406.
Accession number:20113214212582
Title:Simulation of terahertz generation in corrugated plasma waveguides
Authors:Pearson, Andrew J. (1); Palastro, John (1); Antonsen, Thomas M. (1)
Author affiliation:(1) Institute for Research in Electronics and Applied Physics, University of Maryland, College Park, MD 20742, United States
Corresponding author:Pearson, A.J.
Source title:Physical Review E - Statistical, Nonlinear, and Soft Matter Physics
Abbreviated source title:Phys. Rev. E Stat. Nonlinear Soft Matter Phys.
Volume:83
Issue:5
Issue date:May 25, 2011
Publication year:2011
Article number:056403
Language:English
ISSN:15393755
E-ISSN:15502376
CODEN:PLEEE8
Document type:Journal article (JA)
Publisher:American Physical Society, One Physics Ellipse, College Park, MD 20740-3844, United States
Abstract:We simulate the response of a corrugated plasma channel to an ultrashort laser pulse in two dimensions with the goal of demonstrating the production of terahertz frequency electromagnetic modes. Corrugated channels support electromagnetic modes that have a Floquet-type dispersion relation and thus consist of a sum of spatial harmonics with subluminal phase velocities. This allows the possibility of phase matching between the ponderomotive potential associated with the laser pulse and the electromagnetic modes of the channel. Since the bandwidth of an ultrashort pulse includes terahertz frequencies, significant excitation of terahertz radiation is possible. Here we consider realistic density profiles to obtain predictions of the terahertz power output and mode structure for a channel with periodic boundary conditions. We then estimate pulse depletion effects from our simulation results. The fraction of laser energy converted to terahertz is independent of laser pulse energy in the linear regime, and we find it to be around 1%. Extrapolating to a pulse energy of 0.5 J gives a terahertz power output of 6 mJ with a pulse depletion length of less than 20 cm.
Number of references:23