

The imprint of dark matter spike on the merger rate history of primordial black hole binaries

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We show that the merger rate of primordial black hole (PBH) binaries in the dark matter (DM) spike can greatly change the merger rate history of PBHs in late universe, since the high DM density in DM spike enhances the merger rate of PBHs, especially for the DM profile index γ , larger than 1.7. This PBH merger rate from DM spike causes a bump structure in its merger rate history at redshift around 5, due to the larger matter density and rapid halo formation at that era, which is consistent with the star formation rate. Such an additional merger rate contribution could be strongly affected by two extra phenomena, two body relaxation and loss cone refilling. We calculate their impacts on PBH merger rate in DM spike for various galaxy models, and find the modification on PBH merger rate remains for f_{PBH} around 10^{-4} .

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