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Probing Supermassive blackholes with LISA

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We study hydrodynamical simulations of galaxy formation, based on the GADGET-3 code, and investigate supermassive black hole binaries coalescence at $5.5 < z < 14$ and the expected gravitational waves emitted from the binary mergers for different AGN feedback models. A fraction of the accreted rest-mass energy is radiated away by each black hole. A fraction of this radiated energy is coupled to the surrounding gas as feedback energy. We consider the cases of AGNfiducial feedback where the feedback energy is thermal, as well as kinetic feedback,which includes AGNcone and AGNsphere,where in the former case the kinetic black hole feedback is distributed inside bi-cone (45\textdegree half opening angle) and in latter the kinetic feedback is distributed in sphere (90\textdegree half opening angle). We further consider the case in which no AGN feedback is implemented in the simulation. We find the merger rate for the kinetic feedback of the order between 100 to 1000 mergers per year for the chirpmass range less than 10^6 $msun$ and for the thermal feedback model to be between 100 to 500 in the same chirp mass range. We stress the comparisons to be made between simulations of same resolution: kinetic with R_{smooth}= 1ckpc/h and thermal with R_{smooth}=0.5 ckpc/h.

For each model, we estimate the expected characteristic strain of gravitational waves emitted by supermassive black hole binary mergers, the time to coalesce, and the expected number of resolved events and compare our predictions with the LISA sensitivity and resolution.

We further investigate the host galaxy properties for the events detectable by LISA and make predictions of the electromagnetic counter parts expected events to be detected by other electromagnetic instruments operating along the proposed operational time of LISA and present a panoramic view of merger events through different detectors.

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