GRAVITATIONAL WAVES DETECTED FROM SECOND PAIR OF COLLIDING BLACK HOLES

Abuduuxbiisiiya o?bigimskAAsts noo?gutsiisaduubya iduutsatsii nAbuutsbiiya sigooxgiya*

The LIGO Scientific Collaboration and the Virgo collaboration identify a second gravitational wave event in the data from Advanced LIGO detectors.

muuxiisk LIGO myanitsxiinimatstu?xiniists i_gansbuum_dayaa gii Virgo i_gansbuum_dayaa Abuduuxbiisiiya o?bigimskAAsts mu?k oxtsimya miix Advanced LIGO oo?gutsiisaduumya.

On December 26, 2015 at 03:38:53 UTC, scientists observed gravitational waves—ripples in the fabric of spacetime—for the second time.

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The gravitational waves were detected by both of the twin Laser Interferometer Gravitational-(LIGO) detectors, located in Livingston, Louisiana, and Hanford, Washington, USA.

miistsk Abuduuxbiisiiya o?bigimskAAsts Iiinapsgoosiimya miixi niistsimii Laser Interferometer Gravitational-wave Observatory (LIGO) oo?gutsiisaduumya, itstsiiya Livingston, Louisiana, gii Hanford, Washington, USA.

The LIGO Observatories are funded by the National Science Foundation (NSF), and were conceived, built, and are operated by Caltech and MIT. The discovery, accepted for publication in the journal *Physical Review Letters*, was made by the LIGO Scientific Collaboration (which includes the GEO Collaboration and the Australian Consortium for Interferometric Gravitational Astronomy) and the Virgo Collaboration using data from the two LIGO detectors.

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Gravitational waves carry information about their origins and about the nature of gravity that cannot otherwise be obtained, and physicists have concluded that the detected gravitational waves once again were produced during the final moments of the merger of two black holes—14.2 and 7.5 times the mass of the sun—to produce a single, more massive spinning black hole that is 20.8 times the mass of the sun.

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"It is very significant that these black holes were much less massive than those in the first detection," says Gabriela Gonzalez, spokesperson of the international LIGO Scientific Collaboration (LSC) and professor of physics and astronomy at Louisiana State University. "Because of their lighter mass, they spent more time – about one second – in the sensitive band of the detectors. It is a promising start to mapping the populations of black holes in our universe."

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During the merger, which occurred approximately 1.4 billion years ago, roughly the equivalent of the mass of the sun was converted into gravitational waves. The detected signal comes from the last 55 orbits before the merger. The arrival time of the signals, with the Livingston detector measuring the waves 1.1 milliseconds before the Hanford detector, gives a rough idea of the position of the source in the sky.

gyamuu udAbuutu?biisaa, udAtsiigyabis a?gumayagiduuduu anuum xa?gui iduumadabaabii aganyuup iguma?xtsisim idumanistanik*xim nah naduus anistsI isawaiidagiduupya Abuduuxbiisiiya o?biginsAAsts. niitsiwa uutu?guunimaanuwa uudaayinapsguuguwatsix itu?badatsimya mi_k oda~ku*biiwI niisitsiibuuitsisidoi bitsiisyuui nii iibuutu?biiya. idustimya muustsk uudaayinapsguuguwatsix, gyamuu Livingston itu?gutsiisaduubyuyix issxgwiipya miistsk o?bigimskAAsts idabanatsi bitsiistuui miik Hanford itu?gutsiisaduubyuyix, amu*gI ak*tsxiniip utsitstsiip spuu?ts.

Fulvio Ricci, the Virgo Collaboration Spokesperson, noted that “In the near future Virgo, the European interferometer will join the network of gravitational wave detectors and will improve our contribution to the multi messenger astronomy. The three interferometers together will permit a far better location in the sky of the signals.”

Fulvio Ricci, Virgo Collaboration uudAbuwadumaguwaa udAbuwaduumuuguwa, awanii “madaxisamuu aganistsii Virgo abaamsxagui nuu?giitsiidabuuyix anatsi ayagidu gii idumuya issxgwiipiists agitsibuutstsii muuststsk udaabsduudaxinwa Abuduuxbiisii o?bigimskAAsts itu?gutsiisaduubyuyix gii axuugabi_duumya nitsbuum_daanin muux?k igagayim Asesduu axiibiisabesspsabii. muux nuuxge anatsi ayagidutsim gii idumuya issxgwibiists igak*tsugAstamutsgagiya tsima idA_ststsii muustsk Iyiinapsgagii.”

