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Primordial Black Holes from First Principles (Statistics)[1] ZANDER MOSS, JOLYON BLOOMFIELD, CASEY LAM, MEGAN RUSSELL, STEPHEN FACE, ALAN GUTH, Massachusetts Institute of Technology (MIT) —
To compute estimates for the number density of candidates for black hole formation, we will examine the statistics governing peaks in the density perturbation field arising from inflation. The number density of peaks was calculated for gaussian random density perturbations by BBKS (1984). However, we are interested in hybrid inflation, where the perturbation spectrum is governed by "chi-squared" random fields. We will review the formalism of BBKS and extend it to the chi-squared case. The chi-squared field statistics present mathematical challenges due to the participation of multiple inflaton fields in the generation of density perturbations. We exploit a symmetry of these fields to reduce the density calculation to a numerically tractable integration. Surprisingly, the result for an arbitrarily large number of inflaton fields is simpler than the two and three field cases. We will relate these exceptional cases to the dimensionality of space and resulting topological defects. The final number density estimate depends on a single parameter derived from the power spectrum of the gaussian fields that comprise the chi-squared perturbation field.

[1]MIT UROP Office

Zander Moss
Massachusetts Institute of Technology (MIT)

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