Miniworkshop difrakce a ultraperiferálních srážek
2-3 May, 2018
Děčín, Česká republika

Amplitude for vector-meson photo-production in the colour dipole model: main components

J. G. Contreras
Czech Technical University

May 2, 2018, Děčín

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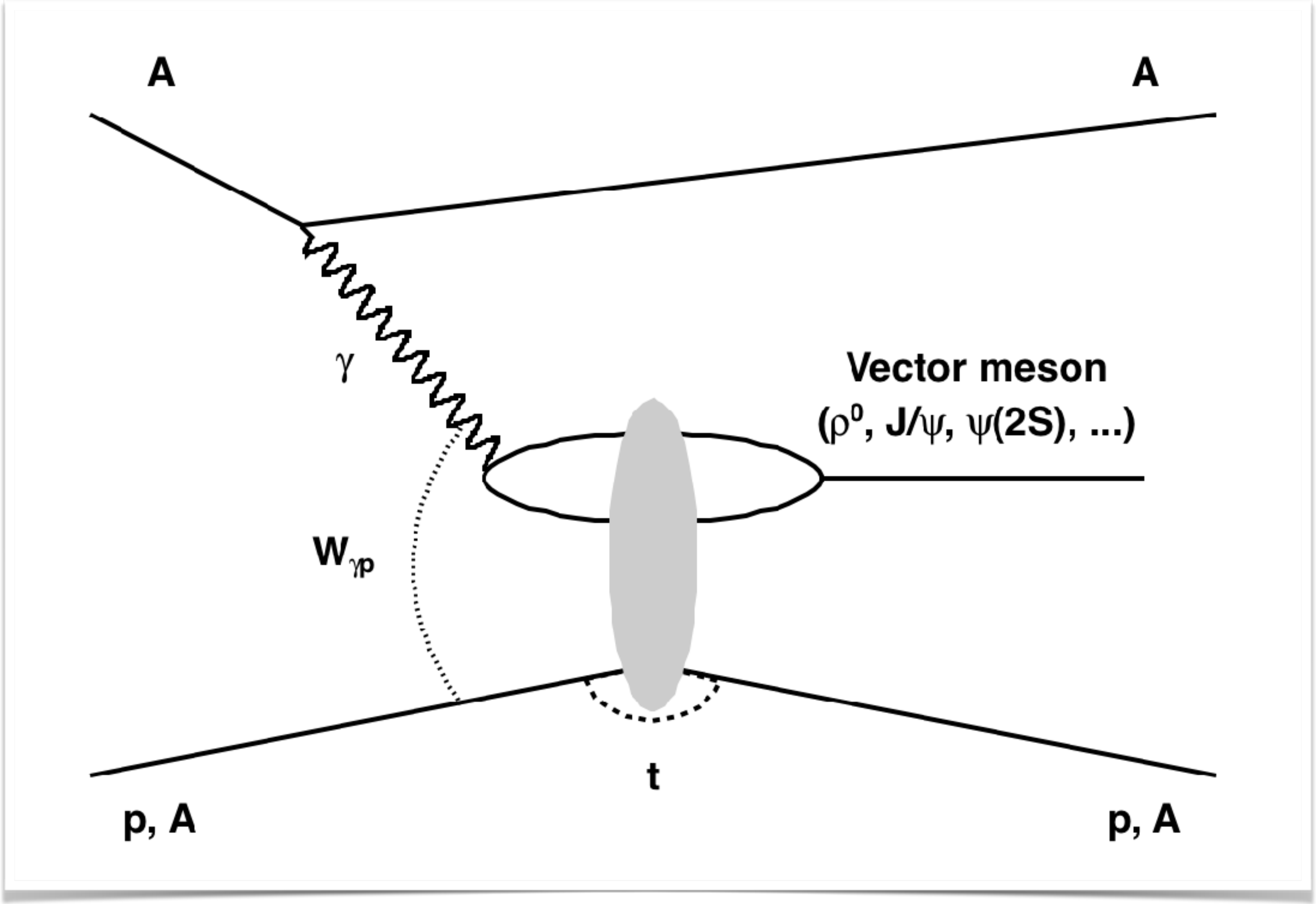
The process we are interested in



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The process can be factorised in two parts:

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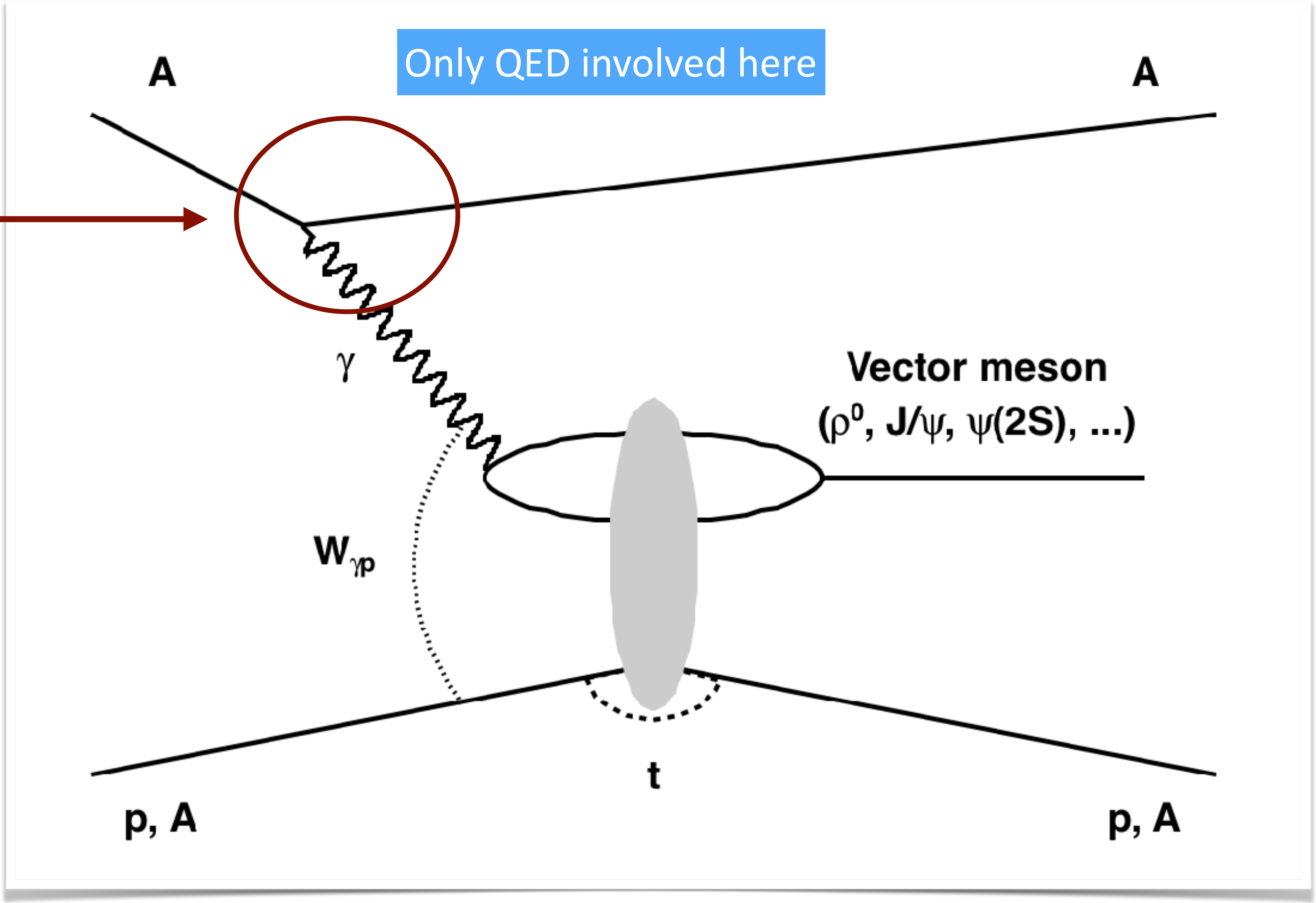

