

Can primordial black holes form without fine-tuning?

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(+Pippa Cole, Chris Byrnes, Subodh Patil)



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PBHs from inflation

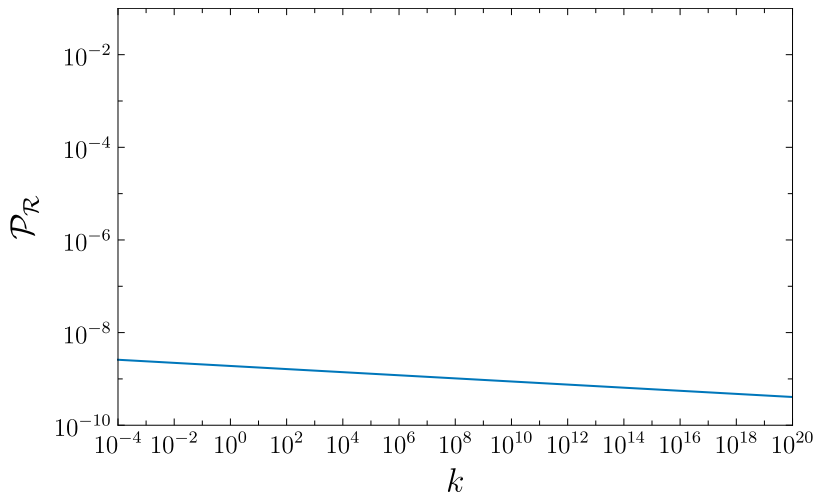
Fine-tuning

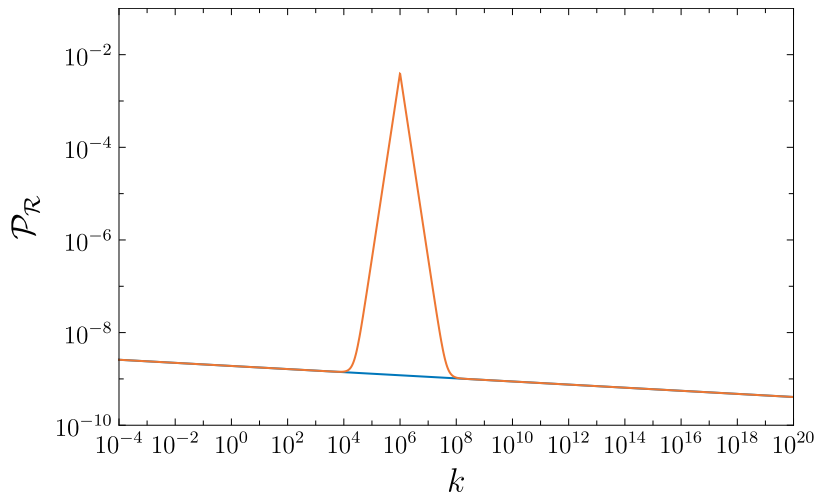
Conclusions

- ▶ Overdensities seeded by inflation

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- ▶ Nearly scale-invariant power spectrum

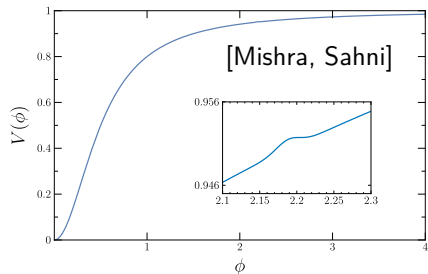


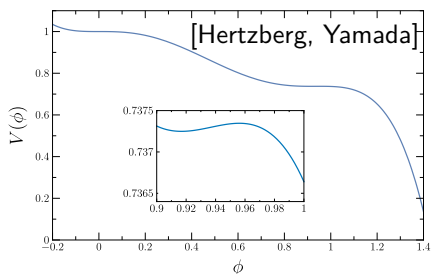
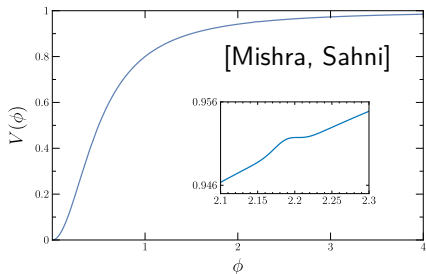


