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The remnants of first stars for gravitational wave sources

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Using our population synthesis code, we found that the typical chirp mass of binary black holes (BH-BHs) whose origin is the first star (Pop III) is ~30Msun with the total mass of ~60Msun so that the inspiral chirp signal as well as quasi normal mode (QNM) of the merging black hole are interesting targets of LIGO,VIRGO and KAGRA (Kinugawa et al.2014 and 2016). The detection rate of the coalescing Pop III BH-BHs is ~ 180 events/yr (SFR_p/(10^{-2.5} Msun /yr/Mpc^3))*([f_b/(1+f_b)]/0.33)*Err_sys in our standard model where SFR_p, f_b and Err_sys are the peak value of the Pop III star formation rate, the binary fraction and the systematic error with Err_sys=1 for our standard model, respectively. Furthermore, we found that the chirp mass has a peak at ~30Msun in most of parameters and distribution functions (Kinugawa et al.2016). This result predicted the gravitational wave events like GW150914 and LIGO paper said 'recently predicted BBH total masses agree astonishingly well with GW150914 and can have sufficiently long merger times to occur in the nearby universe (Kinugawa et al. 2014)' (Abbot et al. ApJL 818,22 (2016)).
Thus, there is a good chance to check indirectly the existence of Pop III massive stars by gravitational waves.

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Talk/Poster

Talk

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