Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

Ultracompact quasi-monoenergetic GeV-scale laser plasma accelerator based on all-optical control of dark current in longitudinally tapered plasmas[1] S.Y. KALMYKOV, B.A. SHADWICK, University of Nebraska - Lincoln, USA, X. DAVOINE, CEA, DAM, DIF, France — Negative chirp of an ultrabroad-bandwidth, sub-100-TW driving laser pulse, in combination with a plasma density taper and a plasma channel, prevents formation of an optical shock [1], reduces bubble expansion, and delays dephasing in the blowout regime of laser wakefield acceleration [2]. Precise compensation of the nonlinear frequency shift delays self-compression of the driving pulse into the optical shock; this compensation is achieved by using the specific shape of the frequency chirp extracted from reduced simulation models. In addition, plasma channel suppresses the diffraction of the pulse leading edge, further delaying formation of the optical shock, reducing longitudinal deformations of the pulse to a minimum. These features help suppress the continuous self-injection of electrons (a.k.a. the dark current), making possible to use the entire dephasing length to generate low-background, quasi-monoenergetic GeV electron beams from mm-scale dense plasmas (viz. $n_{e0} \geq 5 \times 10^{18}$ cm^{-3}).

[1] S. Y. Kalmykov et al., Phys. Plasmas 18 (2011) 056704;
[2] S. Y. Kalmykov et al., New J. Phys. 14 (2012) 022025.

[1]Supported by the U.S. DOE Grant DE-FG02-08ER55000, and AFOSR Grant FA9550-11-1-0157.

Serguei Y. Kalmykov
University of Nebraska - Lincoln

Date submitted: 18 Jul 2012 Electronic form version 1.4