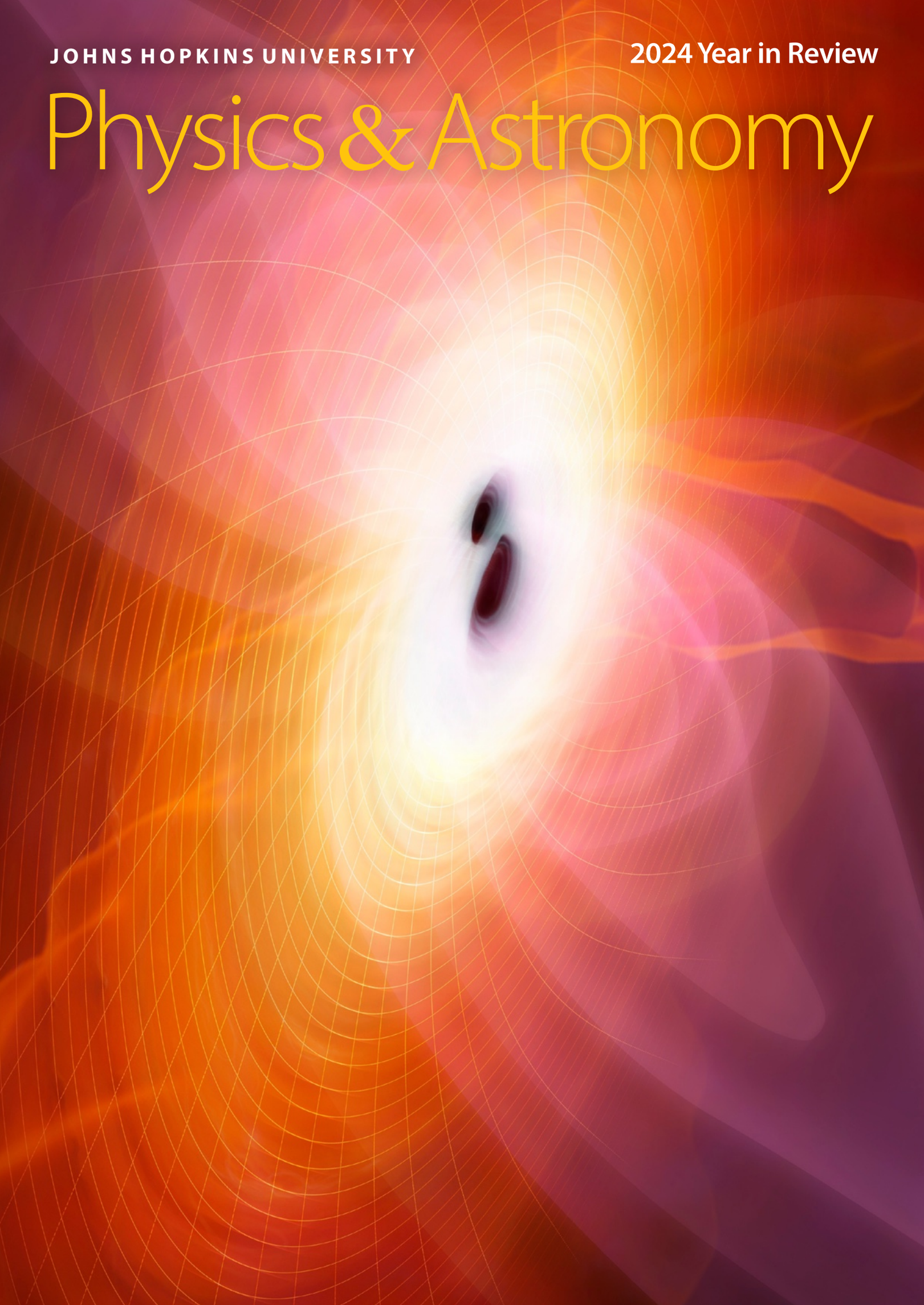
JOHNS HOPKINS UNIVERSITY

2024 Year in Review

Physics & Astronomy



JOHNS HOPKINS
KRIEGER SCHOOL
of ARTS & SCIENCES

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Physics and Astronomy is an annual publication of the Johns Hopkins University Zanvyl Krieger School of Arts and Sciences and the William H. Miller III Department of Physics and Astronomy. Send correspondence to: jon.schroeder@jhu.edu.

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Front cover: The conceptual image on the cover depicts gravitational waves eminating from a blackhole collision 1.3 billion light years away. Three faculty members and supporting scientists breakdown their gravitational wave research in "From Rays to Ripples: Combining Light and Gravitational Waves to Understand the Universe" on page 4.

Credit: Science RF

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Letter from the Chair

Dear alumni, colleagues, and friends,

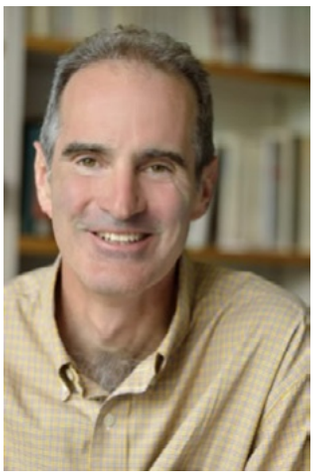
This letter is my last to you as Chair of the Department of Physics & Astronomy. As you may know, the position of Chair in our department rotates among the faculty, and we are in the process of finalizing the choice of my successor, who will take the helm this summer.

