

# Particles from viscous hydrodynamics - with GPUs

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An open question in heavy-ion theory is to calculate the momentum distribution of particles in viscous fluids. This is necessary because hydrodynamic simulations of heavy-ion collisions only provide the evolution of hydrodynamic fields, whereas experiments measure particle momenta. A self-consistent solution to this problem can be formulated within linearized relativistic kinetic theory [1] (at least as long as the fluid can be approximated as a weakly interacting gas of particles). In this approach the momentum distributions are given by a set of linear integral equations that can be solved variationally. The most time-consuming part of the computation involves  $O(10^5)$  four-dimensional integrals, essentially moments of products of relativistic thermal distributions. On CPUs, these can be readily handled by adaptive quadrature routines, such as those in the GNU Scientific Library. I will discuss our experience with moving this task to GPUs, specifically an OpenCL implementation on AMD Radeons at the Wigner GPU Laboratory.

[1] D. Molnar & Z. Wolff, Phys. Rev. C95, 024903 (2017) [arXiv:1404.7850 [nucl-th]]