spectral decomposition of the [OIII] and Hα line profiles with spatial information on ~0.5kpc scales to understand the outflow kinematics and energetics in these objects. We find clear evidence for strong outflows in [OIII] and occasionally Hα that are clearly driven by the ionizing radiation of the AGN. We kinematically and spatially decompose outflowing and rotating ionized gas components. We find [OIII] to be a better tracer of AGN outflows, while Hα appears to be strongly affected by both stellar rotation and outflows induced by ongoing star formation. The observed kinematics and spatial distribution of the ionized gas imply a large opening angle for the outflow. Finally, we find the projected outflow velocity to decrease as a function of distance, while its dispersion shows a more complex structure with a potentially initially increasing trend (out to 0.5-1kpc distances).

[구 GC-15] How did the merger remnant galaxy M85 form?: A follow-up spectroscopy for M85 globular clusters

Youkyung Ko[1], Myung Gyoon Lee[1], Jubee Sohn[2], Sungsoon Lim[3,4], Hong Soo Park[5], Narae Hwang[5]
[1]Department of Physics and Astronomy, Seoul National University,
[2]Smithsonian Astrophysical Observatory,
[3]Department of Astronomy, Peking University,
[4]Kavli Institute for Astronomy and Astrophysics, Peking University,
[5]Korea Astronomy and Space Science Institute

M85 is a nearby merger remnant galaxy located at the northern part of the Virgo Cluster. Because of its remarkable merging features, it is an interesting object to investigate its formation history. Globular clusters are a great tracer of the formation history of early-type galaxies, so that we study the globular cluster system of M85. It has been already found that there are “intermediate-color” globular clusters as well as blue and red ones based on the photometric survey using CFHT/Megacam. For follow-up research, we obtain the spectra of 21 globular clusters in the central region of M85 using Gemini-N/GMOS. We estimate their ages and metallicities based on the strength of Lick indices. We detect the intermediate-age population (~ 2 Gyr) with solar metallicities, comprising about 50% of the observed globular clusters, as well as old and metal-poor population. It suggests that M85 experienced a major merging event around 2 Gyr ago. We discuss these results regarding to the formation history of M85.

[구 GC-16] Deciphering Diverse Color Distribution Functions of Globular Cluster Systems

Sang-Yoon Lee[1,2], Suk-Jin Yoon[1,2]
[1]Center for Galaxy Evolution Research, Yonsei University, [2]Department of Astronomy, Yonsei University

The color distribution functions (CDFs) of globular clusters (GCs) in individual early-type galaxies show great diversity in their morphology. Based on the conventional "linear" relationship between colors and metallicities of GCs, the inferred GC metallicity distribution functions and thus their formation histories should be as diverse as they appear. In contrast, an alternative scenario rooted in the "nonlinear" nature of the color-to-metallicity transformation finds the various CDFs pointing systematically to a simple picture, i.e., such a high degree of variety stems predominately from only one parameter, the mean metallicity of GCs. The simulated CDFs of GCs aimed to reproduce 67 massive early-type galaxies from the ACS Virgo & Fornax Cluster Survey show that over 70% of the CDFs concur fully with the nonlinearity scenario. We discuss our new findings in terms of early-type galaxy formation in the cluster environment.

[구 GC-17] Mean Velocity of Globular Cluster Systems in M86 Virgo Giant Elliptical Galaxy and Massive Early-Type Galaxies

Hong Soo Park[1], Myung Gyoon Lee[2], Nobuo Arimoto[3]
[1]KASI, [2]SNU, [3]NAOJ/Subaru Telescope

We present the spectroscopic study of the globular clusters (GCs) in the massive elliptical galaxy M86 in the Virgo galaxy cluster. Using the spectra obtained from the Multi-Object Spectroscopy (MOS) mode of Faint Object Camera and Spectrograph (FOCAS) on the Subaru Telescope, we measure the radial velocities for 56 GCs in M86. The mean velocity of the GCs is derived to be $\langle v_p \rangle = -335 \pm 41$ km/s, which is different from the velocity of the M86 nucleus ($\langle v_{gal} \rangle = -224 \pm 5$ km/s) within ~ 2.5 σ. The mean velocity ($\langle v_p \rangle = -342 \pm 60$ km/s) of 33 blue GCs in M86 is similar to that ($\langle v_p \rangle = -314 \pm 71$ km/s) of 23 red GCs. We also derive the mean velocities of the GC systems in other 16 nearby early-type galaxies (ETGs) from the radial velocity data in the

literature. The mean value of the differences between the mean velocity of the GC systems in each galaxy and the nucleus velocity of their host galaxies, is almost zero except the M86 GC system. But the scatter of the differences in the blue GC system is larger than that in the red GC system. We will discuss these results in the context of GC formation in ETGs.

