THE UNIVERSITY  OF HONG KONG

*Institute of Mathematical Research*
*Department of Mathematics*

# COLLOQUIUM

# On the relativistic Boltzmann equation with long range interactions


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**Abstract**

In this Colloquium talk I will discuss three recent related results regarding the special relativistic Boltzmann equation without angular cutoff. In the non-relativistic situation without angular cutoff, the change of variables from $v \to v'$ is a crux of the widely used "cancellation lemma". In a first result, in collaboration with James Chapman and Jin Woo Jang, in the special relativistic situation we calculate this very complex ten variable Jacobian determinant and illustrate some numerical results which show that it has a large number of distinct points where it is machine zero. In a second result, in collaboration with Jang, we prove the sharp pointwise asymptotics for the frequency multiplier of the linearized relativistic Boltzmann collision operator that has not been previously established. As a consequence of these calculations, we further explain why the well known change of variables $p \to p'$ is not well defined in the special relativistic context. The third result, also in collaboration with Jang, I will explain our recent proof of global-in-time existence, uniqueness and asymptotic stability for solutions nearby the relativistic Maxwellian to the special relativistic Boltzmann equation without any angular cutoff. We work in the case of a spatially periodic box. We assume the generic hard-interaction and soft-interaction conditions on the collision kernel that were derived by Dudyński and Ekiel-Jeżewska (in 1985). In this physical situation, the angular function in the collision kernel is not locally integrable, and the collision operator behaves like a fractional diffusion operator. This is the first global existence and stability result for relativistic Boltzmann equation without angular cutoff.


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| Date: | April 7, 2021 (Wednesday) |
| Time: | 10:00 – 11:00am (Hong Kong Time) |
| Venue: | ZOOM: https://hku.zoom.us/j/<br>Meeting ID: 926 5000 3662<br>Password: 592257 |

*All are welcome*