Forward Dihadron Angular Correlations in pA collisions

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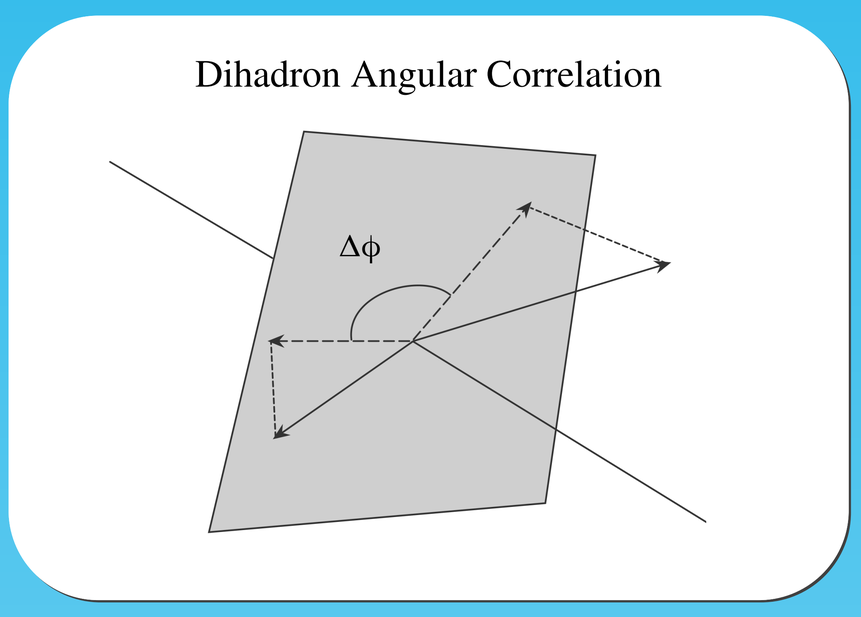
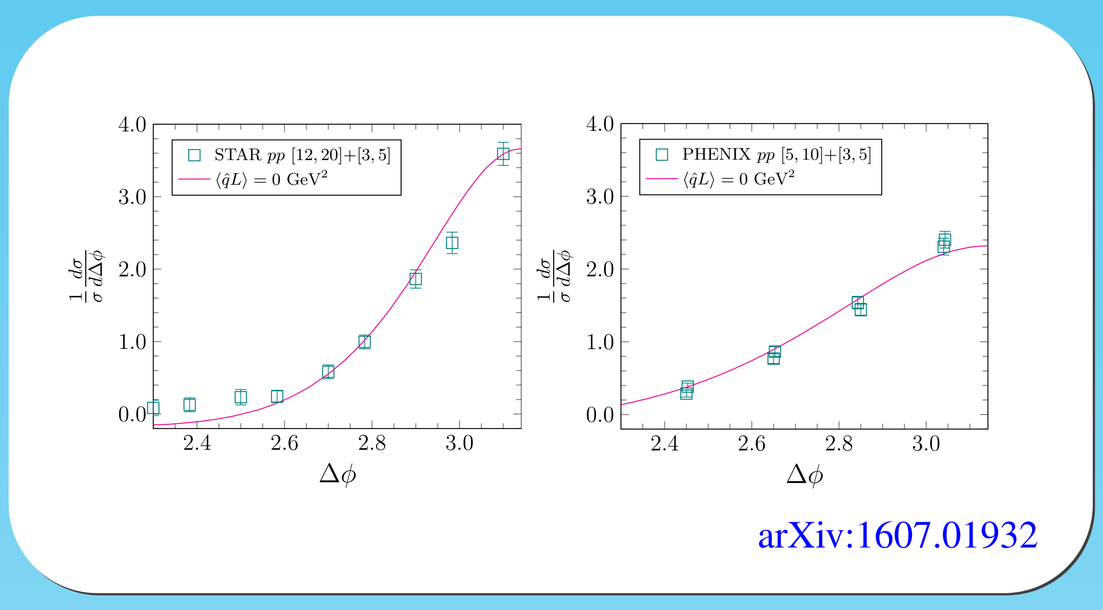
1 Introduction & Motivations



