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Understanding the stellar progenitors of binary black holes

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The black holes detected by the LVK gravitational wave detectors have masses (typically 20-50 Msun) that are systematically heavier than those detected in X-ray binaries (5-20 Msun). This mass discrepancy suggests different progenitor stellar environments, especially metallicity, between X-ray binary and gravitational wave black holes. We have built a model Universe that represents star formation for different redshift, host galaxy mass, stellar metallicity and in which we incorporate a binary evolution model under different conditions (stellar-wind, mass-transfer, Supernova). In this presentation, I will discuss preliminary results on our simulated binary black hole merger rates and binary evolution models that are consistent with the LVK population. Our analyses show that large black hole mergers are typically at redshift < 1, from dwarf galaxies with a low metallicity (0.02 Zsun) environment. However, most black hole systems arise at large redshifts(2-3), from Milky way mass galaxies in a high metallicity (<.9 Zsun) environment. The number of gravitational wave observations will increase in the following years and will further constrain the comparison. We will also extend our analyses to X-ray binaries in the Milky Way.

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