# Comparing Poynting Flux Dominated Magnetic Towers with Kinetic-Energy Dominated Jets

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**Abstract**

Magnetic Towers represent one of two fundamental forms of MHD outflows. Driven by magnetic pressure gradients, these flows have been less well studied than magneto-centrifugally launched jets even though magnetic towers may well be as common. In this talk we present new results exploring the behavior and evolution of magnetic tower outflows and demonstrate their connection with pulsed power experimental studies. High-resolution AMR MHD simulations (using the AstroBEAR code) provide insights into the underlying physics of magnetic towers and help us constrain models of their propagation. Our simulations have been designed to explore effects of thermal energy losses and rotation on tower flows. In addition we also explore

the effect of the Poynting-to-kinetic energy flux ratio and toroidal-to-poloidal magnetic flux ratio. We find these parameters have significant effect on the stability of magnetic towers. Current-driven perturbations in the Poynting Flux Dominated (PDF) towers are shown to be amplified in both the cooling and rotating cases. Our studies of the the long term evolution of the towers show that the formation of weakly magnetized central jets within the tower are broken up by these instabilities becoming a series of collimated clumps whose magnetization properties vary over time.In addition to discussing these results in light of recent laboratory experiments we also show their relevance to astrophysical observations of young star jets and outflow from highly evolved solar type stars.