

Cosmological studies with cosmic microwave background and radio observations

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Observations of the cosmic microwave background (CMB) and radio wavelengths can probe multiple evolutionary stages spanning the early to late Universe, which feature large-scale structures and long-timescale processes. These observations are therefore of fundamental importance for investigating core physical problems concerning dark matter, dark energy, and gravitational waves. Future CMB polarization observations, with unprecedented sensitivity and resolution, may detect more exotic early- and late-Universe polarization signals, posing potential challenges to the standard cosmological model. The CMB formed when photons decoupled from the photon-baryon plasma during hydrogen recombination, as free electrons were captured to form neutral atoms. Similarly, the redshifted 21 cm line of neutral hydrogen can also trace dark-matter-dominated large-scale structures across a wide range of redshifts and spatial scales. This talk will present the scientific objectives, recent research progress, and future plans for cosmological studies centered on the cosmic microwave background (CMB) and neutral hydrogen.

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