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Probing the longitudinal matter distribution in heavy ion collisions with heavy flavor

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Non-central relativistic heavy ion collisions break longitudinal boost invariance due to forward-backward asymmetry in local participant densities. This gives rise to the observed rapidity-odd directed flow of charged particles. We demonstrate that the heavy flavor v_1 due to the forward-backward asymmetric drag of the bulk is several times larger than that of the bulk v_1 [1]. This makes the heavy flavor v_1 slope at mid-rapidity, a sensitive probe of the initial longitudinal distribution of the thermalized medium. Further, the electromagnetic fields of the initial stage can also give rise to rapidity-odd v_1 but of opposite signs for D and \bar{D} mesons, unlike the tilt mechanism which provides same sign v_1 to both D and \bar{D} . We show that the measurement of the v_1 sum as well as difference of D and \bar{D} can provide simultaneous constraint on the initial longitudinal asymmetry in matter distribution as well as the electromagnetic field produced by the passage of the heavy nuclei.

[1]. S. Chatterjee and P. Bozek (2017), arXiv:1712.01189 [nucl-th]

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