Resolving the Antiproton Production Puzzle in High-Energy Heavy-Ion Collisions

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Abstract

Antiproton yields in heavy-ion collisions at SpS energies, which are in line with standard chemical freezeout predictions, have been difficult to understand as one expects substantial annihilation in the subsequent hadronic evolution towards thermal freezeout. Within a thermal equilibrium framework, and employing detailed balance, we show that the backward direction in the reaction $p\bar{p} \leftrightarrow n\pi$ (with $n \simeq$ 5-6) maintains approximate chemical equilibrium for the antiproton abundance in the hadronic phase of Pb(158AGeV)+Pb collisions. The build-up of appreciable pion-chemical potentials, $\mu_\pi \simeq$ 60-80 MeV, between chemical and thermal freezeout then entails a strong enhancement of this multi-pion annihilation channel. As a result, a large number of antiprotons is regenerated towards thermal freezeout, being consistent with experiment. Implications for RHIC will be discussed.

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