted to produce one unified image of the same star using only the NIRCam instrument. This image of the star [...] uses a red filter to optimize visual contrast." Credits: NASA/STScI

WELCOME TO THE UNIVERSITY OF TEXAS AT AUSTIN

Free time? Try visiting these recommended sites around UT's Austin campus.

See Vincenzo Coronelli's three-dimensional conception of Western constellations in the form of a 16th century Celestial Globe on view in the Stories to Tell exhibition at the Harry Ransom Center.
Free admission; Tue-Fri: 10 a.m.-5 p.m.; Sat-Sun: noon-5 p.m.

Visit the Oscar Muñoz retrospective on view at the Blanton Museum of Art.
$12 admission for an adult; Wed-Sat: 10 a.m.-5 p.m.; Sun: 1-5 p.m.

View José Parlá's monumental ***Amistad America*** *mural on view on the B4 level of Rowling Hall (RRH), accessible from the AT&T Conference Center. This massive piece was commissioned by UT Landmarks in 2018 specifically for this location.*

AGENDA

Department of Astronomy and McDonald Observatory May 2022 Board of Visitors Meeting

AUSTIN, TEXAS

FRIDAY, MAY 6, 2022

AT&T EXECUTIVE HOTEL AND CONFERENCE CENTER

3:30 – 5 p.m.
New Member Orientation
Classroom 301

4:30 p.m.
Registration Opens
2nd Floor Foyer

5 – 6 p.m.
Break
(take a nap, freshen up for dinner, check your email, etc.)

6 p.m.
Cocktail Reception
Tejas Patio

7 – 9 p.m.
Dinner and Awards Presentation
Tejas Dining Room & Patio

SATURDAY, MAY 7, 2022

AT&T EXECUTIVE HOTEL AND CONFERENCE CENTER

7:30 a.m.
Breakfast
Amphitheater 204

9 a.m.
Board of Visitors Business Meeting
Amphitheater 204

10 – 11 a.m.
Remarks and Reports
Amphitheater 204

CNS Dean
Dr. David Vanden Bout
Astronomy Department Chair
Dr. Volker Bromm
McDonald Observatory Director
Dr. Taft Armandroff

11 a.m.
Break

11:30 a.m. – 12:30 p.m.
Science Talks
Amphitheater 204

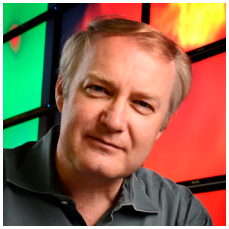
Faculty Talk
Dr. Caitlin Casey
Postdoctoral Fellow Talk
Dr. Amber Medina
Graduate Student Talk
Boyuan Liu

12:30 – 2 p.m.
Lunch
Tejas Dining Room

2:00 – 3:00 p.m.
The Great Lecture
Amphitheater 204

An Improbable Universe: Dark Matter, Dark Energy, and Growth of Cosmological Structure
Dr. Michael Boylan-Kolchin

A LETTER FROM
DR. VOLKER BROMM
ASTRONOMY DEPARTMENT CHAIR



On behalf of the UT Department of Astronomy, I am delighted to welcome you to the 2022 “Winter” Board of Visitors Meeting, seeing our return to the UT Austin campus!

We are excited to come back to our offices and classrooms, and to reenergize the global scientific exchange of discoveries and ideas through international conferences and workshops. With renewed focus, Astronomy looks now to rebuilding the “social capital” of the scientific enterprise, including our program’s public outreach and education activities.

One guiding theme of our meeting’s scientific program highlights the promise of the James Webb Space Telescope (JWST). Successfully launched last December, the JWST has reached its final destination 1.5 million kilometers away, passing all tests and commissioning steps with flying colors so far. The JWST revolutionizes astronomy, with views into the beginning of the Universe and the origin of life. Excitingly, UT astronomers will make prime contributions to this unfolding saga. You will meet many of the researchers leading JWST projects, both at this meeting and at future ones.

