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Applications of the Corrugated Plasma Waveguide ANDREW YORK, BRIAN LAYER, THOMAS ANTONSEN, HOWARD MILCHBERG, University of Maryland, College Park — The corrugated plasma channel [1] allows micron-scale control of the instantaneous intensity and phase velocity of a guided femtosecond laser pulse, at focused intensity, with no damage threshold. We review several applications of our new device. Extremely efficient direct electron acceleration by a radially polarized laser pulse can be achieved by quasi-phase matching in a fully ionized plasma. Since this acceleration is a linear process, very modest pulse energies (~ 1 mJ) could potentially give MeV-level acceleration. A similar setup could quasi-phase match guided high-harmonic generation in deeply ionized gas [2]. The short, tunable corrugation periods ($< 35 \mu m$) produced by our method are well suited for quasi-phase matching extremely high harmonic orders, potentially allowing us to reach the predicted atomic cutoff. Finally, recent theoretical work [3] shows that these channels could convert multi-millijoule femtosecond laser pulses into terahertz radiation with high efficiency by spatial control of ponderomotively driven electron currents. [1] Brian Layer, Advanced Accelerator Concepts Conference 2006 [2] H. M. Milchberg et. al., Phys. Plasmas 3, 2149 (1996) [3] T. Antonsen and H. M. Milchberg, submitted for publication.

Andrew York
University of Maryland, College Park

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