Absolute versus convective instabilities in subcritical tokamak plasmas.

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In tokamak plasmas, sheared flows perpendicular to the driving temperature gradients can strongly stabilize linear modes. While the system is linearly stable, regimes with persistent nonlinear turbulence may develop, i.e. the system is *subcritical*. A perturbation with small but finite amplitude may be sufficient to push the plasma into a regime where nonlinear effects are dominant and thus allow sustained turbulence. The resulting excitation of the system spreads through the system and can progressively destabilise larger and larger regions of the device. Interestingly, for sufficiently large values of shear flow, the excition propagates only in one direction, and the turbulence is transient when viewed at a fixed spatial location. The system is thus only convectively unstable, and in a bounded physical tokamak, the plasma will eventually return to a quiscent state. This suggests a strong role for nonlocality in the system, and provides a mechanism for trigerring of the plasma edge by core turbulence, even if the edge region is locally quiescent. We numerically explore these issues using a standard tokamak testcase, the CYCLONE benchmark, by scanning the size of the background flow shear. The relationship between this phenomena is examined in light of propagating phenomena found in the edge of chaos, and the the avalanche-like bursts found in earlier work.