Texas Astronomy continues to honor the legacy of physicist Steven Weinberg. Following in his footsteps, we have come to realize that the world of galaxies and stars is ultimately governed by the world of the smallest ingredients of matter and their fundamental interactions. Our next challenge is to elucidate the nature of the “dark Universe”, that of dark matter and energy. Since we cannot seem to detect or create dark matter particles in our Earth-bound laboratories, we astronomers have a vital role to play, in studying their imprint on the heavens. This topic lies at the heart of this year’s “Great Lecture”.

We are truly grateful to have your support, advocacy, and partnership, to the benefit of astronomy at UT and McDonald Observatory, and beyond that for Texas and the world.

Volker Bromm

A LETTER FROM

DR. TAFT ARMANDROFF

MCDONALD OBSERVATORY DIRECTOR

We deeply appreciate your support of the UT Astronomy Program through your membership in the Board of Visitors (BoV) and welcome you back to campus for this in-person gathering of the BoV.

McDonald Observatory has been active for decades in efforts to preserve the dark skies that we enjoy in West Texas, the darkest skies of any professional observatory in the continental United States. McDonald Observatory, The Nature Conservancy, and the International Dark-Sky Association recently announced the creation of the world's largest International Dark Sky Reserve. Encompassing more than 15,000 square miles, the new Greater Big Bend International Dark Sky Reserve includes portions of west Texas and northern Mexico. It is the only such reserve to cross an international border. This reserve protects both the scientific research and public education missions of McDonald Observatory.

The U.S. astronomy community conducts a comprehensive review of its scientific priorities every ten years to help inform federal funding priorities. Released on November 4, 2021, the "Pathways to Discovery in Astronomy and Astrophysics for the 2020s" report ranked the Giant Magellan Telescope (GMT) in the Southern Hemisphere and the Thirty Meter Telescope (TMT) in the Northern Hemisphere as the top priority for ground-based astronomy. Recommending federal support toward their construction and operations, the survey detailed that building extremely large telescopes "is absolutely essential if the United States is to maintain a position as a leader in ground-based astronomy." Highlighting the GMT's enormous light collecting power, wide field of view, and high-resolution spectroscopic and diffraction-limited imaging capabilities, the report emphasized that the GMT's capabilities can be applied to nearly all of the important questions in astronomy today, and "open an enormous discovery space for new observations and discoveries not yet anticipated."

On behalf of everyone associated McDonald Observatory, we look forward to hosting you and conversing with you during this BoV meeting.

Taft Armandroff

BOV EXCELLENCE AWARDEES

The Board of Visitors (BOV) honors the following staff and faculty of the University of Texas Department of Astronomy and McDonald Observatory for their excellence in service and in teaching:

2020-2021

BOV TEACHING EXCELLENCE AWARD

Dr. Brendan Bowler
Assistant Professor, Department of Astronomy

BOV STAFF EXCELLENCE AWARDS

Dr. Erin Mentuch Cooper – Austin
Research Associate, Department of Astronomy
Stephen Hummel – West Texas
Dark Skies Sr. Outreach Coordinator, McDonald Observatory
Emily Mrozinski – West Texas
HET Mechanical Engineer, McDonald Observatory
Kalyn Williams - Austin
Sr. Academic Program Coordinator, Department of Astronomy

2021-2022

BOV TEACHING EXCELLENCE AWARD

Dr. Caroline Morley
Assistant Professor, Department of Astronomy

BOV STAFF EXCELLENCE AWARDS

Stephen Cook – West Texas
HET Systems Administrator II, McDonald Observatory
Lara Eakins – Austin
Public Outreach and Visiting Scholars Program Coordinator
Department of Astronomy
Angela Otoupal – West Texas
Visitors Center Gift Shop Manager, McDonald Observatory
Greg Zeimann - Austin
HET Research Scientist, McDonald Observatory

