SIMULATION IN 3D OF ELECTRON TRANSPORT & EMISSIONS IN RADIO GALAXIES

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We have developed numerical techniques for including CR acceleration at shocks in multidimensional, time-dependent MHD simulations of astrophysical objects. These allow us to study production, transport and emissions produced by CRs inside very complex and unsteady flows. Here we report some results of our 3D simulations of supersonic jet flows that are designed to represent jets responsible for formation of radio galaxies. Initial findings demonstrate several important physical points:
(1) The flows, including the jets when they become fully 3D, are highly unsteady. Clear terminal shocks are uncommon, so that CRs are accelerated by a complex web of shocks in the "head" of the flow. (2) The energy spectra of the accelerated CRs is spatially and temporally complex, and not simply the canonical "strong-shock" power law. (3) Magnetic fields within the "backflow cocoon" are highly intermittent, so conventional "aging" models, based on synchrotron losses are not reliable measures of time.
Acknowledgment
This work is supported by NASA, NSF and the University of Minnesota Supercomputing Institute.