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Continuum kinetic plasma modeling by the Vlasov-Maxwell system in multiple dimensions[1] NOAH REDDELL, URI SHUMLAK, Aerospace & Energetics Research Program, University of Washington — A kinetic plasma model for multiple particle species described by the Vlasov equation and coupled to fully dynamic electromagnetic forces is presented. The model is implemented as evolving continuous PDFs (probability density functions) in particle phase space (position-velocity) as opposed to particle-in-cell (PIC) methods which discretely sample the PDF. The hyperbolic model is evolved using a high-order finite element method (discontinuous Galerkin), with excellent conservation of system mass, momentum, and energy – an advantage compared to PIC. Simulations of two- to six-dimensional phase space while resolving the plasma frequency and cyclotron frequency are computationally expensive. To maximize performance and scaling to large simulations, a new framework, WARPM, has been developed for many-core (e.g. GPU) computing architectures. WARPM supports both multi-fluid and continuum kinetic plasma models as coupled hyperbolic systems with nearest neighbor predictable communication. Simulation results are compared to existing benchmark problems and newly achievable studies of wave-particle interactions are presented.

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