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Intermittent Convective Transport In DIII-D Edge Plasmas[1]

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Plasma density, temperature, potential and the inferred $E \times B_T$ radial transport measured with probes in the scrape-off-layer (SOL) of H- and L-mode plasmas in the DIII-D tokamak display intermittent bursts. These are caused by plasma structures featuring higher pressure than the surrounding plasma and are responsible for approximately 50% of the $E \times B_T$ radial transport in both L- and H-mode discharges. The intermittent transport is convective in nature and a potential source of enhanced radial transport over diffusion. In L-mode the radial transport is sufficient to produce flat far SOL profiles. In H-mode the particle content of the bursts and inferred particle transport is considerably smaller. The bursts appear at a rate of approximately $10^4 s^{-1}$ and conditional averaging reveals they are positively charged and polarized. The polarization results in poloidal fields of up to 4000 V/m which propel the structures radially with $E \times B_T / B^2$ velocities of approximately 2600 m/s near the last closed flux surface (LCFS) and approximately 330 m/s near the wall. The BES diagnostic shows similar features. The bursts move poloidally at speeds of up to 4500 m/s at the LCFS, slowing down towards the wall as they shrink in radial size from 2cm to 0.5 cm. The bursts possess an internal radial electric field, which is gradually lost as they leave the LCFS. The measured cross-field turbulent transport and intermittent bursts affect the plasma refueling and impurity generation from the wall thus, studying them is fundamental to understanding of the interaction of a plasma core with its walls. Simulations by BOUT, a nonlinear Braginskii code, featuring similar plasma structures and comparisons, are shown.

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