구 두 발 표 초 록

초 청 강 연

[초 IT-01] Episodic Accretion in Star and Planet Formation

Jeong-Eun Lee
School of Space Research, Kyung Hee University, Yongin-shi, Korea

Protostars grow their mass by the accretion of disk material, which is infalling from the envelope. This accretion process is important to the physical and chemical conditions of the disk and envelope, and thus, the planets yet to be formed from the disk material. Therefore, if we map the physical and chemical properties of disks and envelopes, we can study indirectly the accretion process in star formation. In particular, the chemical distribution in the disk and the inner envelope of a young stellar object is greatly affected by the thermal history, which is mainly determined by the accretion process in the system. In my talk, I will review the episodic accretion model for the low mass star formation and observational efforts to find the evidence of episodic accretion. Finally, I will present our recent ALMA detection of several complex organic molecules associated directly with the planet formation in V883 Ori, which is in the burst accretion phase.

[초 IT-02] Horizon Run 5: the largest cosmological hydrodynamic simulation

Juhan Kim[1], Jihye Shin[2], Owain Snaith[3], Jaehyun Lee[3], Yonghwi Kim[3], Oh-Kyung Kwon[4], Chan Park[4], and Changbom Park[3]
[1]*Center for Advanced Computation, Korea Institute for Advanced Study, Korea*
[2]*Korea Astronomy and Space Science Institute, Korea*
[3]*School of Physics, Korea Institute for Advanced Study, Korea*
[4]*Korea Institute of Science and Technology Information, Korea*

Horizon Run 5 is the most massive cosmological hydrodynamic simulation ever performed until now. Owing to the large spatial volume (717×80×80 [cMpc/h]^3) and the high resolution down to 1 kpc, we may study the cosmological effects on star and galaxy formations over a wide range of mass scales from the dwarf to the cluster. We have modified the public available Ramses code to harness the power of the OpenMP parallelism, which is necessary for running simulations in such a huge KISTI supercomputer called Nurion. We have reached z=2.3 from z=200 for a given simulation period of 50 days using 2500 computing nodes of Nurion. During the simulation run, we have saved snapshot data at 97 redshifts and two light cone space data, which will be used later for the study of various research fields in galaxy formation and cosmology. We will close this talk by listing possible research topics that will play a crucial role in helping us take lead in those areas.

외부은하 / 은하단

[구 GC-01] A new approach to classify barred galaxies based on the potential map

Yun Hee Lee[1], Myeong-Gu Park[1], Hong Bae Ann[2], Taehyun Kim[3], and Woo-Young Seo[4]
[1]*Department of Astronomy and Atmospheric sciences, Kyungpook National University*
[2]*Pusan National University*
[3]*Korea Astronomy & Space science Institute*
[4]*Department of Physics & Astronomy, Seoul National University*

Automatic, yet reliable methods to find and classify barred galaxies are going to be more important in the era of large galaxy surveys. Here, we introduce a new approach to classify barred galaxies by analyzing the butterfly pattern that Buta & Block (2001) reported as a bar signature on the potential map. We make it easy to find the pattern by moving the ratio map from a Cartesian coordinate to a polar coordinate. Our volume-limited sample consists of 1698 spiral galaxies brighter than Mr = -15.2 with z < 0.01 from the Sloan Digital Sky Survey/DR7 visually classified by Ann et al. (2015). We compared the results of the classification obtained by four different methods: visual inspection, ellipse fitting, Fourier analysis, and our new method. We obtain, for the same sample, different bar fractions of 63%, 48%, 36%, and 56% by visual inspection, ellipse fitting, Fourier analysis, and our new approach, respectively. Although automatic classifications detect visually determined, strongly barred galaxies with the concordance of 74% to 86%, automatically selected barred galaxies contain different amount of weak bars. We find a different dependence of bar fraction on the Hubble type for strong and weak bars: SBs are preponderant in early-type spirals, whereas SABs are in late-type spirals. Moreover, the ellipse fitting method often misses strongly barred galaxies in the bulge-dominated galaxies. These explain why previous works showed the contradictory dependence of the bar fraction on the host galaxy properties. Our new method has the highest agreement with visual inspection in terms of the individual classification and the overall bar fraction. In addition, we find another signature on the ratio map to classify barred galaxies into new two classes that are probably related to the age of the bar.

