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Early structure and binary formation with primordial black holes

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Primordial black holes (PBHs) are a compelling dark matter candidate, with their gravitational interactions shaping the evolution of cosmic structure from the earliest times. In this talk, I will present results from our recent fully-collisional simulations of PBH structure formation and binary evolution. We find that the dynamic interactions between PBHs introduce significant feedback effects, influencing the growth of early structure and altering predictions for large-scale structure formation. Additionally, our simulations confirm that existing semi-analytical models accurately predict the formation of PBH binaries but fail to capture the correct merger rate, highlighting the need for improved treatments of PBH interactions. These findings have important implications for both gravitational wave astronomy and the broader search for PBH dark matter.

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