Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

Self-injection Dynamics in Long Wave Infrared Laser Driven Wakefield Acceleration in Self-modulated and Blowout Regimes[1] PRABHAT KUMAR, Stony Brook University, MICHAEL DOWNER, University of Texas, Austin, VLADIMIR LITVINENKO, IRINA PETRUSHINA, NAVID VAFAEI-NAJAFABADI, Stony Brook University, RAFAL ZGADZAJ, University of Texas, Austin, ROMAN SAMULYAK, Stony Brook University — Recent advances in CO_2 laser technologies have renewed interest in long wave infrared (LWIR) laser driven wakefield accelerators in low density ($10^{16} - 10^{17}$ cm^{-3}) plasmas[1,2]. Evolution of the self-injection process in the transition of a LWIR laser driven LWFA from self-modulation to blowout regime has been investigated using 3D Particle-in-Cell simulations. The simulation results show that in SM-LWFA regime, self-injection arises with wave breaking, whereas in the blowout regime, self-injection is not observed under the simulation conditions. The wave breaking process in SM-LWFA regime occurs at a field strength that is significantly below the 1D wave-breaking threshold. This process intensifies at higher laser power and plasma density and is suppressed at low plasma densities ($\leq 1 \times 10^{17}$ cm^{-3} here). The produced electrons show spatial modulations with a period matching that of the laser wavelength, which is a clear signature of direct laser acceleration (DLA). Optimal parameters for transition into the blowout regime have been presented. [1] P. Kumar, et al., Physics of Plasmas, vol. 26, no. 8, 2019. [2] P. Kumar, et al.,Journal of Physics: Conf Ser, vol. 1067, no. 4, p. 42008, 2018.

[1]This work was supported by the grant DE-SC0014043 funded by the U.S. Department of Energy, Office of Science, High Energy Physics.

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Date submitted: 29 Jun 2020 Electronic form version 1.4