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3-D MHD Simulations of Astrophysical Jets

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Jets and outflows are ubiquitous among the accretion process in a variety of astrophysical objects. Global three-dimensional (3-D) magnetohydrodynamic (MHD) simulations of accretion flows have revealed the generation of jets by the emergence of a magnetic tower. In other words, the magnetic interaction associated with stars and/or accretion disks is a promising universal mechanism of launching jets. However, photon spectra of accretion flows and jets in some microquasars display some serious problems. When spetrum is dominated by non-thermal emissions, a mildly relativistic steady jet is observed. On the other hand, when spectrum is dominated by thermal emissions, no jet is observed. Remarkably, during a transition from a non-thermal state to a thermal state, a ultra-relativistic transient jet is observed. Therefore, the radiation in a magnetized accretion flow is a key to understand the formation of jets. In this talk, we present 3-D MHD simulations of magnetic tower jets and also 3-D radiation transfer (RT) simulations of magnetic tower jets. The possible connection between the emergence of magnetic tower jets and the evolution of radiation properties will be discussed.