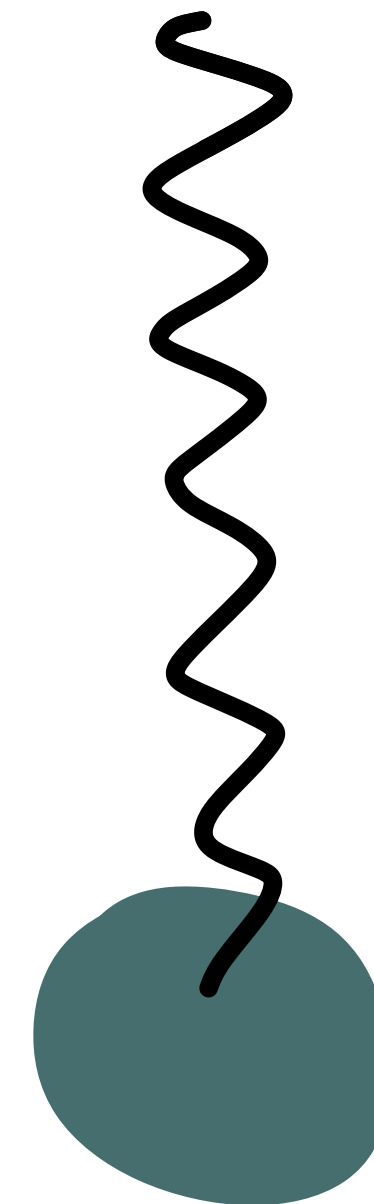


# The NLO Balitsky-Kovchegov equation

# Intro

- low- $x$  hadron structure, gluon saturation
- probing hadron (target) with photon (projectile)
  - ep (HERA), el (EIC), pp, pPb, PbPb (LHC)
- Balitsky-Kovchegov equation
  - gluon evolution  $\sim$  dipole evolution

