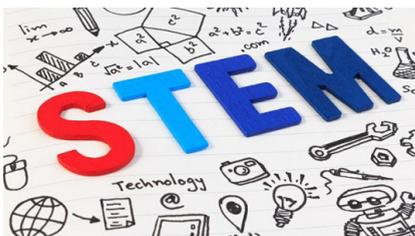


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### Integrating Math Into Science Teaching



**With their three-year, \$1,147,000 National Science Foundation STEM + Computing grant, University researchers will explore new ways to integrate computational and mathematical thinking into earth and environmental science teaching and learning.**

“This innovative program embodies STEM the way it should be, by breaking down traditional disciplinary boundaries and appealing to children’s natural creativity and curiosity to explore their world, connect with the environment and solve problems,” says College of Science and Mathematics Acting Dean **Lora Billings**.

Team members include Principal Investigator and Computer Science Professor **Michelle Zhu**

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## Neutron Stars Collide

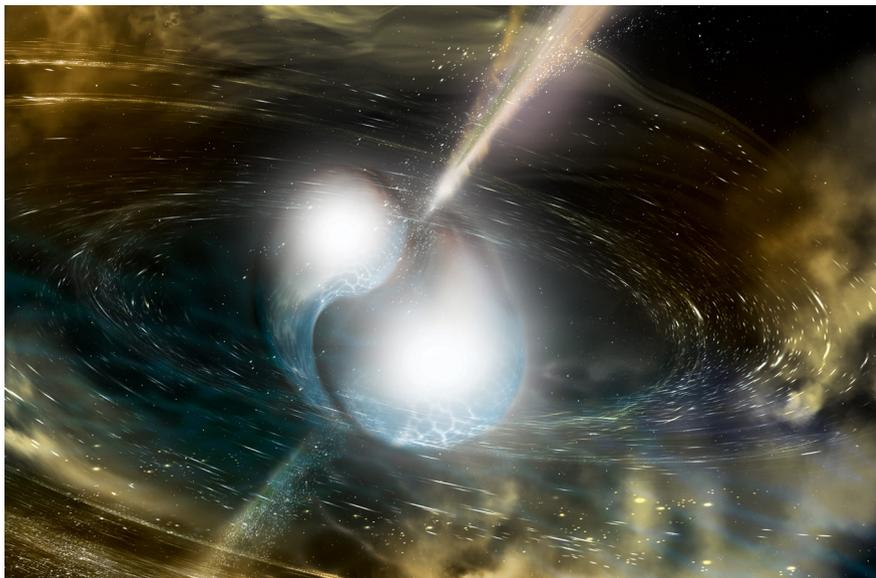


Illustration courtesy of LIGO

**Scientists have recently detected gravitational waves and light produced by the collision of two neutron stars in a galaxy 130 million light years away.**

The historic discovery on August 17 was made using the U.S.-based Laser Interferometer Gravitational-Wave Observatory (LIGO); the Europe-based Virgo detector; and some 70 ground- and space-based observatories.

Montclair State physics professors **Rodica Martin** and **Marc Favata** are part of the international LIGO Scientific Collaboration team that made the discovery.

This is the first time a collision of two neutron stars — small, dense stars formed when huge stars explode in supernovas — has been detected using gravitational waves. It is also the first time a gravitational-wave signal has been accompanied by coincident detections with conventional telescopes.

In a galaxy 50 times farther away than our neighboring Andromeda galaxy, two neutron stars spiraled toward each other, emitting powerful gravitational waves before colliding and causing a burst of gamma rays. Their collision produced a “chirp” recorded by the LIGO and Virgo detectors that lasted nearly 100 seconds. “This is a really big deal,” says Favata. “Neutron star collisions are a key source LIGO was hoping to observe — and now we have.”

According to Favata, the discovery confirmed a persistent suspicion that short-duration gamma ray bursts (GRBs) result from the collision of two neutron stars. Long-standing speculation as to how heavy elements, such as gold and lead, are produced has also been resolved. A byproduct of the collision of the two neutron stars, these elements are distributed throughout the universe.

