

HYBRID ACCRETION-DISKS IN AGN

and the AGN contribution to the XRB

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Abstract. The hybrid accretion-disk (HAD) model links the two characteristic components of AGN spectra – the UV bump and the X-ray power-law – in the framework of one physical model. The radially stratified hybrid disk is a self consistent combination of a thin, cool accretion disk at large radii, with an inner hot two-temperature disk. Its spectrum consists of three components, corresponding to the three radial disk regions: a blackbody thermal spectrum from the outer cool disk, a Comptonized soft photon power-law spectrum from the intermediate region, and a thermal Comptonized bremsstrahlung spectrum from the inner region. The dependence of the hybrid disk spectrum on the accretion rate and on other parameters is discussed and applied to AGN spectral evolution, and in particular to explaining the cosmic X-ray background by AGN.

Key words: accretion-disk, active nuclei, quasars, x-rays

0.1. RADIAL DISK STRUCTURE

The thin accretion disk (Sakura and Sunyaev 1973) is unstable in the inner, radiation- pressure dominated region. The HAD model (Wandel and Liang 1991) removes this instability by assuming that in the inner region the disk heats up reaching a stable configuration - the two temperature hot disk (Lightman and Eardley 1974). For high accretion rates the hot disk has two parts - an outer part, where the cooling is dominated by inverse Compton scattering of the soft photons from the cool disk, and an inner region, which is shaded from most of the soft photon flux, and is dominated by Comptonized bremsstrahlung. Unlike the vertically stratified cold-hot disk models, the radial configuration involves no additional free parameters and is thermally self consistent.

0.2. SPECTRUM

The HAD spectrum consists of three components, corresponding to the three hybrid disk regions: modified black body from the outer cool disk, Comptonized soft photon power-law from the intermediate region, and thermal Comptonized bremsstrahlung from the inner region.

0.3. THE HAD-AGN MODEL OF THE XRB

Wien pair equilibrium leads to electron temperatures in a narrow range of 50-100keV in the inner region, which makes the HAD in AGN an attractive model for the X-ray background (Wandel 1992, in Proc. MPE conf. on AGN and the XRB). Convoluting the HAD AGN spectrum with the X-ray luminosity function of AGN (Boyle et.al. 1993) gives a good fit to the hard XRB (Wandel 1993).