

AGN DISK TENSIONS FROM AN INCONSISTENT A-DISK CLOSURE (FINAL CLOSURE)

MOHAMMAD-HASSAN NADDAF

University of Liege, Belgium, mh.naddaf@uliege.be

ABSTRACT

The standard α -disk formalism parametrizes turbulent angular momentum transport through a dimensionless coefficient α , assumed to be spatially and thermodynamically invariant. While analytically convenient, this assumption leads to the classical thermal and viscous instabilities in radiation-pressure dominated regions. We show that this instability is not an inevitable consequence of radiation pressure, but is an artifact of enforcing a constant α across distinct thermodynamic regimes. We present a solution that follows directly from the internal consistency of the thin-disk equations. Implemented within the standard framework, it removes the classical radiation-pressure unstable branch without modifying the stress tensor or invoking additional transport physics.

Disk structure, including surface density, optical depth, and midplane temperature, becomes smooth and single-valued across regimes while preserving the standard effective-temperature profile. The resulting denser and more optically thick inner disk may naturally alleviate several long-standing AGN disk tensions, including oversized microlensing disk estimates, continuum reverberation lag excesses, and accretion-state dependent variability timescales. These results suggest that the classical radiation-pressure instability, and perhaps some associated AGN disk tensions, may be artifacts of an inconsistent viscosity closure.