

## How Black Holes Could Determine the Future of Life on Earth



When night falls on the West Coast, Misty Bentz sits at a desk in her Atlanta office, logs into a program on her laptop and tells an 11-foot-wide telescope in New Mexico where to point in the sky.

She's more than 1,300 miles away from Apache Point Observatory, but no matter. From her living room sofa or on campus at Georgia State, where Bentz is an assistant professor of astronomy, she can observe black holes in faraway galaxies.

"As soon as I'm done observing, I can close my laptop and go sleep in my own bed and not have to fly all the way to New Mexico and sit on top of the mountain to control the telescope," she says. Georgia State is a part owner of the observatory.

She uses the telescope to take measurements she needs to determine the masses of black holes in surrounding galaxies, a project funded by the National Science Foundation that could help explain fundamental mysteries of the universe, such as how galaxies evolve.

"Black hole is a terrible name," she says. "People think of a hole as something that's empty. But a black hole is something that's as full as can possibly be. You've squished as much stuff into that space as you can." But why are scientists so interested in black holes in the first place? Because they could answer questions about human existence and the conditions that allowed life to form on Earth—and maybe even in other galaxies, Bentz says.

## Department Highlights (2015)

**Dr. Mark Stockman became a GSU Distinguished University professor.**

Dr. Sebastian Lepine and Dr. Russel White hosted an international conference, "IAUS 314: young stars and planets near the sun" on GSU campus.

**The Nuclear Physics faculty (Drs He, Sarsour and Connors) organized a workshop on the Hadronic Calorimeter Detector, a part of Brookhaven National Laboratory, on GSU campus.**

Dr. Sebastian Lepine and his collaborators discovered three nearby earth-size planets orbiting nearby stars.

**GSU's program on physics teacher education, under the leadership of Dr. Brian Thoms, has been recognized as a national model with GSU's membership in the 5+ Club of the American Physical Society and the American Association of Physics Teachers.**

Dr. Rachel Kuzio Naray discussed a recent discovery of earth-like planets and the possibility of extraterrestrial life on a GPB show.

**Dr. Piet Martens and Dr. Rafal Angryk went to the White House to discuss preparedness for space weather.**

Dr. Steve Manson received a DOE grant award for his research, "Complexity and correlation motion of electrons in free and confined atomic systems".

## Department Chair's Message



Welcome to the 3<sup>rd</sup> edition of our annual Departmental Newsletter. We hope that you enjoy reading about the accomplishments and goals of our faculty, staff, and students. The Department continues to grow, with two additions to our faculty and a new administrative coordinator, as described on page 3. Our faculty continues to make groundbreaking discoveries in physics and astronomy; the accomplishments of two of our faculty members are described on page 2. On this page, we highlight fundamental work on supermassive black holes, which are thought to live in the centers of most galaxies, by Dr. Misty Bentz. Dr. Bentz's observations have been made possible through GSU's new partnership with the Astrophysical Research Consortium on the

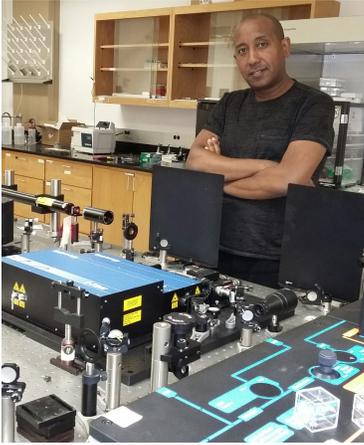
Apache Point Observatory's 3.5-meter telescope in New Mexico.

A few selected highlights of this past year are listed above - many more can be found on the home page of our department website: <http://www.phy-astr.gsu.edu>. We invite you to share in our excitement as the reputation of GSU's Department of Physics and Astronomy grows, its faculty members continue to gain international prominence, its graduate students win national fellowships and continue on to prestigious postdoctoral positions, and its undergraduate physics majors graduate in record numbers and go to top graduate schools or fulfilling and high-paying jobs. Feel free to contact us by email and/or arrange for a visit.

