EXPERIMENTAL SETUP TO STUDY THE EFFECT OF NONLOCAL THERMAL TRANSPORT IN PLASMA

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The effect of nonlocal electron heat conduction occurs under conditions of large temperature gradients, when electron mean free paths became comparable to the spatial scale of temperature change L_T ($\lambda_{ei} > 0.06Z^{-1}/2L_T$). In such a situation, the proportionality between the heat flux and the temperature gradient is broken; the flux at a point begins to depend on the temperature distribution in some vicinity of that point. A complete description of such an effect is possible using the collisional Fokker-Planck equation, but this approach requires significant computational resources for many practical problems. Existing semi-empirical models that can be incorporated into hydrodynamics predict significant discrepancies in heat wave propagation and require experimental verification. This paper will present a setup that initiates the propagation of a heat wave in laser plasma. A cylindrical box is filled with a low-density substance (gas, foam). Laser radiation enters the box through a hole in its side surface and heats up a part of the inner substance. At intensities of about 10^{15} W/cm^2, heating up to several keV occurs and a large temperature gradient is formed. This results in a heat wave traveling along the capsule axis, the dynamics of which is determined by nonlocal effects. Radiation preheat also plays a major role in such energy inputs, but in the proposed experiment it is weaker than preheat by electronic thermal flux. The dynamics of the heat wave in the experiment is determined by the plasma self radiation in the x-ray range. Such an experiment will make it possible to verify the existing semiempirical models, as well as to directly observe the dynamics of the heat wave.