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Parameter Inference on supermassive black holes for the sub-mHz gravitational wave mission ASTROD-GW

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The future space-borne gravitational wave(GW) missions will be able to detect abundant gravitational wave signals in the micro-Hz band. The gravitational wave mission, ASTROD-GW can bridge the gap between the millihertz and nanohertz bands and has a great potential to detect the supermassive black hole binary coalescence events. A large number of galactic binaries will continuously emit GW signals below ~10 mHz. The GW signals from enormous unresolved sources become a confusion noise. The ASTROD-GW mission will face serious foreground, and the spectrum of foreground noise will even exceed the instrumental noise in some frequency bands. We investigate the detectability of sub-mHz GW missions to detect supermassive black hole binaries and evaluate the effect of foreground noise on the detection of supermassive black hole binaries. ASTROD-GW can detect extremely distant events of supermassive black hole binaries with unprecedented precision. The parameter accuracy is reduced by about an order of magnitude due to foreground noise. With the fitted model of foreground spectra, we examine the parameters determination of the foreground from the simulated observation data. In the optimistic assumption, if the foreground could be well modeled and characterized, the foreground noise may be subtracted from the data and the PSD of residuals would be around two orders lower than the original data. If this could be achievable, the estimation of supermassive black hole binaries will be greatly improved.

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