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Kinetic simulation of Macroscopic Physics in the Pedestal/Scrape-off region C.S. CHANG, S. KU, New York University, M. ADAMS, Columbia University, CPES* TEAM — Understanding and predicting the pedestal/scrape-off plasma behavior from first principles kinetic physics is one of the top priority issues for ITER. Previous studies modeled the edge plasma with fluid plasma models using phenomenological diffusion coefficients. The edge plasma distribution functions are likely to be non-Maxwellian with many important physics to be determined by the kinetic ion orbit dynamics. A self- consistent inclusion of the neutral particle dynamics is another essential element. We have obtained from the edge PIC code XGC-1, for the first time, comprehensive kinetic macroscopic solutions in the pedestal/scrape-off region, after averaging over the turbulent fluctuations. As indicated by many experiments, the simulation shows negative electrostatic potential in the H-mode layer where a strong plasma pedestal exists, and a positive potential in the scrape-off plasma. The simulation also shows formation of the co-current flow in the scrape-off layer. The flow in a steep pedestal shoulder region is always in the co-current direction, indicating a co-rotation source for the core plasma. The parallel flow in the vicinity of the separatrix appears sensitive to the neutral density. Another new physics found from XGC-1 is the existence of the global ExB convective flow pattern in the scrape-off region, which may have an important implication to the divertor design.
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