Title:
Transition to turbulence from spatially localised states

Abstract:
Turbulence is a flow state displaying spatio-temporal complexity. It is ubiquitous in nature, from a running tap to atmospheric currents and understanding how flows transition to turbulence has become a key question with societal and natural impact.

Transition to turbulence is best studied using simple flows such as plane Couette flow: a configuration in which a viscous three-dimensional fluid is confined between two parallel walls moving in opposite directions. The transition to turbulence here is subcritical: despite the fact that the laminar, unidirectional flow is stable, turbulence develops above a critical value of the Reynolds number (a measure of the differential speed of the walls). Recent research has realised the importance of spatial localisation in transition: the most dangerous initial perturbations of the laminar solution in large domain prove to be spatially localised.

In this PhD, we will study under which circumstances spatially localised solutions of plane Couette flow transition to turbulence. The candidate is expected to work on and develop further existing numerical codes in C++ or Fortran and run large simulation campaigns. In addition to the fundamental aspect of the project, applications to industrial and astro/geophysical problems will be considered depending on the progress.

The Department of Applied Mathematics at the University of Leeds provides a unique environment for multidisciplinary research, with the presence of internationally leading groups in Astrophysical and Geophysical Fluid Dynamics, and Nonlinear Dynamics. This PhD offers the unique opportunity to be at the forefront of the research progress in transition to turbulence while learning high level fluid dynamics and nonlinear dynamics.

Skills required:
fluid dynamics, dynamical systems, numerics, analytical skills.

Funding notes:
Fees and maintenance will be covered for the successful candidate.

Startdate:
September 2016 or as soon as possible after September 2016.

Contact:
Dr C. Beaume: c.m.l.beaume@leeds.ac.uk
Prof S. Tobias: s.m.tobias@leeds.ac.uk