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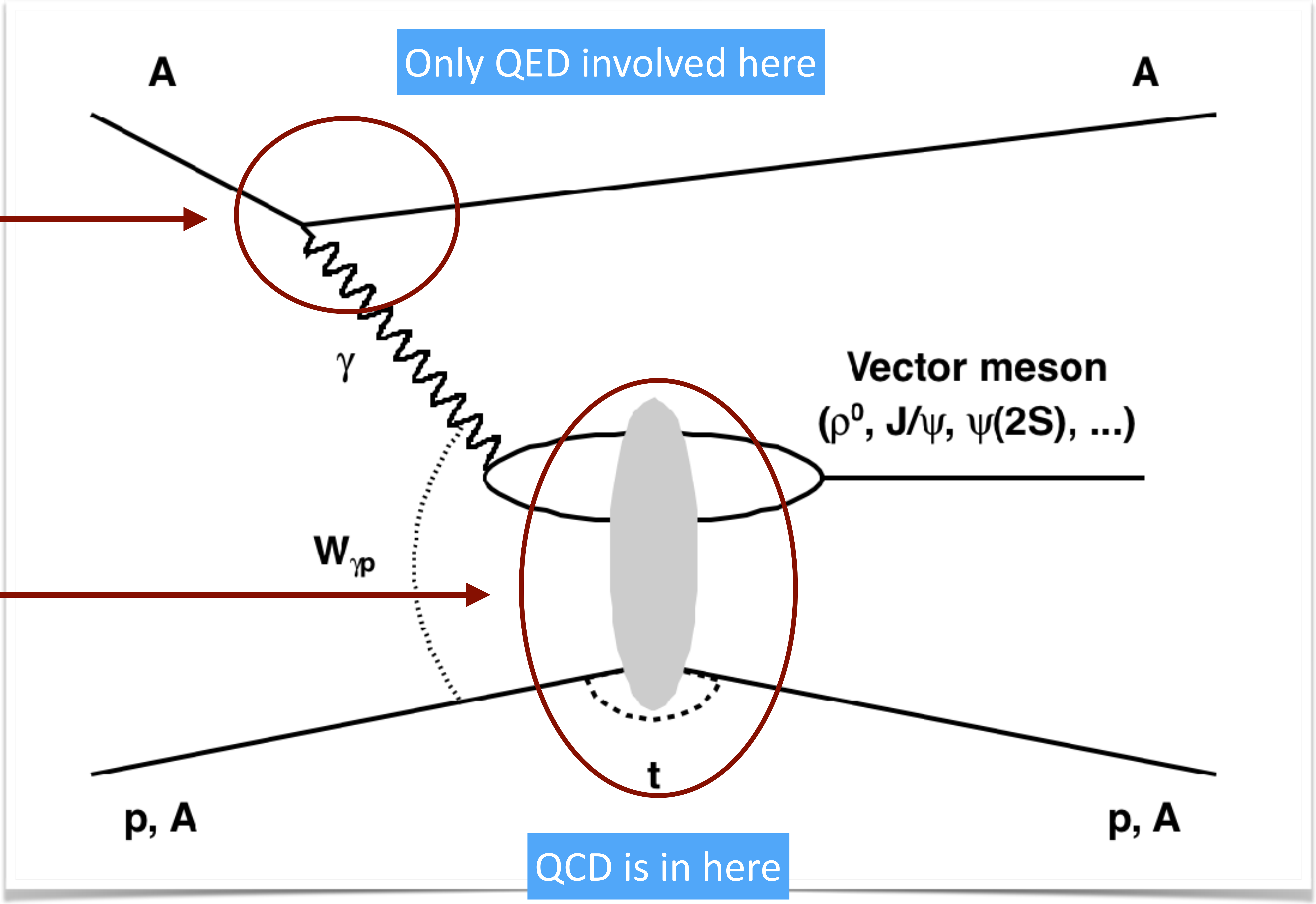
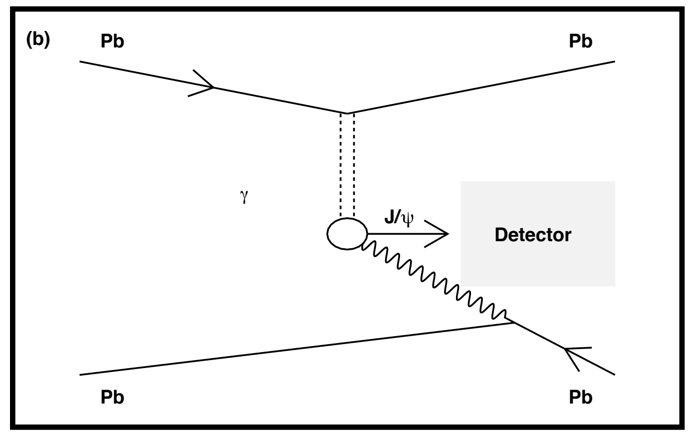
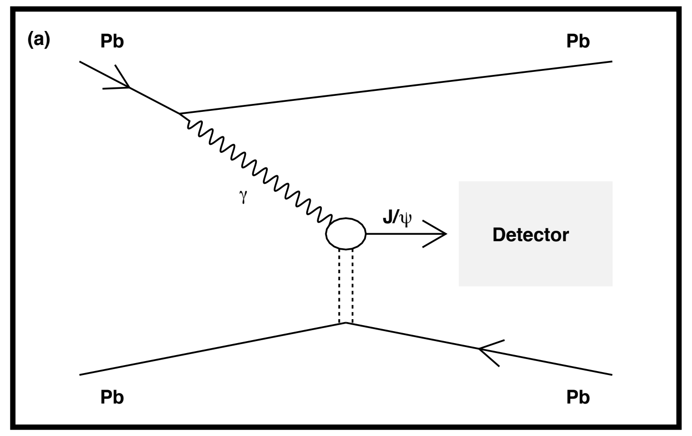
- Emission of the photon.
- Interaction of the photon with the target.



