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Plans for kinetic particle-based predictive transport modeling of whole-volume tokamak plasma C.S. CHANG, G. PARK, S. KU, H. STRAUSS, NYU, L. SUGIYAMA, MIT, G. BATEMAN, A. KRITZ, Lehigh U., D. STOTLER, PPPL, J. CUMMINGS, Caltech, S. PARKER, U. Colorado, S. KLASKY, ORNL, CPES TEAM — Predictive transport modeling codes, such as PTRANSP, are based upon reduced transport equations, and require ad-hoc closures for most of the critical equilibrium physics phenomena (finite banana width effect, ExB shearing rate profile, orbit loss, MHD- effect, rf-driven transport, impurity transport, alpha particle transport, etc). SciDAC proto-FSP CPES is developing a kinetic particle-based transport modeling code XGC0, which utilizes the modern parallel computing environment (∼1,000 processors) and which can evaluate these equilibrium kinetic physics phenomena at first principles level. The basic dynamics of ion, electron and impurity particles obey the Lagrangian guiding-center equation of motion in the self-consistent equilibrium electric field. The modeling region is the whole volume, from the magnetic axis to the material wall. The physics capability includes or will include radial anomalous transport coefficients, Ohmic heating, various auxiliary heatings, neutral kinetic transport with wall-recycling, impurity transport, MHD instabilities (in code integration), fusion reaction, and alpha particles.

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