Numerical simulations of blobs with ion dynamics

The transport of particles and energy into the scrape-off layer (SOL) region at the outboard midplane of medium-sized tokamaks, operating in low confinement mode, is investigated by applying the first-principle HESEL (hot edge-sol-electrostatic) model. HESEL is a four-field drift-fluid model including finite electron and ion temperature effects, drift wave dynamics on closed field lines, and sheath dynamics on open field lines. Particles and energy are mainly transported by intermittent blobs. Therefore, blobs have a significant influence on the corresponding profiles. The formation of a 'shoulder' in the SOL density profile can be obtained by increasing the collisionality or connection length, thus decreasing the efficiency of the SOL's ability to remove plasma. As the ion pressure has a larger perpendicular but smaller parallel dissipation rate compared to the electron pressure, ion energy is transported far into the SOL. This implies that the ion temperature in the SOL exceeds the electron temperature by a factor of 2-4 and significantly broadens the power deposition profile.