S15b Current-driven Instabilities of Poynting flux-dominated Jets

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Non-relativistic three-dimensional magnetohydrodynamic simulations of Poynting flux-dominated (PFD) jets are presented. Our study focuses on the propagation of strongly magnetized hypersonic but sub-Alfvénic flow ($C_{\rm s}^2 \ll V_{\rm jet}^2 < V_{\rm A}^2$) and the development of a current-driven instability (CDI). This instability may be responsible for the "wiggled" structures seen in VLBI-scale AGN jets. In the present paper we investigate the nonlinear behavior of PFD jets in a variety of external ambient magnetized gas distributions, including those with density, pressure, and temperature gradients. Our numerical results show that the jets can develop kink distortions not only in the sub-Alfvénic flows, but also in the super-Alfvénic flows [*i.e.*, Kinetic energy flux-dominated (KFD) jets]. A non-axisymmetric mode ($m = 1$) grows predominantly on time scales of order the Alfvén crossing time (in the jet frame) and proceeds to disrupt the kinematic and magnetic structure of the jet driven in large part by the radial component of the Lorentz force. Because of the external magnetized winds surrounding a well-collimated jet, the growth of surface modes (*i.e.*, MHD Kelvin-Helmholtz instabilities) is suppressed. Detailed studies of the CDI of PFD/KFD outflows using high-resolution computations, and the application of these physical processes to sub-pc to pc scales structures of AGN jets, will be discussed.