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High-Power Tunable Laser Pulse Driven Terahertz Generation in Corrugated Plasma Waveguides CHENLONG MIAO, Univ of Maryland-College Park, JOHN PALASTRO, US Naval Research Laboratory, THOMAS ANTONSEN, Univ of Maryland-College Park — Excitation of terahertz radiation by the interaction of an ultra-short laser pulse and the fields of a miniature, corrugated plasma waveguide is considered. Plasma structures of this type have been realized experimentally [1] and they can support electromagnetic (EM) channel modes with properties that allow for radiation generation. In particular, the mode have subluminal field components, thus allowing phase matching between the generated THz modes and the ponderomotive potential of the laser pulse. Theoretical analysis and full format PIC simulations are conducted. We find THz generated by this slow wave phase matching mechanism is characterized by lateral emission and a coherent, narrow band, tunable spectrum with relatively high power and conversion efficiency. We investigated two different types of channels, and a range of realistic laser pulses and plasma profile parameters are considered with the goal of increasing the conversion of optical energy to THz radiation. We find high laser intensities strongly modify the THz spectrum by exciting higher order channel modes. Enhancement of a specific channel mode can be realized by using an optimum pulse duration and plasma density. As an example, a fixed drive pulse (0.55 J) with spot size of 15 m and pulse duration of 15 fs excites 37.8 mJ of THz radiation in a 1.5 cm corrugated plasma waveguide with on axis average density of 1.410^{18} cm^{-3}, conversion efficiency exceeding 8% is achieved. [1] B. D. Layer et. al., Phys. Rev. Lett. 99, 035001 (2007).

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