Tsinghua University
Department of Physics

Physics Colloquium 2013 Spring

The Rayleigh-Taylor instability in inertial confinement fusion, flames and supernovae

Abstract

The Rayleigh Taylor (RT) instability is a universal hydrodynamic process, which transforms excess of potential energy into kinetic energy of the flow. The instability develops when a heavy gas (fluid, plasma) is supported by a light one in a gravitational field, real or effective. In this talk I will consider development of the RT instability at the linear and nonlinear stages in applications to inertial confinement fusion, flames, quantum gases and thermonuclear supernovae. In inertial confinement fusion, we will discuss linear stabilization of the RT instability by the laser ablation flow, and dynamics of the heated plasma bubbles at the nonlinear instability stage. The RT instability in the ablation flow may be also accompanied by the Darrieus-Landau instability of the laser deflagration front. In the context of combustion science, the RT instability is traditionally encountered for upward propagating flames. Another important example is provided by fast burning along the vortex axes, which may be quite important for turbulent combustion. In thermonuclear supernovae, the RT instability results in formation of large scale bubbles of light burnt matter, which move the thermonuclear burning process from the star center to the outer layers, thus preventing from a supernova explosion in a purely deflagration regime.

Speaker

Vitaly Bychkov received his M. S. and Ph. D. in Physics from Moscow Univ. of Physics and Technology in 1991 and 1994, respectively. After postdoctoral work in Uppsala University between 1994-96, he joined Umeå University (Sweden) as Professor Assistant and became Professor in 2008.

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Zheng Yu-Tong Lecture Hall, New Science Building

Vitaly Bychkov

Umeå University, Sweden

http://www.phys.tsinghua.edu.cn/