The cross section for the pp, pPb or PbPb system





$$\frac{d\sigma_{\mathrm{PbPb}}}{dy} = n_\gamma(y; b_{1,2})\sigma_{\gamma\mathrm{Pb}}(y) + n_\gamma(-y; b_{1,2})\sigma_{\gamma\mathrm{Pb}}(-y)$$

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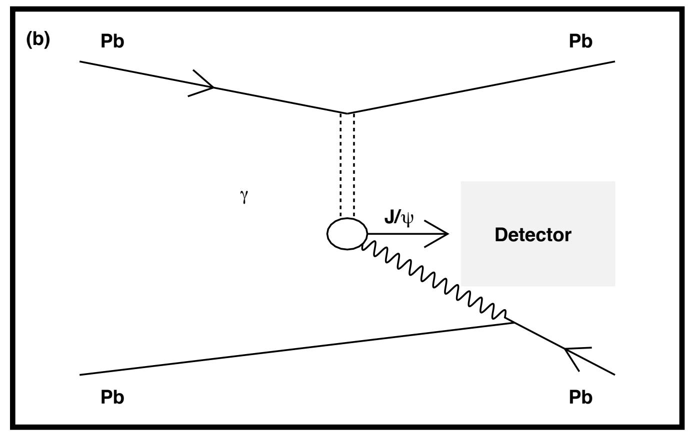

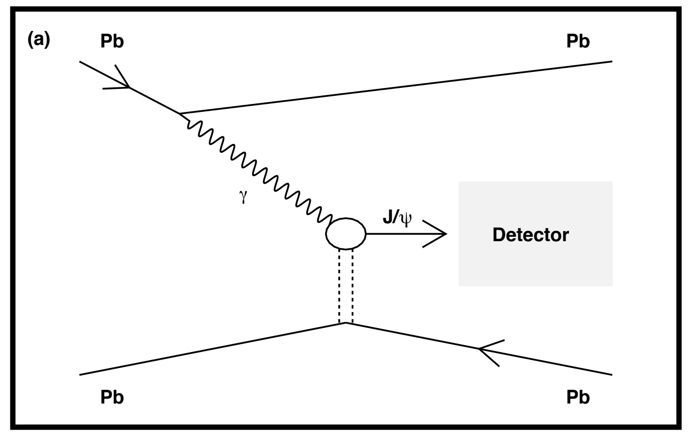

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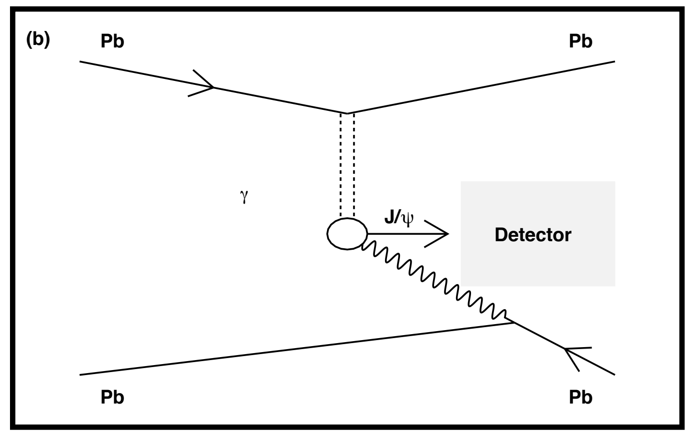

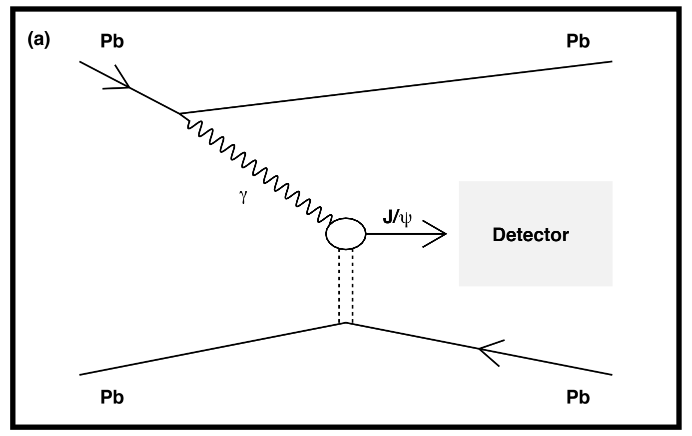

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Emission of the photon by the source.

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- Proton case is similar, but formula is different.

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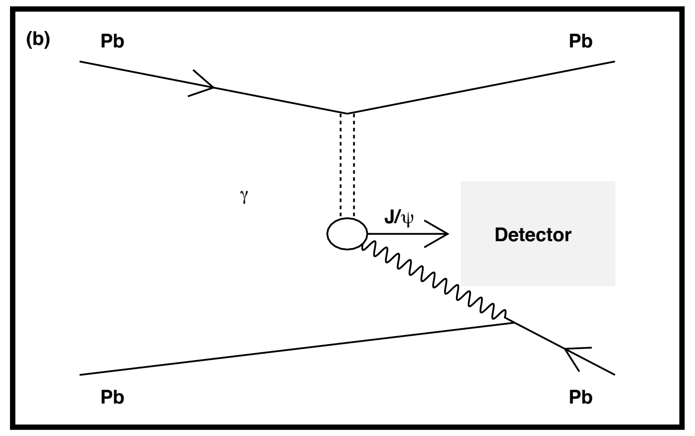

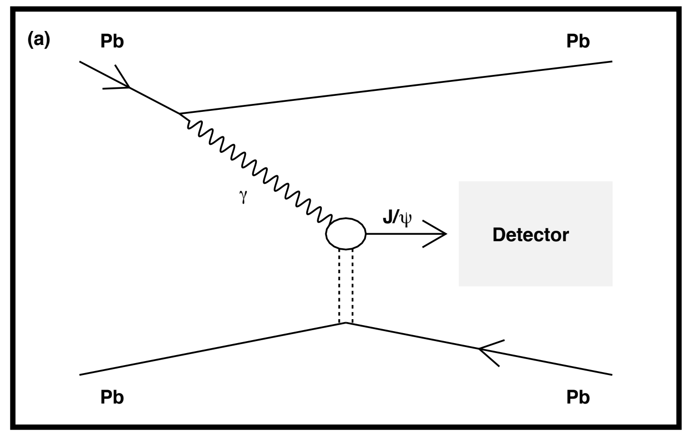

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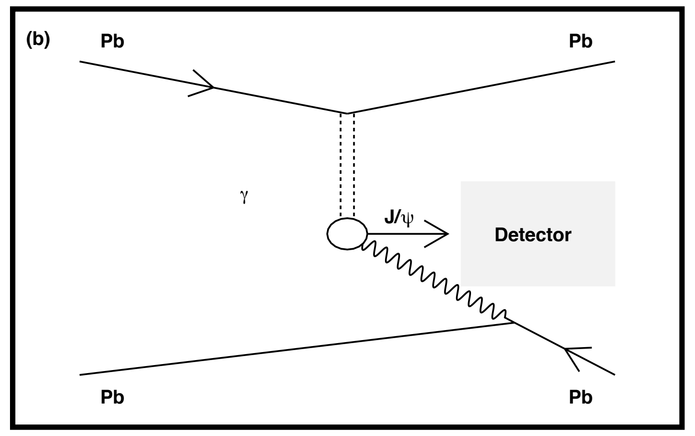

