

Abstract Submitted
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Extragalactic Jets as Electrical Circuits and Transmission Lines¹

PHILIPP KRONBERG, University of Toronto and LANL — I describe the first attempt to measure a current in an extended radio galaxy jet: $\sim 10^{18}$ A at ~ 50 kpc from the elliptical galaxy's ultra-compact nucleus. This class of jet is known to transport its magnetic energy “intact”, up to supragalactic scales. I discuss plasma parameters for 3C303 and recent attempts to measure its jet axial current. I discuss analogies with both electrical circuits, – and transmission lines. Power is delivered into a “load”, whose impedance, Z , is close to that of free space, and the jet power flow $I^2 Z$ is $\sim 10^{35}$ erg s⁻¹ – broadly consistent with astronomically measured total power outputs, luminosities and lifetimes of AGN-powered radio lobes. The current and power levels are also consistent with SMBH accretion disk model predictions by Stirling Colgate, H. Li, V. Pariev, J. Finn, and others, beginning with Lovelace 1976 (Nature). A further analogy with transmission lines shows how the supragalactic power flows can be disrupted by a complex impedance in the “circuit.” Reactive components in space, i.e. a complex Z , can disrupt, reflect or deflect the power flow. This could explain the wide variety of magneto-plasma configurations seen in these systems.

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