S28a Transition of BH feeding from the radiatively inefficient regime into star-forming cold disk regime

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We study the properties of rotating accretion flows onto supermassive black holes (SMBHs) in galactic nuclei using axisymmetric two-dimensional hydrodynamical simulations with radiation cooling and BH feedback processes. The simulations resolve hot gas bounded by the gravity of the central BH and accretion through a torus or disk, depending on the gas inflow rate from the Bondi radius. For lower Bondi rates ($\dot{M}_{\rm B} \lesssim 10^{-3}\ \dot{M}_{\rm Edd}$), where $\dot{M}_{\rm Edd}$ is the Eddington rate, the BH accretion rate is suppressed due to convective motion by several orders of magnitudes from the Bondi rate. Thus, the radiative luminosity results in as low as $\approx 10^{-10} - 10^{-7}\ L_{\rm Edd}$, where $L_{\rm Edd}$ is the Eddington luminosity. For higher rates of $\dot{M}_{\rm B} \gtrsim 10^{-3}\ \dot{M}_{\rm Edd}$, the accreting gas cools and forms a dense geometrically-thin disk in the Bondi radius. Since the cold disk feeds the BH at the Bondi rate, the luminosity increases dramatically to $\approx 10^{-3}\ L_{\rm Edd}$. The transition from radiative inefficient flows to cold disk accretion naturally explain the observed relation between the Bondi accretion rates and radiative luminosities for SMBHs in the local universe. In addition, the dense and cold disk formed in the nuclear region tends to be gravitationally unstable, which leads to active star formation. This suggests a possible explanation of the correlation between star formation rates and BH feeding rates in Seyfert galaxies, the origin of massive stars in the galactic nuclei and the remnant of post-AGN activity.