平成 29 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）

申請者	根岸　宏行

I have mainly studied "Systematic errors due to the inhomogeneous isotropic ultra larger scale structure on the nature of dark energy" and "Gravitational wave produced from density fluctuations 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 general relativity can apply to the universe. However, the homogeneity of the universe is not observationally confirmed, and there is the possibility that there are non-negligible large scale inhomogeneities in our universe. The isotropy of the universe is confirmed from the observation of the cosmic microwave background radiation (CMBR), so that large scale inhomogeneities are isotropic. In order to observationally confirm the homogeneity of the universe, it is important to study the inhomogeneous isotropic universe model.

Purpose and Content of Research of "Systematic errors due to inhomogeneous isotropic ultra larger scale structure on the nature of dark energy"

The existence of isotropic inhomogeneities causes systematic errors on observational results, since observational data is usually interpreted under the assumption that the background spacetime is homogeneous and isotropic in the modern cosmology. In this study, in order to know our universe more accurately, we evaluate systematic errors due to the ultra larger scale structure on the nature of dark energy, and discuss how to remove systematic errors.

In this study, we have evaluated systematic errors on the nature of dark energy determined by the distance-redshift relation. As a result, if there is the ultra larger scale structure whose energy density is increasing along the radial direction near the observer in our universe, the amount of dark energy appears to be increasing and the equation of state of dark energy appears to be decreasing in the FLRW universe model. Conversely, this energy density is decreasing along the radial direction, the amount of dark energy appears to be decreasing and the equation of state of dark energy appears to be increasing in the FLRW universe model.

We have shown a method of using multiple observables to remove systematic errors. We can not remove systematic errors by using the distance-redshift relation only, but if we consider three observables, the distance-redshift relation, the CMBR angular power spectrum and the baryon acoustic oscillation scale, we can remove systematic errors. We have first shown how to remove systematic errors.

Purpose and Content of Research of "Gravitational wave produced from density fluctuations in the inhomogeneous isotropic universe model"

If there is the ultra large scale structure in the universe, a phenomenon that does not occur in the FLRW universe model occurs. One of this phenomenon is that inhomogeneous anisotropic density fluctuations produce the gravitational wave in linear order. Since this gravitational wave is affected by the property of the ultra large scale structure, it is expected that the amplitude of the ultra large scale structure can be restricted by observing this gravitational wave.

I have solved the linear perturbation equation and obtained the power spectrum and the energy density of the gravitational wave to know the nature of the gravitational wave.