Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

A class of generalized Kapchinskij-Vladimirskij solutions and associated envelope equations for high-intensity charged particle beams[1]
HONG QIN, Plasma Physics Laboratory, Princeton University and University of Science and Technology of China, RONALD C. DAVIDSON, Plasma Physics Laboratory, Princeton University — A class of generalized Kapchinskij-Vladimirskij (KV) solutions of the nonlinear Vlasov Maxwell equations and the associated envelope equations for high-intensity beams in a periodic lattice has been derived. It includes the classical Kapchinskij-Vladimirskij solution as a special case. In the classical KV solution, for a given focusing lattice waveform and a specified line density of the beam, the distribution function and associated envelope equations are specified by two free parameters, i.e., the transverse emittances in two transverse directions. In the generalized solutions described here, the distribution function and associated envelope equations are specified by eight free parameters, i.e., two transverse emittances and two 2x2 symmetric and positive definite matrices. The new class of solutions captures a wider range of dynamical envelope behavior for high-intensity beams, and thus provides a new theoretical tool to investigate the dynamics of high-intensity beams.

[1]This research was supported by the U.S. Department of Energy.

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Date submitted: 11 Jul 2012 Electronic form version 1.4