The dawn of gravitational wave astrophysics and the formation channels of compact object binaries

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On September 14 2015, the LIGO interferometers captured a gravitational wave (GW) signal from two merging black holes (BHs), opening the era of gravitational wave astronomy. Five BH mergers and one neutron star (NS) merger have been reported so far. Understanding their formation channels is currently one of the main challenges of astrophysics. In this talk, I will discuss the impact of progenitor's metallicity and of several binary evolution processes on the mass of merging compact objects. Dynamical processes also affect the formation of compact object binaries: dynamical exchanges in star clusters can lead to the formation of massive binaries with relatively high eccentricity and misaligned spins. The runaway collision process can even lead to the formation of intermediate-mass black holes. Finally, I will discuss the BH merger rate evolution across cosmic time and the properties of the host galaxies of compact object binaries.