radio lobes align roughly with the blob's semi-major axis. With the SPOL polarimeter on the MMT telescope, we map the polarization in a grid of circular apertures of radius 0.6" (4.4 kpc), detecting a significant (>2σ) polarization fraction P% in 10 apertures and achieving strong upper-limits (as low as 2%) elsewhere. The degree of the polarization map increases from P% ~ 5% at ~5 kpc from the blob center to ~20% at the outer part (~30 kpc). The detections are distributed asymmetrically, roughly along the blob's major axis. The polarization angles (θ) are mostly perpendicular to this axis. These results are consistent with the picture that Lyα photons produced at the AGN (or the host galaxy) are resonantly scattered away from the center. Higher polarization fraction on the radio jet suggests that the gas is more optically thin along the jet than the off-axis region.

[구 GC-03] The Environmental Dependence of the Mass-Size Relation for the Most Massive Galaxies

Yongmin Yoon , Myungshin Im
CEOU/Astronomy Program, Dept. of Physics & Astronomy, Seoul National University

We study the environmental dependence of the mass-size relation for the most massive early type galaxies ($M>10^{10.7}M_{\odot}$) in the redshift range 0.10~0.15. As a measure of the environment, galaxy number densities are measured by the 10^{th} nearest galaxies within 6500km/s from galaxies with spectroscopic redshifts. The sizes of galaxies are measured by non-parametric method. We find that galaxies more massive than $10^{11.1}M_{\odot}$ show the environmental dependence in the mass-size relation. The galaxies with $M> 10^{11.1}M_{\odot}$ located in the densest, cluster like environment have larger sizes and extended surface brightness profiles than their counterparts located in a low dense environment. We also find that the environmental dependence of the mass-size relation is more significant for the brightest cluster galaxies (BCGs) than non-BCGs. Our result can be explained with a hierarchical growth of the most massive galaxies through dissipation-less merger in dense environment.

[구 GC-04] Alignments of interacting haloes in the Horizon run 4 simulation

Benjamin L'Huillier[1], Changbom Park[1] and Juhan Kim[1,2]
[1]School of Physics, Korea Institute for advanced Study,
[2]Center for Advanced Computation, Korea Institute for Advanced Study

Interactions such as mergers and flybys play a fundamental role in shaping galaxy morphology. We used the Horizon Run 4 cosmological N-body simulations to study the aligments of spins and shapes of interacting haloes as a function of the halo mass and large-scale density.

Interactions preferentially occur in the plane of rotation, and in the direction of the major axis of prolate haloes, and the trajectories are preferentially radial and prograde.

We found a very strong alignment of the shapes already at redshift as high as 4.

The spins are initially unaligned or even anti-aligned, and become more and more aligned as the redshift decreases.

The alignment signals are stronger and evolve more at lower densities, and mass plays a secondary role.

[구 GC-05] Mock Galaxy Catalogs from the Horizon Run 4 Simulation with the Most Bound Halo Particle - Galaxy orrespondence Method

Sungwook E. Hong (홍성욱)[1], Changbom Park (박창범)[1] and Juhan Kim (김주한)[2]
[1]School of Physics, Korea Institute for Advanced Study, [2]Center for Advanced Computation, Korea Institute for Advanced Study

We introduce an advanced one-to-one galaxy correspondence method that populates dark matter halos with galaxies by tracing merging histories of most bound member particles (MBPs) identified in simulated virialized halos. To estimate the survival time of a satellite galaxy, we adopt several models of tidal-destruction time derived from an analytic calculation, isolated galaxy simulations, and cosmological simulations. We build mock galaxy samples for each model by using a merging tree information of MBPs from our new Horizon Run 4 N-body simulation from $z = 12$ to 0. For models of galaxy survival time derived from cosmological and isolated galaxy simulations, about 40% of satellites galaxies merged into a certain halo are survived until $z = 0$. We compare mock galaxy samples from our MBP-galaxy correspondence scheme and the subhalo-galaxy scheme with SDSS volume-limited galaxy samples around $z = 0$ with $M_r - 5\log h < -21$ and -20. Compared to the subhalo-galaxy

correspondence method, our method predicts more satellite galaxies close to their host halo center and larger pairwise peculiar velocity of galaxies. As a result, our method reproduces the observed galaxy group mass function, the number of member galaxies, and the two-point correlation functions while the subhalo-galaxy correspondence method underestimates them.