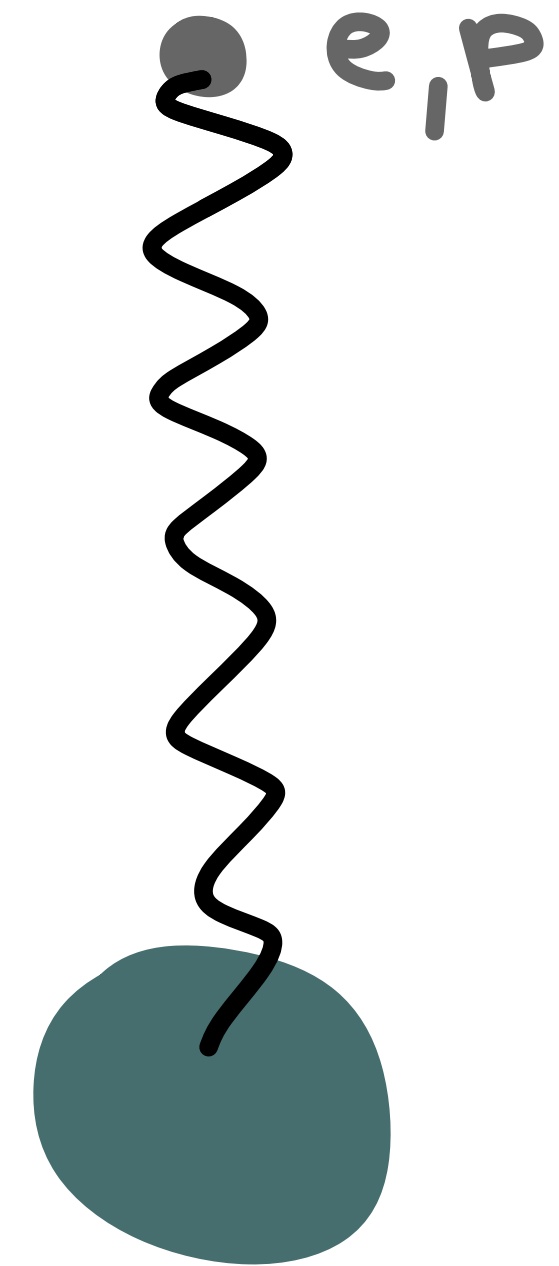
*large  $N_c$*



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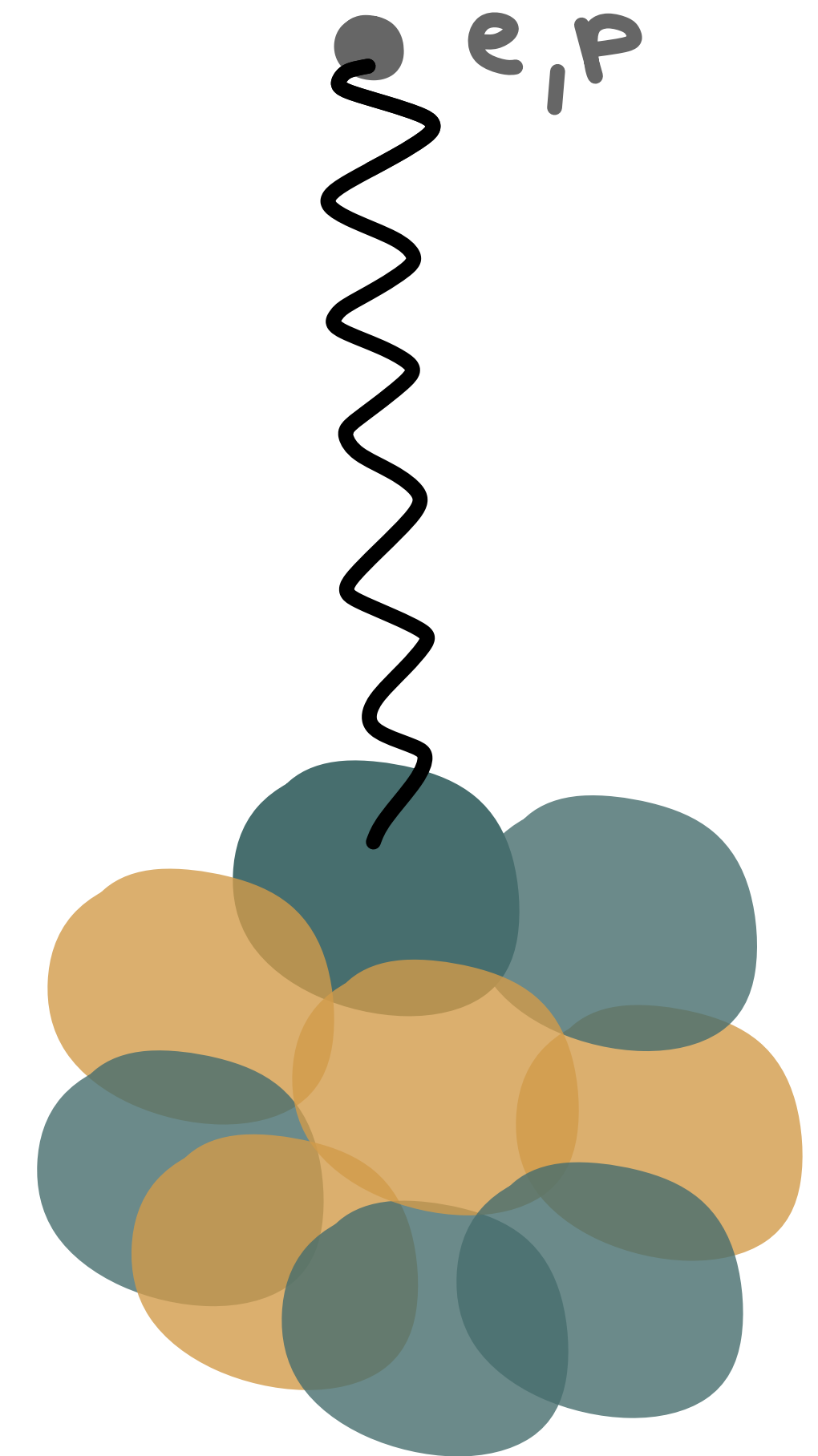
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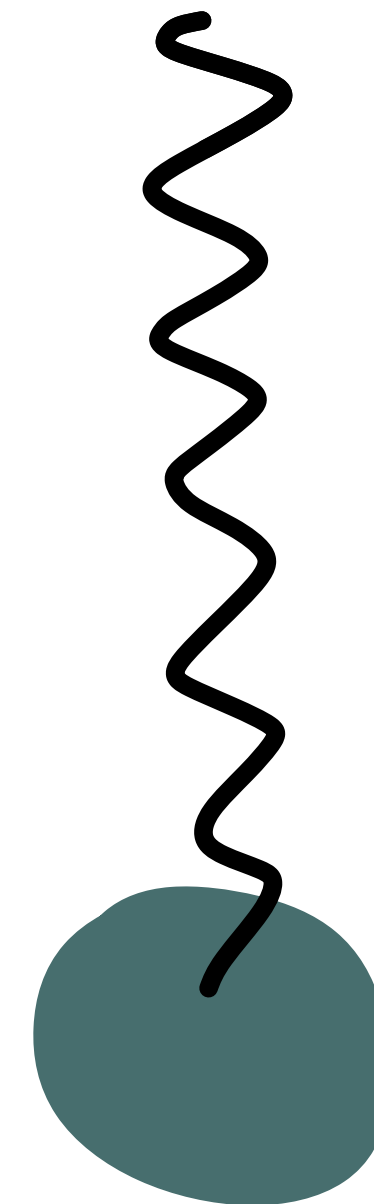
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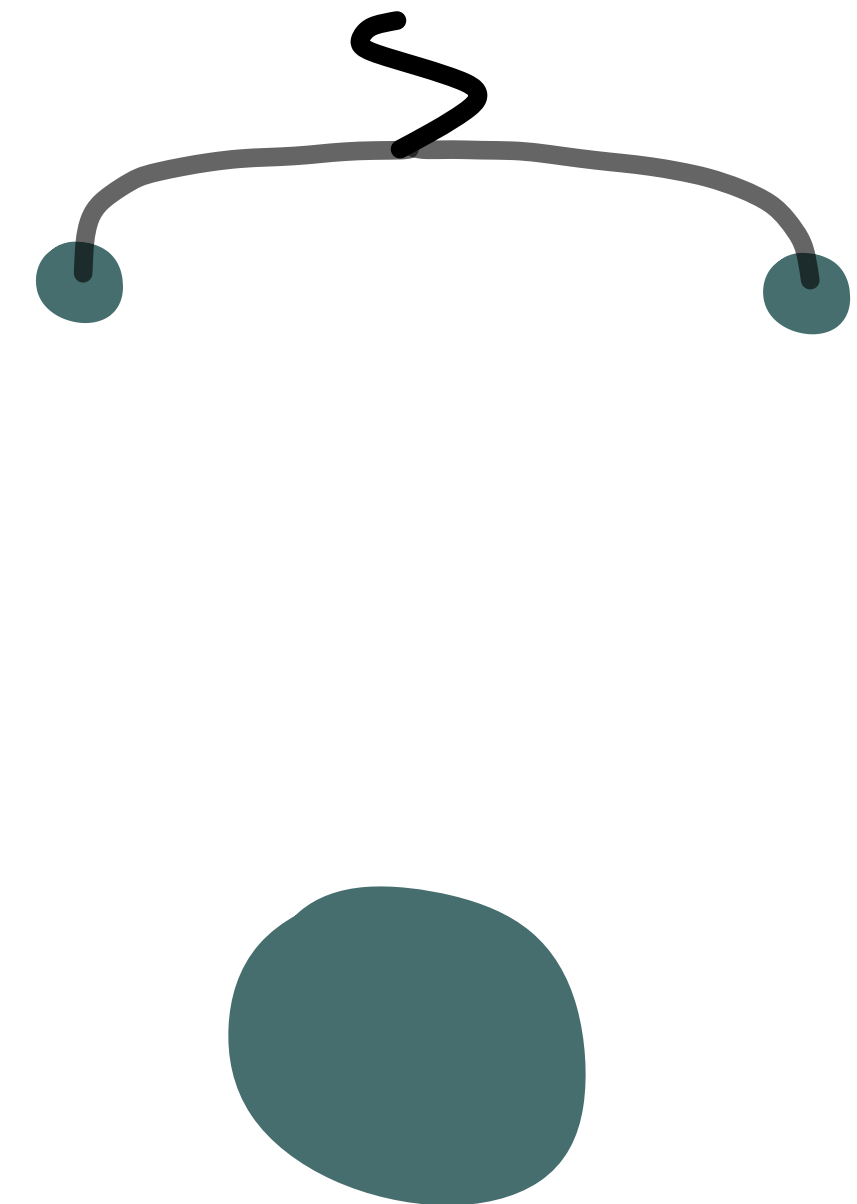
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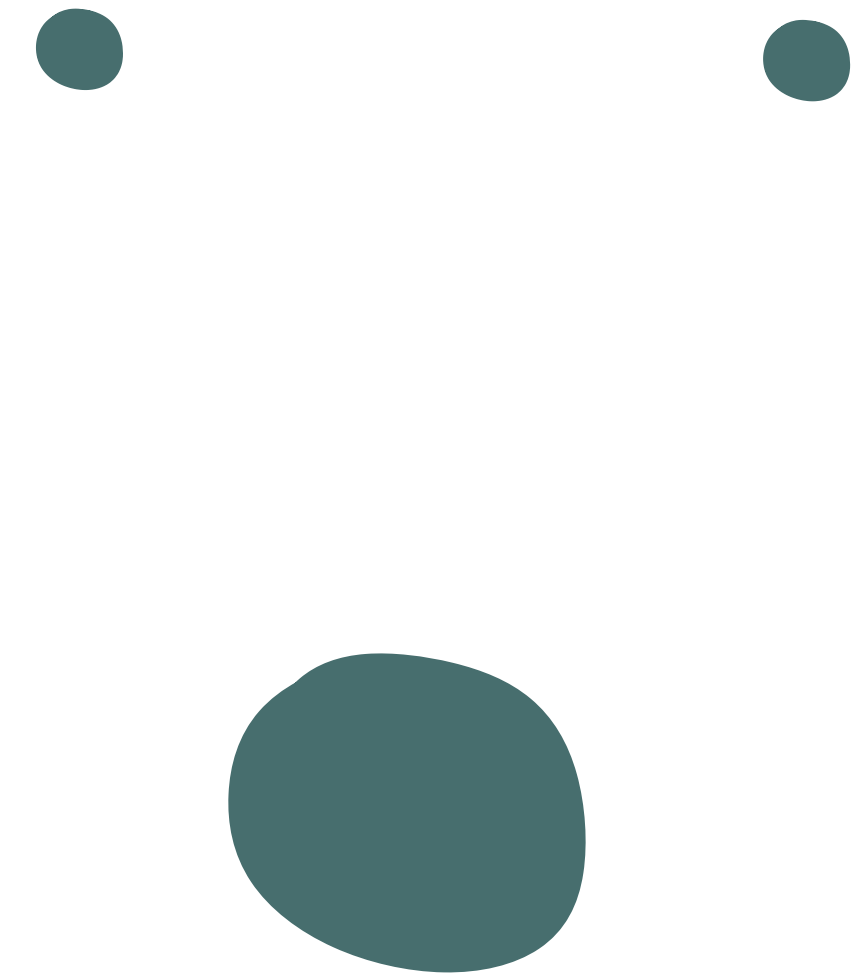
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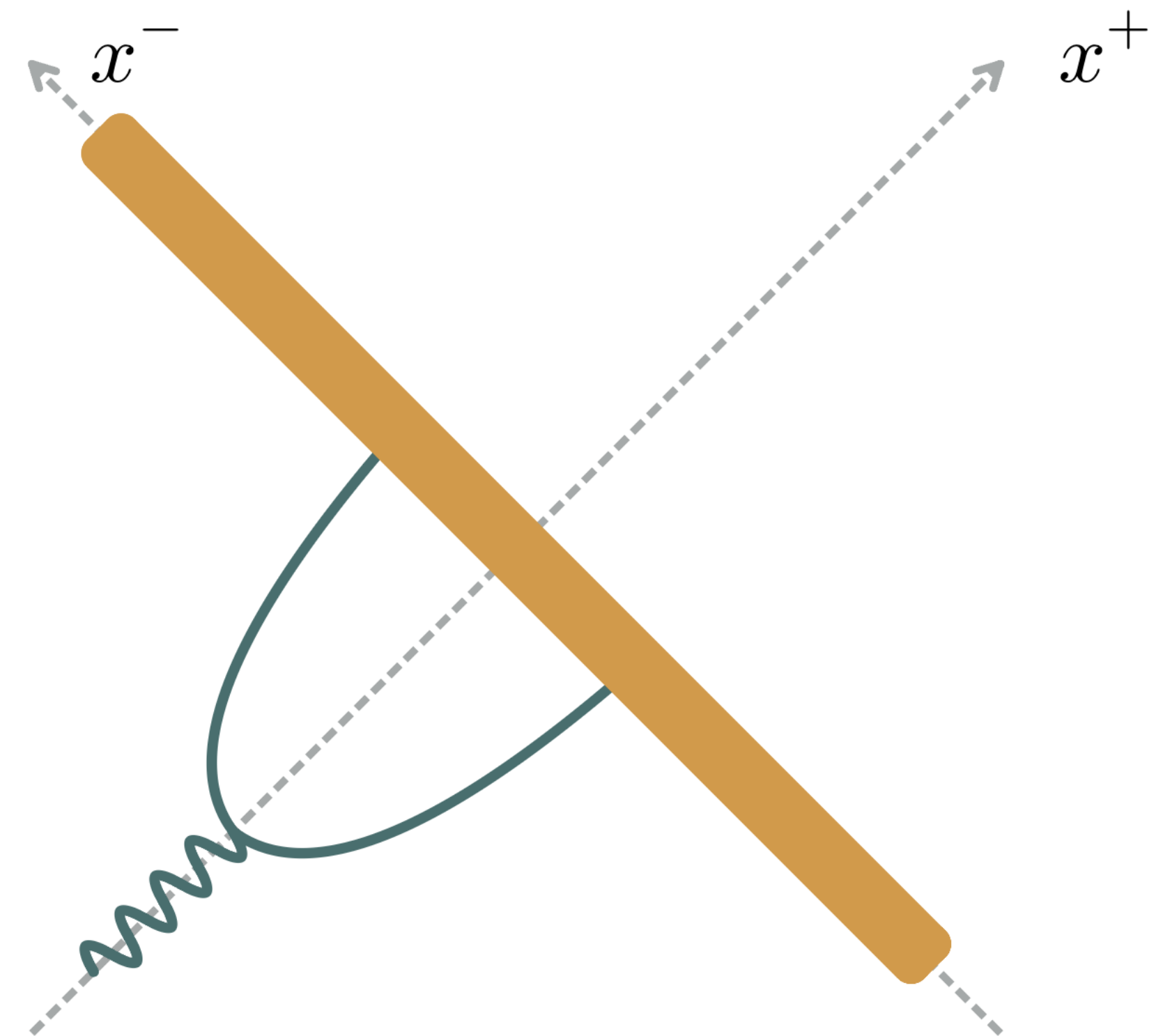
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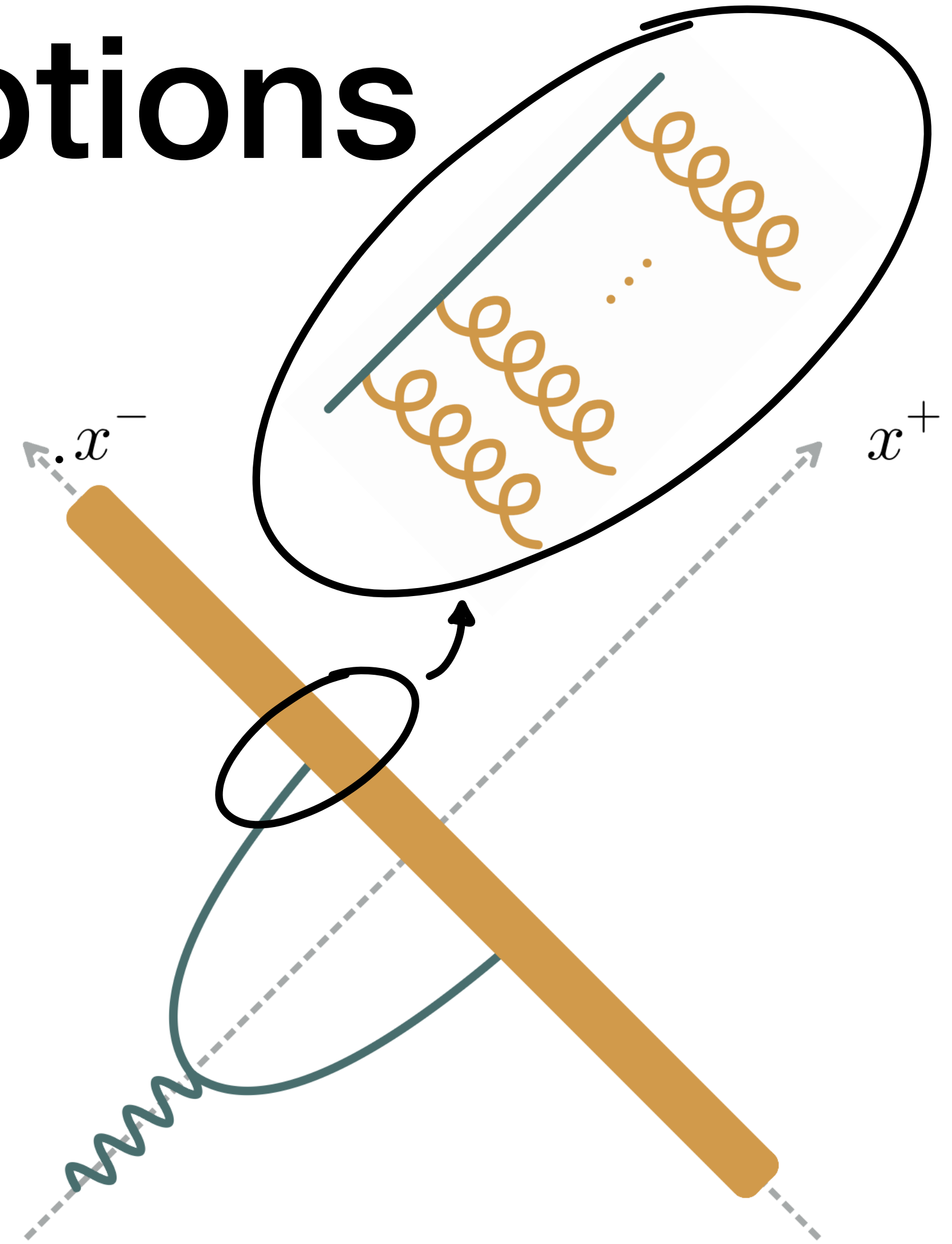
# Key assumptions

