Abstract Submitted
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The high poloidal beta path towards steady state tokamak fusion.[1] A.M. GAROFALO, (GA), X. GONG, (ASIPP), S. DING, (ORAU), D. ELDON, (GA), C. HOLCOMB, (LLNL), J. HUANG, (ASIPP), J. MCCLENAGHAN, (GA), J. QIAN, (ASIPP), H. WANG, (GA), L. WANG, (ASIPP), D. WEISBERG, (GA) — Results from coordinated research on DIII-D and EAST are illustrating the promise of high poloidal-beta (β_P) tokamaks for attractive fusion power reactors. By optimizing at low plasma current and high plasma pressure, high-β_P operation drastically reduces the disruptivity and potential disruption damage, the requirements on external current drive, the ELM size and ELM control challenge, and the difficulty of divertor detachment, while a high energy confinement time (despite the low plasma current) is achieved through Shafranov shift suppression of turbulence enhanced by core density gradients. Fully noninductive operation with a tungsten divertor has been demonstrated on EAST with normalized performance projected to achieve steady state operation with 500 MW of fusion power production in CFETR (Q=5). In DIII-D experiments, high confinement, internal transport barrier operation that projects nearly to Q=10 in ITER at 9 MA has been demonstrated with a fully detached divertor. A synergy between the H-mode pedestal and ITB is found that maintains high global performance as the edge conditions are modified for divertor detachment and heat flux control. Self-consistent simulations predict that, using day-one heating and current drive capabilities, the high-β_P scenario in ITER could achieve either mission goals: inductive Q=10 performance or steady-state Q=5 performance.

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