平成 30年度大阪市立大学数学研究所 専任研究所員 ：申請書

これまでの研究内容の要旨（英訳）

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I have studied "Systematic errors due to large scale isotropic inhomogeneities on the nature of dark energy" and “Perturbation theory in the inhomogeneous isotropic universe model”.

Background of Research

The standard model of the modern cosmology assumes that the universe is homogeneous and isotropic on large scales and the general relativity can apply to the universe. The isotropy of the universe is implied by the observation of the cosmic microwave background radiation (CMBR). However, the homogeneity of the universe is not observationally confirmed yet, and there is a possibility that there are non-negligible large scale isotropic inhomogeneities in our universe. I studied what happens if there are large scale isotropic inhomogeneities in our universe.

Purpose, Content and Result of Research of "Systematic errors due to large scale isotropic inhomogeneities on the nature of dark energy”

If there are large scale isotropic inhomogeneities in our universe and we interpret observational data assuming that our universe is homogeneous and isotropic on large scale, isotropic inhomogeneities cause systematic errors on observational results. In this study, I evaluated systematic errors on the nature of dark energy determined by the distance-redshift relation. As a result, the equation of state of dark energy changes by about 1%, if there isotropic inhomogeneities whose amplitude is about 0.01. In addition, I proposed a method to remove systematic errors. Systematic error occurs, if we consider only the distance-redshift relation. I found that we can remove systematic errors, if we consider three observables, the distance-redshift relation, the CMBR angular power spectrum and the baryon acoustic oscillation scale.

Purpose, Content and Result of Research of "Perturbation theory in the inhomogeneous isotropic universe model”

Observables related to the large scale structure and the CMBR have not been used much to restrict isotropic inhomogeneities. This is because the perturbation theory is useful to predict these observables, but the perturbation theory in the inhomogeneous isotropic universe model is difficult and has not yet fully studied. In this study, I solved the metric perturbation equation in the inhomogeneous isotropic universe model and investigated properties of the gravitational wave background and the frame-dragging.

Unlike the homogeneous isotropic universe model, the gravitational wave background is induced by density perturbations in the inhomogeneous isotropic universe model. I found that this gravitational wave background may have a great influence on the CMBR.

The frame-dragging can not grow as time evolution in the homogeneous isotropic universe model. I found that the frame-dragging can grow as time evolution in the inhomogeneous isotropic universe model.