Abstract Submitted
for the DPP07 Meeting of
The American Physical Society

Phase-matched even harmonic generation in relativistic ionization fronts FREDERICO FIUZA, RICARDO FONSECA, LUIS SILVA, GoLP/Centro de Física dos Plasmas, Instituto Superior Técnico, Lisboa, Portugal — Relativistic harmonic generation in plasmas is an active field of research. Generating harmonics efficiently is still a challenge, mainly due to the difficulties in guaranteeing phase-matching in the conversion process over long interaction lengths. We present a novel scheme to generate phase-matched even harmonics in relativistic ionization fronts. The magnetic mode induced in the collision of e.m. radiation with relativistic ionization fronts, driven by an ultra-intense laser pulse propagating in a gas target, is used to generate even harmonics of the laser pulse. By controlling the frequency of the incident radiation the conversion process can be phase-matched. This scheme also provides a means of indirect detection and characterization of the magnetic mode, which was never observed experimentally. Our theoretical model predicts the phase-matching conditions and describes the amplitude evolution of the generated even harmonics. In order to check the validity of the model, detailed 1D and 2D PIC simulations were preformed with OSIRIS 2.0. The analysis reveals a good agreement between the theoretical model and the simulation results. The conversion efficiency of the process was also studied, indicating the possibility of achieving controlled highly efficient even harmonic generation.

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Date submitted: 23 Jul 2007 Electronic form version 1.4