[구GC-21] Gas Dynamical Evolution of Central Regions of Barred Galaxies

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We investigate dynamical evolution of gas in barred galaxies using a high-resolution, grid-based hydrodynamic simulations on two-dimensional cylindrical geometry. Non-axisymmetric gravitational potential of the bar is represented by the Ferrers ellipsoids independent of time. Previous studies on this subject used either particle approaches or treated the bar potential in an incorrect way. The gaseous medium is assumed to be infinitesimally-thin, isothermal, unmagnetized, and initially uniform. To study the effects of various environments on the gas evolution, we vary the gas sound speed as well as the mass of a SMBH located at the center of a galaxy. An introduction of the bar potential produces bar substructure including a pair of dust lane shocks, a nuclear ring, and nuclear spirals. The sound speed affects the position and strength of the bar substructure significantly. As the sound speed increases, the dust lane shocks tend to move closer to the bar major axis, resulting in a smaller-size nuclear ring at the galactocentric radius of about 1 kpc. Nuclear spirals that develop inside a nuclear ring can persist only when either sound speed is low or in the presence of a SMBH; they would otherwise be destroyed by the ring material with eccentric orbits. The mass inflow rates of gas toward the galactic center is also found to be proportional to the sound speed. We find that the sound speed should be 15 km/s or larger if the mass inflow rate is to explain nuclear activities in Seyfert galaxies.

[구GC-22] Relativistic Hydrodynamic Codes for Adiabatic and Isothermal Flows

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Many astrophysical high energy phenomena involve relativistic flows. We describe codes for adiabatic and isothermal flows in relativistic regimes. For adiabatic flows, we employ an equation of state (EOS) which is simple and yet approximates very closely the EOS of the single-component perfect gas. For isothermal flows, we use an EOS of constant sound speed. We present the eigenstructures of relativistic hydrodynamics which can be used to build numerical codes, and discuss the calculation of primitive variables from conservative ones for both adiabatic and isothermal flows. The shock tube tests show differences between the two flows.