Sincerely,

Dr. D. Michael (Mike) Crenshaw

## Faculty and Event Highlights



Dr. Yohannes Abate

### Dr. Yohannes Abate

What does the world at a very small scale, a billionth of a meter, look like? Dr. Yohannes Abate can tell you about his exciting research at that scale. He was recently awarded a prestigious Faculty Early Career Development (CAREER) award from the NSF in support of his proposed scientific and educational activities. He obtained the award to experimentally study single- and few-layer two-dimensional (2D) materials. Layered two-dimensional crystals exhibit electronic and excitonic surface properties that emerge due to quantum confinement and symmetry breaking associated with reduced dimensionality in these materials. He uses a novel near-field scanning optical microscope to study these materials at a spatial resolution down to 15 nm. The educational component of the grant involves promoting undergraduate and graduate nanoscience and nano-optics education in the Greater Atlanta area. High school teachers and students will be provided with advanced multidisciplinary skills such as scanning-probe microscopy techniques and laser spectroscopy. Dr. Abate is a member of the Center for Nano-optics, directed by Dr. Mark Stockman.

### Dr. Todd Henry



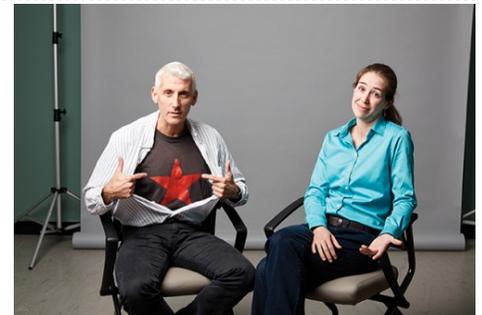
Dr. Todd Henry

It's easy to see very bright stars, even when they are relatively far away. But what about "typical" stars in our home galaxy, including the dim ones that are hard to detect? Without answering this question, we cannot understand the composition of the Milky Way Galaxy. The big questions are: (1) How do our Sun and Solar System fit into the Galaxy? (2) Where are the planets and life likely to be found? Dr. Todd Henry excels at detecting and analyzing the many stars that are within 100 parsecs of the Sun (about 500,000 of them), including the dimmest ones. "We care about everything," he says, including characterizing the stars and any orbiting companion stars or planets. To accomplish this goal, Dr. Henry operates and manages a telescope in Chile, which targets the nearest stars 80 nights out of the year, including some that emit only 1/1,000,000th as much energy as the Sun. Locating all of these stars requires scanning a database of 1.9 billion objects and determining which are likely to be nearby. Dr. Henry's group includes a total of eight undergraduates, graduate students, and postdocs in Atlanta, about six outside the group in the U.S., and even a citizen-scientist.

## BrainModes 2015 – an international conference



MACHOs versus WIMPs



The mystery of dark matter drew a debate showdown between two GSU Astronomers: Dr. Todd Henry and Dr. Rachel Kuzio de Naray. Henry said dark matter was made up of MACHOs (massive, compact halo objects) and Kuzio argued it was made up of WIMPs (weakly interacting massive particles). Read the full article at: <http://magazine.gsu.edu/article/machos-vs-wimps/>

Dr. Mukesh Dhamala, along with Dr. Andrew Butler from the Lewis School of Nursing and Health Professions, organized BrainModes 2015 course and workshop at GSU in December of 2015. This international conference (<http://www.brainmodes.org>) held for the first time in the U.S., brought together experts from various disciplines and sought to explore innovative means of understanding complex brain activity and multimodal neuroscience data sets. There were more than 20 at the two-day pre-workshop course, which included hands-on demonstrations of brain recording, stimulation and simulation technology, and about 100 participants in the main workshop. Ms Alicia Rice from Physics and Astronomy and Ms Angela Go from the University Events Management assisted in organizing these events. Read more about BrainModes 2015 at: <http://snhp.gsu.edu/2016/01/20/international-workshop-examines-complex-brain-activity>.

## New Members, Outreach and Student Activities

### Faculty



**Dr. Megan Connors** joined the Department as a tenure-track assistant professor in fall of 2015. She is also a RIKEN research fellow at Brookhaven National Lab (BNL). Dr. Connors was an associate research scientist at Yale University before joining the GSU faculty. Dr. Connors is an expert on jet correlation studies in heavy ion collisions. She is a member of the PHENIX/sPHENIX Collaboration at RHIC at BNL and of the ALICE Collaboration at the Large Hadron Collider at CERN. Welcome Megan!

