A finite volume Fokker-Planck collision operator in constants-of-motion coordinates[1] Z. XIONG, X. Q. XU, B. I. COHEN, R. COHEN, M. R. DORR, J. A. HITTINGER, G. KERBEL, W. M. NEVINS, T. ROGNLIEN, LLNL — TEMPEST is a 5D gyrokinetic continuum code for edge plasmas. Constants of motion, namely, the total energy E and the magnetic moment μ, are chosen as coordinate s because of their advantage in minimizing numerical diffusion in advection operato rs. Most existing collision operators are written in other coordinates; using them by interpolating is shown to be less satisfactory in maintaining overall numerical accuracy and conservation. Here we develop a Fokker-Planck collision operator directly in (E, μ) space usin g a finite volume approach. The (E, μ) grid is Cartesian, and the turning point boundary represents a straight line cutting through the grid that separates the ph ysical and non-physical zones. The resulting cut-cells are treated by a cell-mergin g technique to ensure a complete particle conservation. A two dimensional fourth or der reconstruction scheme is devised to achieve good numerical accuracy with modest number of grid points. The new collision operator will be benchmarked by numerical examples.

Z. Xiong
Lawrence Livermore National Laboratory

Date submitted: 13 Jan 2006   Electronic form version 1.4