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Longitudinal dynamics of multiple conserved charges

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It is the aim of the RHIC BES program and the future FAIR and NICA facilities to produce compressed baryonic matter. In such experiments, strong gradients in baryon density are expected, and therefore the diffusion of baryon number could play a major role in the description of the fireball. The constituents of the produced matter carry a multitude of conserved charges, namely the baryon number, strangeness and electric charge, so that the diffusion currents of conserved charge couple with each other. Therefore, baryon density gradients in the above-mentioned high-density collision experiments will generate equalizing currents in all conserved charges. In common fluid dynamic studies of the evolution of the fireball, this coupling of currents was not accounted for. We provide for the first time a fluid dynamical approach including the complete diffusion coefficient matrix describing the evolution of a dense system with multiple conserved charges. A novel phenomenon arising from the coupled diffusion currents is the generation of positive and negative net-strangeness domains from originally net-strangeness neutral matter. We show how these domains are generated dynamically, and argue that observing the rapidity dependence of net-strangeness can give an experimental access to diffusion.

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