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**High-fidelity Whole Device Model of Magnetically Confined Fusion Plasma**[1] AMITAVA BHATTACHARJEE, PPPL, ECP WDMAPP TEAM — The Whole Device Model Application (WDMApp) in the DOE Exascale Computing Project (ECP) is developing a high-fidelity model of magnetically confined fusion plasmas, urgently needed to plan experiments on ITER and optimize the design of next-step fusion facilities. These devices will operate in high-fusion-gain physics regimes not achieved by any experiment, making predictive numerical simulation the best tool for the task. WDMApp is focused on building the main driver and coupling framework for a WDM. The main driver is based on the coupling of two advanced and highly scalable gyrokinetic codes, XGC and GENE, where the former is a particle-in-cell code optimized for the treating the edge plasma while the other is a continuum code optimized for the core. WDMApp aims to take advantage of the complementary nature of these two applications to build the most advanced and efficient whole device kinetic transport kernel for the WDM. A major part of the technical development work is targeting the coupling framework, which will be further developed for exascale and optimized for coupling most of the physics modules that will operate at various space and time scales. The current MPI+X is to be enhanced with communication-avoiding methods, task-based parallelism, in situ analysis with resources for load optimization workflows, and deep memory hierarchy-aware algorithms. The status of the project and recent results will be presented as the ECP enters its CD-2 phase.

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