~~environment. We conclude that mergers affect a cluster population mainly through the preprocessing of recently accreted galaxies.~~

[구 GC-12] Barred Galaxies Are More Abundant in Interacting Clusters: Bar Formation by Cluster-Cluster Interactions

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Bars are commonly found in disk galaxies. However, how bars form is yet unclear. There are two common pictures for the bar formation mechanism. Bars form through a physical process inherent in galaxies, or through and external process like galaxy-galaxy interaction. In this paper, we present the observational evidence that bars can form from another channel, namely a cluster-cluster interaction. We examined 105 galaxy clusters at $0.015<z<0.060$ that are selected from the SDSS data, and identified 16 interacting clusters. By looking into the fraction of barred disk galaxies in these clusters, we show that the barred disk galaxy fraction is about 1.5 times higher in interacting clusters than in clusters with no clear sign of ongoing interaction (41% vs 27%). There is no increase in close neighbors around barred galaxies in interacting clusters, indicating that galaxy-galaxy interaction during the cluster interaction is not responsible for the enhancement of the bar fraction. We also find that the bar fraction is higher for galaxies with higher stellar mass and B/T, and that, depending on the galaxy stellar mass, the bar formation may or may not accompany increase in star formation rate. These results suggest that bars can form due to a change in the large scale environment caused by cluster-cluster interaction.

[구 GC-13] KROSS: Probing the Tully-Fisher Relation over Cosmic Time

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Using the K-band Multi-object Spectrograph (KMOS) at the Very Large Telescope (VLT), the KMOS Redshift One Spectroscopic Survey (KROSS) has gathered integral-field data for ~800 star-forming galaxies at a redshift z~1, when the universe was roughly half its current age and forming the bulk of its stars. With spatially-resolved observations, KROSS reveals galaxies that are both gas-rich and highly turbulent. It is possible to derive the observed and baryonic Tully-Fisher (luminosity - rotation velocity) relations, thus constraining the mass-to-light ratios and total (luminous + dark) masses of the galaxies. This in turn highlights the dependence of the relation zero-point on the degree of rotational support of the galaxies (rotational velocity to velocity dispersion ratio). By degrading and analogously analysing integral-field data of hundreds of local galaxies from the Sydney-AAO Multi-object Integral-field Spectrograph (SAMI) survey, a robust comparison z=0 Tully-Fisher relation can also be derived, thus further constraining the luminous and dark mass growth of disk galaxies over the last 7 billions years. This unique comparison also reveals that systematic effects associated with sample selection and analysis methods are as large as the effects expected from cosmological evolution, and thus that most other comparisons employing heterogeneous data and/or methods can safely be ignored.

[구 GC-14] The development of field galaxies in the first half of the cosmic history

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One of the most prevalent knowledge about disk galaxies, which dominate the population of the local Universe, is that they consist of stellar structures with different kinematics, such as thin disk, bulge, and halo. Therefore, investigating when and how these components develop in a galaxy is the key to understanding the evolution of galaxies. Using the NewHorizon simulation, we can resolve the detailed structures of galaxies, in the field environment, from the early Universe where star formation and mergers were most active. We first decompose stellar particles in a galaxy into a disk and a dispersion-dominated, spheroidal, component based on their orbits and then see how these components evolve in terms of mass and structure. At high redshift z~3, galaxies are mostly dispersion-dominated as stars are formed misaligned with the galactic rotational axis. At

z=1~2, massive galaxies start to dominantly form disk stars, while less massive galaxies do much later. Furthermore, massive galaxies are forming thinner and larger disks with time, and the preexistent disks are heated or even disrupted to become a part of dispersion-dominated component. Thus, the mass growth of spheroidal components at later epochs is dominated by disrupted stars with disk origins and accreted stars at large radii.

[구 GC-15] Environmental Dependence of High-redshift Galaxies in CFHTLS W2 Field

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Star formation activity of galaxies, along with color and morphology, show significant environmental dependence in local universe, where galaxies in dense environment tend to be more quiescent and redder. However, many studies show that such environmental dependence does not continue at higher redshifts beyond z~1. The question of how the environmental dependence of galactic properties have developed over time is crucial to understanding cosmic galactic evolution. By combining data from Canada-France-Hawaii Telescope Legacy Survey(CFHTLS), Infrared Medium-Deep Survey(IMS), and other surveys, the photometric redshifts of galaxies in CFHTLS W2 field were estimated by fitting spectral energy distribution. The distribution of galaxies was mapped in redshift bins of 0.05 interval from 0.6 to 1.4. For each redshift bin, the number density was mapped. The galaxies in high density regions were grouped into clusters using friend-of-friend method. The color of galaxies were analyzed to study the correlation with redshift as well as environmental difference between field galaxies and cluster member galaxies.

[구 GC-16] Search for Faint Quasars at z~5 using Medium-band Observations

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Cosmic reionization era in the early universe was playing a leading part on making the present universe we know. However, we have not been able to reveal the main contributor to the cosmic reionization to date. Faint quasars have been mentioned as the alternative due to the uncertainty of the faint end slope of the quasars luminosity function. With the availability of the deep (~25mag) images from Subaru Hyper Suprime-Cam (HSC) Strategic Program survey, we have tried to find more quasar with low luminosity in the ELAIS-N1 field. Faint quasar candidates were selected from several multi-band color cut criteria based on the track of the simulated quasar at z ~ 5. The Infrared Medium-deep Survey (IMS) and The UKIRT Infrared Deep Sky Survey (UKIDSS) – Deep Extragalactic Survey (DXS) provide J band information which is used to cover the relatively long wavelength range of quasar spectra. To search the reliable candidates with possible Lyman break, medium-band observation was performed by the SED camera for QUasars in EArly uNiverse(SQUEAN) in the McDonald observatory and Seoul National University 4k Camera(SNUCAM) in the Maidanak observatory. Photometric redshifts of the observed candidates were estimated from chi-square minimization. Also, we predicted the importance of the faint quasar to the cosmic reionization from the expected number density of the faint quasar.

[구 GC-17] Big Data Astronomy: Large-scale Graph Analyses of Five Different Multiverses

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By utilizing large-scale graph analytic tools in the modern Big Data platform, Apache Spark, we