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## A Public Research University Designation

**New Jersey Governor Chris Christie signed legislation in July officially designating Montclair State a public research university.**

The bill was unanimously supported by both the New Jersey Senate and Assembly. In 2016, the University was designated a research doctoral institution by the Carnegie Classification of Institutions of Higher Education.



Researcher Sreedhar Tummalapalli

“Having our home state recognize what has already been acknowledged in the national higher education community is both welcome and appropriate and will further strengthen the University’s ability to contribute to the education of

the state’s workforce, create new knowledge in fields important to the state, nation and the larger world, and help fuel New Jersey’s future economic growth,” says President **Susan A. Cole**.

Montclair State’s continuously expanding research activity spans a wide range of areas, and the University’s scholars and scientists receive federal funding from agencies such as the National Science

Foundation; the National Institutes of Health; the departments of Energy, Defense, Agriculture and Education; NASA; and others, as well as from corporations, foundations and state agencies. *See related Graduate School story, page 6.* ■

## Outsmarting Internet Censorship

**In many countries, internet censorship is a tool used by governments to prevent free speech and the free flow of information.**

More than half the world’s internet users live in places where online activity is censored or restricted, according to a report from the watchdog organization Freedom House. Many organizations are working to break through that censorship to help these citizens advance their human rights.

Researchers at Montclair State and Princeton University have received a three-year, \$1,040,850 grant from the National Science Foundation for a collaborative project that will explore ways to elude internet censorship. “We’re trying to achieve this goal by using reverse engineering to understand how online censorship is enforced, and then to develop methods to evade detection,” says researcher and Computer Science Associate Professor **Christopher Leberknight**.

He and Linguistics Associate Professor **Anna Feldman** are working with researchers from Princeton and Purdue University on the project that incorporates computer science, information security, network analysis and linguistics.

“The first stage is to develop a system to track and monitor content to determine what content is being blocked,” says Leberknight. The researchers are developing computer programs that analyze text from articles, determine if it’s contentious, and then follow it as it is pushed through internet channels in China, which has a sophisticated censorship system. They will see in real time what is being blocked.

“This will allow us to identify certain weaknesses in the censorship system and develop ways to push content through,” says Leberknight.

Students are assisting with a range of tasks, including working on

“This will allow us to identify certain weaknesses in the censorship system and develop ways to push content through.”

– **Christopher Leberknight**

statistical models for the analysis, helping create software to predict and classify content, and building front-end applications.

Their ultimate goal is to develop an anticensorship system that would be published and freely available to others, who can then push out information that would otherwise be censored.

“This would enable citizens in countries that have heavily enforced censorships to freely express ideas on the internet,” says Leberknight. ■

## Charting Paths to STEM Success for Underrepresented Groups



Amy Tuininga and Green Team sustainability students

**University researchers have received a National Science Foundation grant to expand opportunities for historically underrepresented low-income, minority and women students in the areas of science, technology, engineering and math (STEM).**

Called INCLUDES (Inclusion Across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science), the two-year, \$300,000 award funds the pilot project titled, “Sustainability Teams Empower and Amplify Membership in STEM” (S-TEAMS). Nested within the University’s PSEG Institute for Sustainability Studies’ Green Teams program and offered in partnership with the New Jersey Higher Education Partnership for Sustainability (NJHEPS), S-TEAMS will promote collaborative change that increases diversity among public-private partners.

“Transdisciplinary teamwork is a proven way to foster critical thinking and problem solving,” says College of Science

and Mathematics Acting Dean **Lora Billings**. “By targeting underrepresented groups across the entire spectrum of STEM education, this program provides a supportive path into the growing field of sustainability science for an untapped group of students.”

Researchers include Principal Investigator (PI) **Amy Tuininga**, PSEG Institute for Sustainability Studies director, as well as co-PIs Earth and Environmental Studies Professor and PSEG Institute Associate Director **Pankaj Lal** and **Ashwani Vasishth**, Ramapo College environmental studies professor and NJHEPS president. “We’ll test how barriers to STEM retention of underrepresented groups are broken down by building a sense of inclusion through teamwork and peer networks,” says Lal.

