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Hydrodynamics from local phase space dominance

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The apparent onset of hydrodynamics in small systems necessitates a description of hydrodynamics independent of the many-particle limit, and the proper treatment of fluctuations in conditions of near-local equilibrium. We propose an algorithm for the dynamic description of such a few-particle fluctuating fluid. The procedure consists of defining a spacetime lattice in which each cell, containing momentum and energy at a given instant of time, undergoes a production of particles in the regime of phase-space dominance in its respective rest frame followed by an energy-momentum exchange via these particles with neighboring cells. The number of particles (massless quarks and gluons) is generated by a Poisson distribution and Lorentz-invariant phase space weights are calculated by the routine RAMBO (R. Kleiss, W.J. Stirling and S.D. Ellis), a new Monte Carlo treatment that generates random four-momentum for particles in collision events. Performing a new transformation on the energy and momentum quantities to the initial fluid frame, there's a redistribution of values between cells, as after a time step, the particle will be in the neighboring cell (adjacent to the production cell). The process is then carried out for all cells (using the energy from the previous time-step), thus obtaining the total flow of momentum in space. The results obtained are then compared with hydrodynamics, with coarse-grained parameters (flow and energy density) obtained event-by-event.

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