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Electromagnetic Fields of a Laboratory Axial Plasma Jet[1]
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Measurement are presented of the time-varying electromagnetic fields of a plasma jet directed along the background magnetic field in an ambient plasma. The jet is formed by irradiating a solid carbon target at $\sim 1 \times 10^{10}\mathrm{W/cm}^2$ suspended in a cylindrical argon plasma ($B_0 = 750\mathrm{G}$, $n_e = 5 \times 10^{12}/\mathrm{cm}^3$) so that the parallel expansion velocity matches the ambient Alfven speed. The experiments are conducted in the Large Plasma Device (LAPD) which operates at a 1 Hz cadence (matching the laser-target firing) and allows the collection of ensemble datasets. Measurements are made in two orthogonal planes that intersect the diamagnetic cavity formed by the laser-produced plasma jet. Three-axis magnetic induction coils as well as a novel emissive probe reveal the total electric field: $E = -\nabla V_p - \partial_t A$. The measured symmetry in the xy plane is exploited to form a cylidrically symmetric reconstruction of the dynamic, three-dimensional process.

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