Underdense, Passive Plasma Lens for Electron Beams[1] CHRISTO-
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LEE, JOHN CARY, MICHAEL LITOS, University of Colorado, Boulder — The
concept of using plasma lenses to focus high energy electron beams is old, yet it
has seen little use in practice. This is in part because the many varieties that have
been considered are often limited by fundamental constraints that can lead to un-
manageable aberrations in the focal quality. Here we present a largely unexplored
and underutilized incarnation of the plasma lens: the underdense plasma lens (UPL).
Unlike most plasma lenses, the UPL operates passively in a regime where the plasma
density is lower than the driving electron beam density, resulting in the nonlinear
blowout of plasma electrons and the formation of a wake behind the head of the elec-
tron beam. The UPL can produce focusing strengths orders of magnitude stronger
than conventional quadrupole magnets found in accelerators while being orders of
magnitude more compact. In addition, the focusing is linear and axisymmetric, al-
lowing for aberration-free focusing. This type of electron beam optic is an attractive
solution to the problem of matching beams to plasma wakefield accelerators. It may
also find use as a final focus device for applications such as a future lepton collider
or in high energy energy density physics research. Experimental plans to study the
UPL at SLACs FACET-II facility will be presented.

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