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Title: "A new exploration of the Universe through gravitational waves and multimessenger observations"

Abstract. On September 14, 2015, gravitational waves were detected for the first time by Advanced LIGO detectors, making binary coalescence of black holes, previously invisible to electromagnetic observations, accessible. This momentous discovery marked the beginning of gravitational wave astronomy, which in just a few years is revealing the mysteries of stellar-mass black holes and the death of massive stars. On Aug. 17, 2017, the first observation of gravitational waves from the coalescence of a binary system of neutron stars by the Advanced LIGO and Virgo network, followed 1.7 s later by a gamma-ray burst detected by the Fermi and INTEGRAL satellites, initiated most extensive worldwide observing campaign in the human being that has detected the multi-wavelength counterparts of this event. Multi-messenger discoveries have the power to unveil the enigmas of the most energetic transients of the sky, probing neutron star physics, relativistic astrophysics, nuclear physics, nucleosynthesis, and cosmology. The talk will provide an overview of the astrophysical implications of these discoveries, and then focus on the majestic prospects of future gravitational wave detectors on the ground and in space.