- eikonal approximation
- shockwave approximation
- gluon-dominated target
  - Wilson lines as effective propagators
- large  $N_c$



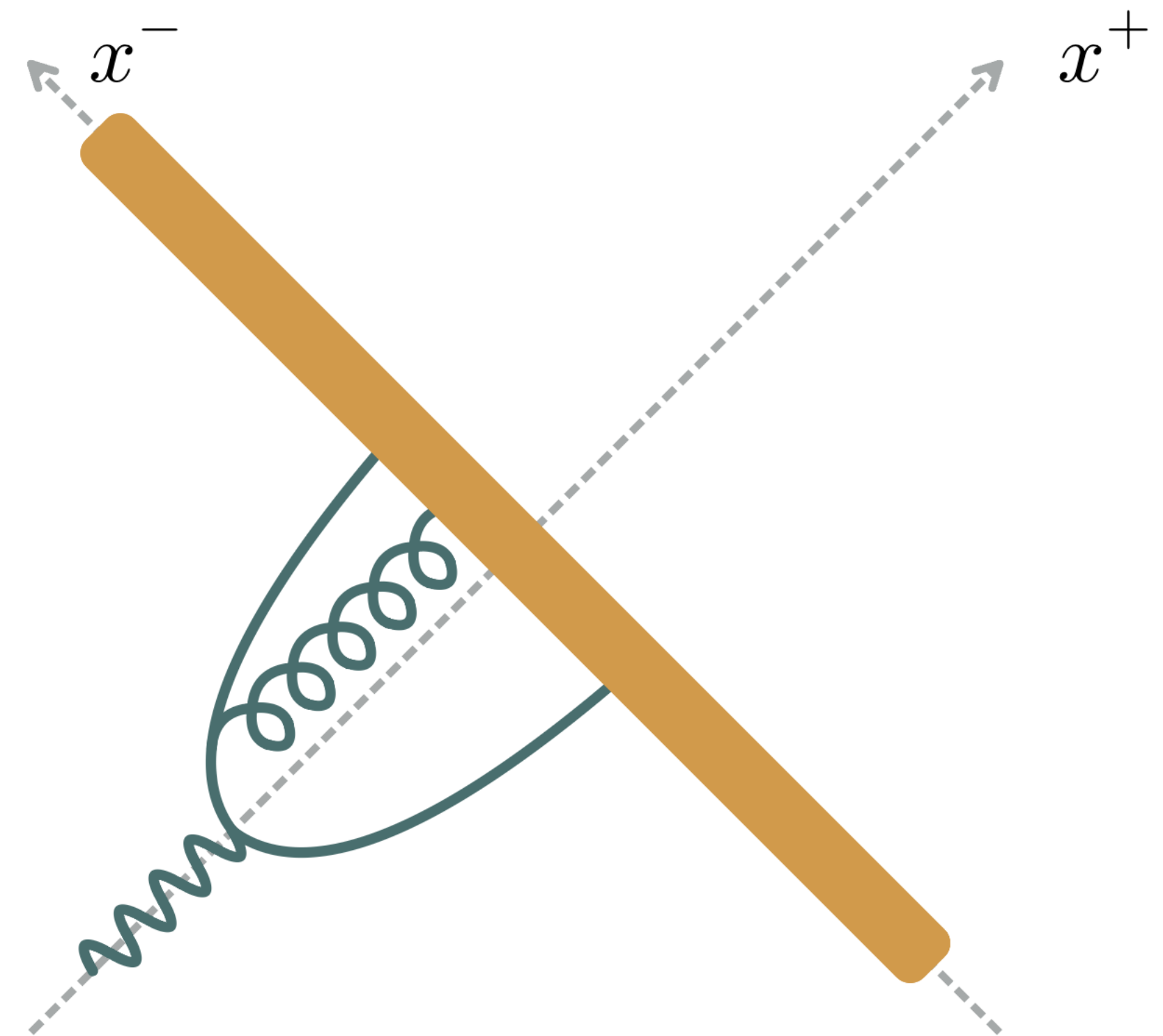
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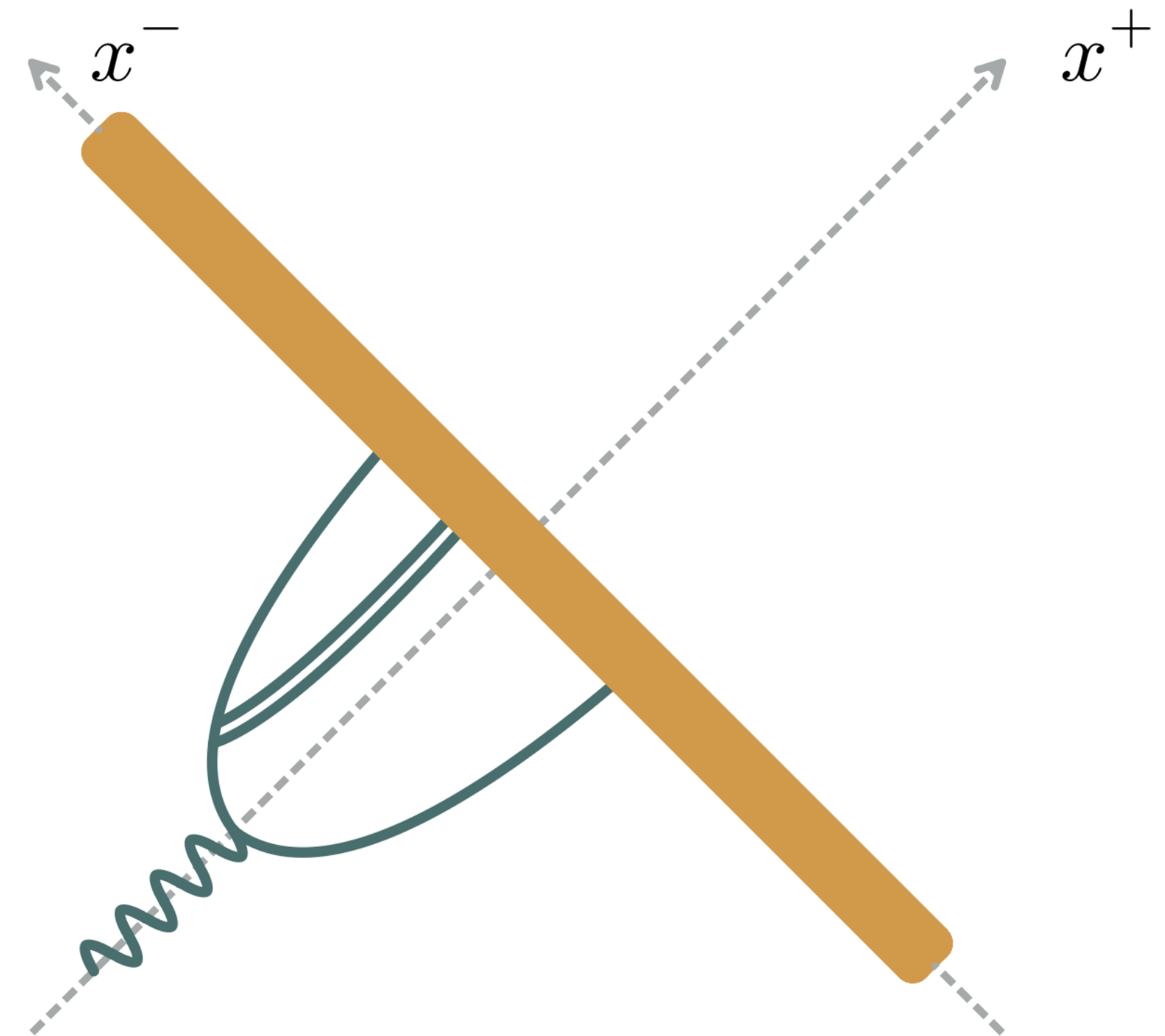
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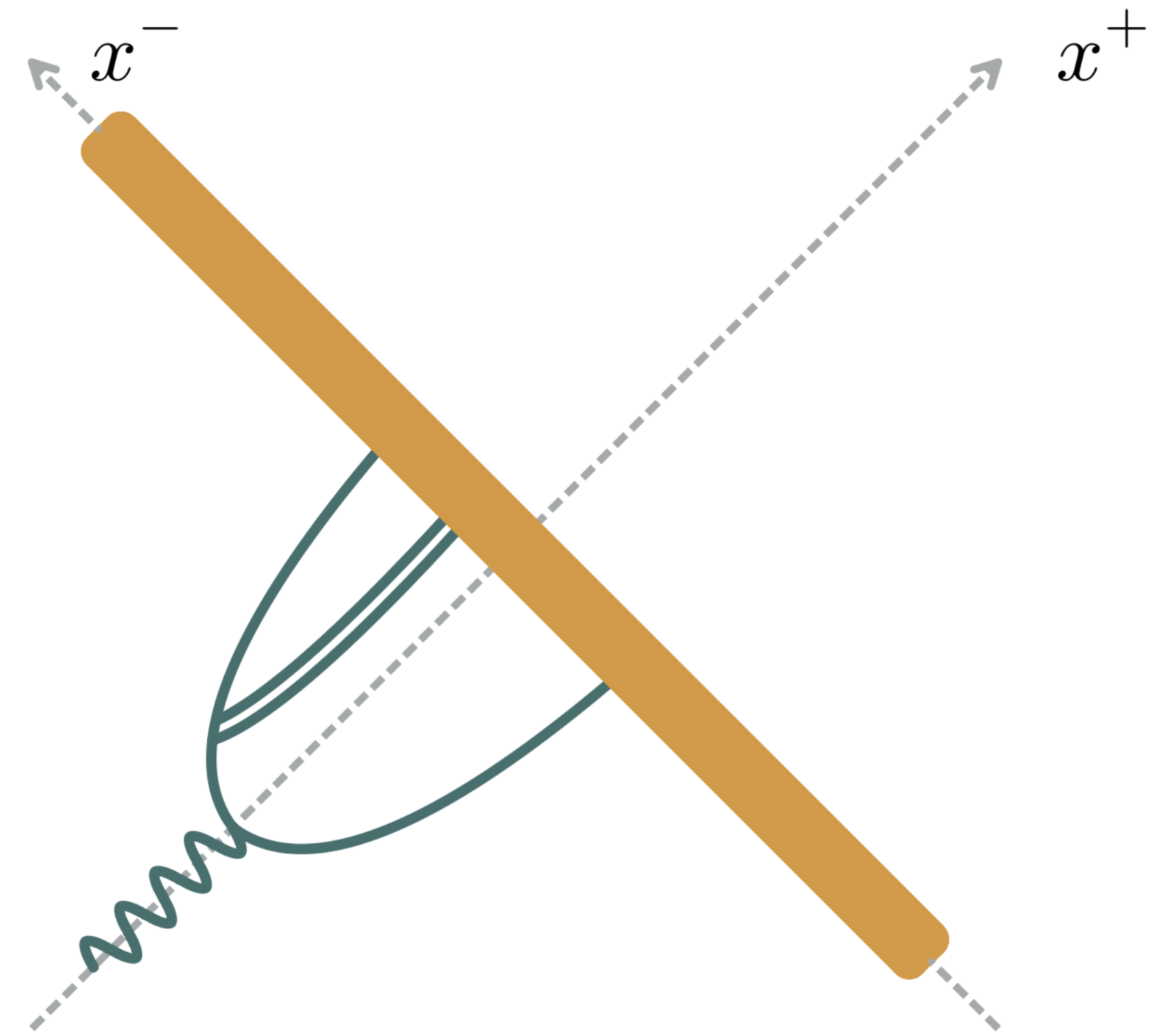
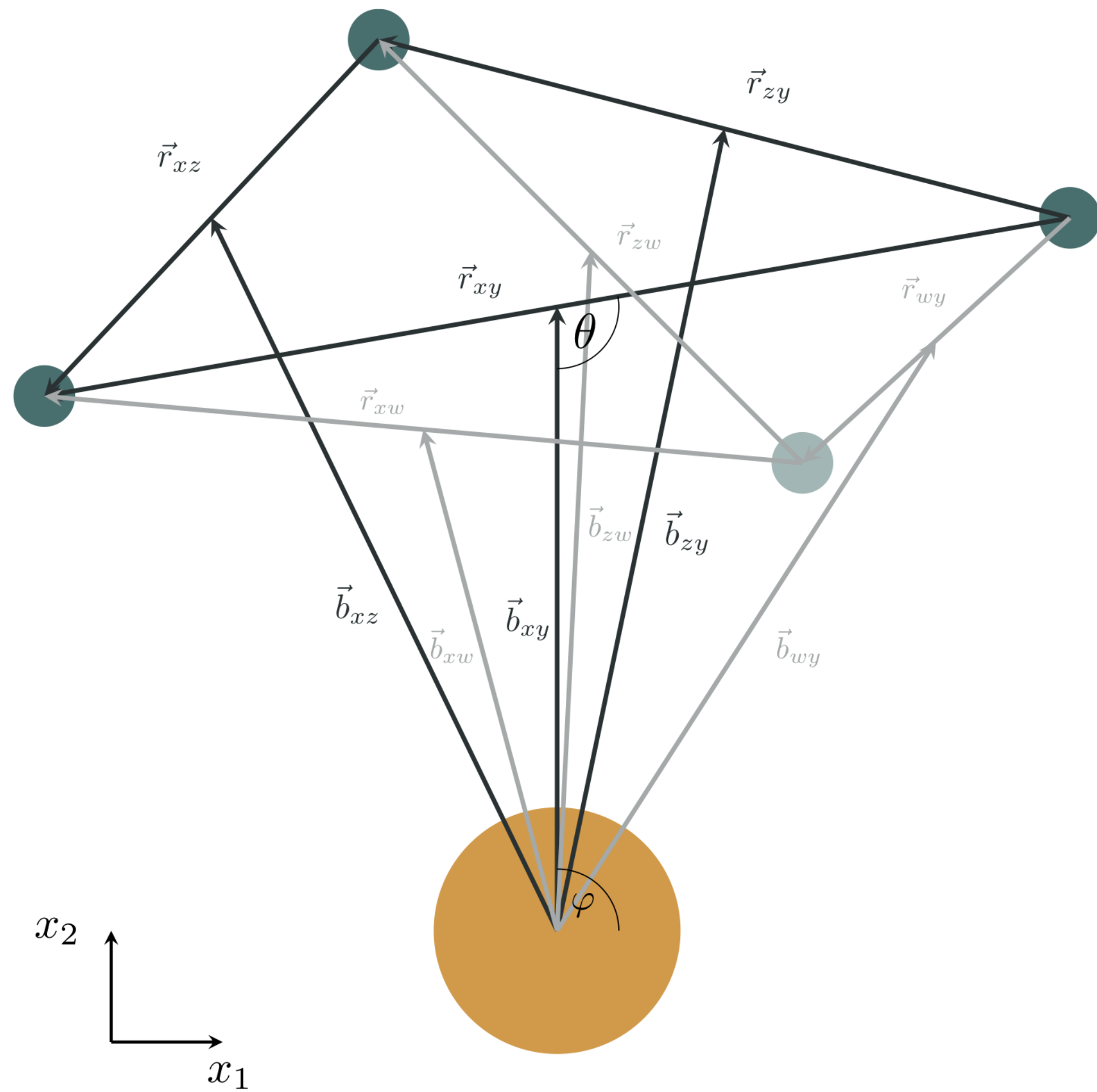


