[구 GC-12] Lyα Radiative Transfer and The Wouthuysen-Field effect

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A three-dimensional (3D) Lyα radiative transfer code is developed to study the Wouthuysen-Field effect, which couples the 21 cm spin temperature of neutral hydrogen and the Lyα radiation field, and the escape fraction of Lyα from galaxies. The Monte Carlo code is capable of treating arbitrary 3D distributions of Lyα source, neutral hydrogen and dust densities, gas temperature, and velocity field. It is demonstrated that the resonance-line profile at the center approaches to the Boltzmann distribution with the gas temperature. A plane-parallel ISM model, which is appropriate for the neutral ISM of our Galaxy, is used to calculate the Lyα radiation field strength as a function of height above the galactic plane. We also use a two-phase, clumpy medium model which is composed of the cold and warm neutral media (WNM). It is found that the Lyα radiation field is strong enough to thermalize the 21 cm spin temperature in the WNM to the gas kinetic temperature. The escape fraction of Lyα is found to be a few percent, which is consistent with the Ly α observations of our Galaxy and external galaxies.

[구 GC-13] Discovery of a significant population of CN-enhanced red clump stars in the Milky Way bulge: Implications for the formation of early-type galaxies

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We report our discovery of a significant population of CN-enhanced red clump stars in the classical bulge component of the Milky Way. Since CN-rich stars trace a population with enhanced Helium, Nitrogen, and Sodium originated in globular clusters (GCs), this is a direct evidence that proto-GCs were the major building blocks in the formation of the classical bulges and early-type galaxies in the hierarchical merging paradigm.

[구 GC-14] Three-Dimensional Structure of Star-Forming Regions in NGC 6822 Hubble V

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NGC 6822 is a dwarf irregular galaxy in the Local Group and it is located in 500 kpc, further than the Large Magellanic Cloud and the Small Magellanic Cloud. Therefore, we can study star-forming processes by local condition in NGC 6822 instead of tidal force of the Galactic gravitational field. Hubble V is the brightest of several HⅡ complexes in this galaxy. We observed Hubble V by using IGRINS attached on the 2.7 m telescope at the McDonald Observatory in Texas, US in May 2016. We performed a spectral mapping of 15″x 7″area on H and K bands, and detected emission lines of bright Brγ λ2.1661 μm and weak HeⅠ λ2.0587 μm. Molecular hydrogen lines of 1-0S(1) λ2.1218 μm, 2-1 S(1) λ2.2477 μm, and 1-0 S(0) λ2.2227 μm was also detected. These emission lines show the structure of an ionized core and excited surface of clouds by far-ultraviolet photons, photodissociation region (PDR). We present three-dimensional maps of emission line distributions through multi slit scanning data and compare these results with the previous study. This presentation shows the physical structure of the star-forming regions and we discuss a PDR model and an evolution of Hubble V complex.

[구 GC-15] Bar Fraction in Early-type and Late-type

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Bar fractions depend on the properties of host galaxies. However, the observational studies did not provide consistent tendency. We investigated the bar fractions and their dependence on properties of host galaxies using three bar classifications: visual inspection, ellipse fitting method and Fourier analysis from a volume-limited sample of 1,698 disk galaxies brighter than Mr=-15.2 within z = 0.01 from the Sloan Digital Sky Survey (SDSS) Data Release 7 (DR7). We found two causes to make the discrepancy in previous studies. One is caused by

the difficulty in automatically identifying bars for bulge-dominated galaxies. In particular, ellipse fitting methods could miss early-type barred galaxies when a large bulge weakens the transition between a bar and disk. The other is caused by the difference in the correlation between the bar types and host morphology for strong bars and weak bars. Strong bars are preponderant in early-type spirals which are red, bulge-dominated and highly concentrated, whereas weak bars are frequent in late-type spirals which are blue, disk-dominate and less-concentrated. Therefore, how much weak bars they contain affects the trend of bar fraction on host galaxy properties. We also discuss the effect of host properties on the formation, evolution, and destruction of bars.

[구 GC-16] How does the gas in a disk galaxy affect the evolution of a stellar bar?

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In barred galaxies, gaseous structures such a nuclear ring and dust lanes are formed by a non-axisymmetric stellar bar potential, and the evolution of the stellar bar is influenced by mass inflows to the center and central star formation. To study how the presence of the gas affects the evolution of the stellar bar, we use the mesh-free hydrodynamics code GIZMO and run fully self-consistent three-dimensional simulations. To explore the evolution with differing initial conditions, we vary the fraction of the gas and stability of initial disks. In cases when the initial disk is stable with Q=1.2, the bar strength in the model with 5% gas is weaker than that in the gas-free model, while the bar with 10% gas does not form a bar. This suggests that the gaseous component is unfavorable to the bar formation dynamically. On the other hand, in models with relatively unstable disk with Q=1.0, the presence of gas helps form a bar: the bar forms more rapidly and strongly as the gas fraction increases. This is because the unable disks form stars vigorously, which in turn cools down the stellar disk by adding newly-created stars with low velocity dispersion. However, the central mass concentration also quickly increases as the bar grows in these unstable models, resulting in fast bar dissolution in gas rich models. We will discuss our results in comparison with previous work.

[구 GC-17] The Most Massive Active Galactic Nuclei at $1<z<2$

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We obtained near-infrared spectra of 26 SDSS quasars at $0.7<z<2.5$ with reported rest-frame ultraviolet black hole mass (MBH)~10^^{10}M⊙ to critically examine the systematic effects involved with their mass estimations. We find that active galactic nuclei (AGNs) heavier than 10^^{10}M⊙ often display double-peaked Hα emission, extremely broad FeII complex emission around MgII, and highly blueshifted and broadened CIV emission. The weight of this evidence, combined with previous studies, cautions against the use of MBH values based on any emission line with a width over 8000 km/s. Also, the MBH estimations are not positively biased along the presence of ionized narrow line outflows, anisotropic radiation, or the use of line FWHM instead of σ for our sample, and unbiased with variability, scatter in broad line equivalent width, or obscuration for general type-1 quasars. Removing the systematically uncertain MBH values, ~10^^{10}M⊙ BHs in $1<z<2$ AGNs can still be explained by anisotropic motion of the broad line region from ~10^$^{9.5}$M⊙ BHs, although current observations support they are intrinsically most massive, and overmassive to the host's bulge mass.

[구 GC-18] Are Quasars Growing Fast in the Early Universe?: The Lowest Eddington Ratio Quasar at z~6

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To date, luminous quasars at z ~ 6 have been