- **Middle Rapidity**
  >: large-x
  >: collinear factorization + Sudakov resummation (parton shower)

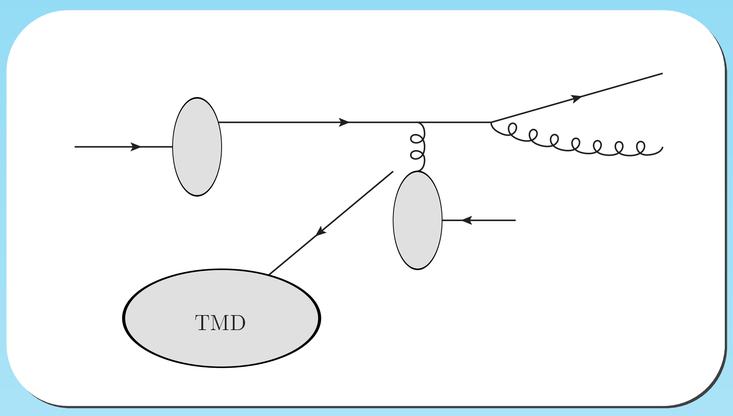


arXiv:1607.01932

- **Forward Rapidity**
  >: small-x: $x_2 = (k_1 e^{-y_1} + k_2 e^{-y_2})/\sqrt{s} < 0.01$
  >: intrinsic TMD can no longer be neglected
  >: probing saturation physics

2 Formalism

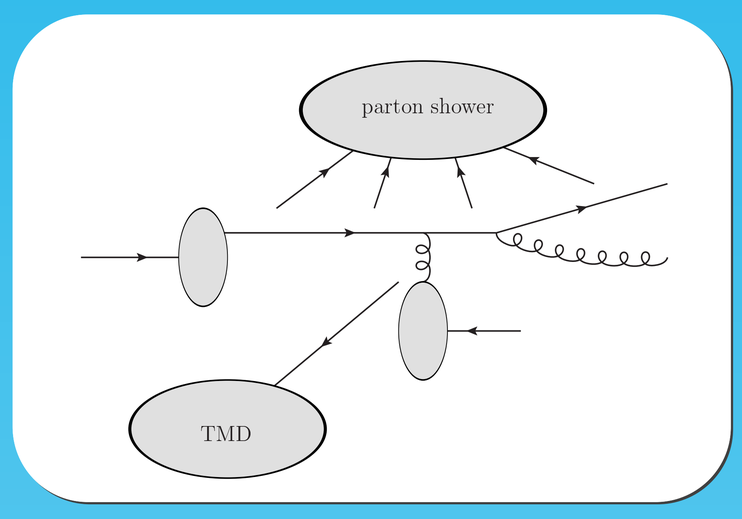
- **leading order**: arXiv:1009.2141, 1101.0715



$$\frac{d\sigma}{dy_1 dy_2 d^2p_{T1} d^2p_{T2}} = \sum_{\text{channels}} \int \frac{dz_1}{z_1^2} \int \frac{dz_2}{z_2^2} D_{h_1}(z_1) D_{h_2}(z_2) x_1 f_1(x_1) \sum_a H^{(a)}(z) \mathcal{F}^{(a)}(x_2, q_\perp)$$

>: $\mathcal{F}^{(a)}(x_2, q_\perp)$: small-$x$ TMD PDFs
>: Sudakov double logs (soft gluon radiation) need to be resummed

