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Blob Stability and Transport in the SOL Plasma*

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A growing body of experimental data suggests that non-diffusive transport of particles can play a major role in the SOL. This transport may be associated with the propagation of high density plasma filaments or "blobs" that have been observed in experiments with both fast cameras and probes. Previous theoretical work [1, 2] showed that these structures would propagate to the wall due to the curvature-drift-induced polarization and the associated **E**×**B** radial drift. A remarkable feature of the blob convection theory is that experimentally observed properties, such as transport coefficients increasing toward the wall, emerge naturally as a result of the relation between the radial (x) convective velocity and poloidal (y) blob scale size, $v_x \propto 1/y_b^2$. The theory is also qualitatively consistent with the experimental observations of spatial and temporal intermittency and non-Gaussian statistics in SOL transport.

The simple blob theory predicts that the radial particle flux depends on the blob size distribution. Recent work has addressed the related question of blob stability. 2D simulations using a reduced MHD model appropriate to the SOL indicate that the dominant instability for small blobs is the Kelvin-Helmholtz mode, while for large blobs it is the sheath-interchange mode; the competition between these instabilities determines the blob size and shape distribution. Blobs that are highly elongated in either x or y are unstable, leading to smaller blobs with scale length L determined by stability considerations. The simulations reproduce the theoretical scaling of the convective transport $v_x(y_b)$ in the limit of a small background density; blobs are observed to merge or bifurcate to reach the optimal scale with corresponding changes in v_x. A background density reduces the radial velocity and modifies the blob structure: the leading edge steepens and the electrostatic potential forms a dipole structure. 1D stability analyses allow a more detailed study of parameter space and put the simulations in context. Implications of this work for SOL transport estimates and data analysis will be discussed.

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