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Magnetized advective accretion disks and their stability at higher acrretion rate: Theory and simulation

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An optically thin advective accretion disk appears to be indispensable to explain hard-state of black hole sources. Any transport of matter therein is assumed to be led by (modified) α-viscosity when the magnetic field is weak. We explore how large scale stronger magnetic field helps in transporting angular momentum, over α-viscosity based transport, depending on the field geometry. Interestingly, while above a critical accretion rate the accretion disk turns out to be thermally unstable, in the presence of stronger magnetic fields the disk regains its stability. We first establish this by theory and then explore the same by numerical simulation based on HARMPI. This increases the upper limit of accretion rate in optically thin flows, which has far reaching implications including explanation of ultra-luminous X-ray sources.

Primary author: MUKHOPADHYAY, Banibrata (Indian Institute of Science)

Presenter: MUKHOPADHYAY, Banibrata (Indian Institute of Science)

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