Exploring Electromagnetic Field Effects on Charge-dependent Directed Flow with STAR BES-II Data

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STAR has recently reported observations consistent with the presence of Faraday+Coulomb and Hall effects in Au+Au collisions at center-of-mass energies of 200 and 27 GeV. Such effects are predicted to result in a negative Δv_1, defined by the difference in rapidity-odd directed flow (v_1) between positively and negatively charged particles, in peripheral collisions. At lower collision energies achieved in beam energy scan phase II (BES-II), the electromagnetic field is expected to last longer, and the corresponding splitting in the charge-dependent directed flow could be more pronounced. In this talk, we present the STAR BES-II results of v_1 for charged pions, kaons, and protons as a function of rapidity, transverse momentum (p_T), and centrality in the rapidity window of $-1 < y < 1$ in Au+Au collisions at $\sqrt{s_{NN}}$ = 19.6 GeV, 14.6 GeV, 11.5 GeV, and 7.7 GeV. Our results of the Δv_1 systematics support the notion of a longer duration of the electromagnetic field at lower collision energies, and exhibit a stronger effect with increasing p_T. Additionally, by extending our measurements down to $\sqrt{s_{NN}}$ = 7.7 GeV, we have an exciting opportunity to gain insights into the role of electromagnetic fields in the system evolution, particularly when the dominant dynamics change from partonic to hardronic degrees of freedom.