I can truly say that I feel honored to have served as Chair during a pivotal period in our department's history, as we continue to realize the opportunities enabled by the generous and visionary endowment provided by Hopkins alumnus William H. Miller. As described later in this newsletter, in the past year we have welcomed several new faculty members who are pioneers in key fields of physics and astronomy, including astrophysicist Alessandra Corsi and statistical physicist Matthieu Wyart, who have been hired to be W. H. Miller Professors, and atomic physicist Dave DeMille and cosmologist Ben Wandelt, who have been hired to be Bloomberg Distinguished Professors. In another exciting advance for the department, Johns Hopkins has recently joined the Magellan Telescopes Consortium, which operates a pair of state-of-the-art optical telescopes located in the Atacama Desert of Chile. Membership in the Consortium will provide Hopkins researchers with guaranteed access to this unique resource, helping to advance further our leadership in astronomy and astrophysics.

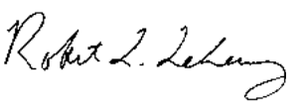
I also want to highlight an exciting development in teaching in the department. As you may know, Johns Hopkins has embarked on an initiative to re-envision undergraduate education, and a centerpiece of this project has been the introduction of First Year Seminars (FYS). As small-enrollment, discussion-based courses, the FYS have become a wonderful vehicle for introducing all incoming students to the university's vibrant intellectual environment, and our department has been an enthusiastic contributor to the effort. FYS offerings by department faculty have included "The Arrow of Time," "Nobel Physics," "The Science Behind the Fiction," and "The Four Great Cosmic Questions: Dark Matter, Dark Energy, Black Holes and the Origin of Life."

I look forward with excitement to working with my successor and my other department colleagues as we continue to advance the cause of physics and astronomy education at all levels, and as we continue to build and strengthen our leadership in pushing the frontiers of physics and astronomy research. The future looks bright!

Thank you once again for your interest in and support of physics and astronomy at Johns Hopkins.



Best regards,



Bob Leheny

WELCOME NEW FACULTY MEMBERS

Alessandra Corsi joined the department in June 2024 as a W. H. Miller Professor of Physics and Astronomy after moving from Texas Tech University. Her research focuses on multi-messenger time-domain astronomy, with an emphasis on relativistic radio transients and gravitational wave physics.

Her work is funded by the National Science Foundation (NSF), from which she also received a prestigious CAREER award. She played a key role in the discovery of the radio afterglow from GW170817, the first Laser Interferometer Gravitational Wave Observatory (LIGO) binary neutron star merger. In 2017, she presented this discovery at an NSF press conference hosted at the National Press Club. She is the Principal Investigator of several guest investigator programs funded by NASA. Additionally, her research on applying resilience solutions to multi-messenger astrophysics is funded by the Department of Energy.

Corsi is a Fellow of the American Physical Society and a recipient of the Edith and Peter O'Donnell Award in Science from the Academy of Medicine, Engineering, and Science of Texas. She has also received an Italian National L'Oreal-Unesco Award for Women in Science. Furthermore, she is a Fellow of the Research Corporation for Science Advancement (Scialog) in Time Domain Astrophysics. In 2020, she was selected as one of the "SN 10: Scientists to Watch" by Science News. She is a recipient of the 2022 New Horizons Breakthrough Prize in physics.

Corsi is a member of the LIGO Scientific Collaboration and works with a talented group of students, post-doctoral researchers, and collaborators. She has extensive teaching experience, offering courses ranging from large introductory astronomy classes for non-science majors to upper-level and graduate courses in Astrophysics and Physics.

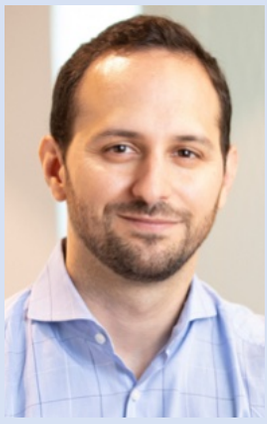
Matthieu Wyart joined the department in November of 2024 and was hired to be a W. H. Miller Professor after moving from École Polytechnique Fédérale de Lausanne in Switzerland. Wyart is a theoretical condensed matter and statistical physicist who is renowned for his research on glasses and related materials. His current research focus is the theory of deep learning. Deep learning algorithms are responsible for a revolution in artificial intelligence, yet why they work is not understood, leading to challenges both in improving these methods and in interpreting their results. Specifically, training deep learning networks corresponds to a descent in a 'loss' landscape similar to complex energy landscapes found in physics. His research group studies how the hierarchical and combinatorial structure of data affects their learnability, in data such as images or text. Wyart's research is thus interdisciplinary and connects statistical physics to computer science and linguistic models. Wyart, along with Brice Ménard, are founding members of the department's new physics of learning research group.

Cosmologist **Ben Wandelt** joined the department in October of 2024 and was hired to be a Bloomberg Distinguished Professor after moving from the University of Paris. He is an expert on applications of machine learning to analyze cosmological data and model the history and future of the universe. Wandelt's research in theoretical, computational, and statistical astrophysics connects fundamental physics and cosmology with astronomical data ranging from stars to the largest scales accessible to observations. He has won multiple awards in several countries including the Xerox award, the Friedrich Wilhelm Bessel prize, the Sofja Kovalevskaja award, and a senior Excellence Chair of the Agence Nationale de Recherche. He co-led the Primordial Non-Gaussianity analysis for ESA's Planck mission and won multiple prizes as a Planck Scientist and core team member, including the 2018 Gruber Prize in Cosmology. Wandelt was elected Fellow of the American Physical Society in 2015 and Fellow of the International Association of Astrostatisticians in 2019.

