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Plasma Physics of Photoionized Gases by Short X-ray Pulses D.V. ROMANOV, University of Alberta, Edmonton, Alberta. Canada, V. YU. BY-CHENKOV, P. N. Lebedev Physics Institute, Moscow, Russia, W. ROZMUS, C.E. CAPJACK, R. FEDOSEJEVS, University of Alberta, Edmonton, Alberta, Canada — A study of nonequilibrium plasma that is created by a femtosecond, linearly polarized x-ray pulse in a gas jet target is presented. The x-ray photoionized gas is described by the anisotropic electron distribution function (EDF) that exists on the picosecond time scale, i.e. until particle collisions establish isotropic velocity distribution. This EDF gives rise to electromagnetic Weibel instability and electrostatic two stream instability. Linear theory and nonlinear evolution of these instabilities are described analytically and by multidimensional particle-in-cell (PIC) simulations. Static magnetic field generation and terahertz nonmonohromatic video-pulse irradiation from such plasmas is predicted. The model accounts for thermo-EMF at the edge of a plasma and the anisotropic EDF due to photoionization. Results from 3-dimensional PIC simulations show new unexpected scenarios of Weibel and two-stream instability nonlinear evolutions in these anisotropic plasmas.

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