

Measuring the growth rate from the SDSSv survey using auto- and cross- power spectrum of the galaxy density and momentum fields

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The large-scale structure of the Universe and its evolution over time contains an abundance of cosmological information. One way to unlock this is by measuring the density and momentum power spectrum from the positions and peculiar velocities of galaxies, and fitting the cosmological parameters from these power spectrum. In this work, we will explore the cross power spectrum between the density and momentum fields of galaxies. We derive the estimator of the density-momentum cross power spectrum multipoles. The growth rate of the large-scale-structure, $f\sigma_8$ is measured from fitting the combined density monopole, momentum monopole and cross dipole power spectrum. The estimators and models of power spectrum as well as our fitting method have been tested using mock catalogues, and we find that they perform well in recovering the fiducial values of the cosmological parameters of the simulations, and we also find that the errors of the parameters can be largely reduced by including the cross-power spectrum in the fit. We measure the auto-density, auto-momentum and cross power spectrum using the Sloan Digital Sky Survey Data Release 14 peculiar velocity catalogue. The fit result of the growth rate $f\sigma_8$ is $f\sigma_8 = 0.413_{-0.058}^{+0.050}$ at effective redshift $z_{\text{eff}} = 0.073$, and our measurement is consistent with the prediction of the Λ Cold Dark Matter cosmological model assuming General Relativity.

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