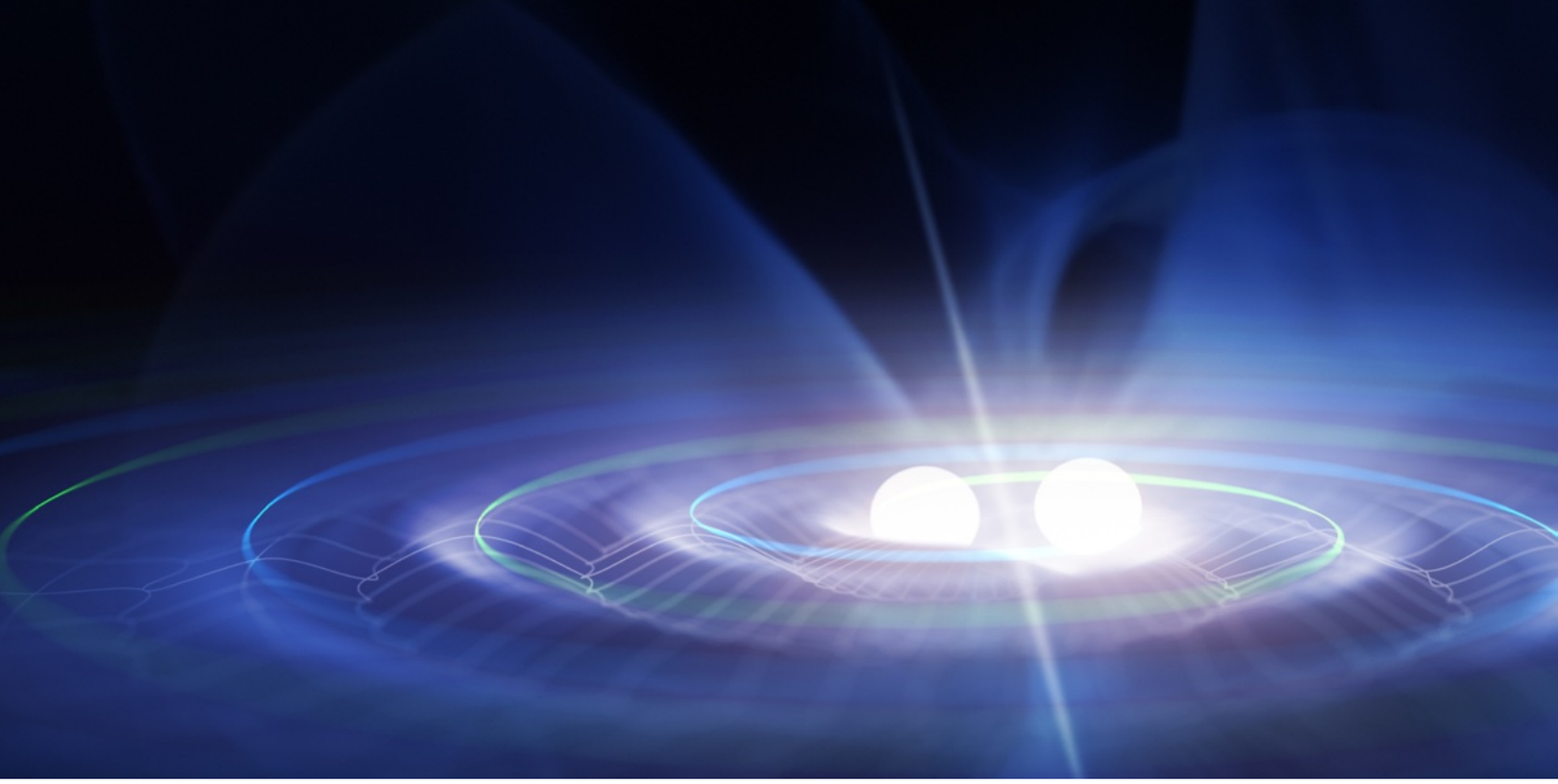
David DeMille joined the department in October of 2024 and was hired to be a Bloomberg Distinguished Professor after moving from the University of Chicago. DeMille is a world-leading Atomic, Molecular, and Optical (AMO) physicist who has developed novel methods of precision measurement to probe for the existence of new fundamental particles and forces. Many of his experiments rely on the amplification of effects, due to new forces, that are present in polar molecules. To enable these measurements—and for other possible applications in quantum science—he has pioneered techniques to manipulate the quantum states of diatomic molecules, including trapping and cooling molecular gases to ultralow temperatures. DeMille was elected a member of the National Academy of Sciences in 2024, and he is the recipient of the 2024 Norman F. Ramsey Prize in Atomic, Molecular and Optical Physics and in Precision Tests of Fundamental Laws and Symmetries, a prize awarded by the American Physical Society. DeMille has shared his expertise in over 250 invited talks at department colloquia, seminars, and conferences – including several at JHU in years past.

Suvi Gezari, who became a research professor in the department in 2024, was named science lead for the dynamic universe on NASA's UVEX (UltraViolet EXplorer) space telescope mission. UVEX is NASA's next Astrophysics Medium-Class Explorer mission and is scheduled to launch in 2030. It will survey ultraviolet light across the entire sky to provide more insight into galaxies near and far, localize gravitational wave events, characterize supernovae within hours of explosion, and provide a legacy data archive for the science community.

Gregory Quiroz, became an associate research professor in the department in 2024, and continues in his position as a staff scientist at the Johns Hopkins Applied Physics Lab. Quiroz spearheaded a new partnership between JHU and Xanadu, a global leader in quantum computing during the 2024 spring semester. The partnership is designed to identify cooperative research projects that JHU students can participate in that advance quantum computing. Quiroz will integrate Pennylane, a software framework for quantum computing, into his curriculum. In particular, he and Dr. Paraj Titum will supplement quantum theory coursework with numerical Pennylane examples provided by Xanadu to bridge the gap between theory and modern quantum computing applications. In the long term, the partnership will seek to enhance quantum computing awareness and research within the department.



Joseph Eimer became an associate research professor in the department in 2024 and also became Director of NASA's Maryland Space Grant program, which is led by JHU. Eimer's research is focused on building instruments and performing ultra-sensitive measurements to reveal fundamental properties of the Universe. Working at the Cosmology Large Angular Scale Surveyor, Eimer led design, construction, instrument characterization, and data analysis teams in the process of building and using an array of telescopes in the Atacama Desert to study the physics of the early Universe and its evolution.