SATURDAY, MAY 7, 2022
11:30 a.m.-12:30 p.m., Amphitheater 204

FACULTY TALK

Into the Deep: Observing the First Galaxies with the James Webb Space Telescope

DR. CAITLIN CASEY, *ASSOCIATE PROFESSOR*

We are on the precipice of incredible new discovery, seeing the most distant objects forged at the dawn of time. The James Webb Space Telescope, which successfully launched and deployed in space over the past few months, is taking us there. While it is commonly referred to as the successor to the Hubble Space Telescope, the James Webb Space Telescope (JWST) is so much more; JWST's much larger and more complex instruments will be able to see objects one hundred times fainter than Hubble, and it will do it with sharper resolution than ever seen before. With this keen new sensitivity, we, at UT Austin will use JWST in its first year to look into the deep — farther than humans have ever looked — at the origins of our own Universe. In single snapshots, we will see the entire ~14 billion year old history of our Universe as told by galaxies stretched over vast distances, from the densest clusters in the cosmos to the most vacant expanses between. What we will find at the farthest distances, during the time of the Universe's infancy, is still unknown. I will share our latest predictions of what is to come from this phenomenal observatory over the next year and how UT Astronomy plays a major role in forging the path of discovery with the most ambitious telescope ever launched.

Caitlin Casey studies the origins of the Universe's most massive galaxies and the prevalence of dust and gas in the cosmos. She specializes in observations of distant galaxies both at long-wavelengths, in the millimeter/radio, as well as at visible wavelengths and has used over 30 observatories world-wide to conduct her research. Casey was the 2018 recipient of the Newton Lacy Pierce Prize given by the American Astronomical Society for outstanding early career achievements in observational astronomy, for her contributions towards understanding the most luminous star-forming galaxies in the Universe. Casey leads the COSMOS-Web Survey, the largest program selected for observations by the James Webb Space Telescope in its first year of operations.

SATURDAY, MAY 7, 2022
11:30 a.m.-12:30 p.m., Amphitheater 204

POSTDOCTORAL FELLOW TALK

The Cradles of Life: Understanding the properties of host stars for exoplanetary systems

DR. AMBER MEDINA

Certain types of dwarf stars, called "M" dwarfs, are only a fraction of our sun's mass, yet display a diversity of magnetic phenomena. High-energy stellar flares, activity and emissions from the star's chromosphere and corona, motivate the question: How do these tiny stars generate and sustain their magnetic fields? Access to new instruments such as the James Webb Space Telescope and the next generation of ground-based extremely large telescopes, will make it possible to study the atmospheres of the rocky "terrestrial" exoplanets that orbit these dwarf stars. These terrestrial exoplanet atmospheres are sculpted by the stellar radiation environment that is the product of the star's magnetic field.

I present an observational study that characterizes the relationship between age, stellar rotation, flares, and chromospheric activity for a sample of M dwarfs with masses between 0.1 and 0.3 solar masses that reside within 15 parsecs - or approximately 50 light-years. These stars fall into two groups: The first set has ages of less than 2 billion years, flares frequently, and has short rotation periods (a rotation period being the approximate time it takes for the star to complete a full turn on its axis). The second group has ages in excess of 6 billion years, with rotation periods exceeding 100 days, and flares very rarely. Most of the terrestrial exoplanets known to us orbit stars in the second group. Preparation for future observations of these planets' atmospheres, or lack thereof, requires that we also understand the radiation they were exposed to within their own star system. By observing the magnetic activity of younger M dwarfs, we are able to reconstruct the history of the stellar radiation environments that these planets orbiting older M dwarf stars may have been exposed to.

Amber Medina grew up under the dark skies of southern New Mexico. She obtained a Bachelor's degree in Physics from New Mexico State University and completed her PhD work in 2021 at The Center for Astrophysics | Harvard & Smithsonian. She arrived at The University of Texas at Austin in September of 2021 as the inaugural Provost's Early Career Postdoctoral Fellow. Medina's research focuses on characterizing the various phenomena that result from the strong magnetic fields of our nearest, smallest stellar neighbors. Her aim is to place constraints on the potentially harmful environments that earth-like planets orbiting these very magnetically active stars experience throughout their lifetimes.

