

# Electrostatic Solves for Plasma Physics Using PETSc-PIC

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## **Abstract**

We present a PETSc based particle-in-cell (PIC) method for studying electrostatic plasmas. The PETSc-PIC algorithm is a highly scalable method, with multigrid capabilities, for solving the Vlasov-Poisson equations. In the PETSc-PIC algorithm, the Vlasov equation is solved using a particle representation while a continuum representation is employed for the Poisson solve. We implement our PETSc-PIC method on standard plasma physics test cases, such as Landau Damping. These standard tests in plasma physics provide a baseline to show the effectiveness and correctness of our methodology. Furthermore, we discuss the implementation of PETSc-PIC for Galactic Formation and Ultra-Cold Neutral Plasma applications.