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Long time Simulations of Astrophysical Jets Energy Structure and Quasi-periodic ejection

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We have performed self-consistent 2.5-dimensional nonsteady MHD numerical simulations of jet formation as long as possible, including the dynamics of accretion disks. Although the previous nonsteady MHD simulations for astrophysical jets revealed that the characteristics of nonsteady jets are similar to those of steady jets, the calculation time of these simulations is very short compared with the time scale of observed jets. Thus we have investigated long term evolutions of mass outflow rate, poynting flux, kinetic energy flux, enthalpy flux and the energy of the toroidal magnetic field. We found that average poynting flux is dominant over both kinetic energy flux and enthalpy flux especially when initial magnetic field is strong. The radial dependences of different energies reveal that the main source of collimation comes from the pinching by toroidal field. We found that the ejection of jet is quasi-periodic and the periodicity of the jet can be related to the time needed for the initial magnetic field to be twisted to generate toroidal filed.
Key Words: MHD simulations, astrophysical jets