Exclusive J/Ψ production

Two theoretical descriptions

M. Diehl

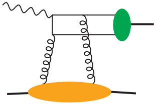
Deutsches Elektronen-Synchroton DESY

30 July 2009

HELMHOLTZ GEMEINSCHAFT

DESY

First description: generalized parton distributions



- generalized gluon distributions $H^g(x, \xi, t; \mu)$ and $E^g(x, \xi, t; \mu)$
- collinear factorization formalism
  GPDs follow DGLAP type evolution equation in μ
- $\xi = (m_{J/\Psi}^2 + Q^2)/(2W^2 - m_{J/\Psi}^2 + Q^2)$
  x integrated over; for $\mathrm{Im}\,\mathcal{A}$ have $x = \xi$
- simplest calc'n for static J/Ψ wave function $(k_c = k_{\bar{c}} = \frac{1}{2} k_{J/\Psi})$
  debate in literature about size of corrections
  also from $m_c \neq \frac{1}{2} m_{J/\Psi}$

see M.D., hep-ph/0307382, sects 7.4.1 and 8.4.2

First description: generalized parton distributions

- full NLO calc'n for $Q^2 = 0$ D.Yu. Ivanov et al, hep-ph/0401131
  - found very large corr's $\sim \alpha_s \log 1/x$
  - BFKL type resummation work in progress
- $H^g(x = \xi, \xi, t = 0) = xg(x)$ only in leading $\log 1/x$ approx.

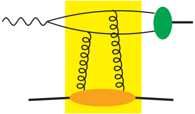
  S.J. Brodsky et al, hep-ph/9402283
- previous claim: $H^g(x, \xi, t = 0) \leftrightarrow xg(x)$

  A. Shuvaev et al, hep-ph/9902410

  not from first principles, but assumption

  K. Kumerički, D. Müller, arXiv:0907.1207
- interest in $H^g(x, \xi, t)$: transverse imaging of gluons, correlation between t and x, ξ
- from A_{UT} could get information on $E^g(x, \xi, t)$

Second description: color dipole formulation



- input: wave fcts. of photon (QED) and J/Ψ
  amplitude $N(r,b,x)$ for scatt. of $q\bar{q}$ dipole on target
- theoretical derivation at level of leading $\log 1/x$
  in phenomenology parameterize $N(r,b,x)$ rather than solve evolution equation in x (BFKL, BK)
- J/Ψ w.f. suppresses large dipole size r
  disfavors region of parton saturation (at least in proton)
- for small r relation between $N(r,b,x)$ and gluon distribution
  at leading $\log 1/x$ cannot distinguish $H^g(x,x,0)$ from $xg(x)$
- physics interest: again transverse gluon imaging