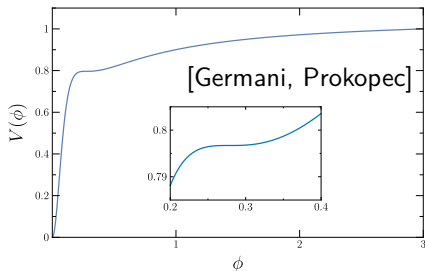
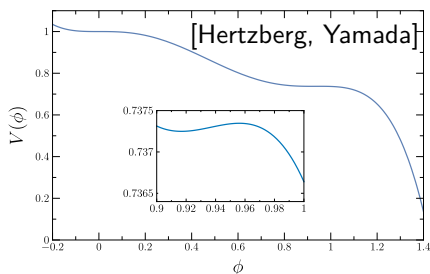
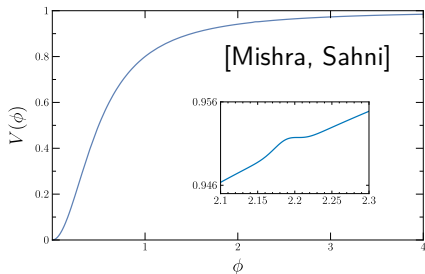
- ▶ Inflation driven by scalar field ϕ

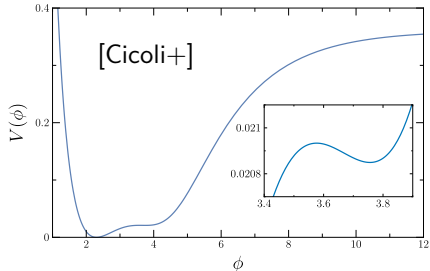
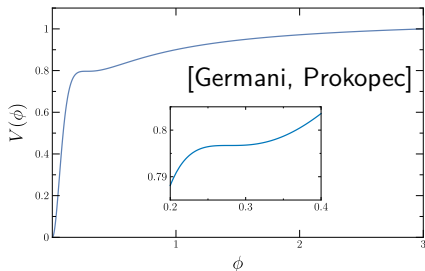
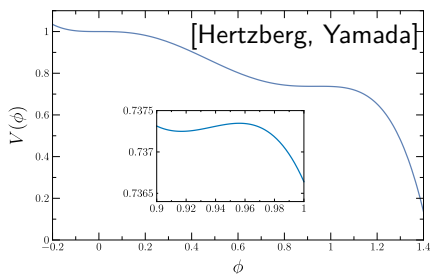
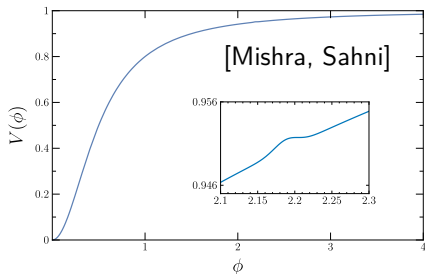
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- ▶ Need some feature in potential









	n_s	r
Mishra & Sahni	0.9648	0.0026
Hertzberg & Yamada	0.9820	4.8×10^{-7}
Germani & Prokopec	0.9567	0.0063
Cicoli <i>et al.</i>	0.9400	0.018

Planck constraint:

