Coherent and incoherent photoproduction of J/ψ in Pb-Pb UPCs at 5.02 TeV

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October 26, 2021

In this note we update our predictions of Ref. [1] to Run 2 Pb-Pb UPCs at $\sqrt{s_{NN}} = 5.02$ TeV. At $y = 0$, this corresponds to $W_{\gamma p} = 125$ GeV and $x = 6 \times 10^{-4}$.
Using our predictions for the leading-twist gluon nuclear shadowing [2, 3], we can estimate the nuclear suppression factor at this value of x (see Eq. (11) of Ref. [1])

$$\begin{aligned} R(x = 6 \times 10^{-4}) &= \frac{\sigma_{\gamma A \to J/\psi Y}(W_{\gamma p})}{A(\sigma_{\gamma p \to J/\psi p}(W_{\gamma p}) + \sigma_{\gamma p \to J/\psi Y}(W_{\gamma p}))} \\ &= \int d^2 b T_A(b) \left(1 - \frac{\sigma_2}{\sigma_3} + \frac{\sigma_2}{\sigma_3} e^{-\frac{\sigma_3}{2} A T_A(b)}\right)^2 = 0.10 - 0.26\,, \end{aligned} \tag{1}$$

where $T_A(b)$ is normalized to unity, i.e. $\int d^2\vec{b} T_A(b) = 1$. These values are expectedly smaller than those for $x = 10^{-3}$ in Ref. [1] because of a somewhat larger suppression due to nuclear shadowing at higher energies.
Combining this with the parametrization of the cross section of elastic J/ψ photoproduction on the proton $\sigma_{\gamma p \to J/\psi p}(W_{\gamma p})$ and proton-dissociative J/ψ photoproduction on the proton $\sigma_{\gamma p \to J/\psi Y}(W_{\gamma p})$, see Ref. [4], one can readily make predictions for the elastic and nucleon-dissociation contributions to the $d\sigma_{\gamma A \to J/\psi Y}(W_{\gamma p})/dt$ cross section as a function of $|t|$. The result is presented in Fig. 1 in next page.
Note that our predictions for the elastic contribution for $|t| \geq 1.2$ GeV^2 is an extrapolation of the H1 parametrization into the unmeasured range of t [4].
One can see from the figure that our predictions for Run 2 are rather close (on the log scale) to our predictions for Run 1. This is a result of a partial compensation of two opposite effects: a decrease of R in Eq. (1) with an increase of energy is partially compensated by an increase of the proton $\sigma_{\gamma p \to J/\psi p}(W_{\gamma p})$ and $\sigma_{\gamma p \to J/\psi Y}(W_{\gamma p})$.

References

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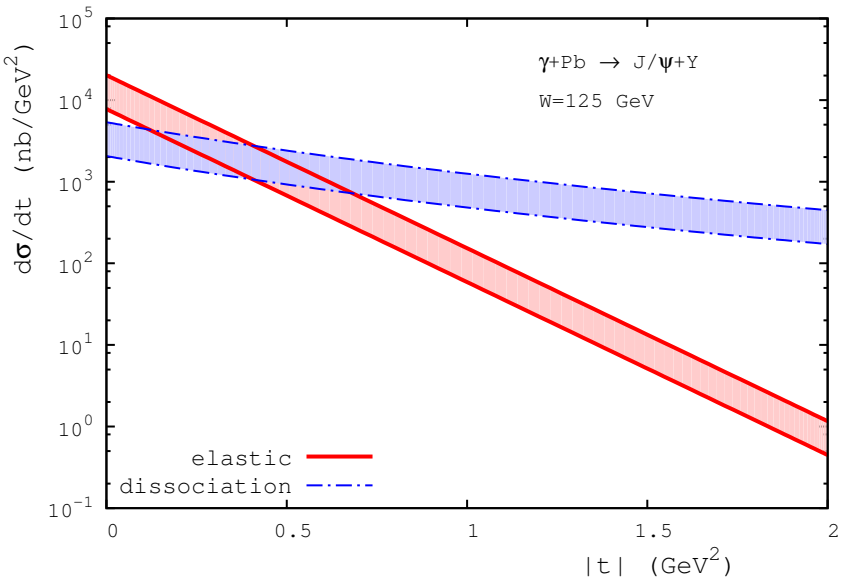

Figure 1: The elastic and nucleon-dissociation contributions to $d\sigma_{\gamma A\to J/\psi Y}(W_{\gamma p})/dt$ cross section as a function of $|t|$. The shaded error bands quantify the uncertainty in the calculation of nuclear shadowing; $W_{\gamma p} = 125$ GeV corresponds to Pb-Pb UPCs at $\sqrt{s_{NN}} = 5.02$ TeV and $y = 0$.