On the Structure of Blobs in Turbulent BOUT Simulations*

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Diagnostics on tokamak experiments[1] and 3D turbulence simulations[2,3] suggest that particle and perhaps energy transport in the scrape-off-layer (SOL) are dominated by filaments of enhanced density called *blobs*.[4,5] Understanding blob dynamics is an important goal in the context of edge and SOL confinement. Although blobs are born intermittently under conditions of strong turbulence near the separatrix, radial blob motion across the SOL is simple (ballistic) and may be amenable to reduced modeling that will, it is hoped, shed light on possible methods of controlling edge transport and improving confinement.

We explore the anatomy of blobs gleaned from a series of BOUT DIII-D simulations[3,6] conducted near the density limit and fueled by strong neutral particle injection, and we test the predictions of simple models of blob dynamics against our observations. We confirm the first law of blob dynamics:[4,5] that the blob's charge dipole, induced by the curvature drift, drives the blob radially outward via the ExB drift. However, the electrostatic potential at the midplane inferred from sheath boundary conditions[4,5] is much smaller than what is measured and cannot account for the surprisingly high radial blob velocity observed in these simulations. Accordingly we present evidence that the blobs are disconnected from the divertor sheath, which has important implications for blob dynamics.[7]

We observe a strong correlation between potential and electron temperature; the blobs consist of correlated dipole pairs of vorticity (charge), potential, temperature and parallel current closely associated with the density monopole, and it is likely that the temperature and current dipoles originate in disconnection.[7] Constraints imposed on blob theory by the 3D simulations will be discussed.

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