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CGWA PRESS RELEASE

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Gravitational waves from a binary black hole merger observed by LIGO and Virgo

The LIGO Scientific Collaboration and the Virgo collaboration report the first joint detection of gravitational waves with both the LIGO and Virgo detectors. This is the fourth announced detection of a binary black hole system and the first significant gravitational-wave signal recorded by the Virgo detector, and highlights the scientific potential of a three-detector network of gravitational-wave detectors.

The three-detector observation was made on August 14, 2017 at 10:30:43 UTC. The two Laser Interferometer Gravitational-Wave Observatory (LIGO) detectors, located in Livingston, Louisiana, and Hanford, Washington, and funded by the National Science Foundation (NSF), and the Virgo detector, located near Pisa, Italy, detected a transient gravitational-wave signal produced by the coalescence of two stellar mass black holes.

A paper about the event, known as GW170814, has been accepted for publication in the journal Physical Review Letters.

The detected gravitational waves—ripples in space and time—were emitted during the final moments of the merger of two black holes with masses about 31 and 25 times the mass of the sun and located about 1.8 billion light-years away. The newly produced spinning black hole has about 53 times the mass of our sun, which means that about 3 solar masses were converted into gravitational-wave energy during the coalescence.

“Little more than a year and a half ago, NSF announced that its Laser Gravitational-Wave Observatory had made the first-ever detection of gravitational waves resulting from the collision of two black holes in a galaxy a billion light-years away," says France Córdova, NSF director. "Today, we are delighted to announce the first discovery made in partnership between the Virgo Gravitational-Wave Observatory and the LIGO Scientific Collaboration, the first time a gravitational-wave detection was observed by these observatories, located thousands of miles apart. This is an exciting milestone in the growing international scientific effort to unlock the extraordinary mysteries of our Universe.”

The Virgo detector joined the LIGO second observational run, O2, on August 1, 2017 at 10:00 UTC. The real-time detection on August 14 was triggered with data from all three LIGO and Virgo instruments. Virgo is, at present, less sensitive than LIGO, but two independent search algorithms based on all the information available from the three detectors demonstrated the evidence of a signal in the Virgo data as well.

Overall, the volume of universe that is likely to contain the source shrinks by more than a factor of 20 when moving from a two-detector network to a three-detector network. The sky region for GW170814 has a size of only 60 square degrees, more than 10 times smaller than with data from the two LIGO interferometers alone; in addition, the accuracy with which the source distance is measured benefits from the addition of Virgo.

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LIGO is funded by NSF and operated by Caltech and MIT, which conceived and built the project. Financial support for the Advanced LIGO project was led by NSF with Germany (Max Planck Society), the U.K. (Science and Technology Facilities Council) and Australia (Australian Research Council) making significant commitments and contributions to the project. More than 1,200 scientists from around the world participate in the effort through the LIGO Scientific Collaboration, which includes the GEO Collaboration. Additional partners are listed at http://ligo.org/partners.php.

The Virgo collaboration consists of more than 280 physicists and engineers belonging to 20 different European research groups: six from Centre National de la Recherche Scientifique (CNRS) in France; eight from the Istituto Nazionale di Fisica Nucleare (INFN) in Italy; two in The Netherlands with Nikhef; the MTA Wigner RCP in Hungary; the POLGRAW group in Poland; Spain with the University of Valencia; and EGO, the laboratory hosting the Virgo detector near Pisa in Italy.

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The **Center for Gravitational Wave Astronomy** is a member of the LIGO Scientific Collaboration since 1998.
The University of Texas Rio Grande Valley houses the Center for Gravitational Wave Astronomy, which was founded in 2003 with grants from the National Aeronautic Space Administration and the National Science Foundation. The CGWA has the largest group of gravitational- wave researchers in Texas and one of the largest in the USA involved in LIGO Scientific Collaboration global research effort. Its scientists and student researchers are key contributors to the first direct detection of gravitational waves.
Dr. Mario Díaz, CGWA director expressed: “this is another milestone in the history of gravitational wave astronomy. In the future the shrinking of the probable area of localization of a gravitational wave source will it make easier for astronomers to find an electromagnetic counterpart if that exists”.

UTRGV scientists and students have been involved for almost twenty years now in the development of core technologies and instrumentation used by the LIGO detectors, installation and commissioning of hardware for the detectors at the Hanford and Livingston sites, modeling of noise sources that can contaminate the data, development of new algorithms that analyze the data in search of gravitational-wave signals and follow-up searches with optical telescopes that try to catch the optical counterpart of these events.

Coauthors of the PRL paper mentioned above are CGWA and UTRGV faculty members Profs.Teviet Creighton, Mario Diaz (CGWA director), Soma Mukherjee, Volker Quetschke, Malik Rakhmanov, Joseph Romano and graduate students Karla Ramirez, Robert Stone, Darkhan Tuyenbayev, Wenhui Wang and former graduate student Dr. Guillermo Valdes, now a Louisiana State University scientist working at the at the LIGO Laboratory in Livingston.

Dr. Volker Quetschke chairs the Lasers and Auxiliary Optics working group of the LIGO Scientific Collaboration guiding the research towards laser systems for the next generation interferometric gravitational wave detectors. He and his group work towards high-power fiber-based laser systems for future cryogenic GW detectors.

Dr. Rakhmanov conducts research in optical resonators and trains the students in techniques of experimental gravitational-wave physics. He has been with LIGO since 1994.

Dr. Soma Mukherjee's research group investigates various aspects to improve gravitational wave detection from core collapse supernovae.

Dr. Romano and Dr. Creighton work in different aspects of gravitational wave data analysis.

Dr. Díaz has more recently being the doctoral dissertation supervisor of Dr. Guillermo Valdes, who just graduated with a PhD in Physics and is now a scientists at the LIGO Livingston Laboratory. He is also the supervisor of another doctoral student Karla Ramirez who is currently a LIGO Scientific Collaboration fellow at the LIGO Livingston Laboratory. Additionally he leads a group in astronomy searching for optical counterparts of gravitational waves. He is also the director of the UTRGV Astronomical Observatory located in Resaca de la Palma State Park.

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