EXPERIMENTAL SETUP TO STUDY THE EFFECT OF RADIATION TRANSFER ON THE DEVELOPMENT OF HYDRODYNAMIC INSTABILITIES

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The equations of hydrodynamics admit unstable solutions, which are critical in many applied and fundamental problems: they break the symmetry of flows, lead to the development of turbulence and enhanced mixing of media. In some problems they are undesirable, for example, in inertial confinement fusion (ICF) their development significantly limits the performance of targets. Sometimes, on the contrary, their contribution turns out to be crucial, as in astrophysics: in supernova explosions, instabilities accelerate the thermonuclear combustion wave, which ends with a successful explosion of the star. Also instabilities appear in many astrophysical phenomena: in stellar evolution, accretion, etc. In addition to its hydrodynamics, the plasma has other physical effects that influence its evolution: large-scale electric and magnetic fields, heat conduction, radiation, etc. The presence of this additional physics also complicates the analysis of instabilities in the plasma. For high-temperature plasmas, radiative transfer is essential. For instabilities its influence is manifested by several effects. On the one hand, radiative preheating reduces pressure gradients, which weakens Rayleigh-Taylor instabilities, which may be useful for ICF. On the other hand, radiation pressure or radiation losses lead to additional acceleration of the system parts, strengthening such instabilities. The paper discusses the possibility of experimentally investigating the influence of radiation effects on the interface instability through which the shock wave passes and proposes an experimental setup. The radiation effects are controlled by a thin metallic shield that separates the instability region from the hot laser corona. This, together with the variation of the types of substances, allows to reproduce different modes of evolution of the unstable boundary and to test the effects of radiation on it. Also, the evolution of the unstable boundary is a good test for radiation-hydrodynamic codes.