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Magnetic Reconnection in Crossed, Plasma-filled Flux Tubes
ZACHARY TOBIN, PAUL BELLAN, Caltech — Magnetic flux tubes are a fundamental feature of solar coronal loops and astrophysical jets, as well as fusion devices, such as tokamaks and spheromaks. The dynamics of arched, plasma-filled flux tubes are being studied in experiments at Caltech. These flux tubes are subject to magnetohydrodynamic forces, expanding, undergoing kink instabilities, and magnetically reconnecting. An upgraded experiment arranges for two of these flux tubes to cross over each other, so that the flux tubes undergo magnetic reconnection at the crossover point, forming one long flux tube and one short flux tube. According to theoretical predictions, this reconnection should also result in a half-twist in the flux tubes at the crossover point, with the twist propagating along each tube as Alfvén waves. Initial observations indicate these flux tubes magnetically reconnect with each other as predicted: merging of flux tubes occurs if the currents and magnetic fields of both tubes are all parallel, but if one of the magnetic fields is directed antiparallel, no merging occurs. If the flux tubes are formed adjacent, rather than crossing over each other, they do not merge. Flux tubes of different species generate protrusions not seen in single-species pairs.

Zachary Tobin
Caltech

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