

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

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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

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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

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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 outskirts ($R < R \leq 2R$) of each CALIFA galaxy. We also find that faint or kinematically misaligned galaxies show stronger coherence with neighbor motions than