Title: Help me Solve Boltzmann Equation Numerically!

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Abstract: Ability to solve the Boltzmann equation is critical to advances in physics, chemistry and engineering and
underpins the development of many new technologies including microelectromechanical devices, hypersonic flight,
plasma and ion thrusters, and optics. Descriptive power of the Boltzmann equation comes from the fact that it
is a microscopic model. At the microscopic level, interactions between individual agents can be described simply using known
laws of physics. The Boltzmann equation provides a mechanism to combine these interactions to obtain insight on the behavior
of the systems at the macroscopic scale. The disadvantage of the approach is that, being a kinetic model, the Boltzmann equation
is high dimensional and involves a multiple-fold integral term that accounts for interactions of all agents. Because of the high
costs to evaluate the integral term, the Boltzmann equation is very difficult to solve. Efforts usually involve powerful computers and
only recently solutions of simple three dimensional problems have been achieved. However, significantly more research and new
ideas are required to make the Boltzmann equation tractable for realistic scenarios.

In this talk we will consider new approaches to solve the Boltzmann equation including the development of discontinuous
Galerkin discretizations in the velocity variable on octrees. We will formulate mathematical challenges that are associated
with this approach and that may be of interest to an analyst, FEM or numerical linear algebra scientist. We
will also consider alternative approaches to computing approximations to the Boltzmann equation and discuss theoretical
challenges that may be of interest to a probabilist or a statistitian.

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