

Abstract Submitted
for the DPP07 Meeting of
The American Physical Society

Evolution of FEL-produced plasma with photoionized electron two-stream instability¹ I.A. ANDRIYASH, V. YU. BYCHENKOV, P.N. Lebedev Physics Institute, RAS, Moscow, Russia, W. ROZMUS, University of Alberta, Edmonton, Alberta, Canada — Plasmas created in the interaction of X-ray laser pulse of a free electron laser (FEL) with gaseous medium display a number of specific properties that are substantially different from characteristics of plasmas produced by optical lasers. An electron distribution function in the FEL-photoionized plasma is anisotropic and monoenergetic or multi-monoenergetic depending on the material. These features make these plasmas unstable with respect to photoionized electron two-stream (PITS) instability. In this paper we represent a kinetic non-stationary theory of PITS instability of a weakly ionized plasma which takes into account an electron production due to photo-effect through the interaction of an ultrashort linearly polarized X-ray FEL pulse with a gas jet, growth of unstable quasistatic electric field, and wave damping and electron distribution relaxation due to electron collisions with atoms. Our theory is based on the integral kinetic equation for correlation function of electron density fluctuations. The evolution and relaxation of PITS instability is illustrated by an example of He gas-jet ionized by EUV pulse of FEL with different pulse durations for typical gas-jet pressures.

¹This work was partially supported by Russian Foundation for Basic Research (Grant No. 06-02-16103) and the Natural Sciences and Engineering Research Council of Canada.

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Date submitted: 27 Aug 2007

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