Contribution ID: **103** Type: **Talk**

Disentangling the formation channels of binary black holes

Tuesday 27 May 2025 10:48 (12 minutes)

In the last years, gravitational wave detectors proved for the first time the existence of binary black hole mergers. Investigating their formation history can give us an useful insight on poorly constrained binary interaction processes. For instance, the properties of the binary black hole population are heavily influenced by the stability and efficiency of mass transfer events, since unstable mass transfer can reduce the orbital separation by several order of magnitudes, facilitating a merger by gravitational wave emission but also increasing the risk to have a premature coalescence between the two objects. Recent detailed modeling of the stellar and binary physics involved in mass transfer events indicated that the standard prescriptions adopted for mass transfer stability were likely understimating the number of binary black holes formed through stable mass transfer evolution. In my work, I used detailed modeling and population-synthesis simulations (MESA and SEVN softwares) and showed that caution must be taken when different mass transfer models are compared. Changes in the input stellar physics, in the mass transfer prescription or in the tidal model can have similar effects in selecting the final binary properties and formation channels. Being able to disentangle between stellar evolution, mass transfer and tidal effects is crucial to correctly interpret the population of binary black hole mergers.

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Session Classification: Observational Science (OSB)

Track Classification: Observational Science (OSB): Div3