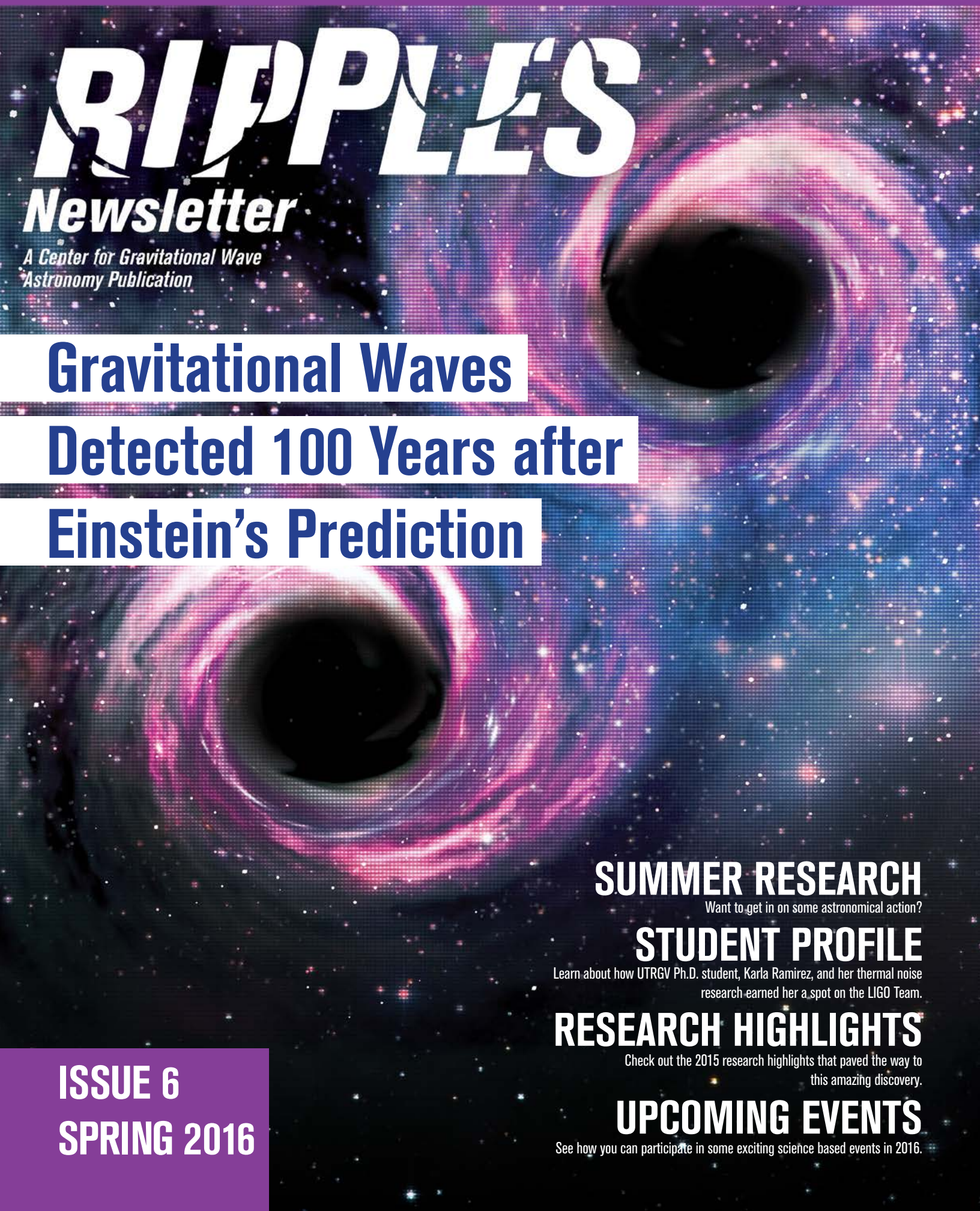
The University of Texas Rio Grande Valley

RIPPLES Newsletter

A Center for Gravitational Wave Astronomy Publication



Gravitational Waves Detected 100 Years after Einstein's Prediction

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ISSUE 6
SPRING 2016

RIPPLES
Newsletter
A Center for Gravitational Wave Astronomy Publication
ISSUE 6 | SPRING 2016

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The University of Texas Rio Grande Valley
Center for Gravitational Wave Astronomy

Upcoming Events

Brownsville Science Café

The second Monday of every month at 7:30 p.m. at El Hueso de Fraile. Three short talks by local and visiting experts on science, arts, and humanities topics, free and open to the public.

