Abstract Submitted
for the APR12 Meeting of
The American Physical Society

Fast Non-Fourier Methods for Landau-Fluid Operators[1] A.M. DIMITS, I. JOSEPH, M.V. UMANSKY, LLNL — Landau-fluid (including gyro-Landau-fluid) equations use closure terms that involve nonlocal operators. When the background plasma has significant inhomogeneities, or sometimes because of particular code design or boundary conditions, it is desirable to compute the closure terms in configuration space. The nonlocality of Landau-fluid operators makes the naïve direct computation of the closure terms in configuration space via convolution or matrix multiplication expensive. We have developed a fast non-Fourier method for the computation of Landau-fluid closure terms based on an accurate and tunable approximation that can be numerically implemented through the solution of matrix equations in which the matrices are tridiagonal or narrowly banded. The accuracy and fast computational scaling of the method are demonstrated. The accuracy is quantified, both semi-analytically for the operator itself and for the resulting plasma response function, as well as for the results of the numerical implementation of the method. A spectral colocation analysis has been developed that greatly aids in the optimization of the approximations for accuracy and computational cost, both for cases that are collisionless and for cases where collisional and collisionless damping processes compete.

[1]Work performed for US DOE by LLNL under Contract DE-AC52-07NA27344 and LLNL LDRD project 12-ERD-022.

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Date submitted: 10 Jan 2012 Electronic form version 1.4