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Universal mechanism for collimation of magnetic flux tubes PAUL BELLAN, Caltech — Vacuum magnetic flux tubes are typically non-collimated. This is because a vacuum flux tube is produced by currents located outside the flux tube. The distance from these currents varies along the length of the flux tube causing B to vary. Since the axial flux in the flux tube is BA, a vacuum flux tube will have an axially non-uniform cross-sectional area $A \sim 1/B$, i.e., will not be collimated. Observations of flux tubes in laboratory, solar, and astrophysical situations show that bright flux tubes are always collimated and so cannot be vacuum flux tubes. Notable examples include solar coronal loops observed by the TRACE spacecraft, astrophysical jets, and Edge Localized Modes (ELMs) in tokamaks. Laboratory experiments at Caltech simulating astrophysical jets and solar coronal loops also show collimated profiles. A model has been developed showing that collimation results from axially directed MHD forces filling the flux tube with plasma which carries along frozen-in azimuthal flux that accumulates and pinches down the flux tube diameter until collimation results (P. M. Bellan, Phys. Plasmas **10**,1999(2003)).

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