W23a Impact of initial mass functions on the dynamical channel of gravitational wave sources

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Dynamically formed and perturbed black hole (BHs) binaries are one important progenitors of gravitational waves (GWs). The globular clusters (GCs) are considered to be one of the major environment to produce such binaries due to its high central density. There is an argument that the dynamical contributions to GW mergers from GCs is small due to a small number of observed GCs in the Galaxy. However, this assumes that GCs contain a canonical initial mass function like that in the field star. But GCs formed at high redshift and in a metar-poor environment, where top-heavy IMFs might appear. Although GCs with top-heavy IMFs tend to disrupt fast or become dark clusters, their contribution to the GW sources can be significant. By using star-by-star accurate N-body simulations (PETAR code) for dense GCs with different IMFs, we find that the properties of BBH mergers have depends on the stellar-wind mass loss and stellar dynamics in a complex way. The merger rate does not monotonically correlate with the slope of IMFs. The formation rate continues decreasing as cluster expands due to BH heating. But since the total number of BHs is much larger, the final contribution can still be much more if the initial mass and density of GCs is high.