**Dr. Stuart Jefferies** joined our Department as a tenured professor in January 2016 through GSU's Second Century Initiative program on Stellar Astrophysics and Astroinformatics. Dr. Jefferies comes to us from the University of Hawaii at Manoa, where he was a Professor of Physics and Astronomy working at the Advanced Technology Research Center in Maui. He is an expert in solar physics as well as space situational awareness and methods for high resolution imaging. He also spends a good deal of time in Antarctica leading the effort on the South Pole Solar Observatory. Dr. Jefferies enjoys good food, surfing, swimming, running, and mountain biking. Welcome Stuart!



### Staff



**Alicia Rice** is a Senior Administrative Coordinator working on our sponsored programs. She comes to us from Michigan State University where she spent over seven years as an Administrative Assistant. Alicia was born and raised in Ocala, FL. She enjoys spending time with family and watching sports. Welcome Alicia!

### Outreach



Girl Scouts from the greater Atlanta area spend a beautiful Saturday learning about the sun with Dr. Bentz.



Astronomy Club members at JSC in Houston

The **Astronomy Club** (Dr. Kuzio de Naray, advisor) had an exciting Spring Break in 2015. The Club traveled to the Johnson Space Center in Houston, Texas, where they toured just about everything! They saw Mission Control and the Orion training facility. They were able to go inside and get an up-close look at the International Space Station and Space Shuttle trainers. The Club also toured Rocket Park where they saw the giant Saturn IV rocket, the Space Shuttle sitting on top of a 747 airplane, and a Mercury capsule sitting on top of a Redstone rocket.



SPS members at SpaceX in Los Angeles, CA

Members of the **Society of Physics Students** (SPS; Dr. Bentz, advisor) had a busy 2015. SPS members continued to offer free tutoring for intro physics classes. Over Spring Break, several members drove to Los Angeles to visit SpaceX and the Mt. Wilson Observatory. They oversaw two events at the regional competition of the middle school Science Olympiad and, together with PGSA, organized the annual department picnic. In the fall, SPS members were involved in Maker Faire Atlanta and volunteered at Fernbank's Annual Science at Hand Day.

## Participation and Support Opportunities

- Visit us online at <http://phy-astr.gsu.edu>
- Contact us at:

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View our schedule of  
public events and colloquia

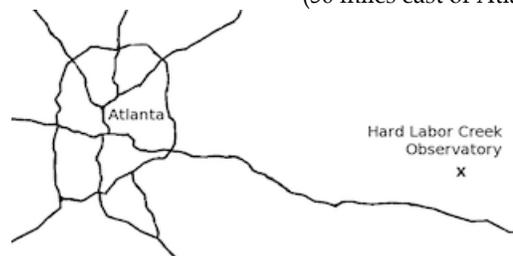
<http://phy-astr.gsu.edu/about/events>

### Hard Labor Creek Observatory

Free monthly public open houses, Mar - Oct

<http://www.astro.gsu.edu/HLCO>

(50 miles east of Atlanta)



### Follow us on social media



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Support Physics and Astronomy at GSU: <http://phy-astr.gsu.edu/connections/giving>

There are a number of ways to show your support for our programs through giving:

- Endow an undergraduate scholarship or award in physics and/or astronomy. Set up a general fund or fine-tune the award to a specific field of research, disadvantaged students, etc. (An example is the annual Robert H. Hankla Award for Outstanding Physics Major.)
- Set up an endowment for a graduate research fellowship in your field of interest or contribute to an existing annual student award in physics or astronomy (see <http://phy-astr.gsu.edu/about/awards-honors>).
- Fund a Visiting Distinguished Scholar for a semester-long visit or a Distinguished Speaker Series. (An example of the latter is the William H. Nelson Fund.)
- Endow a professorship or postdoctoral fellowship in a specialized field.
- Help to establish new facilities or enhance existing ones. (Examples include partnerships in large telescope consortia, or the new CeNO).
- Contribute directly to the general fund of our Department (see <http://phy-astr.gsu.edu/connections/giving>) Contributions support faculty, staff, and students, professional and social functions, and recruitment.
- There are many ways and options to support Physics & Astronomy at GSU. See <http://giving.gsu.edu> or call Hope Carter, Senior Director of Development (404-413-5739, [hcarte8@gsu.edu](mailto:hcarte8@gsu.edu)) for more information about giving opportunities. Come visit us! Contact our Chair, Dr. Mike Crenshaw (404-413-6036, [crenshaw@phy-astr.gsu.edu](mailto:crenshaw@phy-astr.gsu.edu)).