

# Unified Gas-Kinetic Schemes

Seminar, Project or Thesis

## Project description

The so-called unified gas-kinetic schemes (UGKS) have been a successful discretization technique for the Boltzmann equation of gas dynamics, and its fluid-dynamic limits, especially the Navier-Stokes equations. Recently, the methodology has been applied to radiation transport by Mieussens. The paper also contains a careful analysis. Especially, the scheme was shown to be asymptotic-preserving, i.e. it becomes a consistent and stable approximation in the diffusive limit. The description and the numerical results so far exist only in one dimension.

## Possible tasks

- Study the literature on UGKS schemes, as well as asymptotic-preserving schemes. Focus on the application to radiation transport
- Confirm the 1D results from the paper by Mieussens
- Extend the scheme to 2D or 3D
- Possibly implement parallelization strategies (OpenMP, MPI, GPU, Xeon Phi)

## Literature

- L. Mieussens, *On the Asymptotic Preserving property of the Unified Gas Kinetic Scheme for the diffusion limit of linear kinetic models*, J. Comput. Phys. 253 (2013) 138-156.

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