A Novel Approach to Solving the Vlasov-Fokker-Planck Equations through Particle-In-Cell Hybridization PAUL CUMMINGS, ALEC THOMAS, University of Michigan — A new computational method for modeling ultra-fast, ultra-intense laser-solid and laser-plasma interactions is proposed. The method consists of a hybridization of the particle-in-cell technique and a direct solution to the collisional Vlasov equation with the Krook operator, wherein the Vlasov equation is expanded in velocity space using Cartesian tensors, and the higher-order terms serve as a source of particles and "holes" to be tracked by PIC methods. The mathematics underlying the solution method for a simple implementation are presented and analyzed; this implementation features one spatial dimension and truncates the expansion to first-order. A computational scheme for this implementation of the solution method is presented. More advanced implementations of the solution method, including retaining second- order expansion terms and replacing the Krook model with the Fokker-Planck model, are discussed.

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