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Net-proton number fluctuations in partial chemical equilibrium

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We calculate the first four cumulants of the net-proton number distribution in partial chemical equilibrium (PCE). Such results serve as a necessary baseline for the identification of any critical phenomena in the collision energy dependence of the cumulants. The PCE scenario is relevant for scenarios of the nuclear collisions where chemical freeze-out coincides with hadronisation, but the fireball cools down further until kinetic freeze-out is reached. As a consequence, each stable hadronic species acquires its own chemical potential which depends on the temperature. Since proton number is not a conserved quantity, it may additionally fluctuate due to random nature of the resonance decays. We calculate the first four cumulants of the net-proton number distribution as functions of temperature for different chemical freeze-outs, which correspond to different collision energies. Interestingly, their temperature dependence is rather flat. Hence, this proves that the results obtained for the cumulants at the chemical freeze-out can still be regarded as relevant.

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