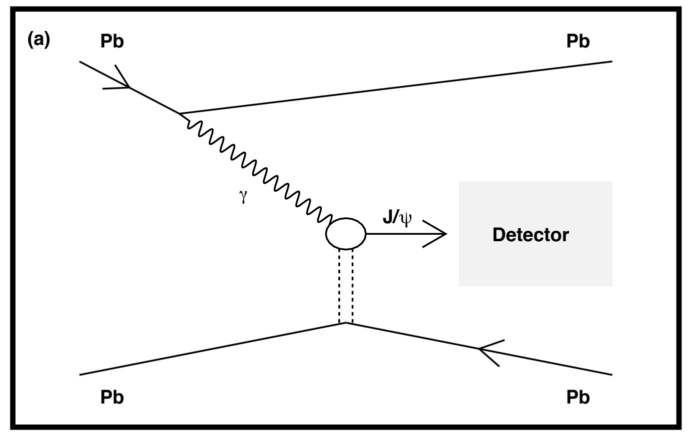

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Emission of the photon by the source.

- Here only the Pb case.
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- If we considered mid-rapidity, y=0, then both terms are equal and we need only one flux and one cross section.
- If one term is much larger then the other, e.g. at forward rapidities or in pPb collisions, then only one term is considered.

The cross section for the γ-target system

$$\left.\frac{d\sigma_{\gamma A}}{dt}\right|_{T,L}^{\mathrm{coh}} = \frac{\left(R_g^{T,L}\right)^2}{16\pi} |\langle A^j(x, Q^2, \vec{\Delta})_{T,L}\rangle_j|^2$$

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- Cross section computed at a value of t and W.
- If only one vector meson is produced, and nothing else, the cross section is known as:
  - Elastic (some HERA papers).
  - Exclusive.
  - Coherent (mainly for nuclear targets, but lately also for production off protons.

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- Average over configuration in models with fluctuations.

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- Some corrections may be applied.
- Here the skewedness correction is shown.
- There may also be a correction for the real part.

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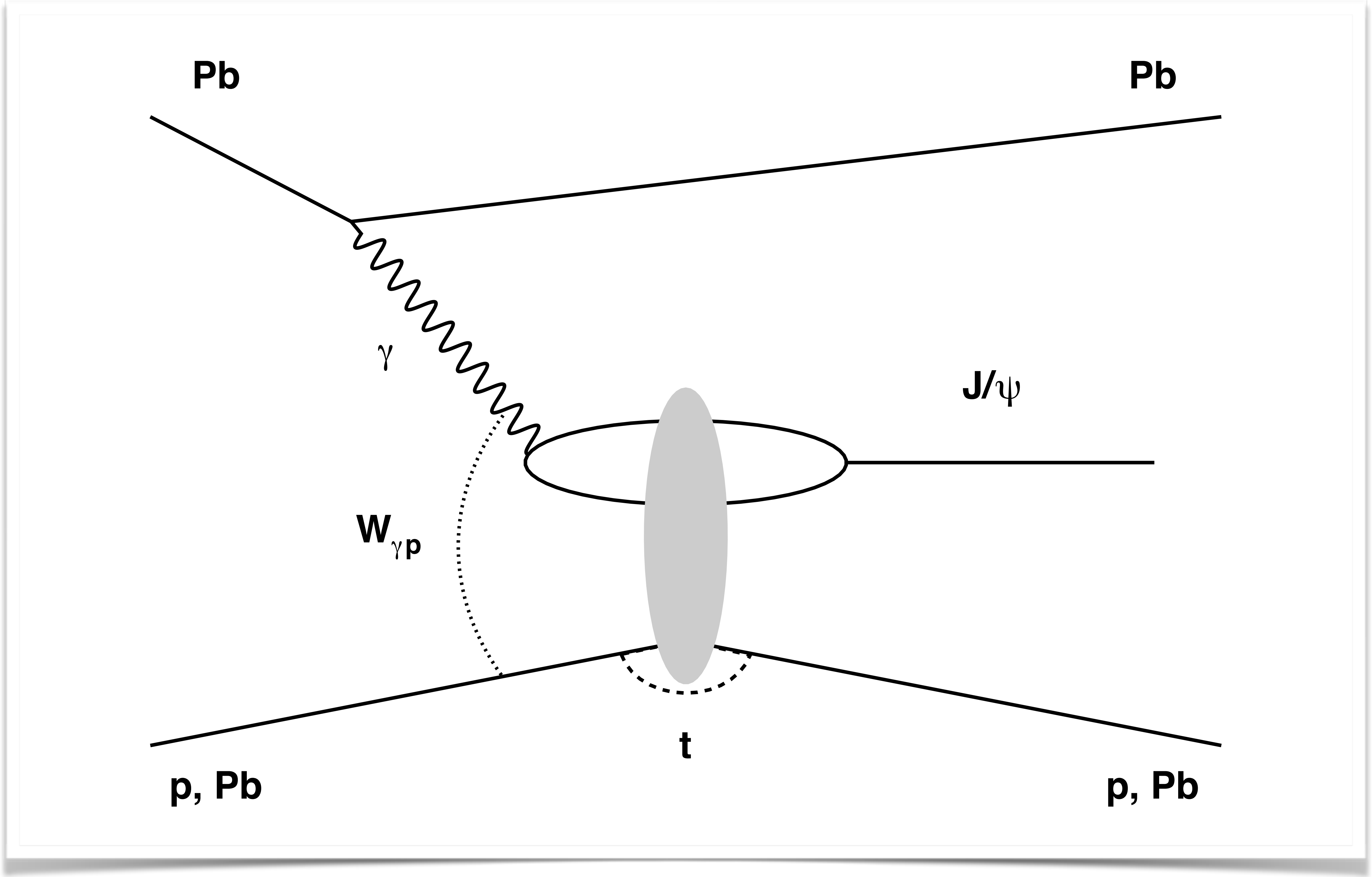
The amplitude in the dipole picture