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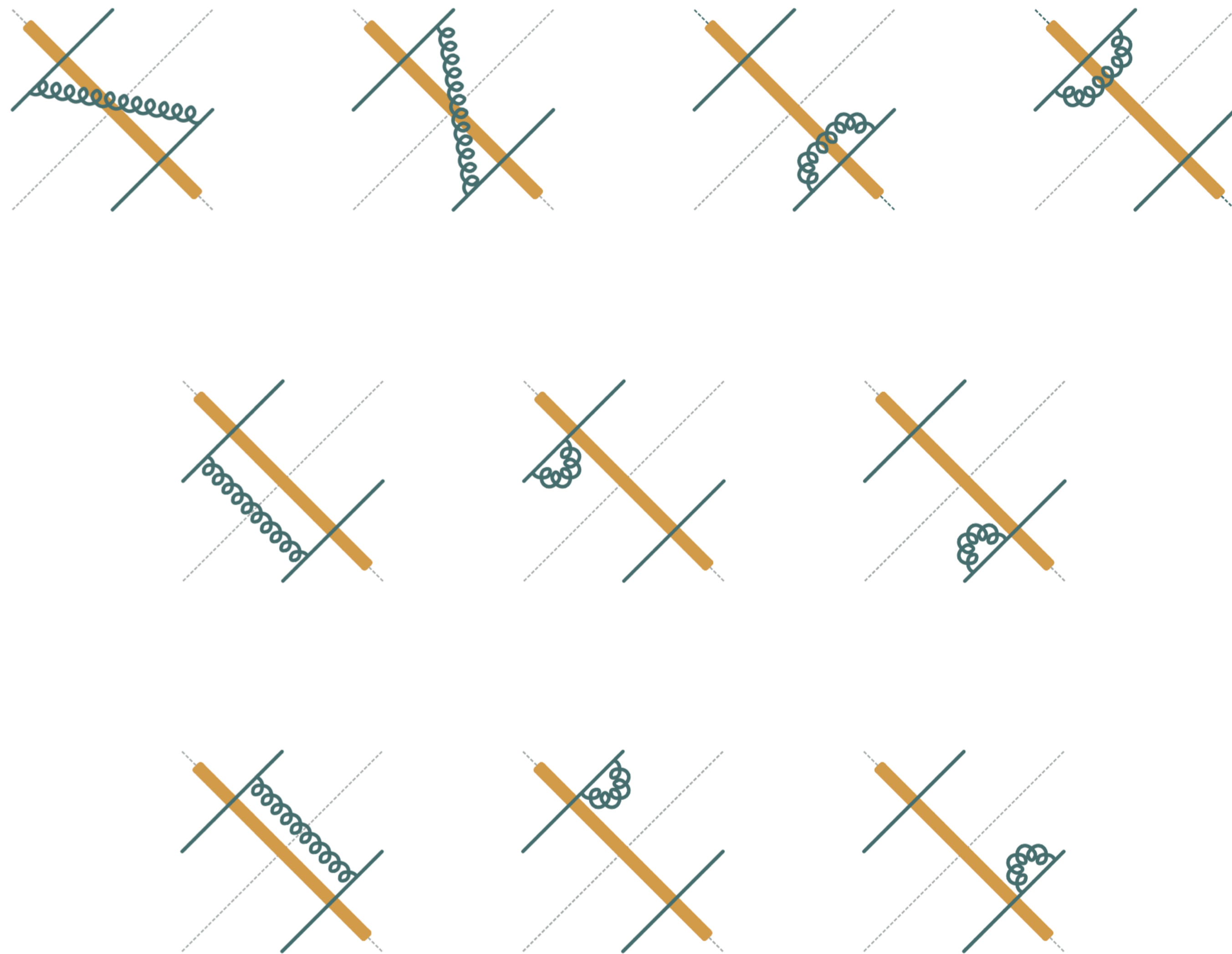
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# Key assumptions



