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QCD evolution of twist-2 and twist-4 fragmentation function for heavy quarkonium production

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Heavy quarkonium production provides valuable grounds to explore fundamental QCD dynamics with multiple scales. Thus far, NRQCD factorization has been successful in describing many features of the data. Despite many theoretical efforts at NLO accuracy, however, there are still unresolved issues, including the lack of a full understanding of quarkonium polarization at high p_t . One significant caveat is that the NRQCD factorization framework does not include the full final state evolution relevant to high p_t quarkonium production. In previous studies [1,2], a QCD factorization formula for high p_t quarkonium production was derived up to next-to-leading power (NLP) in the $1/p_t$ expansion, by including single parton (twist-2) and double parton (twist-4) fragmentation functions. In this talk, we present the first numerical analysis of the scale evolution of the coupled twist-2 and twist-4 fragmentation for quarkonium production [3]. In particular, we will discuss how we succeeded in simplifying the complicated evolution equations [1], using novel input distribution functions [4,5]. We will then pursue the importance of the quantum evolution for solving the quarkonium polarization puzzles at high p_t .

[1] Z. B. Kang, Y. Q. Ma, J. W. Qiu and G. Sterman, Phys. Rev. D 90, no. 3, 034006 (2014).

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[3] K. Lee, J. W. Qiu, G. Sterman, and K. Watanabe, in preparation.

[4] Y. Q. Ma, J. W. Qiu and H. Zhang, Phys. Rev. D 89, no. 9, 094029 (2014).

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