

Strangeness and electric charge dependent splitting of the rapidity-odd directed flow between quarks and anti-quarks in Au+Au collisions

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1 We report the first measurement of the rapidity-odd directed flow (v_1) of multi-strange baryons (Ξ
2 and Ω) in Au+Au collisions as recorded by the STAR detector at the Relativistic Heavy Ion Collider.
3 We focus on particle species where all constituent quarks are produced, as opposed to possibly
4 transported, and demonstrate using a novel analysis method that the coalescence sum rule holds
5 for hadrons with identical quark content. We examine the coalescence sum rule as a function
6 of rapidity for non-identical quark content having the same mass but different strangeness (ΔS)
7 and electric charge (Δq). The difference in the directed flow of different quark and anti-quark
8 combinations, e.g., $v_1(\Omega^-(sss)) - v_1(\bar{\Omega}^+(\bar{s}\bar{s}\bar{s}))$, is a measure of coalescence sum rule violation,
9 and we call it directed flow splitting (Δv_1) between quarks and anti-quarks. This measurement
10 uses the latest high statistics data sample from $\sqrt{s_{NN}} = 27$ GeV Au+Au collisions where we
11 exploit the improved event plane resolution of recently installed Event-Plane Detector (EPD). We
12 measure the ΔS and Δq dependence of the Δv_1 -slope between produced quarks and anti-quarks
13 in Au+Au collisions at $\sqrt{s_{NN}} = 27$ GeV and 200 GeV. It is observed that the Δv_1 -slope as a
14 function of rapidity increases when ΔS and Δq of the quark and anti-quark combinations increase.
15 This Δv_1 -slope signal becomes weaker going from collision energy $\sqrt{s_{NN}} = 27$ GeV to 200 GeV.
16 We compare our measurements with the Parton-Hadron String Dynamics (PHSD) model + EM-
17 field calculations.