流体力学特別セミナーのお知らせ

講演会後、懇親会を開催しますので、参加を希望される場合は８月３０日（日）までに長田 (nagata@nagoya-u.jp)までご連絡をお願いします。場所と会費は参加人数によりますが、人数が多ければ VBL（講演会会場）で３千円程度、少なければ近隣の居酒屋で５千円程度になると思います。

講師　Pedro Valente 博士 (Instituto Superior Técnico)
日時　2015 年 9 月 3 日(木) 15:00～16:30
場所　名古屋大学　VBL 3F ベンチャーホール
（http://www.vbl.nagoya-u.ac.jp/access.html）
タイトル　Manifestations of non-equilibrium turbulence in periodic box turbulence
概要　Turbulence modelling remains one of the major challenges in very many engineering and geophysical applications. One of the core concepts of all existing theories and models of turbulence is the energy cascade mechanism whereby, in a multi-scale process, kinetic energy is transferred into small dissipative scales of motion, and the idea of an equilibrium between the large energetic and the small dissipative scales which dates back to Kolmogorov (1941). Recently, however, it has been experimentally demonstrated that there are situations occurring in many engineering and natural flows where the small dissipative scales are far from equilibrium even though the energy spectra follows a power-law with near -5/3 slope. These non-equilibrium situations are revisited and it is shown that this non-equilibrium leads to an imbalance between the energy cascade flux and the dissipation, which directly disputes Kolmogorov's `four-fifth's law'. Furthermore, it is shown that the energy cascade flux behaves similarly in both equilibrium and non-equilibrium situations which tentatively explains why the energy spectra retains it's -5/3 power-law slope. Extending the matched asymptotic expansion analysis of Lundgren (2002 [Phys. Fluids, 14(2)]), the theoretical support for the -5/3 power-law spectra in the non-equilibrium situations is presented. It is also found that the functional form Kolmogorov-Obukhov spectra $E(k) = C_k ¥varepsilon^{2/3} k^{-5/3}$ may need to be modified by replacing the rate of dissipation with the energy cascade flux as had already been suggested by Kraichnan in 1974 [J. Fluid Mech, 62(2)]. The consequences for turbulence modelling and theories of particle self- and pair dispersion are discussed.

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