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**Relativistic Laser Pulse Propagation in Underdense Plasmas** N. NASERI, S.G. BOCHKAREV, W. ROZMUS, Department of Physics, University of Alberta, Edmonton, Canada — Propagation of relativistic laser pulses in underdense plasmas remains a subject of active studies because of its relevance to different particle acceleration schemes, inertial confinement fusion by fast ignition and new interaction physics of super intense laser pulses. Finding a stable regime of propagation of these pulses over large distances in long scale length plasmas is critical for many of these applications. In this paper we report on detailed studies of relativistic self-focusing and pulse channeling. First, we examine the relevance and stability of exact stationary solutions in two spatial dimensions (2D) [1] by means of 2D PIC simulations. We have found good agreement between analytical, single channel solutions and PIC simulations results at low densities ne/ncr<0.1. Such fully evacuated channels are stable while solutions corresponding to incomplete electron density evacuation are destroyed by Raman and hosing instabilities. At higher densities 0.1 of critical density and above the predicted narrow width, on the order of laser wavelength, of the self-focused channels prevents stable propagation of the laser filaments. We have also found that analytical multi-channel stationary solutions are unstable due to the interaction between filaments. We will also report on the generalization of these results to 3D spatial geometry. [1] Cattani et al. Phys. Rev E, 64, 016412 (2001).

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