Nerd Nite Brownsville

The last Thursday of every month at the Half Moon Saloon in downtown Brownsville. Trivia, talks, and socializing, free and open to the public.

Astronomy in the Park

The last Friday of every month at Resaca de la Palma State Park. Astronomy faculty, students, and telescopes at the UTRGV Observatory are available for public viewing.

Physics and Astronomy Seminars

Every Friday at 10:50 a.m. in Main 1.220 on the UTRGV Brownsville campus.

The University of Texas Rio Grande Valley HESTEC

October 2-8, 2016 on the UTRGV Edinburg campus including Latina Day, Educator Day, and student robotics competitions. See utrgv.edu/hestec for a schedule of events.

RiSA
The University of Texas Rio Grande Valley Science and Arts Festival

November 5, 2016 with events celebrating science and art in the Brownsville Mitte Cultural District. See utrgv.edu/risa for a schedule of events.

Gravitational Waves Detected 100 Years after Einstein's Prediction

LIGO Opens New Window on the Universe with Observation of Gravitational Waves from Colliding Black Holes UTRGV's CGWA Scientists Contribute with Nearly 20 Years of Gravitational Wave Research.

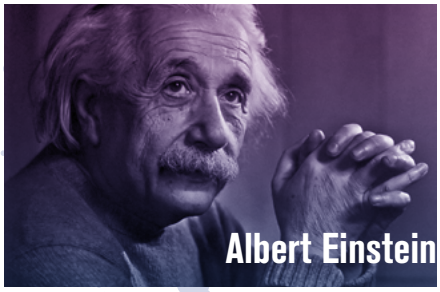


Photo from Wikimedia Commons

This confirms a major prediction of Albert Einstein's 1915 general theory of relativity, and opens an unprecedented new window onto the cosmos.

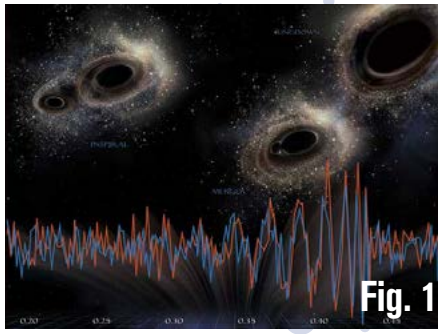
For the first time, scientists have observed ripples in the fabric of spacetime called gravitational waves, arriving at the earth from a cataclysmic event in the distant universe. This confirms a major prediction of Albert Einstein's 1915 general theory of relativity, and opens an unprecedented new window onto the cosmos. Gravitational waves carry information about their dramatic origins and about the nature of gravity that cannot otherwise be obtained. Physicists have concluded that the detected gravitational waves were produced during the final fraction of a second of the merger of two black holes to produce a single, more massive spinning black hole. This collision of two black holes had been predicted, but never observed.

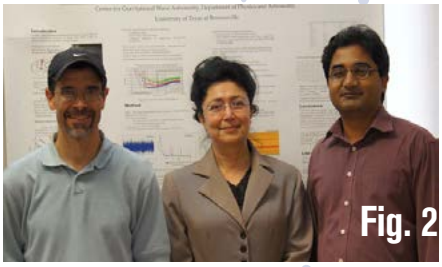
The gravitational waves were detected at 5:51 a.m. (EDT) on Sept. 14, 2015, by both of the twin Laser Interferometer Gravitational-wave Observatory (LIGO) detectors, located in Livingston, Louisiana, and Hanford, Washington. The LIGO Observatories are funded by the National Science Foundation (NSF), and were conceived, built and are operated by Caltech and MIT.