Credit: Andrey VP

FROM RAYS TO RIPPLES:

COMBINING LIGHT AND GRAVITATIONAL WAVES TO UNDERSTAND THE UNIVERSE

BY ANNIE PRUD'HOMME-GENEREUX

Light used to be the only game in town.

Bloomberg Distinguished Professor Chuck Bennett used to tell his students that "Over the history of astronomy, everything we have learned came from light of some wavelength."

On September 14, 2015, that all changed. That day, a gravitational wave gently stretched and squeezed the fabric of spacetime as it passed by our planet. The distortion lasted less than a second. Unfathomable forces 1.3 billion light years away generated it, when two black holes smashed into one another.

In a way, there was nothing special about that wave. The Universe is awash in gravitational waves, and the Earth is ceaselessly rocked by ripples big and small. But on that day, after decades of effort to build an instrument capable of detecting them, a signal was picked up by the two detectors that make up the Laser Interferometer Gravitational Wave Observatory (LIGO).

From that moment on, gravitational waves could be used alongside light to study the Universe.

"It's not just a new way of measuring," says Bennett, "It's a new way of measuring new physics." He explains, "This method allows us to probe physics that we weren't able to probe with light."

This has triggered a goldrush. "A lot of students are interested because it's the hot new thing," says Bennett. In response, P&A set out to recruit gravitational wave experts.

The first to join the faculty was Emanuele Berti. Among thousands of gravitational wave scientists, the editors of Physics Magazine chose him to write an article highlighting the significance of LIGO's discovery. "This speaks volumes about Berti's reputation and expertise," says Bennett.

Berti is a theorist. "What we do as theorists is model the sources of gravitational waves to make the detection easier," explains Berti.

"Let's imagine that you have a long stretch of data as a function of time and they look like wiggles," Berti describes. "Most of those wiggles are actually noise."

LIGO must detect distortions 1,000 times smaller than a proton's width and is so sensitive it picks up human activity. Berti jokes, "Whenever a postman drives over a speed bump near the LIGO detectors, there is a glitch in the data."

Theorists like Berti study astronomical objects that generate gravitational waves, calculating the expected signal's shape, size, and duration to extract it from the noise.

"We do numerical simulations on supercomputers," explains Berti, "and there are public catalogs of hundreds of waveforms produced by different groups."

Knowing what to look for makes it easier to spot it from the noise.

That's very helpful to Alessandra Corsi, the W. H. Miller Professor who joined Berti as the department's second gravitational wave expert.

Unlike most astrophysicists, Corsi does not consider herself a theorist or an experimentalist. "We call ourselves data analysts," she explains. She wrangles data, finds ways to boost faint signals, and fits what's there with the predictions made by theorists like Berti.

Corsi is a rising star. "She led the radio follow up after the detection of the first gravitational wave from a binary neutron star merger," explain Kara Merfeld, a postdoctoral researcher working with Corsi. "That was a big deal and it made her famous," says Merfeld.

In 2017, LIGO's algorithms picked up a gravitational wave signal unlike any it had detected before. Moments later, NASA's Fermi telescope spotted a gamma-ray burst.

"It was too good to be true," recalls Corsi.

The two signals strongly pointed to the merger of two neutron stars—the remnants of supernova explosions that weren't quite massive enough to form a black hole.

Unlike black hole collisions, the merger of two neutron stars was expected to emit light, radio waves, and other electromagnetic radiation—a discovery Corsi had always dreamed of.

The hunt for other signals was on. Corsi requested and was granted time on the

Jansky Very Large Array, a collection of 28 radio telescopes in New Mexico. But where should she point the telescopes?

"Gravitational wave detectors are like ears," describes Corsi. Ears don't need to point in the direction of a signal to hear it, which means they can attend to the environment more broadly.

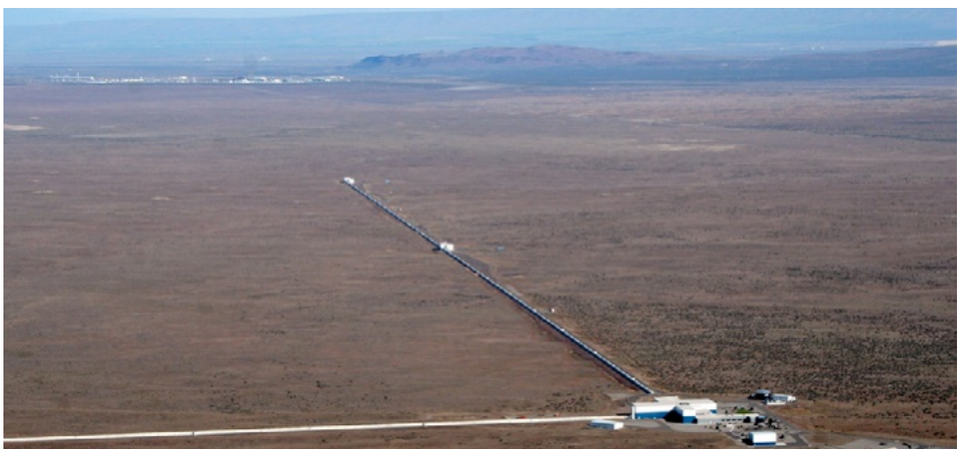
But ears can still identify the general direction in which a signal originated. And in 2017, there were three gravitational wave detectors tuning their ears to the signal – the two LIGO instruments in the United States and Virgo in Italy – allowing researchers to triangulate the patch of sky where the signal came from.

"Thousands of astronomers pointed their telescope there," Berti describes, "and they started seeing all sorts of stuff happening there." They saw optical, X-ray, and radio signals, putting to rest any lingering doubt that LIGO was picking up signals from real events.