# LO vs NLO



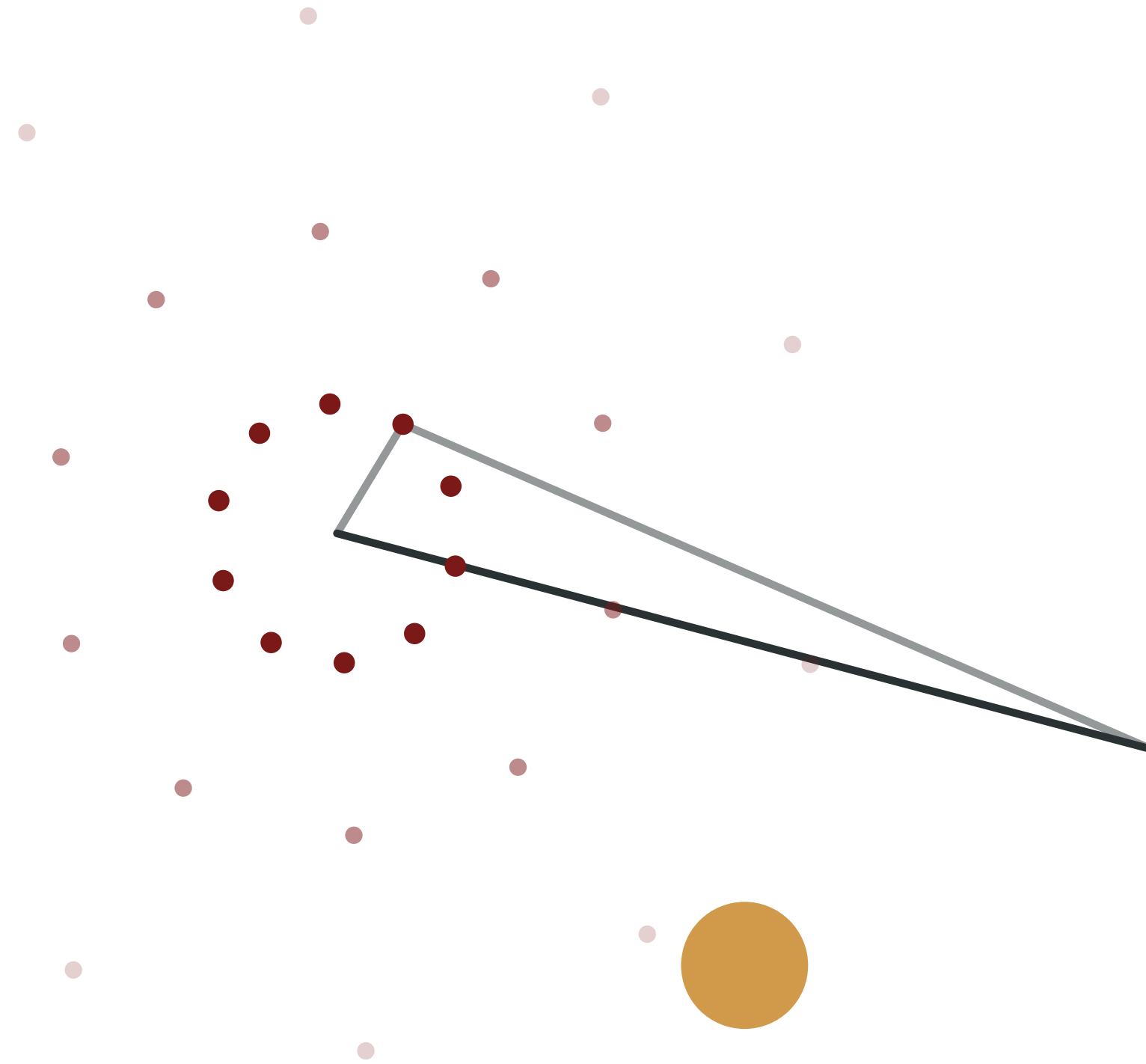
# LO vs NLO

$$\partial_Y N_{xy} = \int d^2 \vec{r}_{xz} K \left[ N_{xz} + N_{zy} - N_{xy} - N_{xz} N_{zy} \right]$$

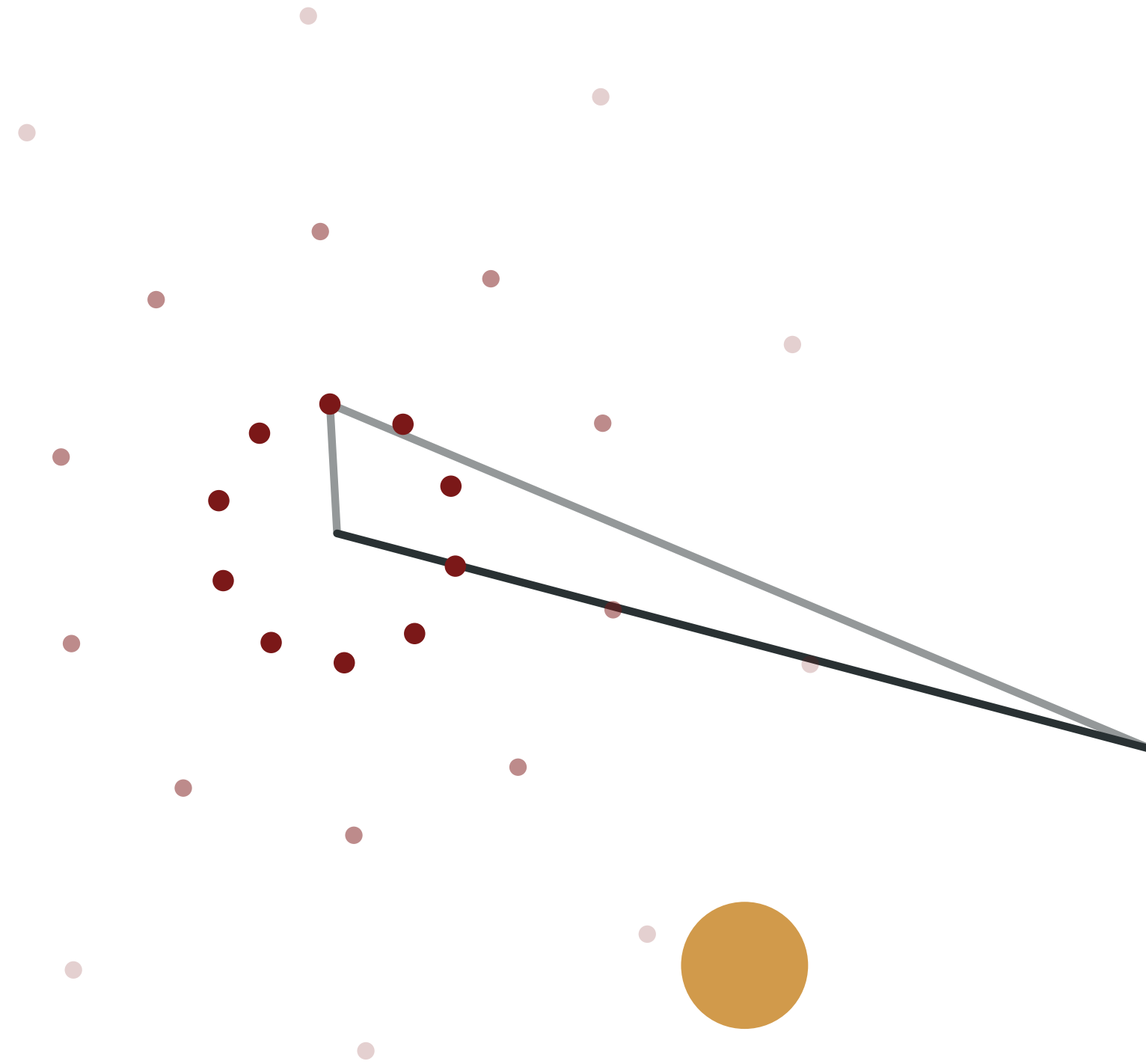
$$N_{ab} = N(Y, \vec{r}_{ab}, \vec{b}_{ab}) \rightarrow N(\eta, r, b, \theta, \varphi)$$

