
NEW DIRECTIONS:

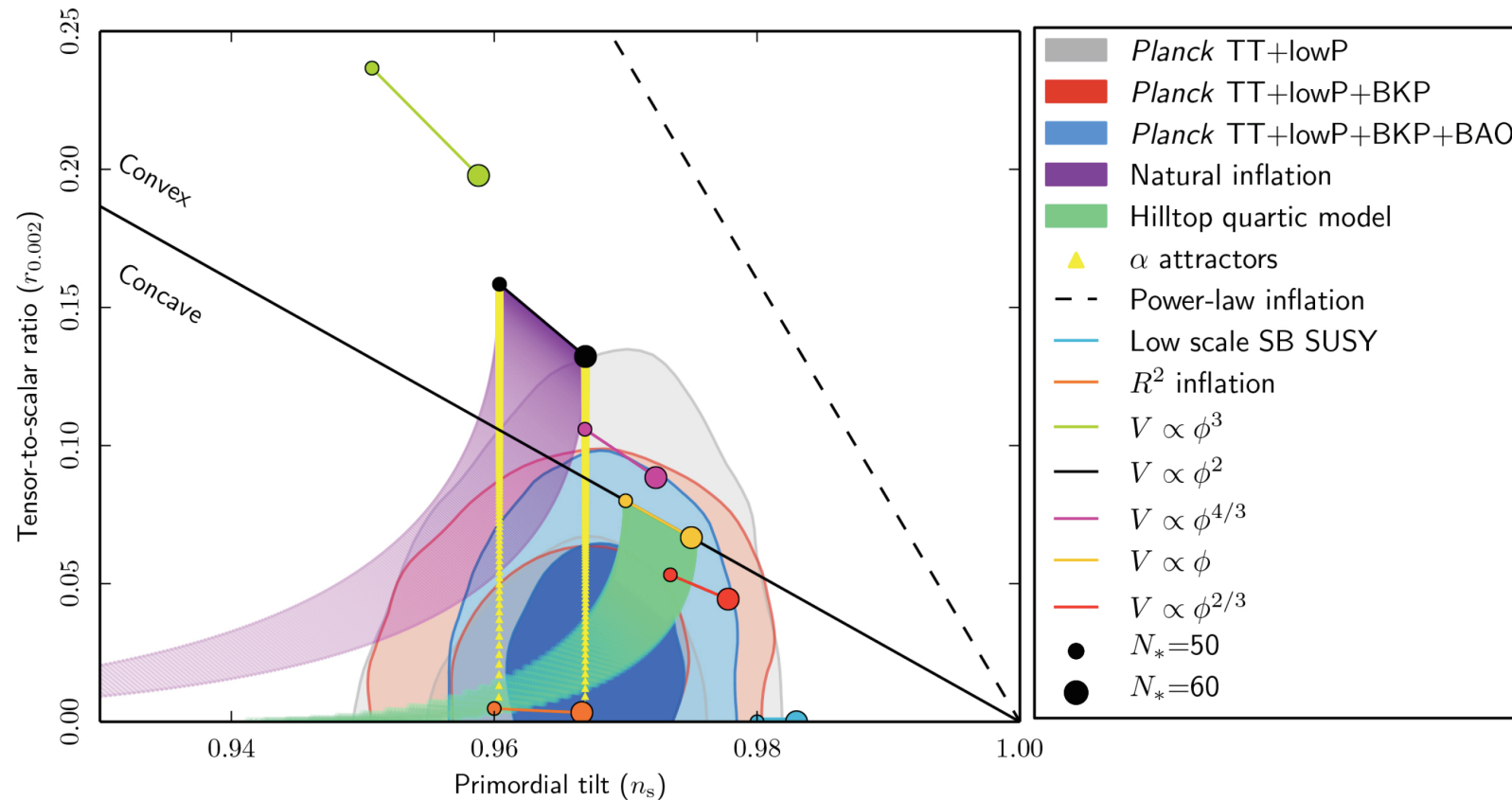
Inflation and Dark energy..what next??

**NICOLA BARTOLO, Dip. di Fisica e Astronomia ``G.Galilei'', Univ. di Padova
INFN, sezione di Padova**

Conveners: Nicola BARTOLO, Paolo de BERNARDIS, Alessandro MELCHIORRI

Thanks to the contributions of: C. Baccigaluppi, S. Borgani, E. Branchini, M. Liguori,
S. Matarrese, M. Pietroni, L.Stanco

Planck & BICEP2/Keck joint constraints on inflation models



$$V^{1/4} = 1.94 \times 10^{16} \left(\frac{r}{0.12} \right)^{1/4} \text{ GeV}$$

Results consistent with *Planck* 2013;

$r_{0.002} < 0.08$ @95%

Increased precision

$V(\phi) \sim \phi^2$ disfavored wr.t. Starobinski model $R+R^2$

Inflation: CMB and new pathways

- A number of inflationary parameters have been constrained with great accuracy:
amplitude of density (scalar) perturbations A_s
spectral index n_s
amplitude of gravity waves (tensor-to-scalar ratio r) \leftrightarrow energy scale of inflation
not only A_s, n_s and r but also:
primordial non-Gaussianity: a cosmic laboratory for scattering experiments
[f_{NL} (g_{NL}): amplitude of bi(tri)spectrum – 3(4)-point function -- of primordial perturbations]
- Despite the simplicity of the inflationary mechanism, the precise model has still to be identified
- How can we improve our knowledge with forthcoming or future experiments??
There is a huge potential improvement

We will present the case for some of the following

- *CMB B mode polarization*
 - *Primordial NG from: Large-Scale Structure surveys (scale-dependent halo bias+ bispectrum)*
high-redshift 21 cm fluctuations; CMB spectral distortions;
 - *Recently developed pipelines to constrain CMB trispectrum*
 - *Synergies between CMB and interferometers*
-

LARGE-SCALE-STRUCTURE SURVEYS (LSS) AND DARK ENERGY

- Euclid:

Over the next 10 years or so study of galaxy clustering will be a major focus for Cosmology that will involve a significant fraction of the community worldwide and **will trigger major theoretical and technical advances** towards a better understanding of the Dark Energy, Dark Matter, neutrinos, and Non-standard gravity issues, **inevitably involving theoretical and particle Physics**.

- **SKA - Square Kilometer Array - radio survey:** important impact for Cosmology
(strong improvement on primordial NG)

- **Huge Synergies between CMB and LSS and among different LSS surveys**

(e.g. CMB cross-correlation with LSS and synergy Euclid-SKA: complementary constraints, control of systematics to test signatures of new physics, CMB lensing for B-mode experiments)

- **Opportunities:**

- two INFN groups PD and BO have started activities related to the Euclid instruments (for the theory side may other INFN nodes are already involved).
 - Example of collaboration between Research institutions (scientific communities) with different know-hows. Within various astroparticle INFN initiatives there is already a strong expertise.
 - Another interesting field could be HPC for cosmological simulations of Λ CDM (and beyond) models, or for demanding pipelines for development of statistical estimators to be applied in various analyses
-