

Department of Mathematics
City University of Hong Kong

Special Colloquium

Organised by Prof. Tong YANG and Prof. Tao LUO

A Fast Spectral Method for the Boltzmann Collision Operator with General Collision Kernels

by

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Abstract :

We propose a simple fast spectral method for the Boltzmann collision operator with general collision kernels. In contrast to the direct spectral method (Pareschi and Russo 00, Gamba and Tharkabhushanam 09) which requires $\mathcal{O}(N^6)$ memory to store precomputed weights and has $\mathcal{O}(N^6)$ numerical complexity, the new method has complexity $\mathcal{O}(MN^4 \log N)$, where N is the number of discretization points in each of the three velocity dimensions and M is the total number of discretization points on the sphere and $M \ll N^2$. Furthermore, it requires no precomputation for the variable hard sphere (VHS) model and only $\mathcal{O}(MN^4)$ memory to store precomputed functions for more general collision kernels. Although a faster spectral method is available (Mouhot and Pareschi 06) (with complexity $\mathcal{O}(MN^3 \log N)$), it works only for hard sphere molecules, thus limiting its use for practical problems. Our new method, on the other hand, can apply to arbitrary collision kernels. A series of numerical tests is performed to illustrate the efficiency and accuracy of the proposed method. Joint work with I. Gamba, J. Haack and C. Hauck.

Date: 15th June, 2017 (Thursday)
Time: 4:30 – 5:30pm
Venue: B5-211, Blue Zone, Floor 5, Academic Building 1
City University of Hong Kong

**** All interested are welcome ****
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