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Title: Computational advances in large-scale gyrokinetic particle-in-cell simulations of tokamak fusion devices

Name: Ethier, Stephane

Affiliation: Princeton Plasma Physics Laboratory

The beginning of the last decade has seen the rapid development of several so-called ?gyrokinetic? codes, which have been successfully employed for simulating the complex, non-linear physics of turbulent transport in magnetic confinement fusion devices. Turbulent fluctuations in the hot plasma core of tokamaks are associated with significant transport of heat, momentum, and particles across the confining magnetic field. Understanding and possibly controlling the balance between these energy losses and the self-heating rates of the actual fusion reaction is key to achieving the efficiency needed to ensure the practicality of future fusion power plants. The particle-in-cell (PIC) method used in several of the existing gyrokinetic codes has been very successful in scaling to the largest computing systems and in keeping pace with their rapid evolution. This presentation will describe the computational development and progress of the global gyrokinetic PIC codes developed at the Princeton Plasma Physics Laboratory, and the collaborative research being done to address the challenges of the upcoming exascale architecture.