[구 GC-02] A Numerical Study of Stellar Bars and Nuclear Rings in Barred Galaxies

Woo-Young Seo[1],Woong-TaeKim[2]
[1]Inistitute for Astrophysics, CNBU, [2]SNU

To study the formation and evolution of stellar bars and gaseous nuclear rings in barred galaxies in realistic environments, we run fully self-consistent three-dimensional simulations of isolated disk galaxies. We consider two groups of models with cold or warm disks that differ in the radial velocity dispersion. We also vary the gas fraction of the disks. We found that a bar forms earlier and more strongly as the gas fraction increases in the cold disks, while the gas delays the bar formation in the warm disks. The bar formation enhances a central mass concentration which in turn weakens the bar strength temporarily, after which the bar regrows to become stronger in a model with a smaller gas fraction in both cold and warm disks. Although all bars rotate fast in the beginning, they rapidly turn to slow rotators. Gas infalling to the central region forms a dense star-forming nuclear ring. The ring size is very small when it first forms and grows over time. The ring star formation is episodic and bursty due to star formation feedback, and has a good correlation with the mass inflow rate to the ring. Some expanding shells produced by star formation feedback are sheared out in the bar regions and collide with dust lanes to appear as filamentary interbar spurs.

[구 GC-03] Spiral Arm Features in Disk Galaxies: A Density-Wave Theory

Yonghwi Kim[1,2], Luis C. Ho[2]
[1]Korea Institute for Advanced Study, [2]Kavli Institute for Astronomy and Astrophysics, Peking University

Several observational results show a tighter pitch angle at wavelengths of optical and near-infrared than those that are associated with star formation, which is in agreement with the prediction of the density wave theory. In my recent numerical studies, the dependence of the shock positions relative to the potential minima is due to the tendency that stronger shocks form farther downstream. This causes a systematic variation of the perpendicular Mach number, with radius and makes the pitch angle of the gaseous arms smaller than that of the stellar arms, which supports the prediction of the density-wave theory, independently. However, some observations still give controversial results which show similar pitch angles at wavelengths, and there is no statistical study comparing observations and numerical models directly. By analyzing optical image of disk galaxies in the Carnegie-Irvine Galaxy Survey (CGS), I measured the physical values of stellar and gaseous arms such as their strength, length, and pitch angles. For direct comparison with numerical results, I analyzed more than 30 additional numerical models with varying the initial parameters in model galaxies. In this talk, I will present results both of observational and numerical samples and discuss the physical properties of spiral structures based on the density-wave theory.

[구 GC-04] Galaxy Rotation Coherent with the Average Motion of Neighbors

Joon Hyeop Lee (이준협)[1,2], Mina Pak (박민아)[1,2], Hye-Ran Lee (이혜란)[1,2], Hyunmi Song (송현미)[1]
[1]Korea Astronomy and Space Science Institute, [2]University of Science and Technology, Korea

We report our discovery of observational evidence for the coherence between galaxy rotation and the average motion of neighbors. Using the Calar Alto Legacy Integral Field Area (CALIFA) survey data analyzed with the Python CALIFA STARLIGHT Synthesis Organizer (PyCASSO) platform, and the NASA-Sloan Atlas (NSA) catalog, we estimate the angular momentum vectors of 445 CALIFA galaxies and build composite maps of their neighbor galaxies on the parameter space of velocity versus distance. The composite radial profiles of the luminosity-weighted mean velocity of neighbors show striking evidence for dynamical coherence between the rotational direction of the CALIFA galaxies and the average moving direction of their neighbor galaxies. The signal of such dynamical coherence is significant for the neighbors within 800 kpc distance from the CALIFA galaxies with a confidence level of 3.5σ, when the angular momentum is measured at the outskirt ($Re<R\leq 2Re$) of each CALIFA galaxy. We also find that faint or kinematically misaligned galaxies show stronger coherence with neighbor motions than