The UTRGV CGWA has the largest group of gravitational-wave researchers in Texas and is one of the largest from the United States involved in the LIGO Scientific Collaboration (LSC) global research effort. Its scientists and student researchers are key contributors to the first direct detection of gravitational waves; more than 20 authors on the detection paper published by Physical Review Letters are current or past members of the CGWA.

CGWA faculty and students contribute to the LIGO effort working at the detector sites installing hardware and commissioning the detectors, characterizing the noise in the detector, and analyzing the LIGO data. Professors Malik Rakhmanov and Volker Quetschke, together with LIGO Hanford senior scientist and CGWA Adjunct Professor Richard Savage, lead an active and very fruitful collaboration between the CGWA and the LIGO Hanford Observatory. The algorithm that first detected the event is based on work done by CGWA Professors Soumya Mohanty and Rakhmanov in collaboration with colleagues at the University of Florida. CGWA Professor Soma Mukherjee, chair of the UTRGV Department of Physics, has contributed to several aspects of detector noise analysis and searches for gravitational-wave signals from supernovae.

CGWA Director Mario Díaz led an international collaboration that operated optical telescopes in the southern hemisphere to perform a follow-up search in the hours immediately after the event, looking for possible visible but faint counterparts in the sky. The group from the UTRGV CGWA was one of only 20 groups of astronomers throughout the world who performed this follow-up.





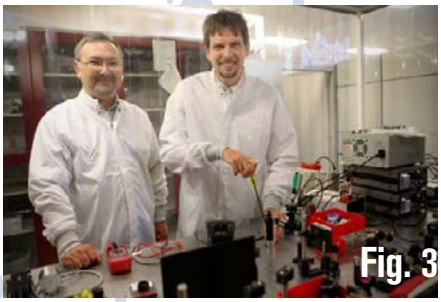
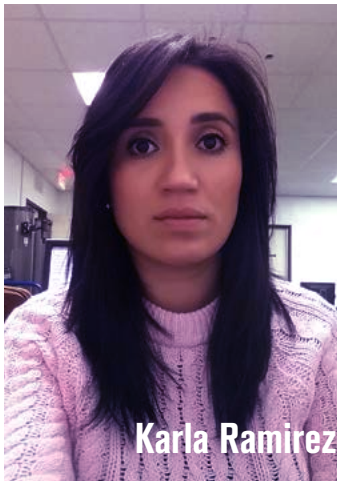


Fig. 1: A visualization of the binary black hole system detected by LIGO and the data from the twin LIGO detectors showing the gravitational wave inspiral, merger, and ringdown from the binary black hole collision.
Fig. 2: The UTRGV CGWA LIGO data analysis team Professors Joe Romano, Soma Mukherjee, and Soumya Mohanty.
Fig. 3: The UTRGV CGWA LIGO detector technology team Professors Malik Rakhmanov and Volker Quetschke.

Student Profile

Karla Ramirez is an international student from Matamoros, Mexico. She is a CGWA Ph.D. student working for the LIGO Scientific Collaboration (LSC) under Dr. Mario Díaz´ guidance. Her research is on thermal noise for the LIGO detector suspension systems, specifically looking for creep noise on the hydroxide-catalysis bonding technique used on the silica fibers welded to the ears that hold the test mass suspensions. The suspensions form the interface between the seismic isolation subsystem and the suspended optics.



CGWA Ph.D. Student

DID YOU KNOW?

This coming summer, Karla will have the opportunity to work at the LIGO Livingston Observatory as a LSC Fellow in Louisiana. As a member of the LIGO team, she has been honored to be part of the discovery of gravitational waves. Kudos, Karla!

Summer Research at CGWA

The CGWA hosts summer research experiences for undergraduate physics students from across the country and local high school physics teachers through the National Science Foundation (NSF) funded Research Experience for Undergraduates (REU) and Research Experience for Teachers (RET) programs. Participants can choose a research experience from the areas of astrophysics, biophysics, gravitational wave detection, lasers, nano-science and advanced materials, or optical astronomy.

