

Coulomb collisions in kinetic models: From infinite-dimensional metriplectic dynamics to finite dimensions and structure-preserving numerics

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In this talk, we first briefly review the basic ideas of so-called metriplectic dynamics and then discuss two widely used kinetic models that display such structure. These models are the regular Vlasov-Maxwell-Landau system and the electrostatic gyrokinetic Vlasov-Poisson-Landau system. After introducing the mathematical formulations, we discuss particle-based discretizations of the collisional contributions in these systems, namely the metric part. Finally, we show that, using the so-called discrete gradient approach, it is possible to obtain structure-preserving discretizations for the collisional contributions that satisfy the first and second laws of thermodynamics algebraically.

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