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Dissipative property of the Vlasov-Maxwell-Boltzmann System with a uniform ionic background

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In this paper we discuss the dissipative property of near-equilibrium classical solutions to the Cauchy problem of the Vlasov-Maxwell-Boltzmann System in the whole space $\R^3$ when the positive charged ion flow provides a spatially uniform background. The most key point of studying this coupled degenerately dissipative system here is to establish the dissipation of the electromagnetic field which turns out to be of the regularity-loss type. Precisely, for the linearized non-homogeneous system, some L^2 energy functionals and L^2 time-frequency functionals which are equivalent with the naturally existing ones are designed to capture the optimal dissipation rate of the system, which in turn yields the optimal L^p-L^q type time-decay estimates of the corresponding linearized solution operator. These results show a special feature of the one-species Vlasov-Maxwell-Boltzmann system different from the case of two-species, that is, the dissipation of the magnetic field in one-species is strictly weaker than the one in two-species. As a by-product, the global existence of solutions to the nonlinear Cauchy problem is also proved by constructing some similar energy functionals but the time-decay rates of the obtained solution still remain open.

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