Corsi's radio signal was "late to the party," she explains, because the jets from the neutron star collision—responsible for the radio signals—weren't aimed directly at Earth and took days to arrive. When they did, they unveiled crucial details about the jets' structure and content.

Laser Interferometer Gravitational Wave Observatory, Livingston, LA,

Credit: Caltech/MIT/LIGO Lab



Laser Interferometer Gravitational Wave Observatory, Hanford, WA,

Credit: Prachatai

This discovery heralded the dawn of multi-messenger astronomy—the combined use of gravitational waves and electromagnetic signals to study the Universe—and Corsi had just revealed herself to be its leading expert.

Corsi's doctoral student Natalie Gottshlich remarks that, "Multi-messenger detection is such a young field that you have to know and do a little bit of everything to make it work."

"I spend half of my time analyzing LIGO data," says Corsi, "which is looking for a signal as a function of time and the big problem is finding tiny signals in lots of noise."

"The other half of my time, I deal with photons, which is like looking at images of the sky," explains Corsi. "There, you either have a dot of light where you expect it to be or not.'"

Few scientists work with both types of data because "they require different types of analysis," explains Corsi.

Her ability to bridge gravitational wave detection with radio telescope observations to make groundbreaking astronomical discoveries earned Corsi the prestigious New Horizon Breakthrough Prize in Fundamental Physics.

And according to Merfeld, this is only the beginning for multi-messenger astronomy. "The most shocking things [we will learn] are going to be surprises," she says.

Last year, buoyed by LIGO's success, the NSF convened a committee to advise on next generation gravitational wave detectors. Bennett, who served on this committee, explains, "There's always a trade-off between the technical risks and the scientific payback, so the NSF wanted advice on 'where to go, where to stay away'."

The committee solicited white papers for detectors ten times more sensitive than current technology. Corsi co-authored a white paper for Cosmic Explorer, a detector modeled after LIGO but on a significantly larger scale.

"These detectors will see thousands of events more than what we can detect now," explains Berti. "We are going to see everything that happens throughout the Universe, pretty much all of the merging binaries."

Corsi explains that with many examples of a phenomenon, "We can make a statistical sample and gain an understanding of the entire population. We can determine if they all look the same or if there are outliers."

While excited for this prospect, Corsi cautions that investments must also support radio astronomy. Otherwise, she says, "We will have very sensitive gravitational wave detectors, but won't have radio telescopes to match."

That's why she also co-authored a report for the next generation Very Large Array, a network of 244 radio telescopes that would be ten times more sensitive than current technology. "I keep working on both," she says.

Though she describes herself as a "data analyst," Corsi excels in LIGO and radio telescope observations, has made significant theoretical advances, and is shaping the future of instrument technology. "Her breadth is the reason she is extraordinary," says Bennett, "She does it all: observations, data analysis, and theory."

NEWS BRIEFS

Marc Kamionkowski Named 2024 Guggenheim Fellow

William R. Kenan, Jr. Professor Marc Kamionkowski was awarded a Guggenheim Fellowship from The John Simon Guggenheim Memorial Foundation in 2024. The Guggenheim Fellowship recognizes exceptional individuals in pursuit of scholarship in any field of knowledge and creation in any art form, under the freest possible conditions. Kamionkowski was recognized for his research in astrophysics.

Charles Meneveau Receives G K Batchelor Prize for 2024

Joint Professor Charles Meneveau was awarded the G K Batchelor Prize for 2024. This prestigious prize of $25,000 is sponsored by the *Journal of Fluid Mechanics* and is awarded every four years to recognize the achievements of an active scientist who has made significant research contributions to fluid mechanics over the previous decade.

David Kaplan and Surjeet Rajendran Receive Frontiers of Science Award in Theoretical Physics

Professor David Kaplan and Associate Professor Surjeet Rajendran were both recipients of the Frontiers of Science Award in Theoretical Physics in 2024. Awarded by the International Congress of Basic Science, the award recognizes a publication that Kaplan and Rajendran co-authored with Peter W. Graham titled "Cosmological Relaxation of the Electroweak Scale" as a breakthrough in its field of cosmological evolution

The Frontiers of Science Award was inaugurated in 2023 under the auspices of the International Congress of Basic Sciences and sponsored by the City of Beijing and the Yanqi Lake Beijing Institute of Mathematical Sciences and Application. A Frontier of Science Award is awarded to a recent paper, recognized for a major breakthrough in its field. Each year, researchers worldwide are invited to nominate candidates for the award, and recipients are invited to accept the award in person at the Great Hall of People of China in Beijing. The total value of the award is $25,000 shared by authors of a winning papers.

David Kaplan

Surjeet Rajendran

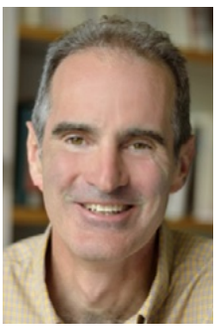
NEWS BRIEFS

Alex Szalay Named a Fellow of the Association for Computing Machinery

Alex Szalay

Bloomberg Distinguished Professor Alex Szalay was named an Association for Computing Machinery Fellow in 2024. Association for Computing Machinery Fellows are recognized for their transformative contributions to computing science and technology. Szalay specifically is recognized for his "contributions in systems, big data, open data, and for service to the community."