The first detection of gravitational waves, announced on February 11, 2016, was a milestone in physics; it confirmed a major prediction of Albert Einstein's 1915 general theory of relativity, and marked the beginning of the new field of gravitational-wave astronomy.

nii_k noduumu?kgoo?gutsiisaduumya miistsk Abuduuxbiisii o?bigimskAAsts idAyn_gatsimaduumya bidedgiisuu, niitsigubudui, 2016, iduuma?gabii mu?k essatsimya tsiimaii_duutstsii amuusts myanitsxiininatstu?xini; gyamuu?gI iigayissxinim nam Albert Einstein's 1915 niidAnii_gahduup bisaatsinsiimaan (general theory of relativity), manumadabii manitstsii issxinimatstu?gii muu?k Abuduuxbiisii o?bigimskAAsts axiibiisabesspsabii.

The second discovery "has truly put the 'O' for Observatory in LIGO," says Caltech's Albert Lazzarini, deputy director of the LIGO Laboratory. "With detections of two strong events in the four months of our first observing run, we can begin to make predictions about how often we might be hearing gravitational waves in the future. LIGO is bringing us a new way to observe some of the darkest yet most energetic events in our universe."

mu?k iduutstsii noo?guniip "Atsapu?duup mu?k 'O' mii_k LIGO," awanii Caltech's Albert Lazzarini, a?batsiina mu?k LIGO Laboratory. "gyamu?k oo?gutsiisaduup igayigu nado?ganabi nu?k nisui nidaduusi maniniip , gyanuu?gI anniinidAynimya axigyabii gii agitsxiniip igagawuu agidaayu?tsiipya miistsk Abuduuxbiisii o?bigimskAAsts issu?tsiigi aganistsii. LIGO oo?gugii manu?gwisxinimya ma?ganistsatsiibuwI gyamuustsii isstu?ganessginatsi gyii issgunadabii o?ganabii amuu spoohts."

"We are starting to get a glimpse of the kind of new astrophysical information that can only come from gravitational wave detectors" says MIT's David Shoemaker, Leader of Advanced LIGO.

"agomadabiniip muustsk manessatsiip tsiimaii_duutstsii myanitsxiininatstu?xiniists Iiinapsgookiya muuxsk Abuduuxbiisii o?bigimskAAsts itu?gutsiisaduubyuyix" awanii MIT's David Shoemaker, iinawasii mii_k Advanced LIGO.

Both discoveries were made possible by the enhanced capabilities of Advanced LIGO, a major upgrade that increases the sensitivity of the instruments compared to the first generation LIGO detectors, enabling a large increase in the volume of the universe probed. Advanced LIGO's next data-taking run will be this fall. By then, further detector tuning is expected to allow LIGO to reach 1.5 to 2 times more of the volume of the universe. The Virgo detector is expected to join in the latter half of the upcoming observing run.

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LIGO research is carried out by the LIGO Scientific Collaboration (LSC), a group of more than 1000 scientists from universities around the United States and in 14 other countries. More than 90 universities and research institutes in the LSC develop detector technology and analyze data; approximately 250 students are strong contributing members of the collaboration. The LSC detector network includes the LIGO interferometers and the GEO600 detector.

LIGO agabo?gwisxinimyAAsts o?badatsimya LIGO Scientific Collaboration (LSC), muuxsk nuu?gadoonugitsimya, aganyup niduuma?guuxdaxin mugagyabiguwex miistsk idespxinimatstuu?giists anuum United States gii miistsk niswigubudui so?bAximskanaa. gyagadanyup i?xiibuu idespxinimatstuu?giists gii iduu?gwisxinimatstuu?gii amuu?k LSC abAstutsimya oo?gutsiisaduumyatsiix manu?gwisxiniipiists gii idessxgatsimyAx agooxtsiimAAx; aganyup nadugibibui itstsiisibui gyax essxinimatsaa stunatsbuum_daaya essdudabodagiiya. mu?k LSC itu?gutsiisaduubyuyix udaabsduudaxin annuyi miixsk LIGO anatsi ayagidu gii idumuya issxgwiipiists agitsibuutstsii gii GEO600 itu?gutsiisaduubyuyix.

