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Importance of stable mass transfer and stellar winds for the formation of gravitational waves sources

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The isolated formation channel is one of the most studied formation
scenarios for stellar mass black hole binary (BBH) mergers detected by LIGO and Virgo. Focusing on the effects of
uncertain stellar and binary physics, we investigate this BBH formation channel using the rapid binary population
synthesis code SeBa.

Regardless of our assumptions, the two must common formation path within the isolated binary scenario involves (i) a stable mass transfer followed by a common envelope evolution or (ii) two stable mass transfers. I will show that uncertainties in the first stable mass transfer can have a significant effect on the relative importance of these two channels. Based on a number of model variations that I simulated, I will show that merger rate of the channel with two stable mass transfers can change an order of magnitude depending on what we assume about the angular momentum lost from the system and the mass accretion efficiency during the first mass transfer phase. At the same time, the merger rates of the common envelope channel can be significantly lower than previously predicted, if we update our models based on recent developments on the mass transfer stability criteria with giants with radiative donors and predictions about at what stage the star develops a deep convective envelope. Finally, I also compare my results to gravitational wave observations and to High-mass X-ray binaries, where the latter can give us important clues about angular momentum lost from the system and the mass accretion efficiency.

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