

Introduction

Charm and beauty (heavy flavor, HF) hadron production in ultrarelativistic heavy ion collisions are key observables for the study of sQGP:

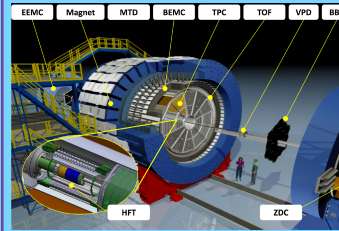
- * Charm and beauty quarks are produced in initial hard scatterings and therefore experience the entire evolution of A+A interactions

- * The nuclear modification factors R_{AA} and R_{CP} of c and b can reveal imprints of jet quenching in sQGP

- * Mass dependence of jet quenching in sQGP is expected

- * Flow of open heavy flavor hadrons helps elucidate interaction of HF with medium, thermalization and production mechanisms of HF and probe sQGP properties

The STAR experiment at RHIC

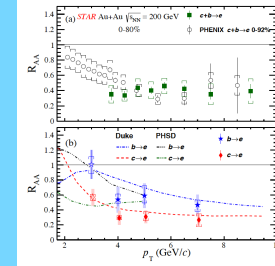


Main detectors used for open heavy flavor measurements: Heavy Flavor Tracker (HFT), Time Projection Chamber (TPC), Barrel Electromagnetic Calorimeter (BEMC) and Time-Of-Flight detector (TOF)

Evidence of mass ordering of charm and bottom quark energy loss

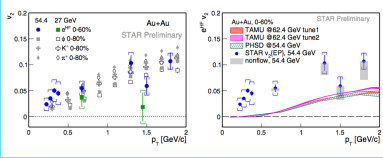
STAR collaboration, 23 June 2022, arXiv:2111.14615

$R_{AA} = \text{yield in A+A} / (\text{yield in p+p scaled by number of binary collisions})$



- * Evidence of mass ordering of R_{AA} of electrons from bottom and charm in Au+Au collisions at 200 GeV is observed
- * Results are consistent with models including mass-dependent energy loss mechanisms

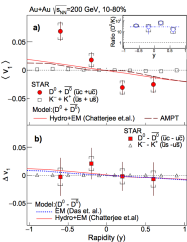
Heavy Flavor elliptic flow in Au+Au collisions at 27, 54.4 and 200 GeV



- * The elliptic flow of heavy flavor electrons in Au+Au collisions at 54.4 GeV is comparable to 200 GeV, indicating strong charm quark interactions with the medium

First measurement of directed flow of D⁰ and D^{0-bar}

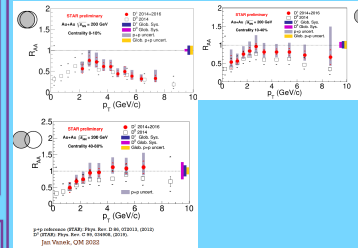
STAR collaboration, PRL 123 (2019) 16, 162301



- * Directed flow of D⁰ and D^{0-bar} in Au+Au collisions at 200 GeV is a factor of 25 higher than that for charged kaons

- * The results are qualitatively described by a hydrodynamic model with an initially tilted QGP source and EM field, and the AMPT model

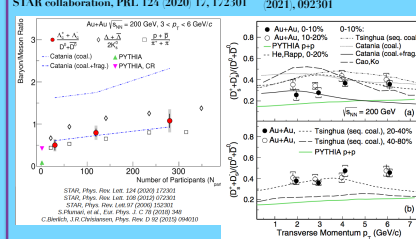
Charmed hadrons: D⁺ and D⁰ measurement



- * Centrality dependence of R_{AA} of D⁺ and D⁰ measured
- * R_{AA} of D⁺ and D⁰ are consistent with each other and suppressed at high p_T in central (0-10%) Au+Au collisions

First Λ_c and D_s measurements with STAR at RHIC

STAR collaboration, PRL 124 (2020) 17, 172301



- * Λ_c D⁰ and D_s D⁰ ratios in 200 GeV Au+Au are higher than PYTHIA

- * Data are in accordance with models that include coalescence hadronization of charm hadrons

Total charm cross section

Collision System	Hadron	$d\sigma_{ch}/dy$ [μb]
Au+Au at 200 GeV Centrality: 10-40% $0 < p_T < 8$ GeV/c	D ⁰ [1]	$39 \pm 1 \pm 1$
	D ⁺ [2]	$18 \pm 1 \pm 3'$
	D _s [2]	$15 \pm 2 \pm 4$
	Λ_c [3]	$40 \pm 6 \pm 27''$
p+p at 200 GeV [4]	Total	$112 \pm 6 \pm 27$
	Total	$130 \pm 30 \pm 26$

- * Total charm production cross section per binary NN collision in Au+Au collisions, is consistent with that in p+p collisions within uncertainties

Outlook

Future data will extend the kinematic range for open heavy flavor hadron measurements by semileptonic decays

