Abstract Submitted
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Radiation emission at Langmuir frequency from laser wake in longitudinally stratified plasma column[1] SERGE KALMYKOV, Leidos - Albuquerque, JENNIFER ELLE , ANDREAS SCHMITT-SODY, High Power Electromagnetics Division, Air Force Research Laboratory, Kirtland AFB — Theoretical analysis shows that a laser wake (an electrostatic Langmuir wave), driven in a periodically stratified, cylindrical plasma column, generates a superluminal rotational current at a Langmuir frequency. This current emits a Cherenkov TM wave into the plasma-free space. The spatial period of stratification defines an opening angle of the emission cone. Wave breaking in the inhomogeneous plasma limits the lifetime of the wake (hence, the THz signal length) to a few tens of picoseconds. Monochromaticity and coherence distinguishes this signal from ultrashort, uncollimated, broadband THz pulses emitted from plasma filaments. The efficiency of electromagnetic energy conversion, from optical to THz, reaches the maximum when the drive pulse waist size is close to the column radius. The efficiency increases with an increase in the drive pulse wavelength, and reaches the maximum when the drive pulse power becomes near-critical for relativistic self-focusing. Theoretically, conversion efficiency of a sub-Joule, near-IR TW drive pulse is expected to reach 10^{-5}, with the emitted energy of several μJ, and a MV m^{-1} electric field a meter away from the source. Approved for public release; distribution is unlimited. Public Affairs release approval AFMC-2020-0266.

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