Virgo research is carried out by the Virgo Collaboration, consisting of more than 250 physicists and engineers belonging to 19 different European research groups: 6 from Centre National de la Recherche Scientifique (CNRS) in France; 8 from the Istituto Nazionale di Fisica Nucleare (INFN) in Italy; 2 in The Netherlands with Nikhef; the Wigner RCP in Hungary; the POLGRAW group in Poland and the European Gravitational Observatory (EGO), the laboratory hosting the Virgo detector near Pisa in Italy.

Virgo agabo?gwisxiniip o?badatsimya miixsk Virgo Collaboration, anni nitsi nadugibibui itstsiisibui myanitsxiininatstu?xiniix gii nAybuutsduumya i_tu?duduya bi_xigubuduu nuu?gitsiya European agabo?gwisxiniimya oo?ganuuyiix: noi miim Centre National de la Recherche Scientific (CNRS) miim France; nanisui miim Istituto Nazionale di Fisica Nucleare (INFN) miim Italy; naduge miim The Netherlands o?bogii Nikhef; miixisk Wigner RCP miim Hungary; muuxisk POLGRAW oo?ganuuya miim Poland gii muuxisk European Gravitational Observatory (EGO), gyamu?k igayiguu madaagabuudaxinaku?ganuuya Virgo itu?gutsiisaduubyayix iduutstsii Pisa miim Italy.

The NSF leads in financial support for Advanced LIGO. Funding organizations in Germany (Max Planck Society), the U.K. (Science and Technology Facilities Council, STFC) and Australia (Australian Research Council) also have made significant commitments to the project.

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Several of the key technologies that made Advanced LIGO so much more sensitive have been developed and tested by the German UK GEO collaboration. Significant computer resources have been contributed by the AEI Hannover Atlas Cluster, the LIGO Laboratory, Syracuse University, and the University of Wisconsin-Milwaukee. Several universities designed, built, and tested key components for Advanced LIGO: The Australian National University, the University of Adelaide, the University of Florida, Stanford University, Columbia University of New York, and Louisiana State University. The GEO team includes scientists at the Max Planck Institute for Gravitational Physics (Albert Einstein Institute, AEI), Leibniz Universität Hannover, along with partners at the University of Glasgow, Cardiff University, the University of Birmingham, other universities in the United Kingdom and Germany, and the University of the Balearic Islands in Spain.

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i_gansbuum_daaya. ododomsii muustsk igegamuu?gwisxinim issbummuuts miixsk AEI Hanover Atlas Cluster, miim LIGO Laboratory, mii_k Syracuse University, gii mii_k University of Wisconsin-Milwaukee. manistssim_bya muustsk idespxxinimatstuu?gii i_tsiiximstaaya, abiistutsimya gii istu?tsixii ododomsii o?ganayagitsduup muk? Advanced LIGO: miixsk Australian National University, gii University of Adelaide, gii University of Florida, gii Stanford University, gii Columbia University of New York gii Louisiana State University. muuxsk GEO nessbuumAx itsiinAbyaa mugagyabiguwex miim Max Planck Institute annim Gravitational Physics (Albert Einstein Institute, AEI), Leibniz Universitat Hannover, igagAdabiiya ax nessbuumya mii_k University of Glasgow, Cardiff University, miixsk University of Birmingham, gya miistskI idespxinimatstuu?gii miim United Kingdom gii Germany, gii miim University of the Balearic Islands in Spain.

***** *This is a translation into the Siksika (Blackfoot) language by Sharon Yellowfly (Siksika Nation) who has a Bachelor's of Arts in Anthropology, a background in linguistics, & who is fluent in the Siksika language. This translation was made from a Blackfoot Dictionary Yellowfly has written. Words are spelled phoenetically with the English alphabet, but here are notes on vowels & other symbols used to make sounds unique to the Siksika language:*

Vowels & Other Sounds

SIKSIKA	**ENGLISH**
a	*f**a**ther*
i	***ea**t*
u	*b**oo**k*
e	*l**e**t*
o	*g**o***

x - *si**x***
A - ***a**corn*
I - ***i**ce*

? - glottal stop
_ - as in '***he***' but held a little longer
***** - *who*
~ - (not quite a full glottal stop) as in '*cotton*'