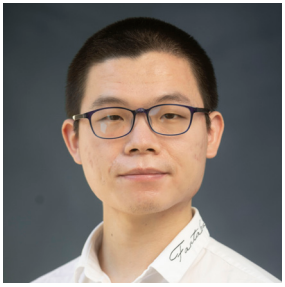
SATURDAY, MAY 7, 2022
11:30 a.m.-12:30 p.m., Amphitheater 204

GRADUATE STUDENT TALK

Probing the First Stars in the Universe with Gravitational Waves

BOYUAN LIU, *PH.D. CANDIDATE*

Recently, the detection of gravitational waves from mergers of black holes has opened a powerful new window into cosmic history. So far, astronomers have detected about 100 merger events, most of which involve massive black holes of 20 to 100 solar masses. Understanding the origins and evolution paths of such black hole mergers is a hot area of research. The first generation of stars formed a few hundred million years after the Big Bang, which are more compact and massive than the stars we see at present, produce massive black holes efficiently when they die, and thus can be important progenitors of gravitational wave sources. It is therefore interesting to figure out how the first stars contribute to gravitational wave events and what we can learn from gravitational wave observations about the first stars. In this talk, I will share my recent progress in theoretical predictions of the gravitational wave signals from mergers of the first star remnants. My research shows that although the first stars only make up a tiny (0.00001) fraction of all stars ever formed in the Universe, a much higher fraction of binary black hole mergers, up to a few percent, can originate from the first stars. This indicates that gravitational waves can indeed be a promising probe to the first stars and the underlying physical processes for their formation and evolution in the early Universe.



Boyuan Liu obtained a Bachelor's degree in Physics from Tsinghua University in Beijing, China. He is now a PhD candidate in Astronomy at the University of Texas at Austin and is a current recipient of the prestigious Donald D. Harrington Graduate Fellowship. This Fall, he continues his career in Astronomy as he heads to the University of Cambridge in the U.K. as a Postdoctoral Fellow. Liu studies the formation and evolution of the first generation of stars and galaxies in the Universe. As a theorist, he uses semi-analytical calculations and numerical simulations to predict the properties of the first stars and galaxies, especially their observational signature, in the context of cosmic structure formation. Liu's current research focuses on the gravitational waves from mergers of the first star remnants. He is particularly interested in what we could learn from the first stars and galaxies about the elusive early Universe and fundamental physics, such as the nature of dark matter.

SATURDAY, MAY 7, 2022
11:30 a.m.-12:30 p.m., Amphitheater 204

THE GREAT LECTURE

An Improbable Universe: Dark Matter, Dark Energy, and the Growth of Cosmological Structure

DR. MIKE BOYLAN-KOLCHIN, *ASSOCIATE PROFESSOR*

The history of the Universe is remarkable and surprising: based on a wealth of data, our best models say that cosmic structure formation starts with quantum fluctuations in the earliest fraction of an instant and continues as a tug-of-war between the inexorable pull of gravity and the overall expansion of the Universe. And yet, there are major unresolved questions about dark matter (which dominates the gravity), dark energy (which drives late-time acceleration of the expansion), and their impact on the formation and evolution of galaxies. I will explain how observational and theoretical efforts have established this improbable cosmological model and why we are poised for dramatic revelations about its components in the coming years.

Mike Boylan-Kolchin is an associate professor of astronomy at The University of Texas at Austin. His research focuses on theoretical astrophysics, including numerical simulations of the formation and evolution of cosmological structure and the nature of dark matter, and he is an author of over 140 refereed scientific papers. Boylan-Kolchin is the recipient of a National Science Foundation CAREER Award and was named a Highly Cited Researcher in 2021. He received his PhD in Physics from the University of California, Berkeley and spent time at the University of Maryland, the University of California, Irvine, and the Max Planck Institute for Astrophysics before coming to Austin.

