Premixed flames, from linear regime to non linear complex dynamics

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Abstract

A premixed flame is a thin reactive layer that propagates into a reactive mixture and eventually folds due to hydrodynamic instabilities. Both linear destabilization and non linear evolution are studied theoretically, numerically with a Lattice Boltzmann Method, and experimentally in a Hele-Shaw cell.
We estimate the exact evolution at any time and for any initial condition, by taking into consideration all the roots of the dispersion relation in the linear regime, and by exploring the non linear evolution in comparison with analytical pole trajectories. We demonstrate that it is experimentally possible to impose the whole evolution of the flame in the late non linear regime, up to times at which additional stochastic processes are at play. For later times, when a steady stochastic dynamics is reached, we demonstrate that it is still possible to describe precisely the size distribution of the pattern.

Keywords: interface dynamics, combustion, pattern

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