

# **QCD resummation for heavy quarkonium production in high energy collisions**

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In this talk, we explicitly demonstrate that the perturbatively calculated cross section for heavy quarkonium production in terms of the NRQCD factorization formalism have large logarithms as the collision energy  $s \gg M$ , the heavy quarkonium mass. Using  $e^+e^- \rightarrow J/\psi + X$  as a case study, we derive a new factorization formalism for the cross section that systematically reorganizes the perturbatively calculated short-distance factors and resums the large logarithmic contributions. The new factorization formalism keeps the perturbative QCD calculations reliable for a wide range of collision energies. When the collision energy  $s$  increases, the heavy quarkonium cross section is smoothly transformed from the less logarithmic “direct” contribution to the contributions dominated by the resummed logarithms. The new formalism greatly improves the scale dependence of the perturbatively calculated cross section. The impact of the new factorization formalism on the heavy quarkonium production in hadronic collisions is also discussed.