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Gyrokinetic simulations of turbulence and transport in the SPARC tokamak N.T. HOWARD, P. RODRIGUEZ-FERNANDEZ, Massachusetts Institute of Technology MIT, C. HOLLAND, University of California - San Diego, M. GREENWALD, J.W. HUGHES, Massachusetts Institute of Technology MIT, SPARC TEAM — Gyrokinetic simulations have been used to understand the turbulence and transport in the core of the SPARC tokamak. Building off of ongoing predictive TRANSP (1.5D) modeling that utilizes physics-based models (TGLF) to predict SPARC performance, we have performed linear and nonlinear gyrokinetic simulation across the SPARC profile using the CGYRO code. Simulations were performed with high physics fidelity: 6 gyrokinetic species, E&M turbulence, Sugma collisions, realistic geometry, etc. Single-scale simulations were used to probe the turbulence at both ion (ky*rho_s <1.0) and electron-scales (ky*rho_s >1.0) to understand the origin of heat and bulk particle transport and to estimate the steady state impurity profiles expected in the SPARC baseline condition. The results of this analysis indicate that near marginal ITG turbulence and extremely stiff transport is expected in the core of SPARC. Ion-scale turbulence will likely play a dominant role with only small contributions from intermediate and high-k turbulence over most of the plasma profile, opening the possibility for tractable gyrokinetic profile prediction. High fidelity gyrokinetic simulation results will be discussed in detail and compared directly with reduced models to quantify differences in profile predictions and thus performance. Research supported by Commonwealth Fusion Systems.

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