Research Interests past, present and future

Subodh P. Patil

CERN

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- ▶ 'String cosmology' beyond a low energy supergravity approx?

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Some of my past research interests:

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- String inspired, non-inflationary mechanisms for structure formation w/ R. H. Brandenberger, A. Nayeri and C. Vafa, Phys. Rev. Lett. **98**, 231302 (2007) [hep-th/0604126]; Int. J. Mod. Phys. A **22**, 3621 (2007) [hep-th/0608121]

All hands on deck!

- WMAP, ACT, SPT
- LSS surveys...
- Planck (2013)
- Euclid (2019)
- CMB polarization?
- 21 cm cosmology (20xx)

The present: the EFT of inflation

- arXiv:1005.3848, Phys. Rev. D **84**, 043502 (2011)

  A. Achúcarro, S. Hardeman, J-O. Gong, G.A. Palma, S.P. Patil

- arXiv:1010.3693, JCAP **1101**, 030 (2011)

  A. Achúcarro, S. Hardeman, J-O. Gong, G.A. Palma, S.P. Patil

- arXiv:1201.6342, JHEP **1205**, 012 (2012)

  A. Achúcarro, S. Hardeman, J-O. Gong, G.A. Palma, S.P. Patil

- axXiv:1205.0710, *to appear*, Phys. Rev. D

  A. Achúcarro, V. Atal, S. Céspedes, J-O. Gong, G.A. Palma, S.P. Patil

- arXiv:1209.5701, *in press*

  C.P. Burgess, M.W. Horbatsch, S.P. Patil

- arXiv:1210.xxxx, *in preparation*

  A. Achúcarro, J-O. Gong, G.A. Palma, S.P. Patil

Three notions of 'heavy'

Being able to write down an EFT is premised on the existence of a hierarchy between fast and slow modes. Easy to define on static backgrounds. But what about time dependent backgrounds?

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▶ The true EFT is very clever– low energy accounts for all the curvature scales present in the parent theory.

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- ▶ In the EFT of Senatore et al. (arXiv:0709.0293) all co-efficients parametrized in terms of the scale M and $c_s, \dot{c}_s, \ddot{c}_s...$
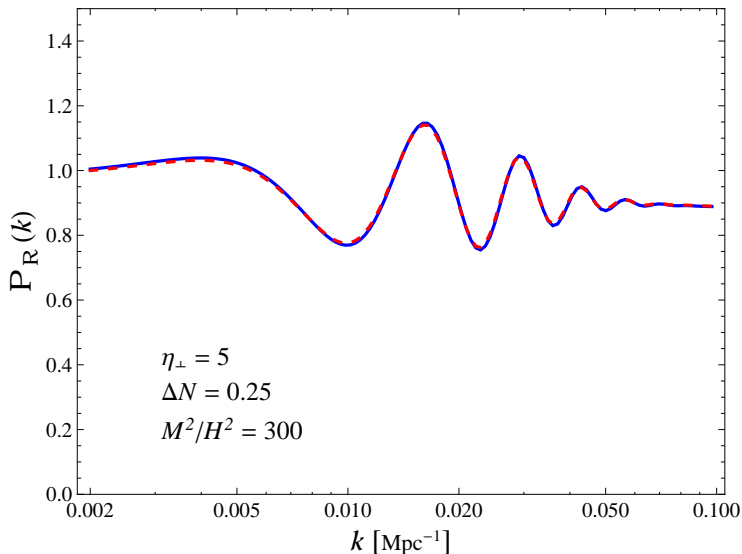
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► Evaluate the power spectrum from the full coupled equations, and from the effective theory, from a single sudden bend in field space preserving slow roll. Picking a fiducial background solution which renders the attractor values $\epsilon = 0.022, \eta_{||} = 0.034$ in the absence of any bending in field space. N.B. in what follows, we have COBE normalized at the pivot scale $k_* = 0.002 Mpc^{-1}$, and where we define $\eta_\perp^2 = \dot\theta^2/H^2$.

A primordial spectroscopy?

$\eta_\perp = 5$
$\Delta N = 0.25$
$M^2/H^2 = 300$

Plot with x-axis labeled $k\ [\mathrm{Mpc}^{-1}]$ and y-axis labeled $\mathrm{P}_{\mathbb{R}}(k)$.
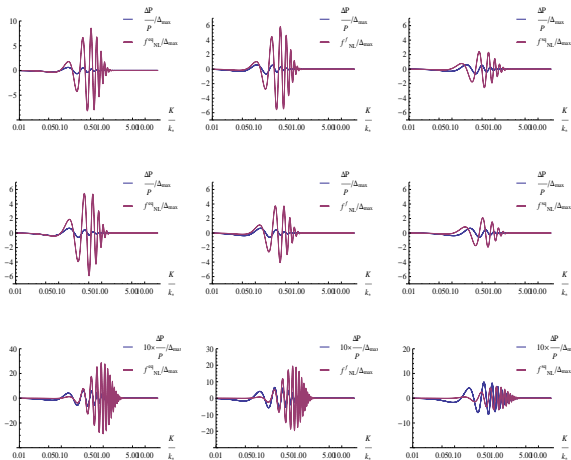
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Figure : f_{NL}^{eq} vs $\frac{\Delta P}{P}$ (left), f_{NL}^{f} vs $\frac{\Delta P}{P}$ (middle) and f_{NL}^{sq} vs $\frac{\Delta P}{P}$ (right) for $\tau_0 k_* = -11$, $c = 0.8$ (top), $\tau_0 k_* = -9$, $c = 0.8$ (middle) and $\tau_0 k_* = -11$, $c = 1.5$ (bottom) respectively for the 'cosh' drop in the speed of sound given by $\Delta_s = -\frac{\Delta_{max}}{Cosh[c(\tau - \tau_0)]}$.