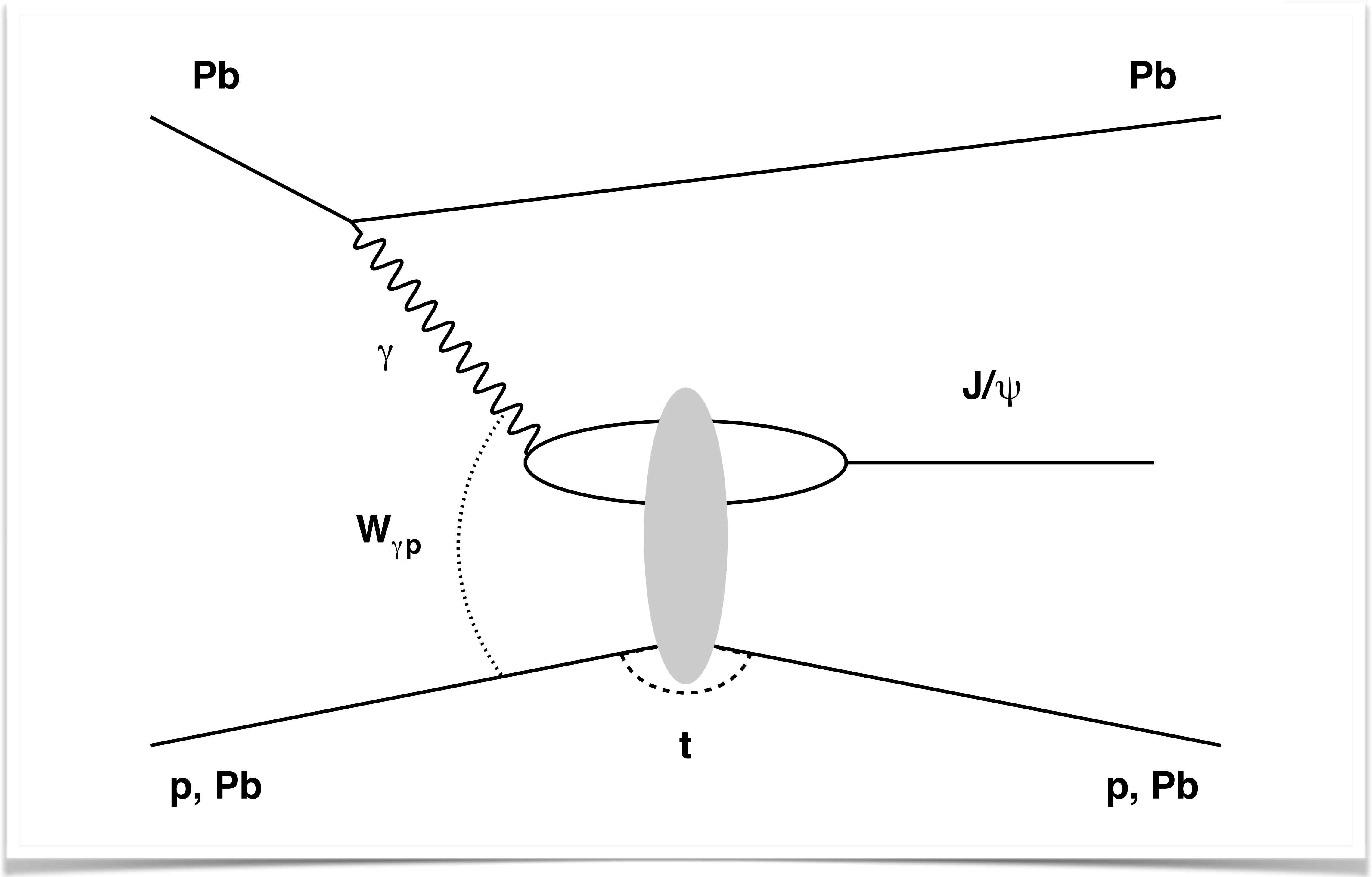


e.g., Kowalski, Motyka, Watt, PRD74 (2006) 074016

The amplitude in the dipole picture

x related to Wγp which is related to the rapidity of the vector meson

$$A(x,Q^2,\vec{\Delta})_{T,L} = i\int d\vec{r}\int_0^1 \frac{dz}{4\pi}(\Psi^*\Psi_V)_{T,L}\int d\vec{b}\, e^{-i(\vec{b}-(1-z)\vec{r})\cdot\vec{\Delta}}\frac{d\sigma_{\rm dip}}{d\vec{b}}$$



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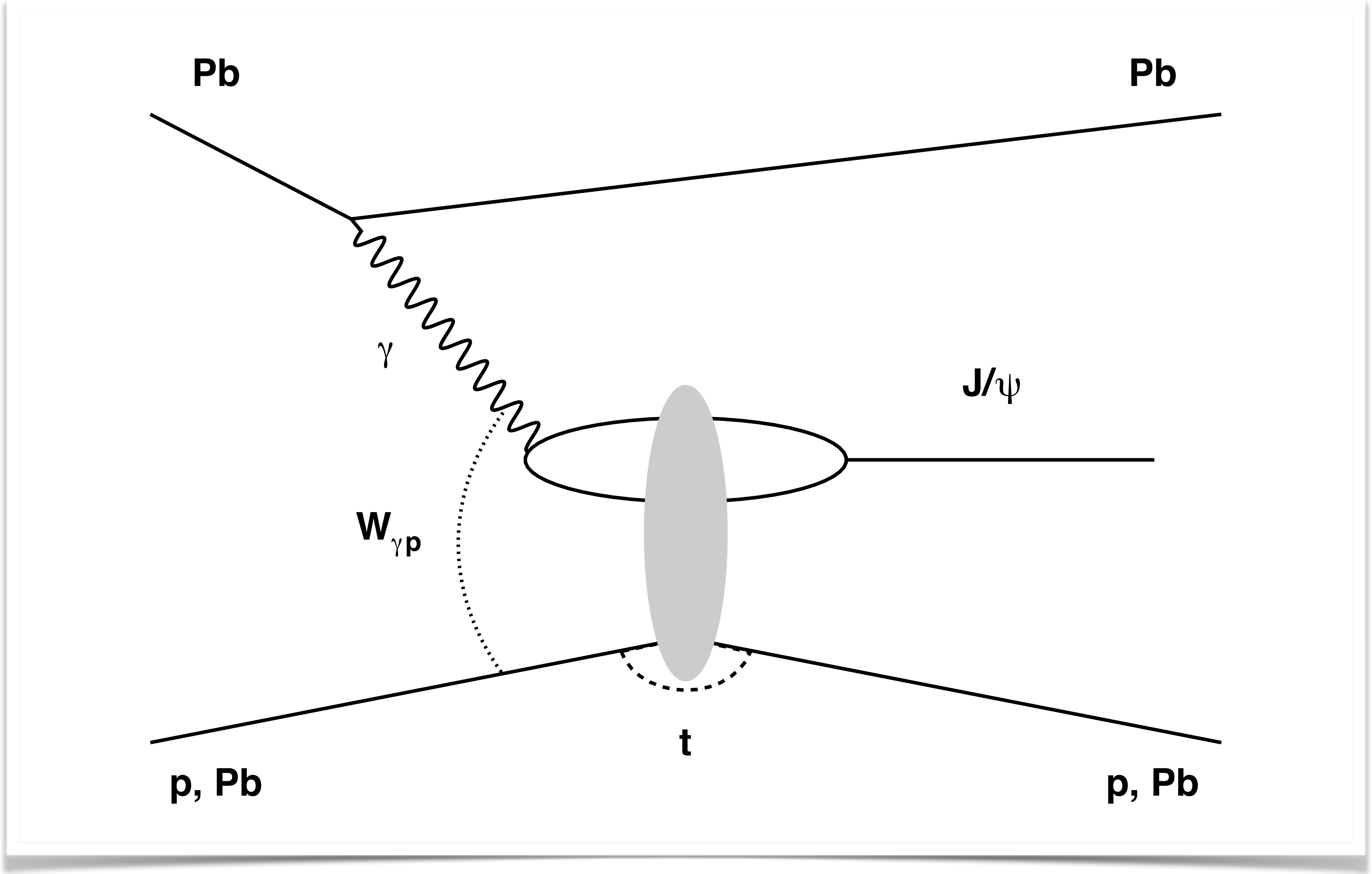