$\sim \ln \frac{1}{x}$

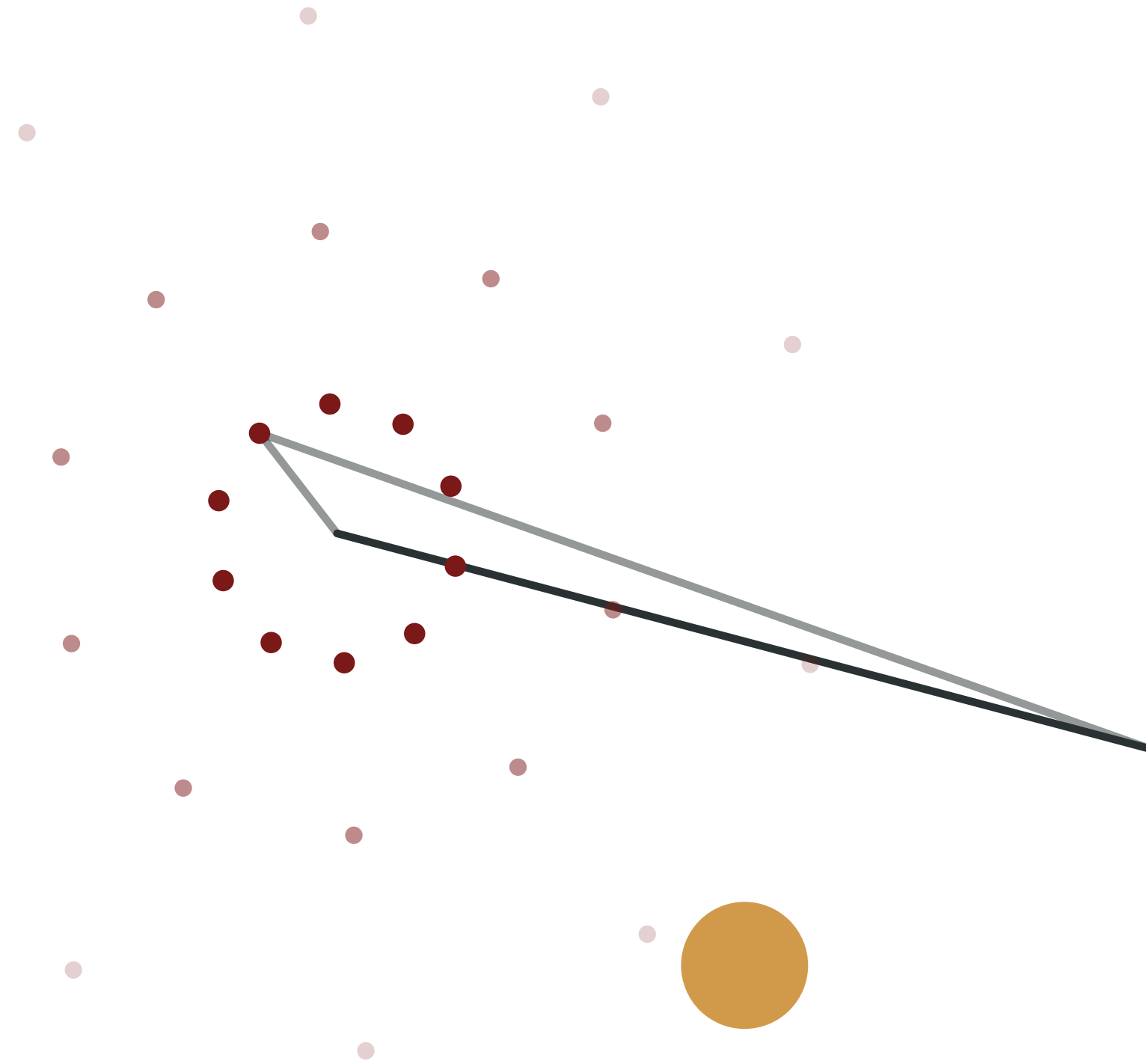
# Integrating a single gluon



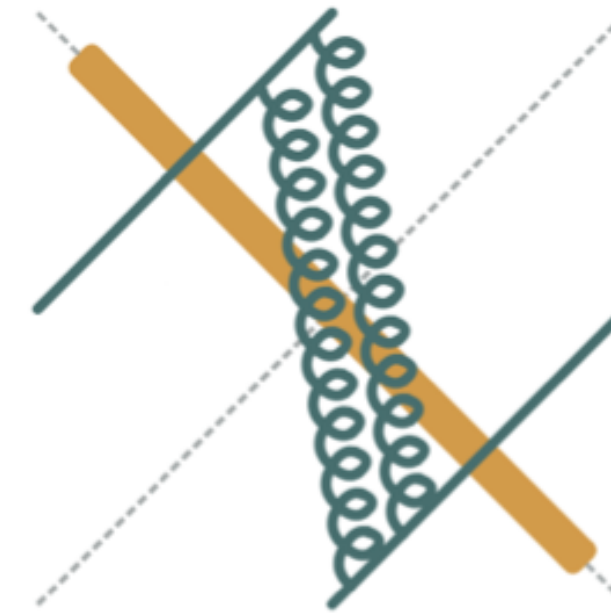
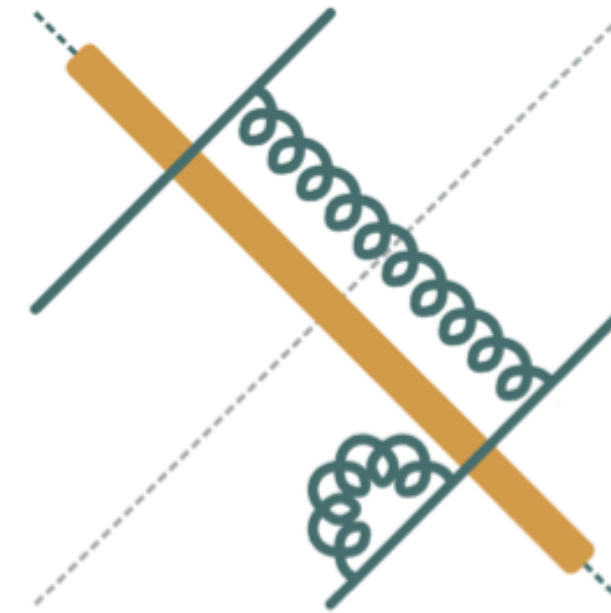
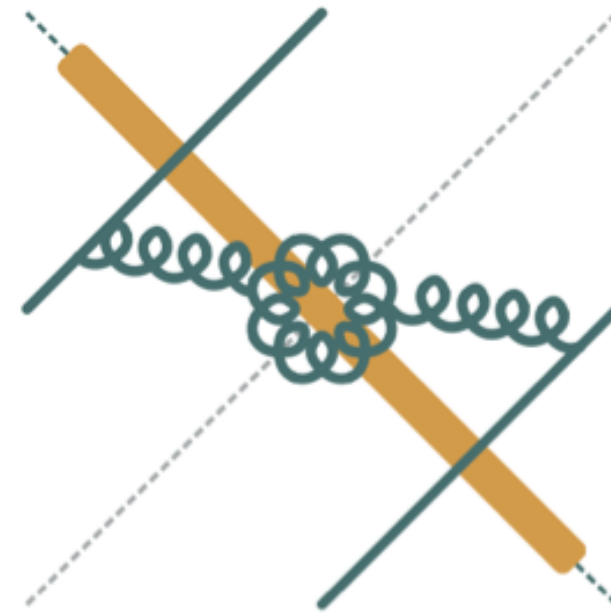
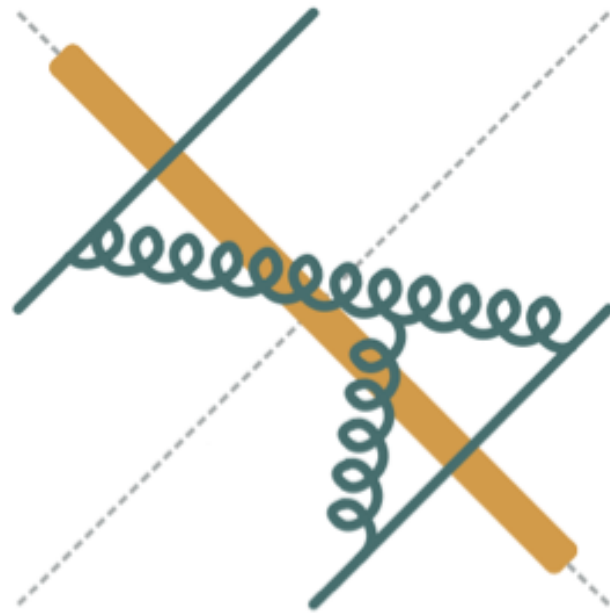
# Integrating a single gluon



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# LO vs NLO



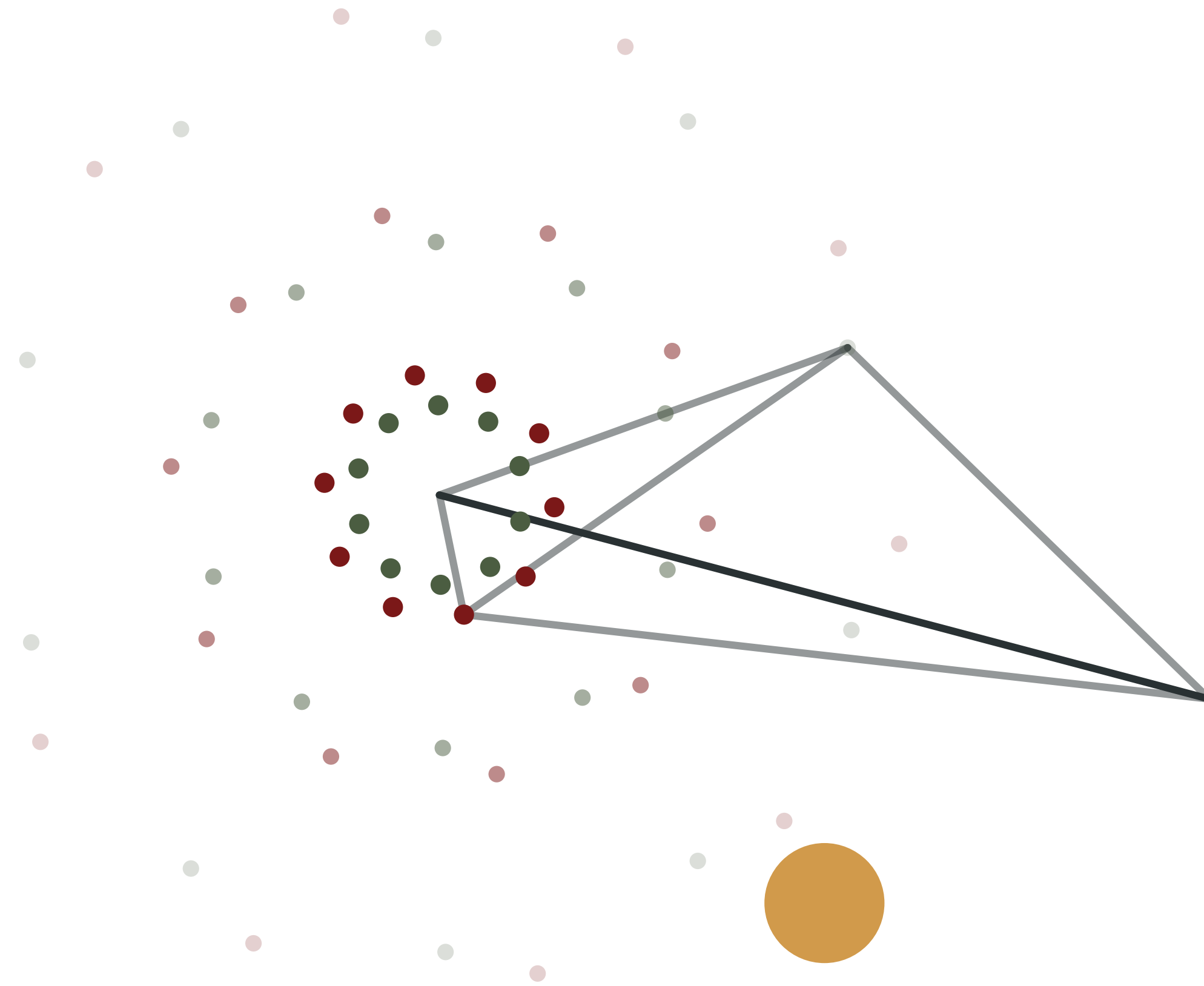
# LO vs NLO

$$\begin{aligned}\partial_Y N_{xy} &= \int d^2z K_0 \left[ N_{xz} + N_{zy} - N_{xy} - N_{xz}N_{zy} \right] \\ &+ \int d^2z d^2w K_1 \left[ N_{wy} + N_{zw} - N_{zy} - N_{xz}N_{zw} - N_{xz}N_{wy} \right. \\ &\quad \left. - N_{zw}N_{wy} + N_{xz}N_{zy} + N_{xz}N_{zw}N_{wy} \right] \\ &+ \int d^2z d^2w K_2 \left[ N_{xw} - N_{xz} - N_{zy}N_{xw} + N_{xz}N_{zy} \right],\end{aligned}$$

