Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

Integrated accretion disk angular momentum removal and astrophysical jet acceleration mechanism[1] PAUL BELLAN, Caltech — A model has been developed for how accretion disks discard angular momentum while powering astrophysical jets. The model depends on the extremely weak ionization of disks. This causes disk ions to be collisionally locked to adjacent disk neutrals so a clump of disk ions and neutrals has an effective cyclotron frequency $\alpha\omega_{ci}$ where α is the fractional ionization. When $\alpha\omega_{ci}$ is approximately twice the Kepler orbital frequency, conservation of canonical momentum shows that the clump spirals radially inwards producing a radially inward disk electric current as electrons cannot move radially in the disk. Upon reaching the jet radius, this current then flows axially away from the disk plane along the jet, producing a toroidal magnetic field that drives the jet. Electrons remain frozen to poloidal flux surfaces everywhere and electron motion on flux surfaces in the ideal MHD region outside the disk completes the current path. Angular momentum absorbed from accreting material in the disk by magnetic counter-torque $-J_r B_z$ is transported by the electric circuit and ejected at near infinite radius in the disk plane. This is like an electric generator absorbing angular momentum and wired to a distant electric motor that emits angular momentum.

[1]Supported by USDOE/NSF Partnership in Plasma Science

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Date submitted: 22 Jul 2015 Electronic form version 1.4