Robert L. Leheny Elected Fellow of the American Physical Society

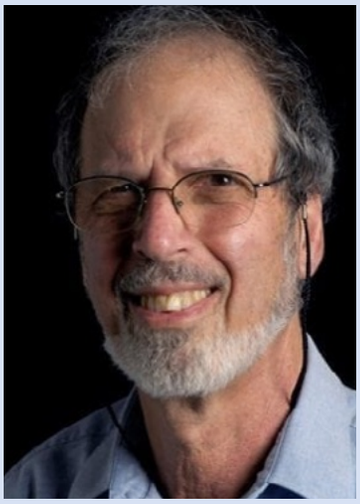


Professor and Department Chair Bob Leheny became a 2024 recipient of the American Physical Society's Division of Soft Matter Fellowship. His citation reads "for elucidating dynamics of colloidal glasses, nanoparticles in polymer matrices, liquid crystals, and interfacial layers, employing XPCS and active microrheology." Leheny is one of four recipients in 2024. The Soft Matter Fellowship is presented to those APS members "who have contributed to the advancement of physics by independent, original research or who have rendered some other special service to the cause of the sciences."

Yahui Zhang Named 2024 Sloan Research Fellow

Assistant Professor Yahui Zhang was named a Sloan Research Fellow in 2024. Zhang was among 126 early-career scholars to earn the fellowship who represent the most promising scientific researchers working today. Each recipient received $75,000, which may be spent over a two-year term on any expense supportive of their research.

Paul Feldman and David Sing Awarded by the American Astronomical Society



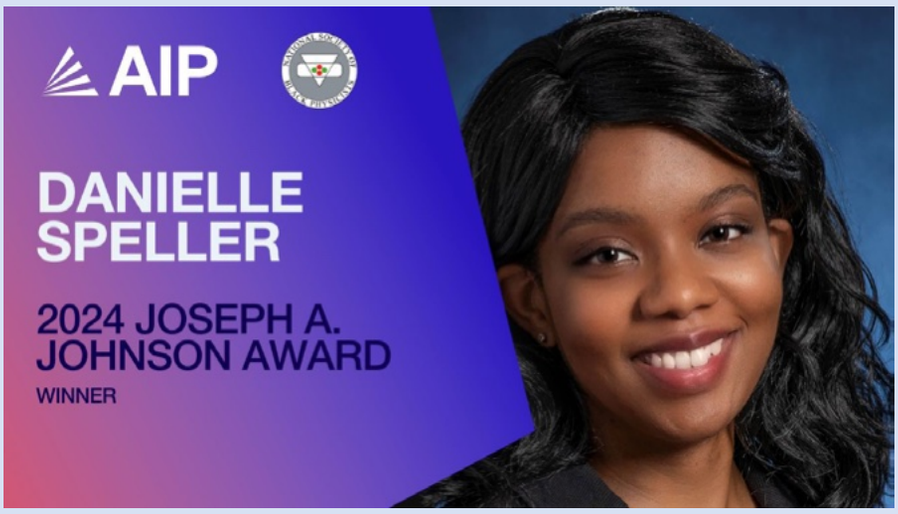
Paul Feldman

David Sing

The Division for Planetary Sciences of the American Astronomical Society posthumously awarded Paul Feldman with the 2024 Kuiper Prize for outstanding contributions to planetary science. In addition, the American Astronomical Society awarded Bloomberg Distinguished Professor David Sing with the 2024 Alexander Prize. The Alexander Prize acknowledges a mid-career scientist who has made outstanding contributions to our knowledge of planetary systems.

NEWS BRIEFS

Danielle Speller Receives Joseph A. Johnson Award for Excellence from AIP and NSBP



Assistant Professor Danielle Speller received the 2024 Joseph A. Johnson Award for Excellence from the American Institute of Physics and the National Society of Black Physicists in November. Speller was recognized for her neutrinoless double beta decay and dark matter research and for her efforts mentoring the next generation of aspiring physicists. "Dr. Speller not only explores the secrets of the universe but also shares them through science outreach and mentorship," said Michael Moloney, CEO of AIP.

Joseph A. Johnson III, of Florida A&M University, was a pioneering and renowned experimental physicist, mentor to many Black doctoral students, and a founder of the National Society of Black Physicists. In honor of his iconic legacy, the American Institute of Physics and NSBP have partnered to recognize an NSBP experimental physicist who exemplifies Johnson's ingenuity as a scientist and passion for mentorship and service. This honor comes with a $5,000 award along with an invitation to give physics department colloquia at partner universities.

Kevin Schlaufman Receives NSF CAREER Award & Named a Fellow of the Vera C. Rubin Observatory "Legacy Survey of Space and Time" (LSST)

Assistant Professor Kevin Schlaufman was honored in two different capacitates in 2024. First, he received a National Science Foundation CAREER Award for his research focused on Population III stars titled "The Most Ancient Stars in the Milky Way." The NSF CAREER Awards are given in support of junior faculty who exemplify the role of teacher-scholars through research and education, and the integration of these endeavors in the context of their organizations' missions. The awards, presented each year, include a federal grant for research and educational activities for five consecutive years.

In addition, Schlaufman was selected as one of the Fellows for the first meeting of a Scialog initiative to advance the foundational science needed to realize the full potential of the Vera C. Rubin Observatory's upcoming Legacy Survey of Space and Time (LSST). This interdisciplinary community of Fellows represents institutions across the United States, Canada, and Chile (the Rubin Observatory's host country) and includes early career observational astronomers, cosmologists, theoretical physicists and astrophysicists, computational modelers, data scientists, instrument developers, and software engineers. The Vera C. Rubin Observatory's first public release of astronomical images is expected in mid-2025.

Kevin Schlaufman

Scialog, a program created by the Research Corporation for Science Advancement in 2010, is short for "science + dialog." The goal of each Scialog series is to facilitate connections among scientists from a variety of disciplines and research areas so they can discuss challenges and bottlenecks to advancing fundamental science, build community around visionary goals, and develop ideas for innovative team projects. Schlaufman's fellowship will continue through 2026.

NEWS BRIEFS

Michael Falk Receives the American Physical Society's 2024 Five Sigma Physicist Award

Joint Professor and Vice Dean for Undergraduate Education within the Whiting School of Engineering, Michael Falk, received the Five Sigma Physicist Award from the American Physical Society (APS) in 2024. The award recognizes APS members who perform outstanding volunteer advocacy work to help advance APS's science policy priorities. Recipients demonstrate impactful advocacy actions with APS Government Affairs throughout the year.