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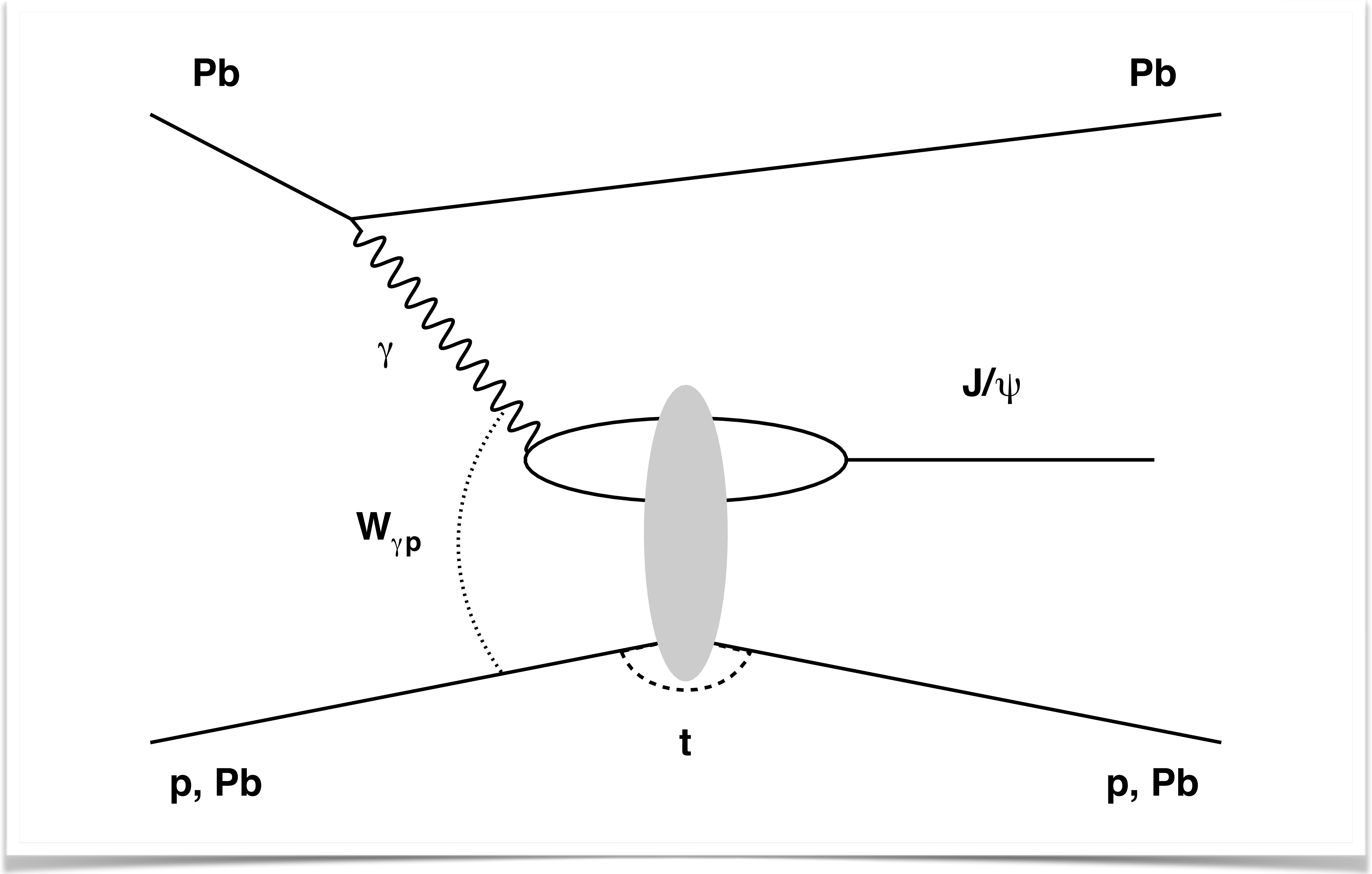