Tuininga notes that the program offers “sustainability training to students from a variety of academic institutions who will deliver projects to corporations and municipalities in summer 2018, while learning about teamwork, sustainability, professionalism and service to their communities.”

The grant will also accelerate the growth of the Institute’s innovative Green Teams summer internship program, which places students with leading corporations and community organizations to help solve pressing sustainability issues. ■

## Preventing Sexual Violence



**As recent headlines attest, sexual predators can come from all walks of life.**

Public Health professors **Amanda Birnbaum** and **Stephanie Silvera** will evaluate efforts at reducing sexual violence from predators in New Jersey with a \$141,000 subaward from the New Jersey Department of Children and Families that is partially funded by a Rape Prevention and Education grant from the U.S. Department of Health and Human Services/Centers for Disease Control.

“We hope to help increase the capacity for effective and sustainable monitoring and evaluation of statewide efforts to reduce sexual violence,” explains Birnbaum, who chairs the University’s Public Health department, adding that they will track data that includes children and men as well.

The state will then use the data to monitor and evaluate the New Jersey Rape Prevention and Education program efforts.

According to Silvera, current initiatives in the field focus on reducing predation, rather than preventing victimization: “As a result, the responsibility for prevention falls to us all collectively, requiring that we address underlying factors that contribute to sexual violence and shift the ways that gender, power and violence relate to one another.” ■

## How Scouting Builds Character

**For more than 100 years, Boy Scouts of America (BSA) has offered young people programs and activities that build character — and develop leadership skills.** Family Science and Human Development professors **Jennifer Urban** and **Miriam Linver** have received a Boy Scouts of America National Character Initiative subaward to explore and understand how scouting helps to build character.

Principal Investigator (PI) Urban and co-PI Linver have received a \$780,000 grant funded by the Stephen D. Bechtel Jr. Foundation that was awarded in February for their yearlong study, which is the first phase of a more extensive project. The team has subcontracted with partner American Institutes for Research to learn more about the role training and experience play in developing effective adult volunteer leaders, including scoutmasters and others with direct contact with scouts.

“Historically, little attention has been paid to understanding how adults develop youth character,” says Urban. “We want to understand the process adults go through so we can replicate it.”

The two have developed a “pathway model” of the training and experiential process adult volunteers go through, as well as a model that sketches out how youth character-building happens.

They are currently conducting nationwide focus groups with young people and adults to get feedback on the models. “Preliminary data indicates there is nationwide consistency in understanding how the Boy Scouts work,” says Urban. “It is one of the few examples of a clear, shared understanding of how a program is supposed to work.”



While the team’s youth model focuses on how scouts develop moral and ethical character, emotional skills and a sense of identity, their adult model emphasizes sustained caring relationships between youth and adults, skill building and youth leadership. “Helping young people take on leadership roles is an especially hard thing for

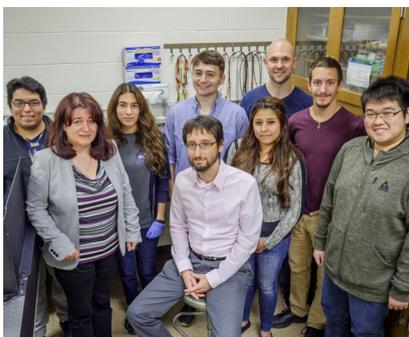
adults to do unless they understand that a significant part of the process is allowing the young would-be leaders to fail,” explains Urban.

By mapping insights from what the focus groups have told them, as well as from research literature, Urban and Linver will be able to understand and pinpoint gaps in adult development and training methods.