- ▶ $n_s = 0.9649 \pm 0.0042$
- ▶ $r < 0.032$

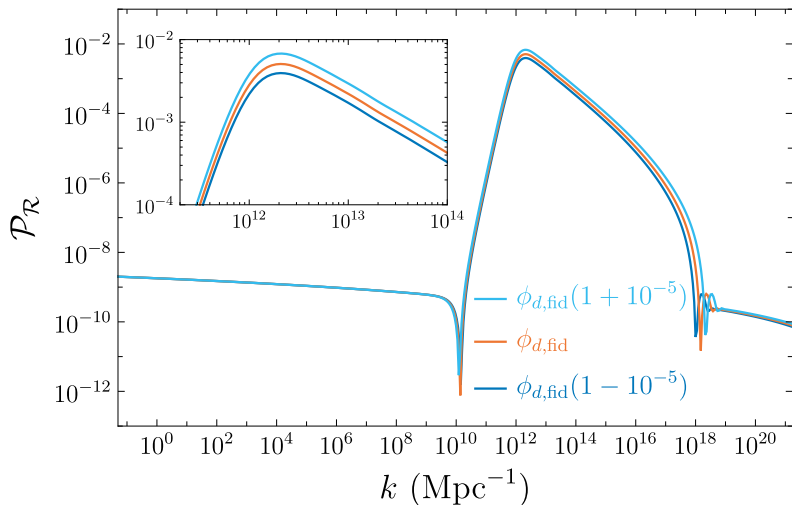
PBHs from inflation

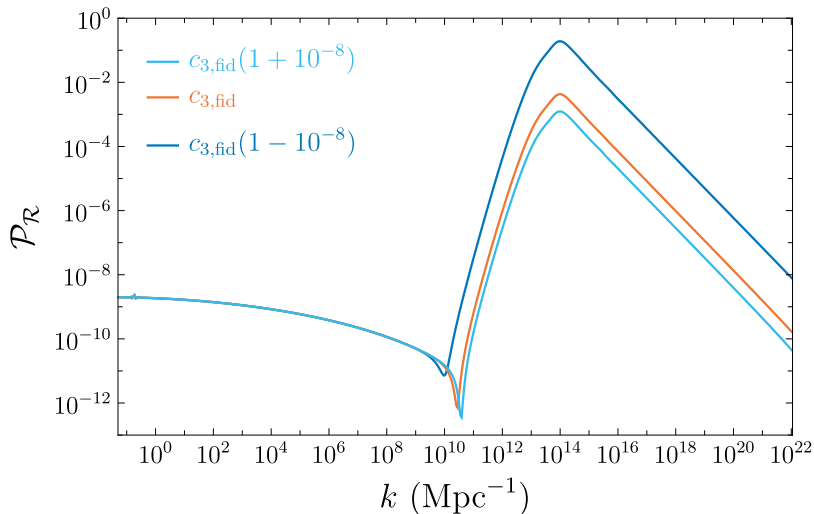
Fine-tuning

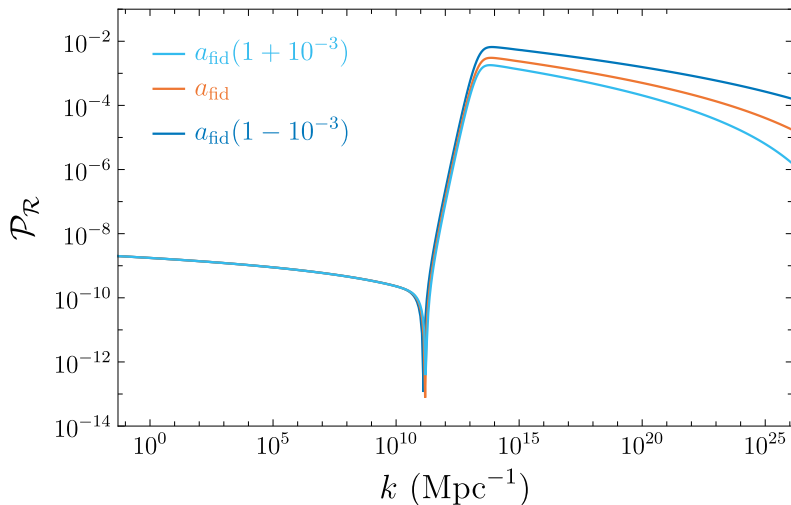
Conclusions

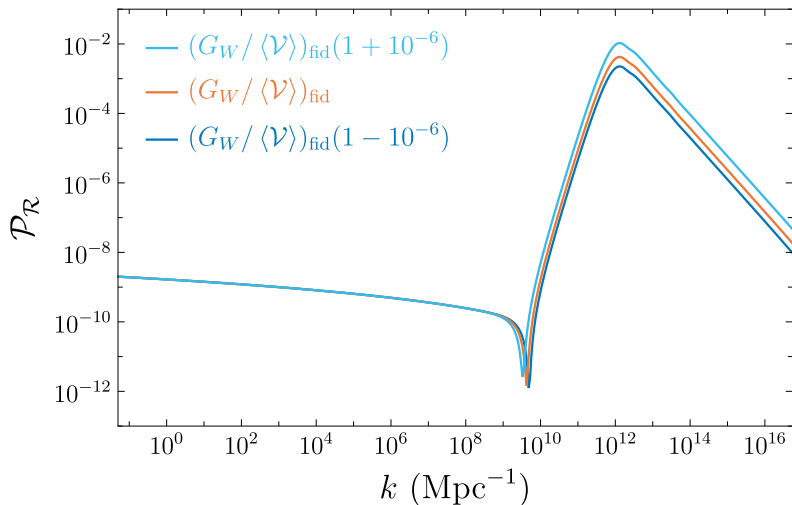
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- ▶ Perturb potential parameters and compare power spectra









- Quantify fine-tuning using differential measure [Azhar, Loeb]

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Model	$\epsilon_{\mathcal{P}_{\text{peak}}}$	$\epsilon_{f_{\text{PBH}}}$	ρ
Mishra & Sahni	2.7×10^4	6.2×10^5	23
Hertzberg & Yamada	-1.8×10^8	-4.7×10^9	27
Germani & Prokopec	-6.0×10^2	-2.2×10^4	37
Cicoli <i>et al.</i>	7.5×10^5	2.2×10^7	29

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- ▶ Typical potentials seem to be quite fine-tuned
- ▶ Total PBH fine-tuning actually dominated by power spectrum fine-tuning
- ▶ Could we be saved by non-Gaussianity?

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