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Solving Problems in Plasmas by Using Hamiltonian Splitting

Many problems from plasmas have very rich conservative properties. The important and interesting characteristics of these problems are the long-term behavior and multi-scale structures. Classical numerical methods usually cannot provide the long-term stable numerical results because of lacking the ability of preserving the conservative properties inherited by systems.

In this talk, we mainly focus on solving the Vlasov–Maxwell equations which can be written as a Hamiltonian system with the corresponding Poisson bracket. Based on the Poisson structure, the Poisson-preserving numerical methods are established by decomposing the system as several solvable subsystems, and taking the composition of solutions of subsystems. In the implementation of numerical methods, the combination of the finite volume and Fourier methods is used for the spatial discretization of the system. The problems of Landau damping, Weibel instability, Bernstein wave, and evolution of the laser are simulated by the resulting numerical discretizations.

Yajuan Sun is a Professor at the Academy of Mathematics and Systems Science. Her research focuses on construction, analysis, and application of geometric numerical methods for ODE and PDE problems. She received her Ph.D. in 2001 from the Academy of Mathematics and Systems Science. She has spent one year and three months at the La Trobe University as a postdoctoral researcher from 2014–2015.