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**Dynamics and generation mechanisms of meso-scale structures in tokamak edge plasmas.**[1]

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In recent years, it became clear that intermittent convective-like transport associated with meso-scale coherent structures extended along the magnetic field lines is often dominant in the cross-field transport of tokamaks, stellarators, and linear devices. Such structures can propagate in a ballistic way toward the wall for the distance of tens of centimeters and can strongly enhance plasma energy and particle transport and plasma-wall interactions. The apparent examples of such meso-scale structures in the edge and the Scrape-off Layer (SOL) plasmas are Edge Localized Modes (ELMs) and blobs, and pellet clouds in the core of fusion devices. Significant amount of theoretical and computational work on the physics of coherent structures has been done to date. It was found that in many cases, an effective gravity (e.g. due to curvature effects in a tokamak) plays a very important role in the dynamics of the evolution of the structures. It turns out that reduced 2D models with different closures accounting for the parallel plasma dynamics give tractable and useful approach to understand the main features of meso-scale structures. In particular, the dynamics of the propagation of ELMs and blobs in the SOL plasma is understood rather well. However, while the origin of ELMs is widely assumed to be due to peeling-ballooning instabilities, the generation mechanism (-s) of blobs are still dim. Here we review the models of blobs developed so far and present new both analytic and modeling results describing the mechanisms of the blob generation triggered by sub-critical phenomena related to the ballooning drive.

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