PHYSICS OF ACTIVE GALACTIC NUCLEI *Fall 2015*
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PROBLEM SET 1

Problem 1 (...)

Consider two thin annuli (rings) in accretion disk. If ν the coefficient of kinematic viscosity in the gas, show that

(a). viscous torque exerted on the outer ring is

$$G(R) = 2\pi R\nu\Sigma R^2 \mathrm{d}\Omega/\mathrm{d}R,$$

where all the variables and constants have been defined in LECTURE 2 slides (see the website).

(b). Prove the mass conservations equation for such a disk

$$R\frac{\partial\Sigma}{\partial t} + \frac{\partial}{\partial R}(R\Sigma v_{\mathrm{R}}) = 0,$$

where v_{R} is the small radial velocity in the disk.

(c). Prove the equation of angular momentum conservation ina geometrically-thin disk

$$R\frac{\partial}{\partial t}(\Sigma R^2\Omega) + \frac{\partial}{\partial R}(R\Sigma v_{\mathrm{R}} R^2\Omega) = \frac{1}{2\pi}\frac{\partial G}{\partial R}.$$