

## Cosmological Implications from BICEP

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We would like to present our latest findings in the series of our recent papers [1-5]. Recently BICEP2 (B2) claimed that the relic gravitational waves (RGW) is discovered directly. Before BICEP2, we also found some signals of relic gravitational waves with low confidence level [1]. Using BICEP2 data, in [2] we constrain the tilt of RGWs spectrum and found that a scale-invariant power spectrum of RGWs is consistent with the data, and it provides strong evidence for supporting inflation model.

Even though there is a moderately tension between Planck data release in 2013 (P13) and B2, WMAP 9-year (W9) data are consistent with B2 quite well. Combining B2 with W9, we found that the chaotic inflation is marginally disfavored at around 95% confidence level, but the power-law inflation model and the inflation model with inverse power-law potential can fit the data [3]. On the other hand, since the temperature fluctuations in cosmic microwave background (CMB) on large-angular scales probe length scales that were super-horizon sized at photon decoupling and hence insensitive to microphysical processes, the low-multipole CMB data are supposed to be a good probe to the physics of the primordial Universe. Using the combination of both B2+W9 and B2+P13+WP, a blue tilted power spectrum of scalar perturbation is preferred at around 95% confidence level [4], and therefore only the inflation model with inverse power-law potential is compatible with the data.

In order to reconcile the tension between B2 and P13, a running spectral index of scalar power spectrum should be taken into account. In [5] we found that a negative running of spectral index is preferred at around 2.7 standard deviation level. Furthermore, once the running of running is taken into account, a positive running of running is preferred at 1.7 standard deviation level.

### References:

- [1] W. Zhao, C. Cheng and Q.-G. Huang, arXiv:1403.3919.
- [2] C. Cheng and Q.-G. Huang, arXiv:1403.5463.
- [3] C. Cheng and Q.-G. Huang, arXiv:1404.1230.
- [4] C. Cheng and Q.-G. Huang, to appear.
- [5] C. Cheng and Q.-G. Huang, arXiv:1404.3467.