Editorial

The past decade has witnessed the birth of the golden age of precision cosmology. In particular, cosmic microwave background (CMB) measurements have provided a powerful observational window to probe the earliest epochs of our Universe. Recently (March, 2014), the Background Imaging of Cosmic Extragalactic Polarization (BICEP2) telescope at the South Pole announced the first detection of primordial B-mode polarization of the CMB that, if confirmed, provides the first detection of gravitational waves on cosmological scales. Hence, this announcement has become a hot topic in media reports. The BICEP measurement remains controversial in the community, especially since the treatment of the dust foreground is yet to be convincing and the observation used only a single frequency band. However, this result, if confirmed by other independent CMB experiments such as the Planck satellite mission or ground-based telescopes such as Atacama Cosmology Telescope (ACT) and South Pole Telescope (SPT), will be able to provide us fingerprints of the baby universe as early as about 10^{-35} s after the big bang.

In the research field of cosmology, Chinese scholars have made a number of remarkable progresses for years. In light of the recent great developments in observational and theoretical cosmology, the *SCIENCE CHINA Physics, Mechanics & Astronomy* editorial board invited a number of active cosmologists in this field to contribute to this special topic on the experimental developments, theoretical implications, and underlying challenges brought about by the BICEP2 results, and more importantly, to share their vision on the direction of cosmological studies over the next decades.

This special topic on “BICEP2 and Beyond” consists of seven selected articles including two reviews and five research papers. The article contributed by Cai [1] reviews recent developments of extended scenarios of inflationary cosmology and possible alternatives that are expected to connect with fundamental theories. Li et al. [2] review recent progress on the study of observational cosmology. In the paper by Gong, Li and coworkers [3], potential challenges of the standard inflationary LCDM model in explaining the present observations are discussed. Chen and coworkers [4] study the fitting analysis of recent data to constrain cosmological parameters. Zhang and coworkers [5] study the correlation between the primordial gravitational waves and sterile neutrinos. In the paper by Huang, Zhao et al. [6], constraints on the extensions of the basic CDM model from cosmological observations are studied. Wang and Ma [7] present a forecast for future experiments.

It is our great pleasure to have served as the guest editors of the special topic on “BICEP2 and Beyond”, and we are very grateful to all the authors who have carried out the original research and compiled the review articles contained in this special topic. We expect that the contents of this special topic will shed light on the developments of theoretical and observational cosmology in the near future.

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2 Li H, Li M Z, Qiu T T, et al. What can we learn from the tension between PLANCK and BICEP2 data? <i>Sci China-Phys Mech Astron</i> , 2014, 57(8): 1431–1441	5 Li Y H, Zhang J F, Zhang X. Tilt of primordial gravitational wave spectrum in a universe with sterile neutrinos. <i>Sci China-Phys Mech Astron</i> , 2014, 57(8): 1455–1459
3 Gao Q, Gong Y G, Li T J, et al. Simple single field inflation models and the running of spectral index. <i>Sci China-Phys Mech Astron</i> , 2014, 57(8): 1442–1448	6 Cheng C, Huang Q G, Zhao W. Constraints on the extensions to the base Λ CDM model from BICEP2, Planck and WMAP. <i>Sci China-Phys Mech Astron</i> , 2014, 57(8): 1460–1465
4 Wu F Q, Li Y C, Lu Y J, et al. Cosmological parameter fittings with the BICEP2 data. <i>Sci China-Phys Mech Astron</i> , 2014, 57(8):	7 Wang Y, Ma Y Z. Precision of future experiments measuring primordial tensor fluctuation. <i>Sci China-Phys Mech Astron</i> , 2014, 57(8): 1466–1470