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The role of resonant field penetration in ELM suppression and density pump-out in the DIII-D tokamak[1] QIMING HU, RAFFI NAZIKIAN, BRIAN GRIERSON, NIKOLAS C. LOGAN, JONG-KYU PARK, Princeton Plasma Physics Laboratory, CARLOS PAZ-SOLDAN, General Atomics, QINGQUAN YU, Max-Plank-Institut fur Plasmaphysik — Recent nonlinear two-fluid MHD modeling using the TM1 code demonstrates quantitative agreement with ELM suppression and density pump-out by RMPs observed in DIII-D. We find that the formation of magnetic islands at the top and bottom of the pedestal can account for both ELM suppression and density pump-out observed in DIII-D. For low collisionality plasmas with n = 2 RMPs, simulations show that the penetration of RMP at the pedestal foot drives magnetic islands at low amplitude (dB/B = 2.E-5), which flattens the local density and lowers the density at the pedestal top. Comparisons with DIII-D experiments indicate that the formation of magnetic islands at the pedestal foot is the dominant contributor to density pump-out prior to ELM suppression. Stronger RMPs cause further density pump-out and, eventually, formation of magnetic islands at the top of pedestal that can suppress ELMs near the DIII-D experimentally observed threshold dB/B = 2.E-4. A scaling law is derived for the field penetration threshold at the pedestal top, which is consistent with DIII-D experiments. The predicted threshold for forming the necessary magnetic islands in ITER should be lower than present devices due to the much lower plasma flow velocity expected in the ITER pedestal.

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Qiming Hu
Princeton Plasma Physics Laboratory

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