Abstract Submitted
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The Lattice Boltzmann Method for quantum fluids and the fourth order Hermite polynomial expansion[1] MAURO DORIA, RODRIGO COELHO, Univ Fed Rio de Janeiro Brazil, ANDERSON ILHA, RODRIGO MIRANDA PEREIRA, VALTER Y. AIBE, Inmetro Brazil — One of the greatest achievements of the Boltzmann equation is to determine the macroscopic hydrodynamical equations (MHE) of a fluid from a phase space distribution function. Nearly eighty years have passed since E. A. Uehling and G. E. Uhlenbeck solved the Bolztmann equation for the quantum fluid and derived their MHE through the so-called Chapman-Enskog analysis, from where they obtained the viscosity and the thermal conductivity coefficients of the quantum fluid. In the late eighties a numerical method was formulated to solve the Boltzmann equation for the classical fluid with the Bhatnagar-Gross-Krook collision term, the lattice Boltzmann method (LBM), that became widely known because of its numerical advantages. Many years after H. Grad devised another method to solve the Boltzmann equation based on an expansion of the distribution function in terms of Hermite polynomials. Here we show that this Hermite polynomial expansion must be carried to fourth order in order to obtain the MHE of the quantum fluid such that its viscosity and thermal coefficients are those obtained from the Uehling-Uhlenbeck approach. Hence we show how an LBM for the quantum fluid must be constructed and numerically solved.

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