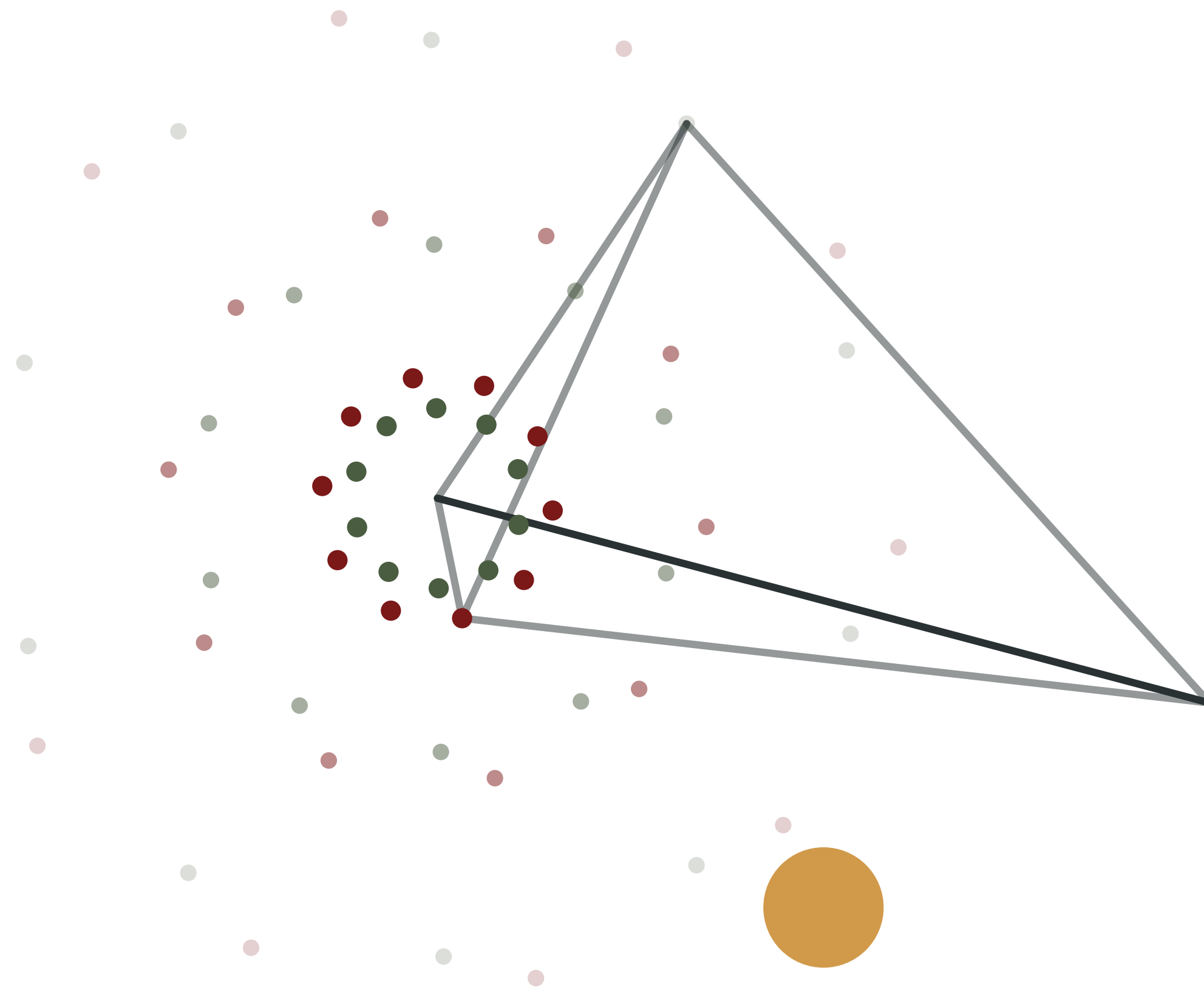
# LO vs NLO

$$K_2(r_{xy}, r_{xz}, r_{zy}) = \frac{n_f N_C \alpha_s^2(r_{xy})}{8\pi^4} \left[ \frac{2}{r_{zw}^4} - \left( \frac{r_{xw}^2 r_{zy}^2 + r_{wy}^2 r_{xz}^2 - r_{xy}^2 r_{zw}^2}{r_{zw}^4 (r_{xz}^2 r_{wy}^2 - r_{xw}^2 r_{zy}^2)} \right) \ln \frac{r_{xz}^2 r_{wy}^2}{r_{xw}^2 r_{zy}^2} \right]$$

