

**[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 virial 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