MAGIC

Science of the Cosmos

Contribution ID: **110** Type: **not specified**

Gravitational Waves Astronomy - ten years of breakthrough discoveries

The first direct detection of gravitational waves on September 14th, 2015 originating from the merger of two stellar-mass black holes, opened an entirely new way of observing the Universe. The signal GW150914, not only marked the birth of gravitational wave astronomy but also provided the first evidence for the existence of binary black holes and validated general relativity in the strong-field regime, previously inaccessible to observation. For this groundbreaking discovery, the 2017 Nobel Prize in physics was awarded to key contributors from the LIGO–Virgo collaboration. Since then, over 300 gravitational-wave signals, predominantly from binary black hole coalescences, have been observed leading to major breakthrough discoveries. Currently, the fourth LIGO-Virgo-Kagra network observing run is ongoing and gravitational wave alerts are sent to the international community to support multimessenger follow-up observations. In my talk, I will review the key results from the first decade of gravitational-wave observations, with emphasis on their implications for astrophysics, fundamental physics and cosmology and present prospects for future detectors.

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