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Landau damping

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The classical theory of Landau damping rests on linearization near a spatially homogeneous equilibrium distribution, but it was noted by Backus half a century ago that the use of linearization to predict the long-time behavior of the Vlasov-Poisson equation seems inconsistent. Together with Clement Mouhot, we solve this problem, showing that Landau damping does occur for the nonlinear Vlasov-Poisson equation starting very close to equilibrium, even beyond the linearization time scale. A key ingredient is that the delay associated with self-induced nonlinear echoes has a stabilizing effect; we also point out the analogy with K-A-M theory and the driving role of smoothness.