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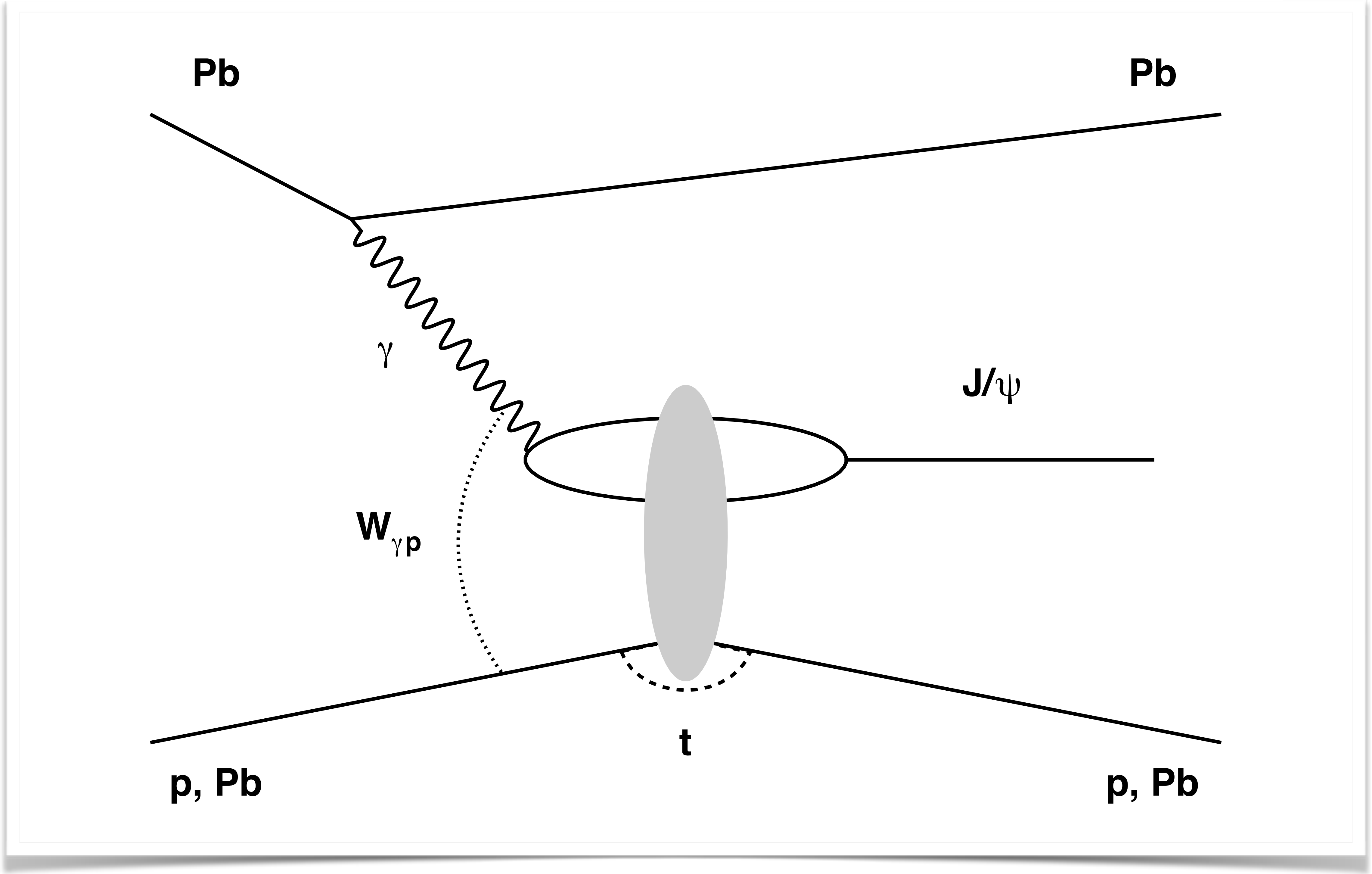

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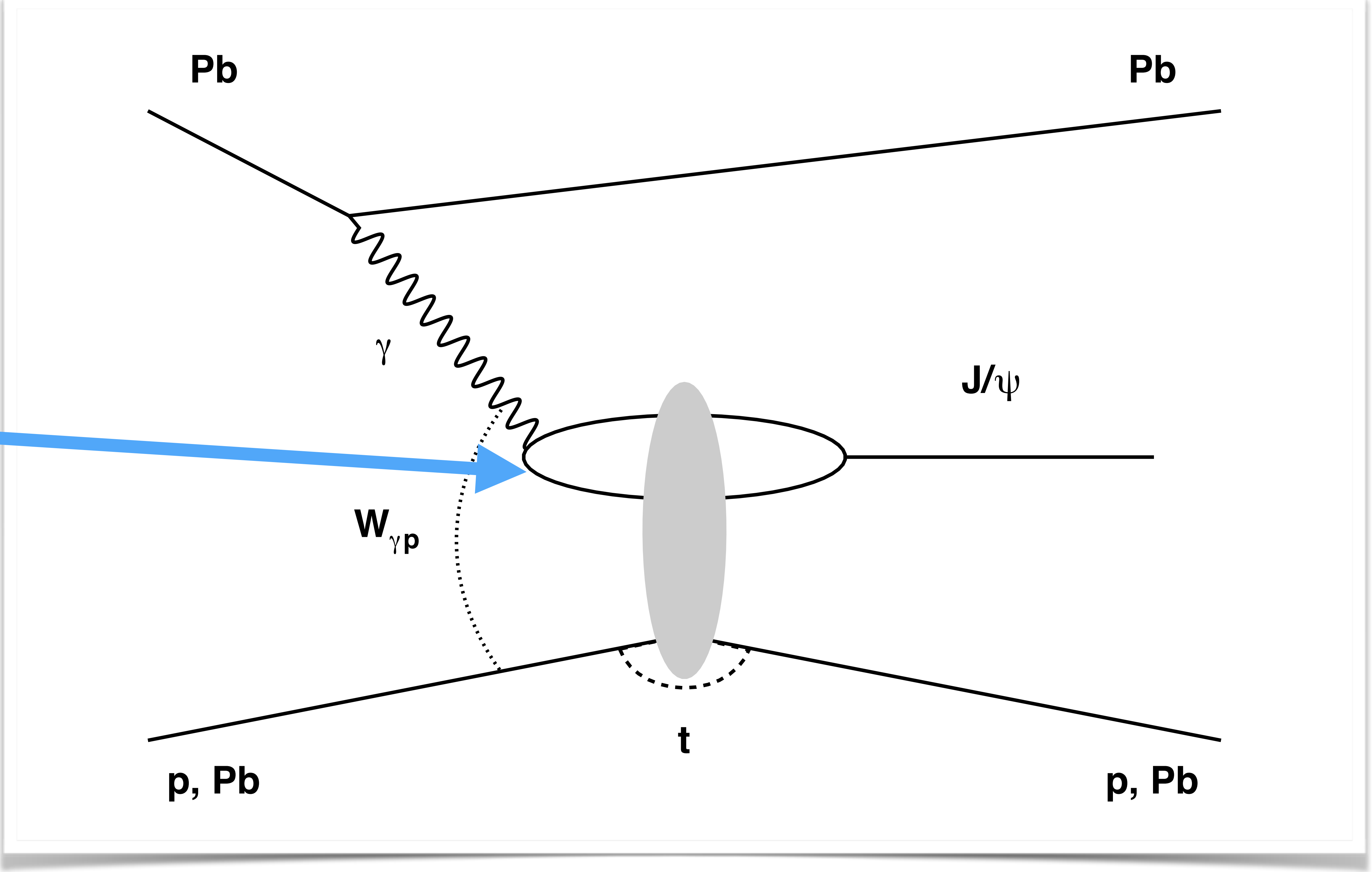
Transverse, Longitudinal photons

