1068-35-110 **Zhiwu Lin*** (zlin@math.gatech.edu), School of Mathematics, 646 Cherry St., Georgia Tech, Atlanta, GA 30332. *Nonlinear Landau damping and inviscid damping.*

Consider electrostatic plasmas described by 1D Vlasov-Poisson with a fixed ion background. In 1946, Landau discovered the linear decay of electric field near a stable homogeneous state. The nonlinear Landau damping was recently proved for analytic perturbations by Villani and Mouhot. But for general perturbations it is still largely open. With Chongchun Zeng at Georgia Tech, we construct nontrivial traveling waves (BGK waves) with any spatial period which are arbitrarily near any homogeneous state in H^s $\left(s < \frac{3}{2}\right)$ Sobolev norm of the distribution function. Therefore, the nonlinear Landau damping is NOT true in H^s $\left(s < \frac{3}{2}\right)$ spaces. We also showed that in small H^s $\left(s > \frac{3}{2}\right)$ neighborhoods of linearly stable homogeneous states, there exist no nontrivial invariant structures. This suggests that the long time dynamics near stable homogeneous states in H^s $\left(s > \frac{3}{2}\right)$ spaces might be much simpler and the nonlinear damping might be hoped for. We also obtained similar results for the problem of nonlinear inviscid damping of Couette flow, for which the linear decay was first observed by Orr in 1907. (Received January 15, 2011)