They spend 10 weeks during the summer working on the UTRGV Brownsville campus. Students and teachers working on LIGO related research travel to the LIGO Hanford Observatory (LHO) in Washington State at the end of the summer to work with LHO scientists and present their research. See utrgv.edu/reu for more information.

Research Highlights

January 2015

The Center for Advanced Radio Astronomy (CARA) at UTRGV and the National Radio Astronomy Observatory (NRAO) signed a Memorandum of Understanding (MOU) on Friday Jan. 23, 2015 in Charlottesville, Va. The purpose of the MOU is to lay the groundwork for the two entities to collaborate on new initiatives and frontier radio astronomical technologies.

March 2015

UTRGV Physics faculty are members of the North American Nanohertz Observatory for Gravitational Waves (NANOGrav) collaboration that was awarded $14.5 Million by the National Science Foundation (NSF) to create and operate a Physics Frontier Center (PFC). This PFC will aim to detect low frequency gravitational waves by observing pulsars with the use of radio telescopes such as the Arecibo Observatory in Puerto Rico and NRAO's Green Bank Telescope. The UTRGV Physics Department will receive $1 Million over five years for the award.

August 2015

The National Science Foundation has awarded Physics professors Dr. Joseph Romano, Dr. Joey Shapiro Key, Dr. Soumya D. Mohanty, and Dr. Soma Mukherjee a $450,000 grant for the period 2016-2018 in support of research projects in gravitational wave astronomy data analysis for the Laser Interferometer Gravitational wave Observatory (LIGO).

Dr. Andreas Hanke, Associate Professor in the Department of Physics, was awarded a new grant from the NIH, titled "Single-Molecule DNA Topology". The project is in collaboration with Dr. S. Levene of the University of Texas at Dallas. Dr. Hanke is the Lead Investigator at UTRGV on the sub-contracted amount of $280K for the period August 2015 - April 2019. The goal of the project is to study enzymatic mechanisms of topology simplification in DNA by type-II topoisomerases in terms of non-equilibrium thermodynamics using time-resolved measurements of topoisomerase reactions on single DNA molecules.

In Memory of Dr. Cristina Torres

Dr. Cristina Torres and members of the Society of Physics Students after a Physics Circus community outreach event.

Dr. Cristina Torres was a research assistant professor in the Center for Gravitational Wave Astronomy from 2012 to 2015. She was a class of 1999 graduate of the University of Texas Brownsville and went on to earn her masters of science in 2001 from UT El Paso and her doctorate in physics from UT Dallas in 2007. Torres focused her research on remote sensing, imaging, applied physics, gravitational wave data analysis, education research, and high performance computing application development. She conducted her post doctoral research at the California Institute of Technology and the Laser Interferometer Gravitational wave Observatory (LIGO) in Livingston, LA. She served as the faculty advisor for the Society of Physics Students (SPS) and Sigma PI Sigma Physics Honor Society and led the community programs Astronomy in the Park and Monday Night Physics. She loved to empower her students to always reach for more than what they could imagine. Dr. Torres passed away in March of 2015 and is dearly missed by her students and colleagues.

She loved to empower her students to always reach for more than what they could imagine.

Note from the Director Dr. Mario Díaz

The CGWA was created in 2003, 13 years ago. Some of us in the CGWA, who were faculty at what was then The University of Texas at Brownsville, started working with LIGO around 1998, sixteen years ago. Many more scientists, visionaries, fighters started working in this field forty years ago. Many years of hard work, patience and perseverance from many, many people (now more than one thousand scientists and engineers) paid off, when on September 14, 2015 the LIGO detectors captured, unambiguously and precisely the first gravitational wave. This clear and loud signal encoded the information about the collision of two black holes coalescing into a single one more massive than each of them, releasing an amount of energy equivalent, in a few thousandths of a second, to several times the total luminous output of all the stars in the universe combined. This story, which sounds almost like a Hollywood script, is a homage to the power of human knowledge and to the beauty of physics, the discipline that seeks to understand how our universe works. Enjoy this issue dedicated to the first detection of gravitational waves!

More pictures on the CGWA website: UTRGV.edu/CGWA