Long time behavior of solutions of Vlasov-like equations and related statistical theories.

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Abstract:

Vlasov-like equations (VLE) are self consistent 1-degree of fredoom (or d-degrees of freedom) Hamiltonian systems, like Vlasov Poisson Equation (VPE); 2D Euler; and the Hamiltonian mean field model (HMF).

In these lectures I'll make a short review of known rigorous results about asymptotic behavior of solutions of Vlasov-like equations: stationary stable solutions, BGK waves for VPE and rotating solutions for 2D Euler; Landau Damping.
In particular I will give a proof of Landau Damping in a simple case.

Also I'll discuss some conjectures on the long time behavior of VLE.

Then I will consider some of the statistical theories that has been developed in order to characterize special class of stationary solutions of VLE.
These theories generally leads to interesting non linear variational principle and PDEs.
In the lectures I will consider in particular the case of the mean-field equations related to Onsager theory of vortices.