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Runaway Mergers from Clustering in a Primordial Black Hole Dominated Universe

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If enough primordial black holes (PBH) are produced in the early Universe, they can come to dominate its energy density. This is usually considered viable as long as the PBHs evaporate and reheat the universe above the temperature needed for Big Bang nucleosynthesis, which requires $m_{\text{BH}} \lesssim 10^9$ g. However, during this period of early matter domination, perturbations can grow and PBH clusters can form, leading to greatly enhanced and even runaway PBH mergers that can dramatically alter the PBH mass distribution. Using the Press-Schechter formalism to model PBH cluster formation, we find that not only does this runaway merger phenomenon exclude parameter space previously thought to be viable, but also in some cases the mergers can actually generate a population of cosmologically stable PBHs with the right abundance to be dark matter.

Mini Symposia (Invited Talks Only)

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