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The host galaxies of binary compact objects

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The merger rate density of binary compact objects and the properties of their host galaxies carry crucial information to understand the sources of gravitational waves. In this talk, I present galaxyRate, a new code that estimates the merger rate density of binary compact objects and the properties of their host galaxies, based on observational scaling relations. We generate synthetic galaxies according to the galaxy stellar mass function of star forming and passive galaxies. We estimate the metallicity according to both the mass-metallicity relation (MZR) and the fundamental metallicity relation (FMR). Also, we took into account the evolution of the galaxy properties from the formation to the merger of the binary compact object. We found that the merger rate density evolution changes dramatically depending on the choice of the star-forming galaxy main sequence, especially in the case of binary black holes (BBHs) and black hole neutron star systems (BHNSs). The slope of the merger rate density of BBHs and BHNSs is steeper if we assume the MZR with respect to the FMR, because the latter predicts a shallower decrease of metallicity with redshift. In contrast, binary neutron stars (BNSs) are only mildly affected by both the galaxy main sequence and metallicity relation. Overall, BBHs and BHNSs tend to form in low-mass metal-poor galaxies and merge in high-mass metal-rich galaxies, while BNSs form and merge in massive galaxies. We predict that passive galaxies host at least ~5-10%, ~15-25%, and ~ 15-35% of all BNS, BHNS and BBH mergers in the local Universe.

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