[구 GC-18] Globular Clusters in the Brightest Coma Spiral Galaxy NGC 4921 and the Distance to the Coma Cluster

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

Deep archival V and I image data taken with Hubble Space Telescope have been used to investigate compact stellar objects in an anemic spiral galaxy NGC 4921 in the Coma cluster. We resolve a significant fraction of globular clusters based on the reconstructed master drizzled image data. The color distribution of globular clusters (GCs) shows a clear bimodal distribution. The blue and red GC populations show significantly different radial number density profiles. We derive the turnover magnitudes of globular cluster luminosity functions (GCLFs) for the blue and red GCs in the bulge and halo of NGC 4921. We also derive the GCLFs of two Coma cD galaxies, NGC 4874 and NGC 4889, and one coma S0 galaxy, NGC 4923. Turnover magnitudes of GCs in four galaxies agree well within uncertainties. A mean distance of four Coma galaxies is derived from turnover magnitudes of GCLFs. A value of the Hubble constant is determined from this distance estimate and radial velocity of the Coma. We discuss implications of our results in relation with the recent determinations of the Hubble constant.

[구 GC-19] Formation and evolution of mini halos around a dwarf galaxy sized halo - Candidate sites for the primordial globular clusters

Kyungwon Chun[1], Jihye Shin[2], Sungsoo S. Kim[1,3]
[1]School of Space Research, Kyung Hee University
[2]Kavli Institute for Astronomy and Astrophysics, Peking University
[3]Department of Astronomy & Space Science, Kyung Hee University

We aim to investigate the formation of primordial globular clusters (GCs) in the isolated dwarf galaxy (~$10^{10}M_{sun}$) with cosmological zoom-in simulations. For this, we modified cosmological hydrodynamic code, GADGET-3, in a way to include the radiative heating/cooling that enables gas particles cool down to T~10K, reionization ($z < 8.9$) of the Universe, UV shielding ($n_{shield} > 0.014cm^{-3}$), and star formation. Our simulation starts in a cubic box of a side length 1Mpc/h with 17 million particles from z = 49. The mass of each dark matter (DM) and gas particle is $M_{DM} = 4.1\times10^3M_{sun}$ and $M_{gas} = 7.9\times10^2M_{sun}$, respectively, thus the GC candidates can be resolved with more than hundreds particles. We found the following results: 1) mini halos with the more interactions before merging into the main halo form the more stars and thus have the higher star mass fraction (M_{star}/M_{total}), 2) the mini halos with the high M_{star}/M_{total} can survive longer and thus spiral into closer to the galactic center, 3) the majority of them spiral into bulge, but some of them can survive until the last as baryon-dominated system, like the GC.

성간물질

[구 IM-01] Infrared Supernova Remnants and Their Infrared to X-ray Flux Ratios

Bon-Chul Koo[1], Jae-Joon Lee[2], Ji-Yeon Seok[3,4], Il-Gyo Jeong[1,2], Hyun-Jeong Kim[1]
[1]Seoul National University, [2]Korea Astronomy and Space Science Institute, [3]Institute for Astronomy and Astrophysics, Academia Sinica, [4]University of Missouri,

Recent high-resolution infrared space missions have revealed supernova remnants (SNRs) of diverse morphology in far infrared (FIR), often very different from their X-ray appearance. This suggests that the FIR emission from SNRs could be of different origins. For a sample of 20 Galactic SNRs, we examine the correlation between their FIR and X-ray properties and explore the origin of the FIR emission. We find that the SNRs with very different FIR and X-ray morphology have relatively large infrared-to-X-ray (IRX) flux ratios. We argue that the FIR emission in these SNRs is likely mainly from dust grains radiatively-heated by shock radiation. For SNRs with similar IR and X-ray morphology, the FIR emission of which is probably mostly from dust grains collisionally heated by hot plasma, we compare their IRX flux ratios with theoretical ratios from a model incorporating time-dependent dust destruction and