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Determining where primordial black holes form

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Primordial black holes (PBHs) are of great interest cosmologically: they are a promising dark matter candidate, and provide plausible explanations for a number of observations, perhaps most noticeably the observations of gravitational waves from merging black holes. Even if they are never detected, this fact can be used to place unique constraints on the small-scale primordial power spectrum. With new surveys beginning operation and new observations becoming available, it is becoming increasingly important to make accurate calculations regarding PBHs, in order to determine their viability in cosmological models - how many PBHs are there? What are their masses? How often would they merge?

Underpinning all of these calculations is the criteria used to determine when and where a PBH will form in the early universe. The use of different criteria has a large impact on the calculation of the abundance, mass function, merger rate of binary PBHs, constraints on non-Gaussianity, and many more. In this talk, I will discuss the pros and cons of various parameters which can be used as the formation criterion, and, making use of recent simulation results, make an argument for the optimum criterion, which gives the most accurate calculations for the initial distribution of PBHs.

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