Dear Editor and Referee,

We thank the referee for careful reading of our manuscript and for his/her insightful suggestions and comments. We enclose our reply to comments in the following part of our reply.

1. In section II, we mainly focused on distinguishing the PBHs from ABHs by sub-solar mass BHs, as the direct detection of sub-solar mass BHs can be taken as a smoking gun for PBHs. Because of the null detection of sub-solar mass BHs, we derived the detectable limits for PBHs. As we cannot decide whether the stellar-mass BBHs detected by LIGO/Virgo are of PBHs or not, we used dashed lines in Fig. 2 and Fig. 3 to denote the detectable limits at super-solar mass range.

2. The paper 1808.04772 focused on the sub-solar mass PBHs in the mass range of $[0.2, 1]\, M_{\odot}$. We extrapolated the results of 1808.04772 in several aspects. Firstly, we adopted the merger rate presented in 1709.06576, which took a more careful examination of the dynamical evolution of the binary systems than the one used by 1808.04772 from the results of 1603.08338. Specifically, when calculating the merger rate distribution, we took into account the angular momentum exerted both by all PBHs and the background inhomogeneity while 1808.04772 only considered the the angular momentum exerted by the nearest PBH. Secondly, we also estimated the detectable limits of $f_{\rm PBH}$ by the proposed third generation GW detectors like CE and ET. Lastly, we did not limit to the mass range of $[0.2, 1]\, M_{\odot}$ but extended to the range constrained by the detectors automatically. These differences were addressed in the paragraph below Fig 1.

   Although 1709.06576 and 1805.09034 both took into account of the angular momentum exerted by all PBHs and the background inhomogeneity, they focused on mass range of $[10, 300] M_{\odot}$ and only used LIGO/Virgo O1 data. We updated their constraints by using both O1 and O2 data. And therefore our upper limits are more stringent than theirs. We add some explanations at the end of the paragraph containing Eq. (6).

3. The estimated 90% upper limits on the merger rate of equal-mass binary black holes, R_{90}, are estimated by Eq. (4) in which the spacetime volume VT should be calculated

first. The calculation of VT is explained after Eq. (5). We add Fig. 1 in the text to show the values of R_{90} for different observations.

4. The `Fiducial` model uses the star formation rate (SFR) given by the observations of the luminous galaxies. To test the effect of SFR on the merger rate distribution of astrophysical origin binary black holes, we also consider another SFR based on the gamma-ray bursts (GRB) observations and denoted this model as `GRB-based` model. Although the SFR would slightly change the redshift distribution of merger rate, the total number of observable events would show a similar redshift distribution as shown in the newly added Fig. 6.

5. The BBH formation mechanisms are mainly characterized by the SFR, the initial mass function and time delay distribution functions. We add more details in section III to explain the assumptions on AOBBH models. In particular, we consider the `Fiducial`, `LongDelay` and `FlatDelay` models which are inspired by the *classical isolated binary evolution*, the *chemically homogeneous evolution* and the *dynamical formation* AOBBH scenarios, respectively.

6. We added more details to clarify the AOBBH models and also improved the captions of Fig. 4 and Fig. 5 as suggested by the referee. The total number of observable events approaches a constant number at redshift $z > 5$ for all the AOBBH models, while the total number of observable events still increases when $z > 5$. Therefore, an "excess" of total number of observable events after redshift $z = 5$ could possibly point to a population of POBBHs.

Please reconsider our paper for publication in JCAP.

Best wishes,
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