



ID de Contribution: 209

Type: Non spécifié

Unveiling the Sky with Gravitational Waves: Discoveries from GWTC-4

mercredi 19 novembre 2025 14:45 (15 minutes)

The detection of gravitational waves emitted by binary mergers has opened a new window onto the Universe, offering a unique probe of compact objects across cosmic history. The LIGO-Virgo-KAGRA collaboration has recently released the fourth Gravitational-Wave Transient Catalog (GWTC-4), featuring over 200 confidently identified events, primarily from binary black hole mergers. This unprecedented dataset enables detailed population studies, providing insights into the mass, spin, and redshift distributions of compact binaries and offering clues about their astrophysical origin and formation channels. Beyond population inferences, GWTC-4 also delivers updated constraints on the Hubble constant and allows for stringent tests of general relativity in the strong-field regime. This presentation will highlight these key scientific results, along with the improved detector sensitivity and analysis techniques that made them possible.

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Classification de Session: Astrophysics & Multi-messenger