Simulate the thermal Navier Stokes equations with a single particle distribution ?*

François Dubois[ab], Pierre Lallemand[c]

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[a] Laboratoire de Mathématiques d'Orsay, Bât. 307, F-91405 Orsay, France.
[b] Conservatoire National des Arts et Métiers, LMSSC laboratory, F-75003 Paris, France.
[c] Beijing Computational Science Research Center, Haidian District, Beijing 100094, China.

In a previous contribution [2], we have observed the difficulties to simulate the thermal Navier Stokes equations with two particle distributions : one for mass and momentum, a second distribution for total energy. In particular, the heat transfer due to viscous dissipation is *a priori* impossible to simulate when we follow the initial framework of multiple relaxation schemes [3] of the lattice Boltzmann method [4].
With an extension of the Taylor expansion method [1] that will be detailed during the conference, we are able to write in a direct and straightforward way the equivalent partial differential equations of any nonlinear lattice Boltzmann scheme. In particular conservation laws including conservation of mass, momentum and energy, with a single particle distribution, as in [5, 6].
During the conference, we will present our results for various lattice Boltzmann schemes and in particular the algebraic difficulties to recover the thermal Navier Stokes equations and in particular the viscous work.

References

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