Intermittent transport of nonlinear reduced models in tokomak plasmas turbulence

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Abstract/Résumé : Understanding the origin and nature of turbulent transport in tokomak plasmas is one of the major challenges of a successful magnetic confinement fusion. The aim of this work is to study instability associated with the ion-temperature gradient (ITG)-driven turbulence in the core of the plasma, which is the seat of fusion reactions. We used a low degree of freedom model composed of 18 ordinary differential equations. When the system is slightly above the stability threshold of the ITG mode, it is considered to be in the convection regime and convective heat transport of the system is time-independent, or oscillates periodically. As ITG is increased further, the system bifurcates to the turbulent regime. In a strongly turbulent regime, intermittent bursts (the so-called avalanches) are observed. This intermittency is a result of the competition among the following three factors: generation of sheared flows and suppression of ITG turbulence, gradual reduction of the sheared flows due to viscosity, and rapid regrowth of ITG modes due to reduction of sheared flows.

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