Astrophysics > Cosmology and Extragalactic Astrophysics

Cosmological implications from the full shape of the large-scale power spectrum of the SDSS DR7 luminous red galaxies

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We obtain cosmological constraints from a measurement of the spherically averaged power spectrum (PS) of the distribution of about 90000 luminous red galaxies (LRGs) across 7646 deg2 in the Northern Galactic Cap from the DR7 of the SDSS. The errors and mode correlations are estimated thanks to the 160 LasDamas mock catalogues, created in order to simulate the same galaxies and to have the same selection as the data. We apply a model, that can accurately describe the full shape of the PS with the use of a small number of free parameters. Using the LRG PS, in combination with the latest measurement of the temperature and polarisation anisotropy in the cosmic microwave background (CMB), the luminosity-distance relation from the largest available type 1a supernovae (SNIa) dataset and a precise determination of the local Hubble parameter, we obtain cosmological constraints for five different parameter spaces. When all the four experiments are combined, the flat LCDM model is characterised by Omega_M=0.259+-0.016, Omega_b=0.045+-0.001, n_s=0.963+-0.011, sigma_8=0.802+-0.021 and h=0.712+-0.014. When we consider curvature as a free parameter, we do not detect deviations from flatness: Omega_k=(1.6+-5.4)*10^{-3}, when only CMB and the LRG PS are used; the inclusion of the other two experiments do not improve this result. Considering the dark energy equation of state w_DE as time independent, we measure w_DE=-1.025+-0.065, for a flat geometry, w_DE=-0.981+-0.083 otherwise. When describing w_DE through a linear function of the scale factor, our results do not evidence any time evolution. In the next few years new experiments will allow to measure the clustering of galaxies with a precision much higher than achievable today. Models like the one used here will be a valuable tool in order to achieve the full potentials of the observations and obtain unbiased constraints on the cosmological parameters.

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