Luminous Accretion Disks Around Black Holes

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Abstract

We review recent progress in understanding the structure of near-Eddington accretion disks around black holes, applicable to active galaxies, IXOs, and black hole X-ray binaries. At high accretion rates, radiation is the dominant pressure, leading to a host of instabilities which make our understanding of the structure, spectrum, and variability of these objects highly uncertain. Radiation can drive strong convection, making the disk nearly isentropic and thinner by a factor of two. However, convection alone is not capable of suppressing thermal instability, but biases the instability towards collapse, shutting off accretion. Photon bubbles and compressibility near the diffusion scale can create a clumpy medium in which radiation can diffuse through underdense regions, enhancing the cooling of the disk. Radiation can damp the azimuthal magnetorotational instability, possibly reducing the stress and heating rate for stronger radiation pressure. Increased cooling and decreased heating may stabilize radiation dominated disks to the thermal instability. We discuss the criteria for when stability can be achieved, and how this might be addressed with numerical simulations.

CATEGORY: ACTIVE GALAXIES AND QUASARS