Ultimately, they will make recommendations for changes that BSA can implement to strengthen its training programs for adult volunteers who help build character in scouts. “We want to create the best programming possible,” says Urban. ■

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### **Neutron Stars Collide** continued from page 1



Rodica Martin, Marc Favata and their students

The new gamma-ray measurements and gravitational-wave detections

further confirm Einstein’s theory of relativity and are ushering in the new field of multi-messenger astronomy—which combines information from gravitational waves, light, neutrinos and other forms of radiation produced by cosmic explosions.

Martin helped design and install various components of the detectors’ advanced LIGO upgrade that enabled the recent discoveries. “Currently, I’m developing and

designing optical components and instrumentation for future detectors that will help us observe even more distant events,” she says.

While Favata helped develop some of the gravitational-wave models used to analyze neutron star collisions, he and Martin and their students are also involved in LIGO education and outreach efforts, such as the [www.soundsofspacetime.org](http://www.soundsofspacetime.org) website. ■

# Innovative Programs Tackle Teacher Shortage

Since its beginnings more than 100 years ago as a teachers college, Montclair State has been a leader in teacher education. Today, the University is at the forefront of reversing a national teacher shortage — felt most in inner cities and in science and math — in part, with innovative, federally funded teacher preparation initiatives such as the Newark Montclair Urban Teacher Residency Program, which is funded by two consecutive, five-year, multi-million-dollar U.S. Department of Education grants.

Indeed, *U.S. News & World Report* ranks Montclair State among the nation's top 100 graduate schools for education and places its graduate programs in both elementary and secondary teacher education among the top 20 in the country — a distinction unmatched by any other New Jersey institution.

The residency is an immersive apprenticeship program for Master of Arts in Teaching candidates who commit to teaching in Newark public schools for three years after they graduate. As residents, they teach on-site for an entire academic year. After graduation, the program



Residency teachers working in Newark

**Robinson** says the program has not only prepared and placed outstanding teachers in Newark's schools, it has given faculty an opportunity to prepare teacher candidates in the schools. "Because faculty are on site teaching candidates how to teach," she says, "graduates are much better prepared."

According to **Susan Taylor**, the program's director, who earned her master's degree from Montclair

of the only programs in New Jersey to emphasize exemplary elementary mathematics education through our teacher candidates," Robinson says.

Additionally, the National Science Foundation's Robert Noyce Teacher Scholarship Program encourages talented STEM students to teach in high-need urban schools. Thanks to a recent \$1,106,026 National Science Foundation grant, eligible mathematics majors will soon take part in a scholarship program preparing them to teach math in the New Jersey elementary schools that need them most.

"We have received well over \$25 million in recent years to support STEM teacher preparation and provide our students with the knowledge and skills they need to be excellent teachers and make a lasting and positive impact on the lives of countless young people across New Jersey," says College of Education and Human Services Dean **Tamara Lucas**. ■

**"We have received well over \$25 million in recent years to support STEM teacher preparation and provide our students with the knowledge and skills they need to be excellent teachers."**

**— Tamara Lucas**

provides three years of additional mentoring and induction support.

The University's Center of Pedagogy Director **Jennifer**

State in 1982, the University researchers studied what urban schools need in order to better address the shortage of qualified teachers in Newark. "We'll be one

## SPOTLIGHT: News Briefs

## A Look at the Income Gap

While the Federal Reserve has maintained historically low interest rates since the credit crisis to revive the economy, a study by Assistant Economics Professor **Edmond Berisha** suggests that doing so may exacerbate income inequality because the middle class borrows more money and goes further into debt while the wealthy derive a larger portion of their income from interest rate-sensitive assets.

After looking at almost 100 years' worth of economic and income information from the World Wealth and Income Database, Berisha and researchers from the U.S. Postal Service and West Virginia University concluded that higher stock prices, lower interest rates and household debt all have a negative impact on income equality.

Their research appears in the February 2018 issue of the *Journal of International Money and Finance*.

