非 線 型 科 学 コ ロ キ ウ ム

Nonlinear Science Colloquium

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講演題目： Effect of compressibility on stability of a planar front of premixed flame

A premixed flame front is very thin in the hydrodynamic scale and can be viewed as a density discontinuity surface with a series of complicated chemical reactions occurring in it. The Darrieus-Landau instability (DLI) is a well-known hydrodynamic instability of a planar front of premixed flame. A planar front is unstable to disturbances with any wave number. This result does not match with the observations in the laboratory. Most of the studies made so far is restricted to incompressible flows, and relatively little is known about the compressibility effect.

The effect of compressibility on the stability of a plane flame front of the premixed flame is investigated in the form of the M^2 expansion for small Mach number M. The method of matched asymptotic expansions is used to derive jump conditions for hydrodynamic variables across a flame front which is separated into the preheat zone and the reaction zone sandwiched in the former. With this jump conditions on the flame front, we obtain the correction to the growth rate of the DLI to $O(M^2)$. It is found that, if the Prandtl number and the heat release are sufficiently large, the compressibility effect can suppress the DLI.

This is collaboration with Keigo Wada, D3 of Graduate School of Mathematics, Kyushu University.

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場所： 早稲田大学 西早稲田キャンパス
55 号館 N 棟 1 階 第一会議室