THANK YOU

to the following Board of Visitors members for their generous support in the 2021-2022 term. From all of the staff, faculty, and students at the Department of Astronomy and McDonald Observatory, we are truly grateful!

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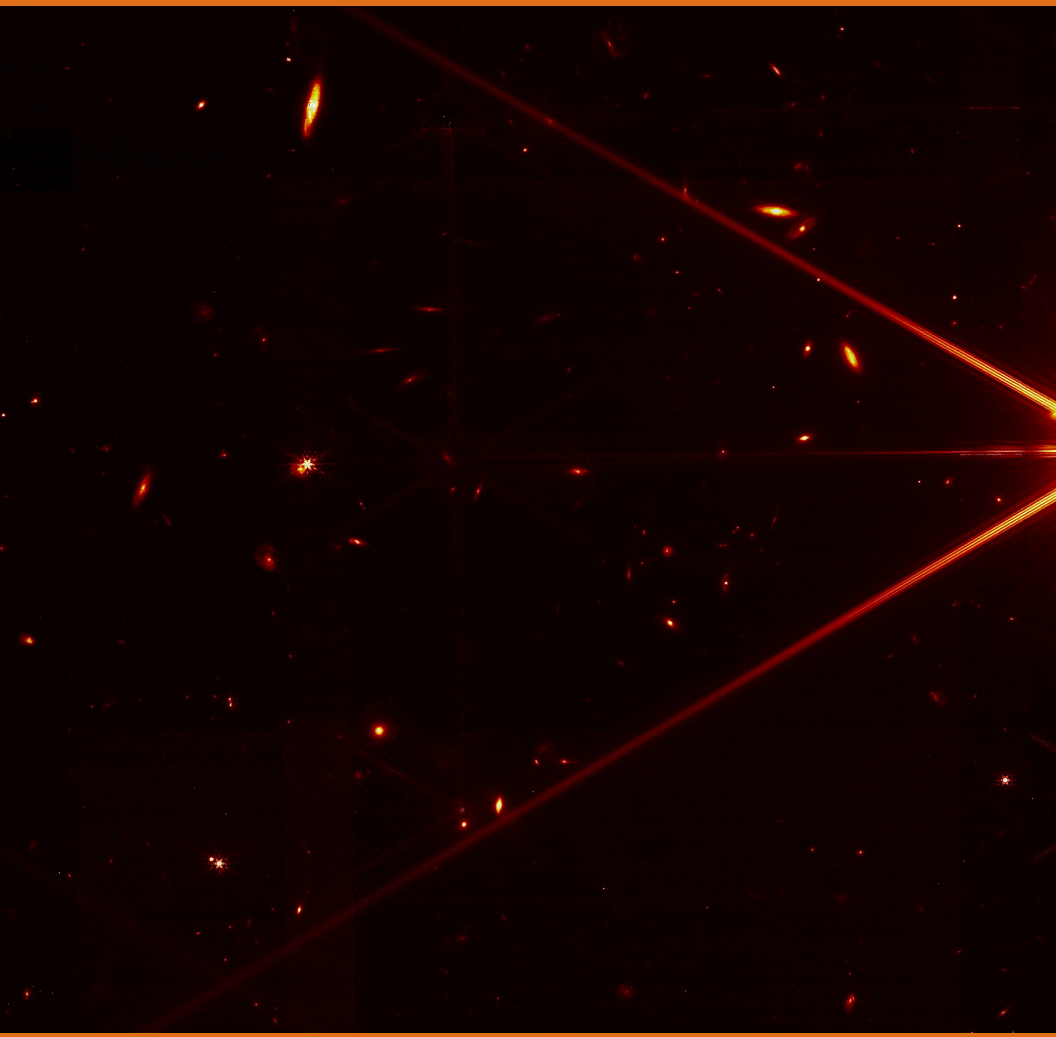
Friday, July 22 - Saturday, July 23, 2022



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