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Simulation of THz Generation in Corrugated Plasma Waveguides

ANDREW PEARSON, JOHN PALASTRO, THOMAS ANTONSEN, IREAP, University of Maryland — It has been suggested [1] that a laser pulse passing through a corrugated plasma channel may generate THz radiation. These channels support EM modes that have a Floquet-type dispersion relation, which allows for phase matching with the ponderomotive force of the pulse. We simulate the response of a channel to a non-evolving laser pulse. The channel density is axially sinusoidal and radially parabolic. We impose a cutoff at fixed radius, resulting in a channel that supports a finite number of quasi-bound modes. This approximates experimentally produced channels [2]. We measure the size and frequency structure of the radial Poynting flux outside the channel. For a 0.25 J pulse with a 15 micron spot size in a channel with density 10^{18} cm^{-3}, the average radial THz output is 10^5 W. We estimate that around ten percent of laser energy is available for conversion into THz radiation. This implies that several hundred centimeters of channel are required to deplete the excited modes through side coupling. This distance can be reduced by decreasing the channel barrier width and peak density.

[1] T. M. Antonsen et. al., Phys. Plasmas 14, 033107 (2007)
[2] B.D. Layer et. al., Phys. Rev. Lett. 99, 035001 (2007)

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