[구 GC-06] Synchrotron Emission Modeling of Radio Relics in the Cluster Outskirts

Hyesung Kang[1], Dongsu Ryu[2]
[1]Dept of Earth Sciences, Pusan National University, [2]Dept of Physics, UNIST

Radio relics are diffuse radio sources found in the outskirts of galaxy clusters and they are thought to trace synchrotron-emitting relativistic electrons accelerated at shocks. We explore a diffusive shock acceleration (DSA) model for radio relics in which a spherical shock with the parameters relevant for the Sausage radio relic in cluster CIZA J2242.8+5301 impinges on a magnetized cloud containing fossil relativistic electrons. This model is expected to explain some observed characteristics of giant radio relics such as the relative rareness, uniform surface brightness along the length of thin arc-like radio structure, and spectral curvature in the integrated radio spectrum. We find that the observed surface brightness profile of the Sausage relic can be explained reasonably well by shocks with speed $u_s \sim 3\times10^3 \mathrm{km/s}$ and sonic Mach number $M_s \sim 3$. These shocks also produce curved radio spectra that steepen gradually over $(0.1-10)\nu_{br}$ with a break frequency $\nu_{br} \sim 1\mathrm{GHz}$, if the duration of electron acceleration is $\sim$60-80 Myr. However, the abrupt increase in the spectral index above $\sim$1.5 GHz observed in the Sausage relic seems to indicate that additional physical processes, other than radiative losses, operate for electrons with the Lorentz factor, $\gamma_e > 10^4$.

[구 GC-07] Compact Stellar Systems and Dwarf Galaxies in the Pandora's Cluster Abell 2744

Myung Gyoon Lee (이명균), In Sung Jang (장인성),
Department of Physics and Astronomy, Seoul National University

Abell 2744 is a giant merging cluster, called the Pandora's Cluster, at the redshift of z=0.308 (corresponding to a distance of 1270 Mpc). Taking the advantage of the deep high resolution images in the Hubble Frontier Field program, we study the properties of compact stellar systems including globular clusters and ultracompact dwarfs (UCDs) as well as dwarf galaxies in this cluster. We find a rich population of globular clusters and UCDs in Abell 2744. The spatial distribution of these objects is consistent with the mass map derived from lensing analysis, while showing a significant offset from the X-ray map of hot gas. The faint end of the luminosity function of the galaxies in the red sequence is fit by a flat slope, showing no faint upturn. We discuss these finding in relation with the origin of UCDs, formation of red sequence dwarf galaxies, and formation of the Pandora's cluster.

[구 GC-08] Kinematic properties of the Ursa Major Cluster

YoungKwang Kim[1], Young Sun Lee[1], Timothy C. Beers[2]
[1]Department of Astronomy and Space Science, Chungnam Natonal University, Daejeon 34134, Korea, [2]Department of Physics and JINA Center for the Evolution of the Elements, University of Notre Dame, Notre Dame, IN 46556, USA

We present a kinematic analysis of 172 likely member galaxies of the Ursa Major Cluster. In order to understand the dynamical state of the cluster, we investigate the correlation of the cluster morphology with rotation, the velocity dispersion profile, and the rotation amplitude parallel to the global rotation direction. Both the minor axis and the rotation are very well-aligned with the global rotation axis in the outer region at half radius (> 0.5 R_{max}), but not in the inner region. The cluster exhibits low velocity dispersion and rotation amplitude profiles in the inner region, but higher in the outer. Both profiles exhibit outwardly increasing trends, suggesting an inside-out transfer of angular momentum of dark matter via violent relaxation, as revealed by a recent off-axis major-merging simulation. From Dressler-Schectman plots in the plane of galactic positions, and velocity versus position angle of galaxy, we are able to divide the Ursa Major Cluster into two substructures: Ursa Major South (UMS) and Ursa Major North (UMN). We derive a mass of $3.2\times10^{14} M_{\odot}$ for the cluster through the two-body analysis by the timing argument with the distance information (37 for UMN and 36 for UMS)