

## The first joint catch by LIGO and Virgo: another black hole merger detected

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*"Three detectors together delivered a significantly better localization of the source and access to polarizations of gravitational waves."*

The LIGO observatories in the USA observed the gravitational-wave signals from yet another merging black hole pair. This time, LIGO was joined by the Virgo observatory from Europe, which significantly contributed to the improved localization of this astronomical source in the sky, and enabled new tests of Einstein's theory based on the polarization of gravitational waves.

This event, detected on 14 August 2017, is the fourth detection of a merging binary black hole system. Three such events were detected by the twin LIGO detectors in the past (first two events in 2015 and the third one in January 2017). It is the first time that such a detection is being confirmed by a third detector. The Virgo detector started collecting data on 1 August 2017, and was soon bestowed with a detection, jointly with LIGO.

The signal was produced by the merger of two massive black holes, weighing 31 and 25 times the mass of the Sun at a distance of 1.7 billion light years away from us. An energy equivalent to the mass of three Suns was radiated as gravitational waves in this energetic astronomical event. These detections of gravitational waves from merging black hole pairs allow us to map out the distribution of black holes in the universe and to do precision tests of Einstein's theory of General Relativity. Results from this detection are presented in a new paper, accepted for publication in the journal *Physical Review Letters*.

The LIGO-Virgo collaboration includes more than a thousand scientists from many different countries, setting a great example in international scientific cooperation. The recent publication has 40 authors from 13 Indian institutions. Over the last three decades, Indian scientists have done foundational work in various aspects of gravitational-wave science, including theoretical calculation of expected signals from astronomical sources, developing sophisticated data analysis techniques for searching weak gravitational-wave signals in noisy data and devising techniques to combine data from multiple detectors. The current Indian team in the LIGO-Virgo collaboration has made direct contributions to the extraction of the properties of the astronomical source from the data and to the first tests of Einstein's theory using these observations. The Indian contribution to this emerging frontier will grow significantly in the future, with the materialisation of the LIGO-India observatory, which is being built on Indian soil. This is expected to bring many-fold improvements to the source localisation accuracy.

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