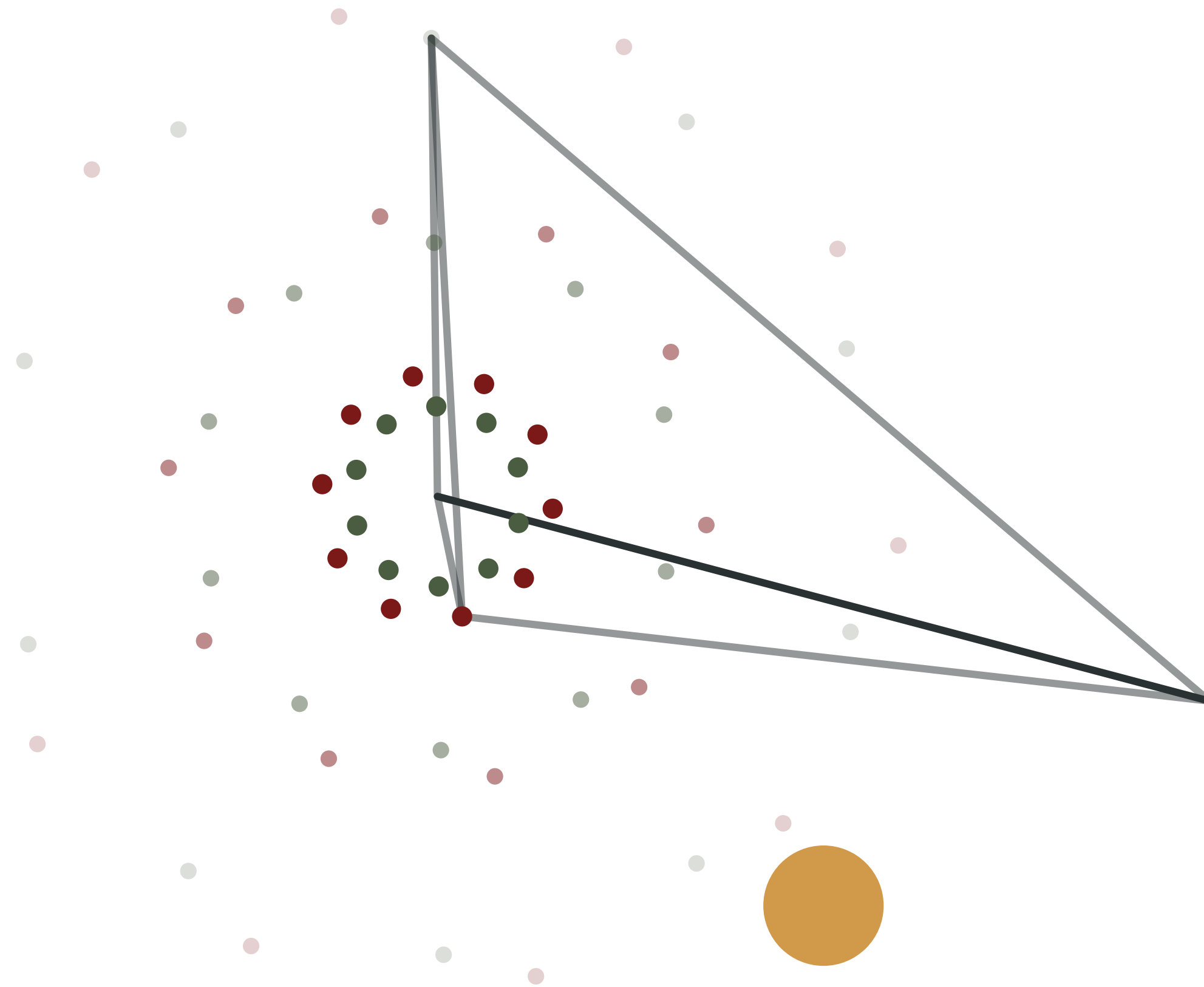
# Integrating two gluons



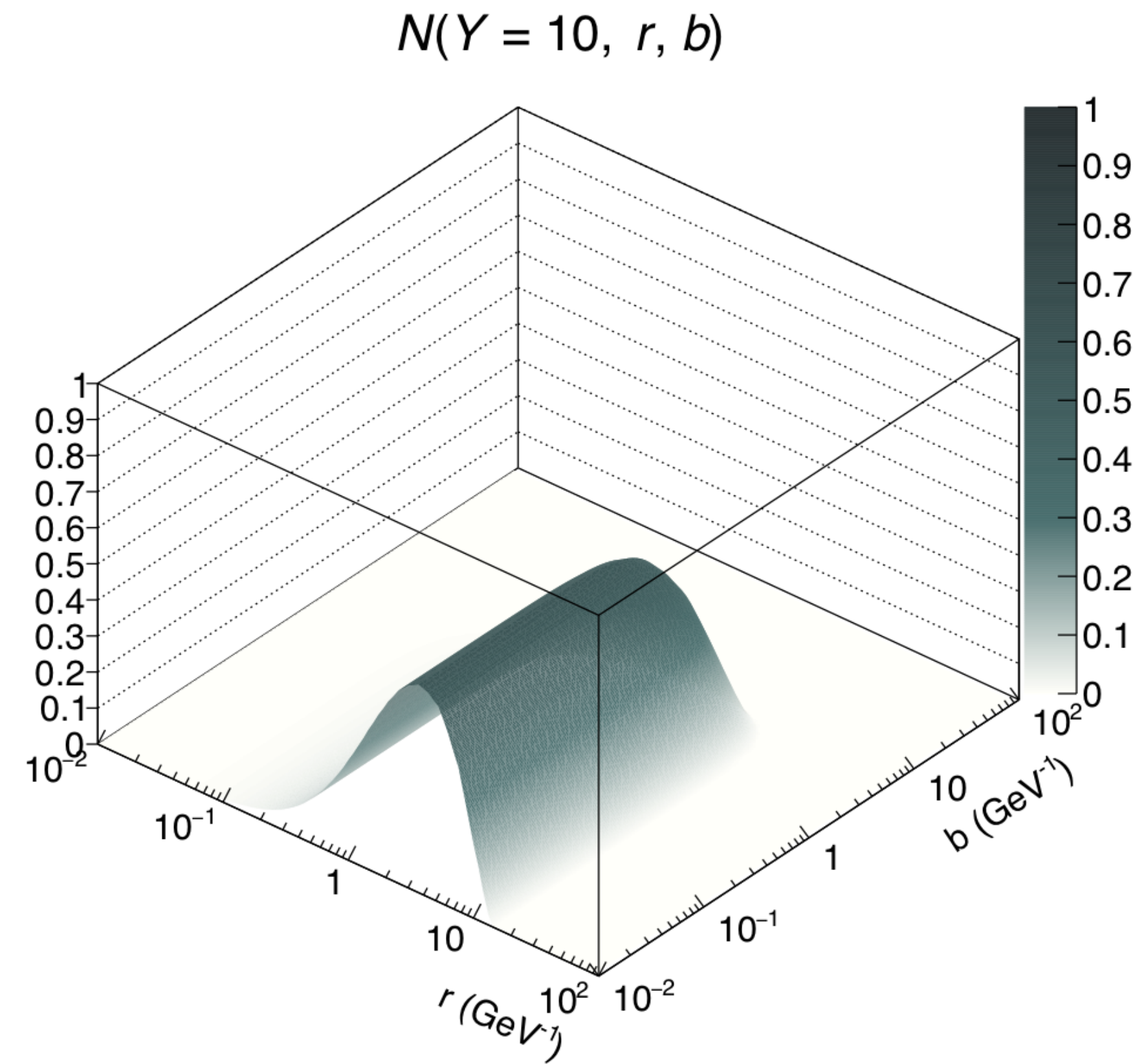
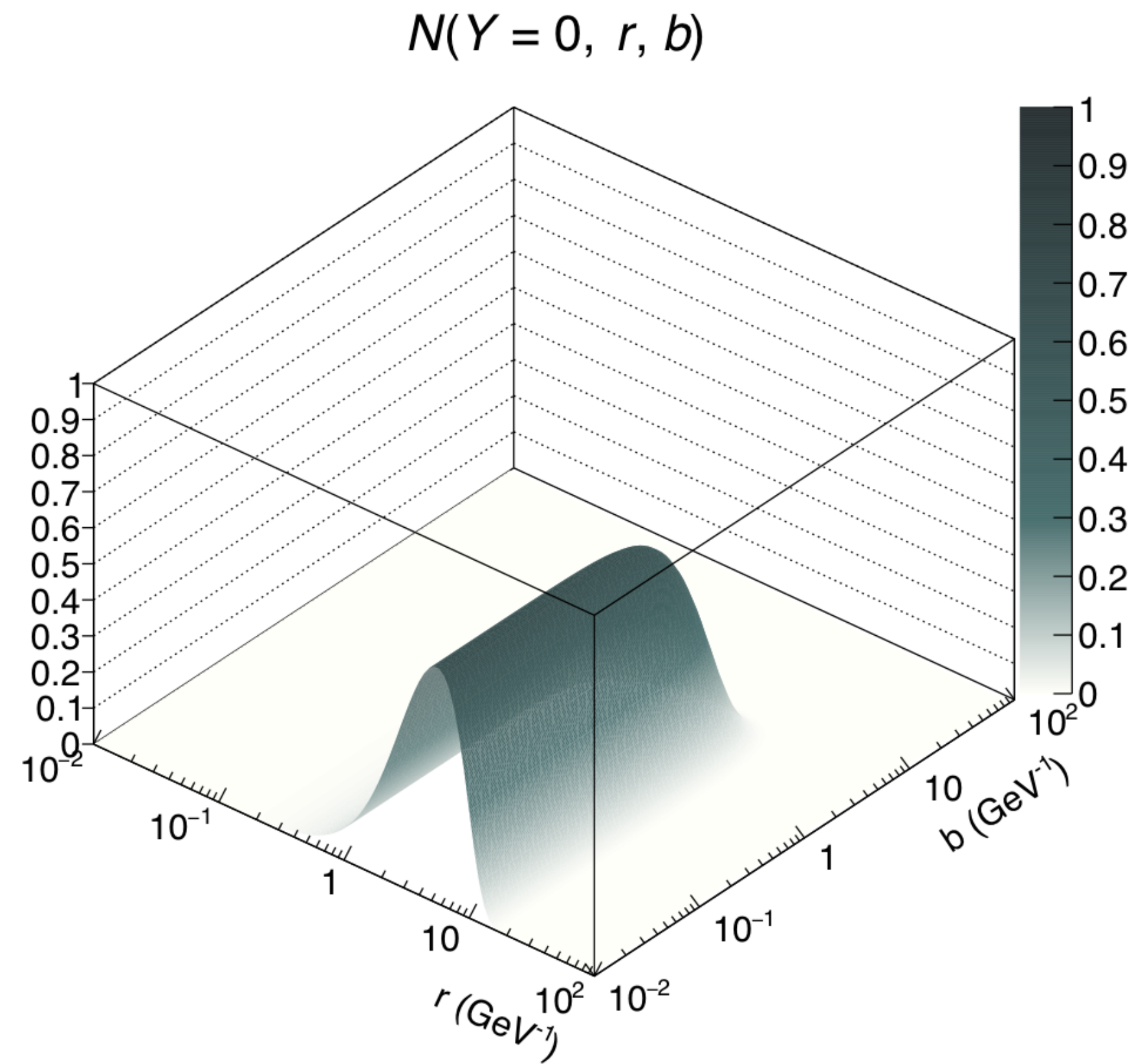
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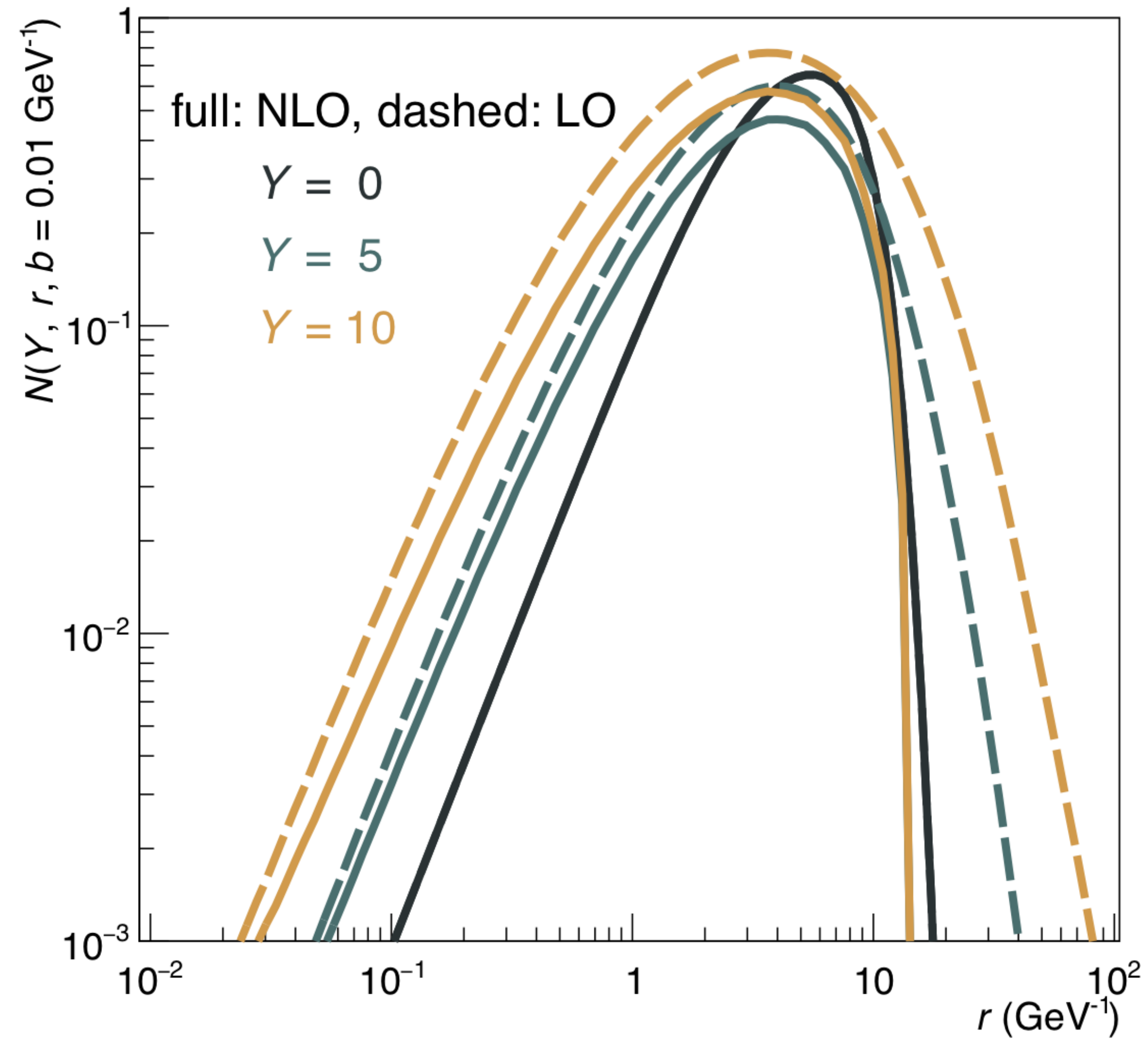
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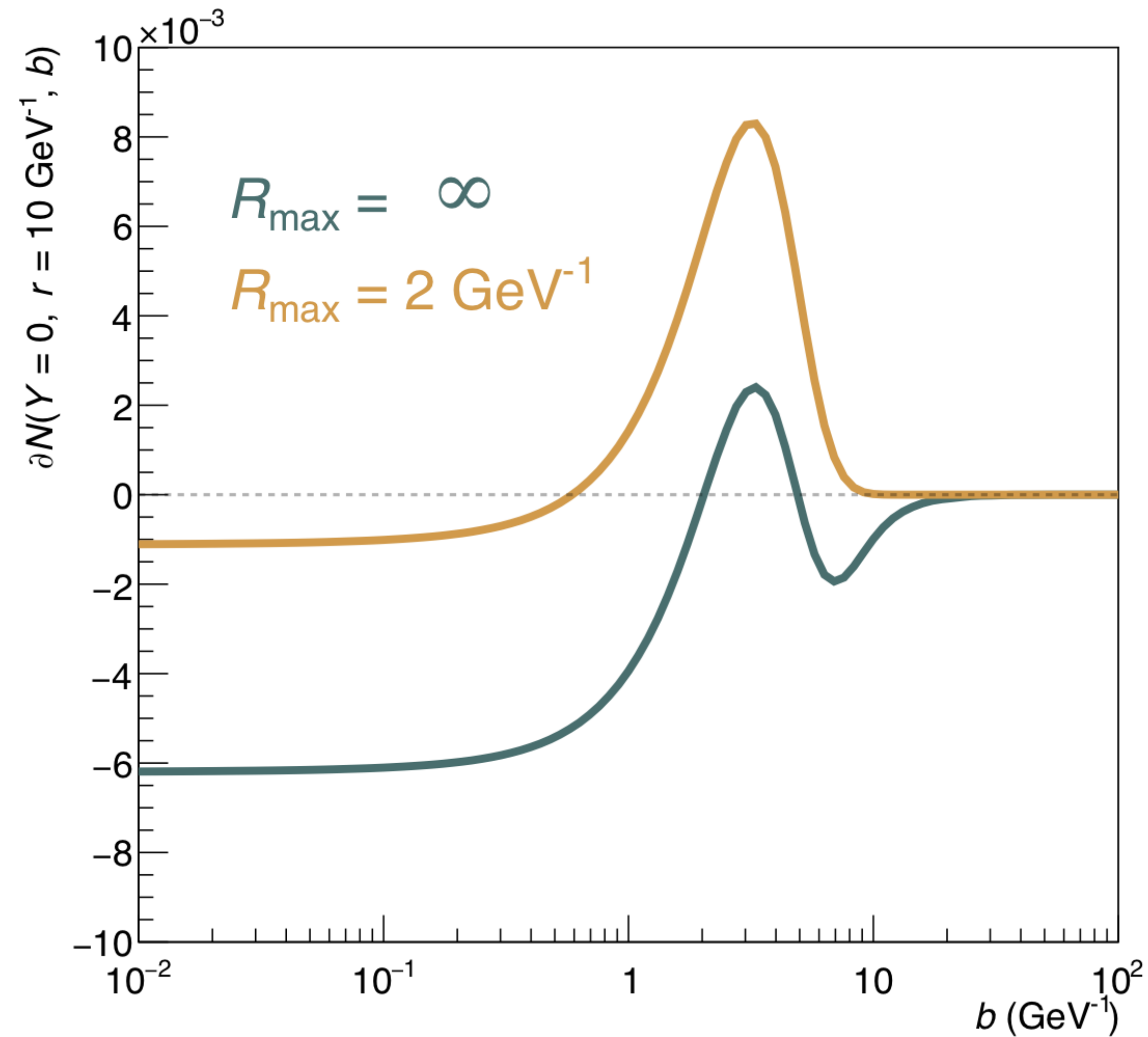
# The amplitude



# The amplitude



# Regulating the suppression



**thank you**