The dynamics of marginality and self-organized criticality as a paradigm for turbulent transport

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Abstract

A general paradigm, based on the concept of self-organized criticality (SOC), for turbulent transport in magnetically confined plasmas has been recently suggested as an explanation for some of the apparent discrepancies between most theoretical models of turbulent transport and experimental observations of the transport in magnetically confined plasmas. This model describes the dynamics of the transport without relying on the underlying local fluctuation mechanisms. Computations based on a cellular automata realization of such a model have found that noise driven SOC systems can maintain average profiles that are linearly stable (submarginal) and yet are able to sustain active transport dynamics. It is also found that the dominant scales in the transport dynamics in the absence of sheared flow are system scales rather than the underlying local fluctuation scales. The addition of sheared flow into the dynamics leads to a large reduction of the system-scale transport events and a commensurate increase in the fluctuation-scale transport events