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Magnetic structures and corresponding flows in current-carrying arched flux tubes[1] EVE STENSON, PAUL BELLAN, Caltech — Arched, plasma-filled flux tubes are created with a magnetized plasma gun. First, external coils generate an initial vacuum magnetic field in the shape of an arch, as between the poles of a horseshoe magnet. Gas is supplied to nozzles at the arch footpoints, each located on an electrode. A voltage is then applied across the electrodes, ionizing the gas and driving a current through the plasma. The resulting plasma structure influences and is influenced by the frozen-in magnetic field. From the outset, $\mathbf{J} \times \mathbf{B}$ forces generate flows along the axis of the arched vacuum field, traveling from the footpoints into the apex. The flows fill the arch with plasma so that it becomes a nearly collimated loop. Both flows and collimation persist as the loop expands due to magnetic forces. "B dot" probe measurements show comparable axial and azimuthal magnetic field strengths, with a structure approximating a force-free Bessel function solution. Further insight has been obtained by altering or eliminating the vacuum field altogether. These experiments demonstrate diminished and incoherent flows, loss of collimation, and weak magnetic fields.

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