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Strong directed flow of heavy flavor as a probe of matter distribution in heavy-ion collisions

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The breaking of longitudinal boost invariance in non-central relativistic heavy ion collisions due to asymmetric local participant densities gives rise to a tilt in the reaction plane in the thermalized medium. A direct consequence of this is the observed rapidity odd directed flow of charged particles. We study the v_1 of D and $\bar{D}$ mesons by evolving the charm quark phase space distribution within Langevin dynamics coupled to a hydrodynamic background. We demonstrate that the drag from the tilted fireball gives rise to directed flow of charm quarks that is $several\ times\ larger$ than that of the v_1 of observed charged particles[1]. The v_1 slope at mid-rapidity is sensitive to the magnitude of the tilt of the initial thermalized medium. Thus, its measurement will allow us to extract the tilt which also sets the scale of longitudinal correlation. Hence, rapidity odd heavy flavor v_1 is an ideal candidate to unravel the longitudinal profile of entropy deposition. We report on the comparison of the heavy flavor v_1 across beam energies as well as symmetric and asymmetric systems. 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 study the interplay of the tilt and the electromagnetic fields on the v_1 of D and $\bar{D}$ mesons.

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

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