# Modelling AUG scrape-off-layer plasma with full-$f$ continuum Electromagnetic Gyrokinetic simulation

**Rupak Mukherjee[1], Noah R Mandell[2,3], Manaure Francisquez[1], Tess N Bernard[4,5], Ammar H Hakim[1], Gregory W Hammett[1]**

[1]Princeton Plasma Physics Laboratory, Princeton, NJ, 08540, USA
[2]Department of Astrophysical Sciences, Princeton University, Princeton, NJ, 08543, USA
[3]MIT Plasma Science and Fusion Center, Cambridge, MA, 02139, USA
[4]General Atomics, PO Box 85608, San Diego, California, 92186, USA
[5]Institute for Fusion Studies, University of Texas at Austin, Austin, Texas, 78712, USA

Divertor heat load reduction is a key issue yet to be resolved for all next-generation tokamaks. However a thorough understanding of the behavior of plasma in the SOL, demands first-principle simulation. We employ Gkeyll computational framework, the first successful full-$f$ continuum electromagnetic gyrokinetic code on open field lines [1] to explore AUG-SOL turbulence. Earlier, Gkeyll has been efficiently employed to analyze the SOL turbulence in NSTX device. Here, we have carried out similar simulation for AUG-like parameters. The ion and electron density and temperature profiles in the outer-midplane region is reconstructed via our simulation and compared with the experimental measurements.

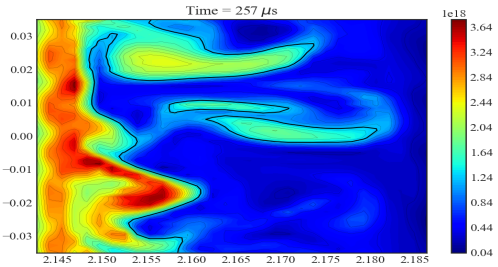


Figure 1: Gkeyll simulation for AUG-like parameters. Density filaments shear-off from the separatrix region and fill-out the SOL area.

The available experimental data from various radial measurements also show generation and propagation of ion-density filaments in the SOL region [2]. Our simulation captures such spontaneously generated density filaments as well. Additionally, we identify and track these coherent structures (Figure 1) within the simulation domain. The radial and poloidal velocity of these blobs, auto-correlation function, packing-fraction of the blobs are measured at a statistically steady-state region [3].

The radial density and temperature profiles appear close to the experimental measurements reported [2]. We measure the root-mean-square density, skewness and excess kurtosis of the fluctuations in the SOL region. We have also measured the spread of heat load onto the lower divertor.

# References

[1] NR Mandell, A Hakim, GW Hammett, and M Francisquez. Electromagnetic full-$f$ gyrokinetics in the tokamak edge with discontinuous galerkin methods. *Journal of Plasma Physics*, 86(1), 2020.

[2] D Carralero, S Artene, M Bernert, G Birkenmeier, M Faitsch, P Manz, P de Marne, U Stroth, M Wischmeier, E Wolfrum, et al. On the role of filaments in perpendicular heat transport at the scrape-off layer. *Nuclear Fusion*, 58(9):096015, 2018.

[3] Rupak Mukherjee, Noah R Mandell, Manaure Francisquez, Ammar H Hakim, and Gregory W Hammett. Electromagnetic full-f gyrokinetic simulation of asdex sol turbulence with discontinuous galerkin method. *Bulletin of the American Physical Society*, 2020.