Fast imaging of edge localized mode structure and dynamics in DIII-D

J.H. Yu[1], J.A. Boedo[1], E.M. Hollmann[1], R.A. Moyer[1], D.L. Rudakov[1], and P.B. Snyder[2]

[1]*University of California at San Diego, La Jolla, California 92093, USA*

[2]*General Atomics, San Diego, California 92186, USA*

Abstract. Fast-framing images of CIII and D_α emission in the low-field-side plasma boundary of the DIII-D tokamak [J.L. Luxon, Nucl. Fusion **42**, 614 (2002)] show that edge localized modes (ELMs) rapidly eject multiple field-aligned filaments from the plasma edge. The toroidal and poloidal mode numbers of these filaments depend on normalized plasma density, with measured ELM toroidal mode numbers ranging from ≤10 to 20 in low density plasmas and 15 to 35 in high density plasmas. In high-density plasmas with moderate collisionality $\nu^*_{ped} = 0.50$, ELMs originate at the low-field-side midplane region and the ion parallel velocity in the scrape-off-layer is faster for ELMs with larger D_α divertor emission, suggesting that large ELMs eject higher temperature ions from deeper within the plasma compared to small ELMs. In low-density plasmas with collisionality $\nu^*_{ped} = 0.25$, the midplane and divertor ELM signals appear simultaneously, indicating that ELM behavior depends on collisionality. At all ν^*_{ped}, ELMs drive parallel fluxes to the divertor; in addition, ELMs drive cross-field propagation of filaments, which results in plasma-wall interactions that are poloidally localized within 15 cm of the midplane. Using the wall interactions as signatures of the filaments in the scrape-off-layer, the measured poloidal width of the filament ranges from 1 to 5 cm.