"The length of our series is important as it allows us to observe inequality through different historical periods," Berisha says. ■

## Breaking the Arts Glass Ceiling



Executive Director for Arts and Cultural Programming **Jedediah Wheeler** received a \$40,000 grant from the National Endowment for the Arts (NEA) to present three multidisciplinary artworks with women as the central creative forces, allowing for the current Peak Performances season to consist entirely of new works by women titled "Women Innovators in the Performing Arts."

"The temper of the times demands a statement: There is no excuse for the remarkably slow progress toward gender parity in the arts," Wheeler says. "I hear time and again that there is a glass ceiling in the arts. Devoting the entire Peak Performances season to the work of these exceptional artists is a continuation of our long-held commitment to shattering that ceiling." See [peakperfs.org](http://peakperfs.org) for more information. ■

## Encouraging Local Political Discourse

The Center for Cooperative Media at the School of Communication and Media received funding to spearhead a project that encouraged civil political dialogue and educated voters in neighborhoods across the Garden State.

Voting Block, a collaborative reporting project on issues important to voters during New Jersey's 2017 gubernatorial race, launched in June with a grant from the Geraldine R. Dodge Foundation through its partnership with the John S. and James L. Knight Foundation. Initial Voting Block news partners included WNYC, WHYY, WBGO, NJ Spotlight and The Record/USA Today Network and grew to add 15 hyperlocal news organizations around the state.

Center for Cooperative Media Director **Stefanie Murray** says Voting Block represented a new way of collaborating to tell stories at the local level as reporters repeatedly returned to the same neighborhoods to help people understand opposing positions through dialogue. ■

## Celebrating 20 Years of Graduate Research

For 20 years, The Graduate School at Montclair State has made a substantial commitment to expanding its master's and doctoral degree programs, milestones that contributed to the University's recent designation as a research doctoral university and met the educational needs of New Jersey. The University offers nearly 100 graduate programs, as well as post-baccalaureate certificates and certifications, many

geared toward future teachers. *U.S. News & World Report* includes the school's graduate education programs on its 2017 Best Education Schools top 100 list and its teacher education programs among the top 15 in the country.

Some 3,930 students are enrolled in 40 master's programs with 270 pursuing doctorates in eight programs. The offerings over



the past two decades have been strategically selected to help shape the future and "illustrate the wide-ranging research opportunities we provide for the next generation of scientists and professionals," Dean **Joan Ficke** says. ■

# Suicide Prevention on New Jersey Campuses

**Montclair State is one of only 17 colleges and universities nationwide to receive the prestigious Garrett Lee Smith Campus Suicide Prevention grant.**

As such, the University will expand its leadership role in preventing violence and suicide on New Jersey campuses, while supporting its commitment to destigmatizing mental health issues.

**Jude Uy**, Counseling and Psychological Services staff psychologist and suicide prevention coordinator, has received \$102,000 of funding for the first year of the three-year award, which is administered by the Substance Abuse and Mental Health Services Administration of the U.S. Department of Health and Human Services. The award supports the University's newly developed Project Suicide Awareness Violence Education and Response (known as Project SAVER) and supplements existing Counseling and Psychological Services initiatives.



It also supports Montclair State's establishment of the first-ever formalized New Jersey campus suicide and violence prevention consortium, in partnership with the College Alliance for Prevention of Suicide. Network members will collaborate to decrease the incidence of suicides on New Jersey campuses by disseminating and sharing suicide prevention resources, information, policies and best practices.

"I'm hopeful Project SAVER can help destigmatize and shift public attitudes about suicide, mental health and help-seeking. We want to continue to create and sustain

a campus culture of tolerance and acceptance, while focusing on the safety and care of our community," says Uy.

Project SAVER's holistic, community-centric approach includes developing "gatekeeper" training to help University faculty and staff recognize and respond to the signs and symptoms of mental health issues, as well as training to help students combat stress, anxiety and depression. Montclair State will also bolster its counseling center clinicians' skills in assessing and treating students with high-risk mental health problems and expand social media outreach for crisis support organizations.