Louise Breuval Receives 2024 Research Fellowship in Space Science from European Space Agency

Louise Breuval

Postdoctoral Researcher Louise Breuval has been selected by the European Space Agency to become one of twelve 2024 Research Fellows in Space Science. Early career postdoctoral scientists are offered the unique opportunity to carry out advanced research related to the space science areas covered by ESA Science missions for a period of up to three years.

Louise's project at ESA focuses on improving the local distance ladder with the goal of reaching a 1% precision in the Hubble constant (the expansion rate of the Universe today). She will characterize various systematic effects in distance measurements using different standard candles (Cepheids, the tip of the red giant branch, carbon stars) in nearby galaxies and improve their calibration with data from the Hubble Space Telescope, James Webb Space Telescope, and Gaia. Her work will help to better understand the puzzling tension between the late and early universe measurements of Hubble constant, and possibly provide stronger evidence for physics beyond the standard model.

Grace Luettgen Receives Goldwater Scholarship

Physics major Grace Luettgen was awarded the prestigious Barry Goldwater Scholarship in 2024. The scholarship, named in honor of late Senator and Major General Barry Goldwater, supports college sophomores and juniors pursuing research careers in engineering, mathematics, and the natural sciences. Luettgen was recognized for her work in the field of biophysics.

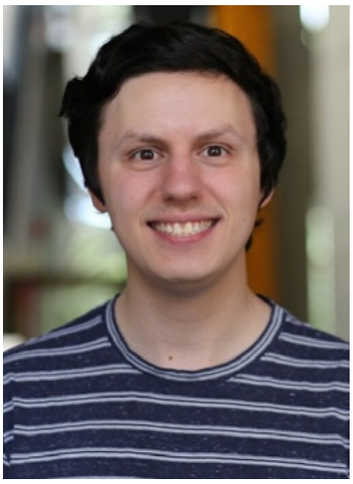
American Institute of Physics Names JHU Society of Physics Students an Outstanding Chapter for 2024

The department's chapter of the Society of Physics Students has been named an Outstanding Chapter for 2024 by the American Institute of Physics. Criteria for Outstanding SPS Chapter recognition includes participation in SPS programs and meetings, outreach efforts, and contributions to student recruitment.

NEWS BRIEFS

Mitchell Karmen and Stephen Schmidt Receive NSF Graduate Research Fellowships

Mitchell Karmen



Stephen Schmidt

Graduate students Mitchell Karmen and Stephen Schmidt were awarded Graduate Research Fellowships from the National Science Foundation in 2024. The NSF Graduate Research Fellowship Program recognizes and supports outstanding graduate students who have demonstrated the potential to be high-achieving scientists early in their careers. Karmen and Schmidt were both recognized for their research in astrophysics.

2nd Annual Gender Minorities and Women in Physics Summit at Johns Hopkins a Success

Organized by graduate students and postdocs in the department, the 2nd annual Gender Minorities and Women in Physics Summit at Johns Hopkins took place in September of 2024. The day-long event included talks, panels, a poster session, and a networking session. More than 100 attendees representing local universities and national labs participated in the summit.

Alexis Li Receives Provost's Undergraduate Research Award

Physics major Alexis Li received the Provost's Undergraduate Research Award from the Hopkins Office for Undergraduate Research in 2024. The award is in recognition of her outstanding undergraduate research titled "A James Webb Space Telescope Mid-Infrared View on the Debris Disk Around Eta Corvi: A New Insight on Time Variability."

PURA
Provost's Undergraduate Research Award

NEWS BRIEFS

Interaction Day at Goddard Space Flight Center a Success

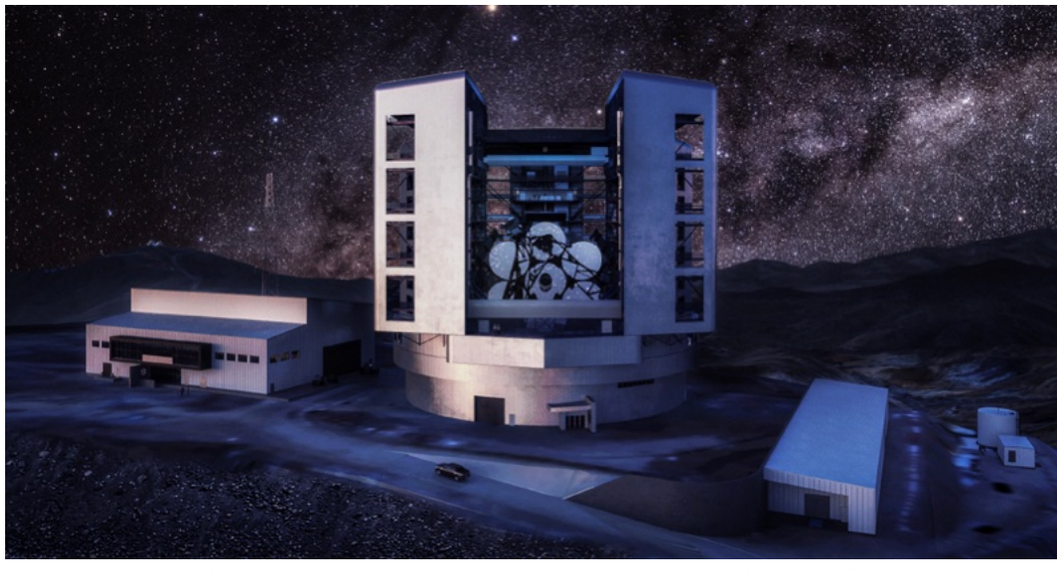
The photo shows Jeff Kruk, now at Goddard but formerly a long-time research staff member at JHU, including on the FUSE mission. Jeff led the tour of the Nancy Grace Roman Space Telescope.

