[구GC-33] 2D genus topology of 21-cm differential brightness temperature during cosmic reionization

Kyungjin Ahn[1], Sungwook E. Hong[2], Changbom Park[3], Juhan Kim[4], Ilian T. Iliev[5], Garrelt Mellema[6]
[1]Chosun University, [2]KAIST, [3]KIAS, [4]KyungHee University, [5]University of Sussex, [6]Stockholm University

A novel method to characterize the topology of the early-universe intergalactic medium during the epoch of cosmic reionization is presented. The 21-cm radiation background from high redshift is analyzed through calculation of the 2-dimensional (2D) genus. The radiative transfer of hydrogen-ionizing photons and ionization-rate equations are calculated in a suite of numerical simulations under various input parameters. The 2D genus is calculated from the mock 21-cm images of high-redshift universe. We construct the 2D genus curve by varying the threshold differential brightness temperature, and compare this to the 2D genus curve of the underlying density field. We find that (1) the 2D genus curve reflects the evolutionary track of cosmic reionization and (2) the 2D genus curve can discriminate between certain reionization scenarios and thus indirectly probe the properties of radiation-sources. Choosing the right beam shape of a radio antenna is found crucial for this analysis. Square Kilometer Array (SKA) is found to be a suitable apparatus for this analysis in terms of sensitivity, even though some deterioration of the data for this purpose is unavoidable under the planned size of the antenna core.

[구GC-34] Simulation of the SDSS Survey Region of the Universe

Changbom Park[1], Rien van de Weygaert[2], Wojceich, Hellwing[3] and Juhan Kim[1]
[1]KIAS, [2]KapteynIns., [3]Nicolaus Copernicus Astronomical Center

We reconstruct the large-scale initial density field from the distribution of galaxies observed by the Sloan Digital Sky Survey (SDSS). After adding the small-scale fluctuations to match the power spectrum to that of the standard LCDM model, we make a cosmological N-body simulation of formation of structures from the initial conditions. Properties of the objects formed in the simulation can be statistically compared with those of the observed SDSS galaxies. The simulation makes it possible to know the past history of evolution of objects located in different environments, and also gives us information on the environmental parameters that cannot be directly obtained observationally. It is hoped that this comparative study leads us to better understanding of formation and evolution of galaxies in conjunction with large-scale structures in the universe.