Nonlocal heat transport in inhomogeneously heated plasma

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Hydrodynamic equations are effective tool in describing laser plasma heating. However, the validity of classical hydrodynamics starts to fail when the inhomogeneity scale length is of the order of hundreds of mean free path length. These conditions are often met in the laser hot spots. Going beyond the standard transport theory, we formulated the model which accounts for the effect of heat delocalization by using nonlocal heat conductivity derived in the linear theory of the electron transport for small perturbations (V. Yu. Bychenkov, W. Rozmus, V. T. Tikhonchuk, and A. V. Brantov, Phys. Rev. Lett. **75**, 4405, 1995). The proposed practical formula for nonlocal nonlinear heat flux has been tested in Fokker-Plank simulation of hot spot relaxation. We found also the solution of the integral-differential equation for electron temperature. This solution demonstrates good agreement with the result of Fokker-Plank simulation on temperature relaxation. Based on the proposed nonlocal heat transport model the temperature profiles have been studied versus energy deposition into the hot spot. The quasistationary temperature profile was compared with the result of the classical Spitzer-Härm approach and considerable deviation from the latter has been found. The nonlocal effect of heat propagation from the heating region qualitatively explains the experimentally measured temperature profiles from the recent experiment on Thomson scattering [G. Gregori *et al.*, 5th International Workshop on Laser-Plasma Interaction Physics, Banff, Canada, 2003].

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