"Shame from stigma prevents important conversations about mental illness from taking place," says Uy. "Grant funding will help us battle stigma on campus, as well as provide safety resources for both students and staff." ■

## **Integrating Math Into Science Teaching** continued from page 1

and Co-Principal Investigators Mathematical Sciences Professor **Nicole Panorkou**, Computer Science Professor **Bharath Samanthula**, and Earth and Environmental Studies Professor and PSEG Institute of Sustainability Studies Associate Director **Pankaj Lal**. University graduate and undergraduate students will also contribute to the project.

Funds for "Assimilating Computational and Mathematical Thinking into Earth and Environmental Science," will be evenly dispersed over the next three years by the Foundation's Division of Research on Learning.

Novel instructional modules, hands-on activities, and laboratory and field experiences will integrate computational and mathematical thinking into earth and environmental science instruction for approximately 2,820 students enrolled in grades 5, 6 and 7 at low-performing schools.

The team will also devise professional development activities for teachers and monitor the efficacy of curriculum on both students and teachers.

"As a math educator, I'm looking forward to providing opportunities for students to see the purpose

and utility of math by integrating it with earth and environmental and computational thinking," says Panorkou, who will lead the assimilation of mathematical thinking into the instructional units.

Zhu is heading efforts to bring computational thinking into the proposed 12 curricular modules and looks forward to working with students and teachers from local school districts. "I hope these modules will not only make science learning attractive, but will also get students interested in developing computer programs to solve STEM-related problems in the future," she says. ■

# Using Drones to Assess New Jersey Floodplains

**Earth and Environmental Studies Professor Robert Taylor has received a \$195,953 grant from the U.S. Department of Defense to further his research on flooding risks and vulnerable housing in the floodplains of Passaic County.**

While conducting research for Passaic County, Taylor and his students at the Center for Environmental Management and

“If you elevate a building using inaccurate elevation data, it may not make that home less vulnerable to flooding,” says Taylor.

The grant will go toward purchasing two unmanned aerial vehicles (UAVs), familiarly called drones, that will provide detailed information on contour elevation and impervious surfaces (like roads and parking lots). The UAV contour maps can estimate

carry two to three pounds of sensors. They will utilize LIDAR technology (which uses lasers to measure distances) and hyperspectral instrumentation (creating thermal imagery) to create 2D and 3D high resolution maps.

Students will receive in-the-field experience and be trained in using drones for environmental research. “Drones are the future,” says Taylor, “and we need to educate our students with practical applications of their use.”

A broader goal of the research is to provide a set of “best practices” for the purchase, relocation and reuse of land in highly vulnerable flood zones in the U.S. and globally — and Taylor is working toward setting up similar research programs with universities in the Philippines and Vietnam, where large cities are subject to flooding. ■

**“If you elevate a building using inaccurate elevation data, it may not make that home less vulnerable to flooding.” —Robert Taylor**

Analysis (CEMA) noticed that the traditional sources of elevation information, such as U.S. geographic information system (GIS) maps, do not provide the detailed information that the county needs to make floodplain management decisions.

elevation at three-centimeter intervals as opposed to three meters. “If you’re in a flood zone, that makes a big difference,” says Taylor.

The lightweight drones have a wingspan of about four feet and can

The Office of Planning in Passaic County has requested more detailed information in order to access FEMA maps and to allow communities to become members of the National Flood Insurance Program’s Community Rating System, a voluntary incentive program that encourages communities to reduce floodplain vulnerability. These ratings can also result in lower costs for floodplain insurance. More precise data can impact housing buyback decisions as well as how much to elevate existing housing.



Building on a distinguished history dating back to 1908, Montclair State University is a leading institution of higher education in New Jersey. Designated a Research Doctoral University by the Carnegie Classification of Institutions of Higher Education, the University’s 10 colleges and schools serve 21,000 undergraduate and graduate students with more than 300 doctoral-, master’s- and baccalaureate-level programs. Situated on a beautiful, 252-acre suburban campus just 12 miles from New York City, Montclair State delivers the instructional and research resources of a large public university in a supportive, sophisticated and diverse academic environment.



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