Interaction Day at Goddard Space Flight Center in October of 2024, offered a chance for more than 80 department members to learn first-hand about the wide range of current research being conducted at NASA GSFC. The learning was 2-way: both Goddard and JHU researchers presented their research. Welcomed by Goddard high energy astrophysicist Andrew Ptak, JHU students and researchers had the opportunity to share their research and learn about ongoing GSFC projects that are recruiting new scientists. In addition, Interaction Day attendees had the chance to tour the construction of the Nancy Grace Roman Space Telescope, set for launch in 2026.

Bloomberg Distinguished Professor Chuck Bennett leads a Cooperative Agreement between JHU and NASA Goddard, which provides a mechanism for close research connections. Andrew Ptak is the Technical Officer of the Agreement. Bennett also Directs Space@Hopkins, which organized this event with Space Fellow and graduate student Caleigh Ryan.

JHU Joins Magellan Telescopes Consortium

Starting in 2024, the department has become a partner in the Magellan Telescopes. These are twin 6.5-meter telescopes, built and operated by a collaborative effort of the Carnegie Institution, University of Arizona, Harvard University, University of Michigan, and Massachusetts Institute of Technology. The telescopes are located at the Las Campanas Observatory in the Chilean Andes, one of the world's preeminent astronomical sites. A part of the generous gift made to the department by William H. Miller III was used to lease a share of eight nights per year for ten years from the Harvard-Smithsonian Center for Astrophysics. This time is being used by JHU faculty and their students and postdocs to undertake wide-ranging research in cosmology, exo-planets, galactic archaeology, galaxy evolution, and stellar evolution.



Nighttime exterior rendering of the Giant Magellan Telescope with support site buildings in the foreground at Las Campanas Observatory in the Chile Atacama Desert. *Credit: Giant Magellan Telescope– GMTO Corporation*

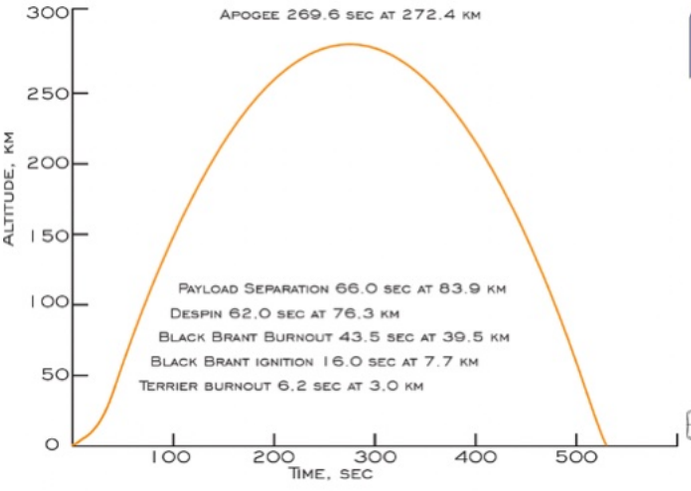
OAxFORTIS Sounding Rocket Mission Completed As Planned

The Off-Axis Far-Ultraviolet Off Rowland-circle Telescope for Imaging and Spectroscopy (OAxFORTIS) sounding rocket mission successfully launched and collected data late in the evening of August 25, 2024 over White Sand Missile Range in New Mexico.

After a month in field, the JHU sounding rocket team led by Graduate Student, Mackenzie Carlson and supported by her cohort of Isu Ravi and Jack Ford — overseen by Systems Engineer Russell Pelton and Research Professor Stephan McCandliss — observed the mysterious population of hot UV emitting stars in the Globular Cluster M10. Globular Clusters are primarily filled with hundreds of thousands of cool old "red" stars. Understanding how a smattering of bright hot stars, which are usually young, can form among such an old stellar population is the mystery.

The sounding rocket achieved an apogee of over 272 kilometers, which provided the more than 360 seconds of exoatmospheric time above 100 km required for UV observations to be free from atmospheric attenuation. Multiple spectra were observed from hot stars in the GC. They were acquired autonomously using our Zero Order Monitor Interface (ZOMI) to the NextGen MicroShutter Array that was developed in collaboration with NASA's Goddard Space Flight Center. The initial development of the ZOMI on FORTIS was led by former graduate student and now Research Professor at University of Colorado, Brian Fleming. JHU's Instrument Development Group, including Aidan Gray, Stephen Hope and Stephen Smee, also contributed by developing the mission's new Ethernet Via TM interface and an on-board data recorder.

The payload was fully recovered on Monday morning. A subsequent turn-on revealed that still to be fully functional. The team will be requesting another flight of OAxFORTIS for some time in the spring of 2025 to observe another Globular Cluster M13.



David Thilker and the PHANGS Team Share Panchromatic Images of Nearby Disk Galaxies

Principal Research Scientist David Thilker and the international team using HST+JWST data called PHANGS (PHysics at High Angular resolution in Nearby GalaxieS) released images of 19 nearby disk galaxies that show stars, gas, and dust on small scales in early 2024. The images contrast the starkly different appearance of spiral galaxies in ultraviolet-to-visible light from HST and in near- and mid-infrared light from JWST. The new data from JWST are revolutionizing our understanding of galaxies, especially the star formation process within them. The disk galaxies' revealed dusty substructure are ideal sites for star formation.

The comparitiave nature of Thilker's imaging project can only be fully interpreted with help from the aging Hubble. This fact underscores the need for realization of a future large UV-visible-NIR telescope such as the Habitable Worlds Observatory concept now under study by NASA.

Two observations of a portion of the galaxy NGC 628 are split diagonally, with Webb's observations at top left and Hubble's at bottom right. Credit: NASA AND STSCI