Abstract

This thesis studies the impact of general relativistic effects in galaxy clustering. A comprehensive description of this topic is of great importance at this particular moment in time. Indeed, in the near future, planned redshift surveys will measure the large-scale galaxy distribution with unprecedented precision. The aim of these experiments is to gain a better understanding of the properties of dark matter and dark energy as well as the behavior of gravity on large scales, where modifications to general relativity may occur. In order to interpret correctly the physical information in the data, we need accurate theoretical predictions for the observables that will be measured. The purpose of this thesis is to provide theoretical predictions for large scale structure observables accounting for all relativistic effects that alter the light propagation with the ultimate goal of testing general relativity on large scales. In particular, we focus on two key observables in cosmology: the galaxy two-point correlation function and the galaxy power spectrum. Using the gauge-invariant relativistic description of galaxy clustering we demonstrate that the complete theoretical expressions for both these observables are devoid of any long-mode contributions from the perturbations and do not have infrared divergences in agreement with the equivalence principle. We numerically compute the two quantities and study the contributions of various relativistic terms in the conformal Newtonian gauge. Our theoretical and numerical studies provide a complete understanding of the relativistic effects in the galaxy two-point correlation function and the galaxy power spectrum. The results of this thesis may then contribute to formulating new tests of general relativity with future large-scale data.