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Advanced kinetic plasma model implementation for new large-scale investigations NOAH REDDELL, URI SHUMLAK, Aerospace & Energetics Research Program, University of Washington — A kinetic plasma model for of one or more particle species described by the Vlasov equation and coupled to fully dynamic electromagnetic forces is presented. The model is implemented as evolving continuous PDF (probability density function) in particle phase space (position-velocity) as opposed to particle-in-cell (PIC) methods which discretely sample the PDF. A new boundary condition for the truncated velocity-space edge, motivated by physical properties of the PDF tail, is introduced. The hyperbolic model is evolved using the discontinuous Galerkin numerical method, conserving system mass, momentum, and energy – an advantage compared to PIC. Simulations of two- to six-dimensional phase space 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. Exemplary physics results and computational performance are presented.

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