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Gravitational Waves and Coalescing Black Holes

Two of the most novel predictions of Einstein's theory of General Relativity were discovered soon after its creation one century ago: Black Holes (Schwarzschild, January 1916) and Gravitational Waves (Einstein, June 1916). It took more than 50 years to grasp the physical significance of these theoretical discoveries. The recent discovery of several gravitational wave events by the two Laser Interferometer Gravitational-Wave Observatory (LIGO) interferometers has brought the first direct evidence for the existence of black holes, and has also been the first observation of gravitational waves in the wave-zone. The talk will review the theoretical developments on the motion and gravitational radiation of binary black holes that have been crucial in interpreting the LIGO events as being emitted by the coalescence of two black holes. In particular, we shall present the Effective One-Body formalism which has been crucial in allowing one to compute the bank of 250 000 templates that has been used to search coalescence signals, and to measure the masses and spins of the coalescing black holes.