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# Kinetic Mini-Course

## A brief on renormalized solution to the Boltzmann equation

by

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### **Abstract :**

The large-data Cauchy problem for Boltzmann equation is one of the significant topics in mathematical study of kinetic models. In this mini course, we shall give an introduction to the celebrated work published in 1989 due to R.J. DiPerna and P.L. Lions, which presented the first general global existence theorem for Boltzmann equations with general collision kernels. Since the physically natural a priori estimates are not strong enough to allow to define the Boltzmann collision operators in a meaningful way, the famous renormalized solution and the corresponding renormalized operator, which is locally integrable, were introduced to overcome this difficulty. We shall give the specific definition of renormalized solutions and sketch the proofs of its existence. It will also include crucial details involving weak compactness criterion and velocity averaging lemmas for  $L^1$  space, which lead to the "stability under weak convergence" result. Although this construction of global weak solutions admits various applications in nonlinear PDE, we confine ourselves here merely for the pure Boltzmann case.

Date :	September 8, 15 and 22, 2022 (Thursday)
Time :	10:00am – 12:00noon (Hong Kong SAR)
Venue:	Room 222, Lady Shaw Building

*All are Welcome*