INTERACTION OF STARS AND GAS DISKS AROUND MASSIVE BLACK HOLES

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Most, perhaps all galaxies host a massive black hole (MBH) in their center. In many cases a gas flows into the MBH through a massive, geometrically thin accretion disk. The disk is involved in the growth and evolution of the MBH mass and spin, in the emission of strong variable radiation, and possibly in the collimation of jets ejected from near the MBH event horizon. These processes affect in turn the disk structure, mass-to light conversion efficiency, and accretion rate. On somewhat larger scales, the disk may exhibit maser emission or fragment into stars.

Stellar dynamical evolution around a MBH leads to the formation of a steep, high-density mass-segregated stellar cusp. Dynamical relaxation in the highly symmetric potential near a MBH proceeds rapidly through the very efficient coherent process of resonant relaxation (RR). The nearly constant torques exerted by the stars on the gas disk can significantly change its angular momentum.

We suggest that RR-torques can explain the observed warps in relatively extended, low density thin maser disks. We also consider the influence of RR on high density fiducial Shakura-Sunyaev disk models for the case of strong ($\theta \geq \pi/3$) and weak ($\theta \ll \pi/3$) warps.