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## TMD evolution study of the azimuthal asymmetry in unpolarized $J/\psi$ production at EIC

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$J/\psi$  production at the future EIC has been proposed as a tool to probe gluon TMDs. Until recently, a common assumption was to decouple the  $J/\psi$  hadronization from other soft mechanisms, even at low transverse momentum. However, at leading order in the TMD factorized expression and within NRQCD,  $J/\psi$  is produced via a color-octet state. So, soft gluon emission to become a color-singlet state should be taken into account. In general, smearing effects are not incorporated in the NRQCD formalism and therefore the TMD shape function (TMDSHF), that enters as a convolution with the TMD, has been proposed recently.

Employing evolution in which one can relate the (small) transverse momentum objects to their large transverse momentum equivalent, i.e. the TMDs to the well-known PDFs and the TMDSHF to its tail, we can improve on previous studies of the azimuthal asymmetry observable that arises from the linear polarization of gluons inside unpolarized protons. Subsequently, these results can be compared with future experiments to set constraints on the TMDs.

In this presentation I explain shortly how to perform the evolution calculation for this azimuthal asymmetry with the inclusion of the TMDSHF, employing the correct soft gluon radiation from both the TMDSHF and the soft function. This talk follows (and improves) the discussion of Ref. [arxiv:2204.01527], where a naïve TMDSHF was assumed.

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