- **small-x TMD + Sudakov resummation**

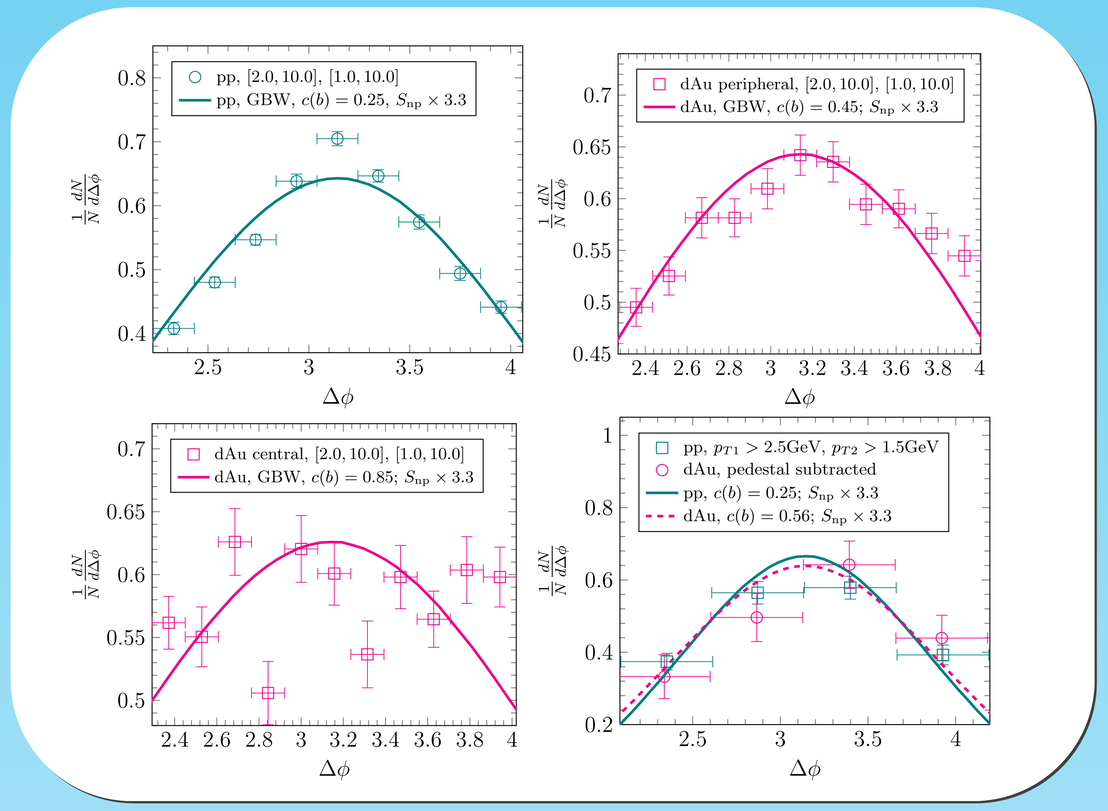


$$\frac{d\sigma}{dy_1 dy_2 d^2p_{T1} d^2p_{T2}} = \sum_{\text{channels}} \int \frac{dz_1}{z_1^2} \int \frac{dz_2}{z_2^2} \int \frac{d^2b_\perp}{(2\pi)^2} e^{-iq_\perp b_\perp} e^{-S_{\text{sud}}} D_{h_1}(z_1, \mu_b) D_{h_2}(z_2, \mu_b) x_1 f_1(x_1, \mu_b) \sum_a H^{(a)}(z) \mathcal{F}^{(a)}(x_2, b_\perp)$$

>: $\mathcal{F}^{(a)}(x_2, b_\perp)$: Fourier transform of $\mathcal{F}^{(a)}(x_2, q_\perp)$
>: S_{sud}: Sudakov factor that resums logarithms such as $\ln^2 Q^2/q_\perp^2$ that come from multiple soft gluon radiation

3 Numerical Results

We compared with the STAR data: forward: arXiv:1008.3989; forward & near-forward: arXiv:1106.0621



4 Summary

we have carried out a comprehensive study of forward rapidity dihadron angular correlations in both pp and dAu (pA) collisions at RHIC, by using the small-x formalism with parton shower effects. This new framework allows to describe the forward dihadron angular correlation in pp collisions, where both the small-x effect and the Sudakov effect are important. By incorporating the parton shower effect, a very good agreement with all the available data is obtained. Using the results in pp collisions as the baseline, we can reliably study the saturation effect which accounts for the difference between angular correlations the pp and pAu collisions, and therefore provide robust predictions. This would allow us to systematically study the signature of gluon saturation at RHIC.