[구 GC-21] Cosmic Distances Probed Using The BAO Ring

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The cosmic distance can be precisely determined using a `standard ruler' imprinted by primordial baryon acoustic oscillation (hereafter BAO) in the early Universe. The BAO at the targeted epoch is observed by analyzing galaxy clustering in redshift space (hereafter RSD) of which theoretical formulation is not yet fully understood, and thus makes this methodology unsatisfactory. The BAO analysis through full RSD modeling is contaminated by the systematic uncertainty due to a non--linear smearing effect such as non—linear corrections and uncertainty caused by random viral velocity of galaxies. However, BAO can be probed independently of RSD contamination using the BAO peak positions located in the 2D anisotropic correlation function. A new methodology is presented to measure peak positions, to test whether it is also contaminated by the same systematics in RSD, and to provide the radial and transverse cosmic distances determined by the 2D BAO peak positions. We find that in our model independent anisotropic clustering analysis we can obtain about 2% and 5% constraints on D_A and H^{-1} respectively with current BOSS data which is competitive with other analysis.

[구 GC-23] Three-dimensional simulations of star formation in central region of barred-spiral galaxies

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The central regions of barred-spiral galaxies contain interesting gaseous structures such as dust lanes located at the leading side of the bar and nuclear rings that are sites of intense star formation. Our previous studies showed how gas structures form under the influence of a non-axisymmetric bar potential and temporal/spatial behavior of the star formation in nuclear rings. However, previous works were limited to 2-dimensional infinitesimally-thin, unmagnetized and isothermal disks. To study effects of cooling/heating, vertical motions of gas structures and magnetic field, we use Mesh-Free magneto-hydrodynamic simulation code GIZMO. We find that temporal variations of the star formation rates in the nuclear ring in the three-dimensional model are overall similar those in the previous two-dimensional results, although the former shows more violent small-scale fluctuations near the early primary peak. We will present our recent results about evolution of gaseous structures and star formation rate compare with results of previous studies.

[구 GC-24] Non-axisymmetric Features of Dwarf Elliptical Galaxies

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About one tenth of dwarf elliptical galaxies found in the Virgo cluster have a disk component, and some of them even possess substructures such as bars, lens, and spiral arms. We use N-body simulations to study the formation of these non-axisymmetric features in disky dwarf elliptical galaxies. By mimicking VCC 856, a bulgeless dwarf galaxy with embedded faint spiral arms, we construct 11 sets of initial conditions with slight dynamical variations based on observational data. Our standard model starts slowly to form a bar at ~3 Gyr and then undergoes buckling instability that temporarily weakens the bar although the bar strength continues to grow afterward. We find 9 of our models are unstable to bar formation and undergo buckling instability. This suggests that disky dwarf elliptical galaxies are intrinsically unstable to form bars, accounting for a population of barred dwarf galaxies in the outskirts of the Virgo cluster. To understand the origin of the faint grand-design spiral arms, we additionally construct 6 sets of models that undergo tidal interactions with their neighbors. We find that faint spiral arms consistent with observations develop when tidal forcing is relatively weak although strong encounter still results in bar formation. We discuss our results in light of the dynamical evolution of dwarf elliptical galaxies including mergers.

[구 GC-25] Formation and evolution of sub-galactic structures around dwarf galaxy-sized halos

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We aim to investigate formation of satellite

sub-galactic structures around isolated dwarf galaxies using cosmological hydrodynamic zoom simulations. For this, we modify a cosmological hydrodynamic code, GADGET-3, in a way that includes gas cooling down to T~10K, gas heating by universal reionization when z < 8.9, UV shielding for high density regions of n_{shield} > 0.014cm^{-3}, star formation in the dense regions (n_H > 100cm^{-3}), and supernova feedback. To get good statistics, we perform three different simulations for different target galaxies of the same mass of ~$10^{10}M_{sun}$. Each simulation starts in a cubic box of a side length of 1Mpc/h with 17 million particles from z = 49. The mass of dark matter (DM) and gas particle is M_{DM} = 4.1×10^3 M_{sun} and M_{gas} = 7.9×10^2 M_{sun}, respectively, thus each satellite sub-galactic structure can be resolved with more than hundreds or thousands particles. We analyze total 90 sub-galactic structures that have formed outside of the main halos but infall the main halos. We found that 1) mini halos that interact more with the other mini halos tend to accrete the more mass, 2) mini halos that interact more before the reionization tend to form more stars, 3) mini halos with the more interaction tend to approach closer to the galactic center and have the lower orbital circularity, 4) survivals even in the strong tidal fields evolve baryon dominated system, such as globular clusters.

[구 GC-26] Rotation of galaxies and the role of galaxy mergers

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Recent integral-field spectrograph surveys have found that similar-looking early type galaxies have wide range of rotational properties (Emsellem et al. 2007). This finding initiated a new point of view to the galaxies; rotation of galaxy as the first parameter of galaxy classification (Emsellem et al. 2011, Cappellari et al. 2011, for example).

Some theoretical studies tried to address the origin of galaxy rotation. Idealized galaxy merger simulations have shown that galaxy-galaxy interactions have significant effects on the rotation of galaxies. Cosmological simulations by Naab et al. 2014 also added some more insights to the rotation of galaxies. However, previous studies either lack cosmological background or have not enough number of samples.

Running a set of cosmological hydrodynamic zoom-in simulations using the AMR code RAMSES(Teyssier 2002). we have constructed a sample of thousands of galaxies in 20 clusters. Here we present a kinematic analysis of a large sample of galaxies in the cosmological context. The overall distribution of rotation parameter of simulated galaxies suggests a single peak corresponding to fast rotating galaxies. But when divided by mass, we find a strong mass dependency of galaxy rotation, and massive galaxies are distinctively slow rotating. The cumulated effective of mergers seems to neutralize galaxy rotation as suggested by previous studies (Khochfar et al. 2011, Naab et al. 2014, and Moody et al. 2014). This is consistent with the fact that massive galaxies tend to rotate more slowly after numerous mergers. However, if seen individually, merger can either increase or decrease galaxy rotation depending on mass ratio, orbital parameter, and relative rotation axis of the two galaxies. This explains the existence of some non-slow rotating massive early type galaxies.

[구 GC-27] A 3-D BICONICAL OUTFLOW MODELING OF GAS KINEMATICS FOR TYPE 2 AGNs

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To understand the observed kinematics in the narrow-line region (NLR) of type 2 AGNs, we construct a model of 3-D biconical outflow combined with a thin dust plane. The model consists of two identical cones whose apex is located at the nucleus, and the cones are axisymmetric with respect to the bicone axis. After we define the properties of the bicone and the dust plane, we calculate a spatially integrated velocity and velocity dispersion along the line-of-sight using various physical parameters. As we test the effect of model parameters, we find three key parameters determining the integrated kinematics: intrinsic outflow velocity, bicone inclination, and the amount of dust extinction. The velocity dispersion increases as the intrinsic outflow velocity or the bicone inclination increases, while the velocity shift increases as the amount of dust extinction increases. We confirm that the integrated velocity dispersion can be a good indicator of the intrinsic outflow velocity unless dust extinction is not very strong (>～80%), while the effect of dust extinction can be alleviated by combining the integrated velocity and the velocity dispersion. Based on the simulated velocity distributions using the 3-D models, the variety of