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phase transition catalyzed by primordial black hole

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We investigate the first-order phase transition catalyzed by primordial black holes~(PBHs) in the early Universe. We find that super-horizon curvature perturbations generated in this scenario lead to the production of gravitational waves when the scalar modes re-enter the horizon. If PBHs with masses about $10^{-13}M_{\odot}$ constitute all dark matter, the first-order electroweak phase transition catalyzed by PBHs can explain the gravitational wave signal observed by pulsar timing array collaborations without the overproduction of PBHs.

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