OPTIMAL LARGE-TIME DECAY RATES FOR COLLISIONAL KINETIC EQUATIONS IN THE WHOLE SPACE

ABSTRACT OF ROBERT STRAIN

Abstract. In this talk we explain several recent results surrounding the problem of determining the large time behavior of the Boltzmann equation and several related physical kinetic models on the full space ($\mathbb{R}^3_x$).

Specifically, in collaboration with R. J. Duan (ARMA 2011, and CPAM *in press*), we introduce new methods which involve a combination of Fourier analytic techniques (in the spirit of Kawashima's work) and the derivation of suitable systems of reduced kinetic equations. These methods enable us to prove the optimal large time decay rates to Maxwellian for several physical models such as the one species Vlasov-Poisson-Boltzmann system and the two-species Vlasov-Maxwell-Boltzmann system. Generalizations to other systems can be expected.

Furthemore, since the work of Ukai-Asano in 1982 for cut-off moderately soft potentials, it has been a longstanding open problem to determine the optimal large time decay rates for the soft potential Boltzmann equation in the whole space, with or without the angular cut-off assumption. For perturbative initial data, we prove that solutions converge to the global Maxwellian with the optimal large-time decay rate of $O(t^{-\frac{n}{2}+\frac{n}{2r}})$ in the $L^2_v(L^r_x)$-norm for any $2 \leq r \leq \infty$ in n-dimensions. The proof of existence of global in time unique classical solutions to this system was a joint work with P. Gressman (PNAS 2010, JAMS 2011, and Adv. Math 2011).