S14b Global Disk Oscillations and Line Profile Variabilities in AGNs

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Accretion disks originate considerable emission in various astronomical objects. Hence, line profiles as well as continuum spectra from these objects have signatures of the presence of accretion disks. In particular, double-peaked emission lines can be direct evidence for the presence of the accretion disks. Recent observations (Eracleous & Halpern 1994; Storchi-Bergmann et al. 1993) have revealed that nineteen radio-loud AGNs and one LINER have shown broad, double-peaked or twin shouldered, Hα emission lines. About a half of these samples have Hα line profiles in which the blue peak is stronger than the red peak, whereas six galaxies have profiles in which the red peak is stronger than the blue peak. The former profiles can be fitted well with a circular, relativistic, Keplerian disk model (Chen & Halpern 1989; Chen et al. 1989). Eracleous et al. (1995) showed that the latter profiles can arise from accretion disks if disks are eccentric.

In this paper, we examine the characteristics of global $m = 1$ oscillation modes of weakly-relativistic accretion disks in AGNs, because the eccentric disk model by Eracleous et al. (1995) should be understood as a kinematical version of disks perturbed by global $m = 1$ modes. The relativistic effect is simulated by the pseudo-Newtonian potential. We consider linear adiabatic $m = 1$ oscillations in geometrically thin, polytropic disks. We find that odd (z-antisymmetric) modes as well as even (z-symmetric) modes exist in weakly-relativistic disks. We also find that only the odd modes can be consistent with the observed asymmetry of broad Hα lines in AGNs. The propagation region of the even modes is so narrow that these modes are unlikely responsible for the line asymmetry.