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Edge gyro-kinetic transport simulations with a kinetic neutral model[1] X.Q. XU, Lawrence Livermore National Laboratory, EDGE SIMULATION LABORATORY TEAM — We report on the derivation of a kinetic neutral model for gyro- kinetic continuum codes. The dominant interactions for hydrogen atoms are charge-exchange with proton, ionization by electron impact and three-body-recombination of ion-electron pairs back to neutrals. Since a neutral dynamics is intrinsic 3D in velocity space, while gyro-kinetic ion dynamics are 2D after gyro-averaging. A proper formulation will be presented to ensure that the essential physics is kept and conservation properties are preserved. An efficient numerical mapping between ion velocity coordinates and neutral velocity coordinates will have to be developed. Assuming the charge-exchange with proton to be dominant process, a simplified neutral diffusion model can be derived. In this case, both neutrals and ions could use the same velocity coordinates and therefore no coordinate mapping is needed. The preliminary simulations with the neutral model will be reported for plasma transport and flow dynamics in single- null tokamak geometry, including the pedestal region that can extend across the separatrix into the scrape-off layer (SOL) and private flux region.

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