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A Delta-f to Full-F PIC Simulation Scheme for Tokamak Plasmas[1]

W.W. LEE, S. ETHIER, Princeton Plasma Physics Laboratory — A generalized weight-based particle simulation schemes suitable for simulating microturbulence in magnetic fusion plasmas, where the zeroth-order inhomogeneity is important, has recently been developed [1]. The schemes is a generalization of the perturbative simulation schemes developed earlier for PIC simulations [2]. The new two-weight scheme, which can simulate both the perturbed distribution and the full distribution within the same code, has now been implemented to simulate tokamak plasmas using the GTC code [3]. Its development is based on the concept of multiscale expansion, which separates the scale lengths of the background inhomogeneity from those associated with the perturbed distributions. The code starts out as a delta-f code and gradually evolves into a full-F code, as such the delta-f part can help us with the noise issue in the linear stage and the full-F part can be useful in the fully nonlinear stage when the particle weights become too large or it becomes necessary to simulate realistic situations where sinks and sources become important.

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W. W. Lee
Princeton Plasma Physics Laboratory

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