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# Magnetically Driven Jets from Accretion Disks: Comparison Between 2.5D Nonsteady Simulations and 1.5D Nonsteady/Steady Solutions

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We have performed 1D(1.5D) and 2D(2.5D) nonsteady MHD numerical simulations of astrophysical jets which are magnetically driven from Keplerian disks, in order to clarify the origin and structure of jets ejected from protostars and active galactic nuclei. The initial and boundary conditions are similar to those of 2D(2.5D) nonsteady MHD simulations of Shibata and Uchida (1986) and Matsumoto et al. (1996); there is initially a Keplerian disk with a non-rotating corona outside, both of which are penetrated by vertical magnetic fields. The subsequent interaction between the disk/corona and the vertical fields are studied as an initial value problem. Against the current belief that this kind of simulations show simply a transient jet caused by nonsteady interaction between the disk/corona and the magnetic field, we have found that the jets ejected from the disk in this way have the same properties of the steady magnetically driven jets that were investigated by using 1D steady wind solution (Kudoh & Shibata 1995), even if the jets are not exactly in steady state. The mass flux and the maximum velocity of 1.5D nonsteady jets are dependent on the poloidal magnetic field strength at the disk surface as

$$\dot{M} \propto B_{p0} \quad , \ v_{\max} \propto B_{p0}^{1/6}$$

where $\dot{M}$ is the mass flux of the jet, $v_{\max}$ is the maximum velocity of the jet, and $B_{p0}$ is the strength of the poloidal magnetic field at the disk (Kudoh & Shibata 1996). We also found that the magnetic energy dependences of the mass flux and velocity of the 2.5D nonsteady jet show similar dependences of the steady ones.

## References

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