However, to the gravitational hand, comparison of the large-volume universe, many observational and numerical simulations have been undertaken. However, alternative galaxy assignment methods to N-body simulations are necessary for successful cosmological studies.

In this talk, I would like to introduce the MBP-galaxy abundance matching. This novel galaxy assignment method agrees with the spatial distribution of observed galaxies between 0.1Mpc ~ 100Mpc scales. I also would like to introduce mock galaxy catalogs of the Horizon Run 4 and Multiverse simulations, large-volume cosmological N-body simulations done by the Korean community. Finally, I would like to introduce some recent works with those mock galaxies used to understand our universe better.

[구 GC-01] Infrared Weak-lensing Detection of an Emerging Galaxy Cluster SpARCSJ1049+56 at \( z = 1.71 \)

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Structure in the universe forms hierarchically with the small scales forming first and merging into larger scales. Galaxy clusters are at the pinnacle of the formation process. Peering far into the universe, we can observe galaxy clusters early in their evolution. SpARCSJ1049+56 is a galaxy cluster located at a redshift of 1.71. It has been shown to be rich in cluster galaxies, to have intense star formation, and to have a significant amount of molecular gas. Through careful control of systematics, we detected the weak-lensing signal from this distant galaxy cluster. I will present our HST infrared weak-lensing signal of the cluster with a focus on the method. Our lensing analysis found that the cluster is massive and is rare in a LambdaCDM universe. I will also present the Chandra X-ray discovery of cold gas coincident with the intense star formation and discuss the implications of the detection.

[구 GC-02] An Improved Weak-Lensing Analysis of the Galaxy Cluster ACT-CL J0102-4915 with New Wide-Field HST Imaging Data

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