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Nonlinear Spatiotemporal Control of Laser Intensity[1] T.T. SIMPSON, D. RAMSEY, P. FRANKE, D.H. FROULA, J.P. PALASTRO, Laboratory for Laser Energetics, U. of Rochester, N. VAFEI-NAJAFABADI, Stony Brook U. — Spatiotemporal control of laser intensity has the potential to revolutionize or enable a wide range of laser-based applications that currently suffer from the poor flexibility offered by conventional optics. In particular, these optics limit the region of high intensity to the Rayleigh range while providing little to no control over its trajectory. Here, we introduce a novel technique for nonlinear spatiotemporal control, the "self-flying-focus," that provides an arbitrary trajectory intensity peak that can be sustained for distances comparable to the focal length. The technique combines temporal pulse shaping with a lens-Kerr lens pair to customize the time and location at which each temporal slice comes to its nonlinear focus. As an example of its utility, simulations show that the self-flying-focus can form a highly uniform, meter-scale plasma suitable for advanced plasma-based accelerators.

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