Photon-dipole wave function

Photon virtuality



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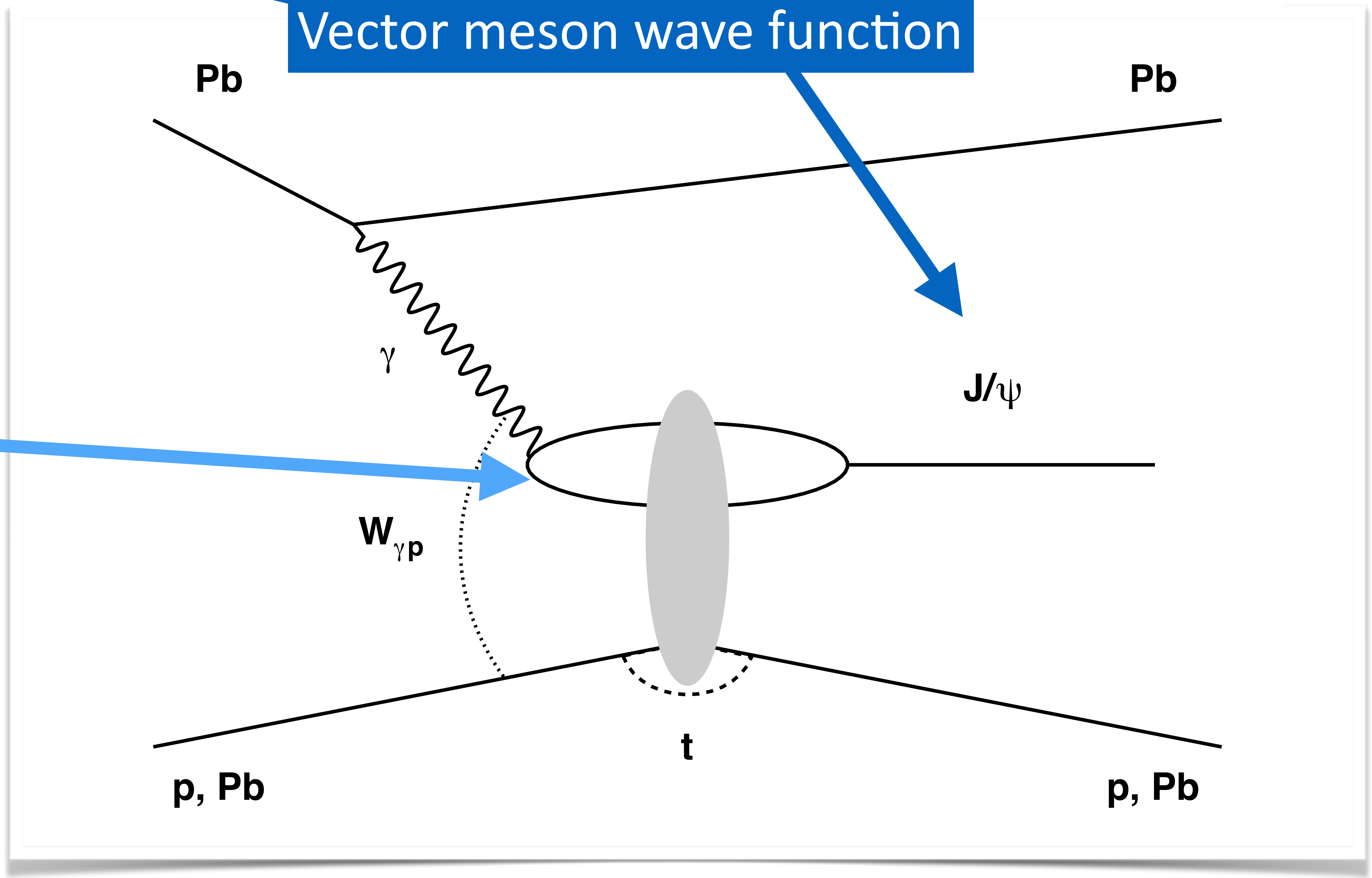

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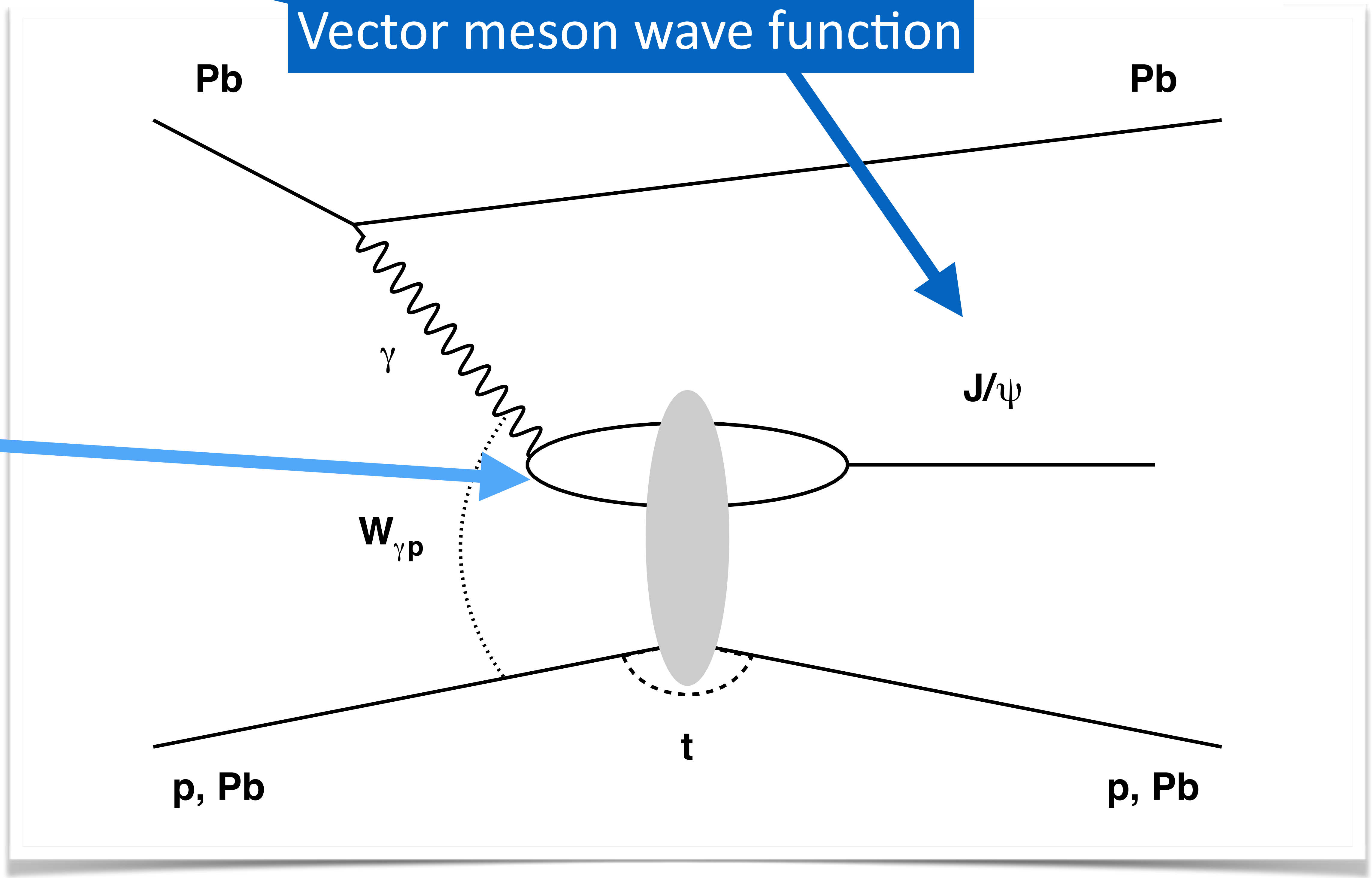

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Dipole-Target cross section
pQCD physics gets here!

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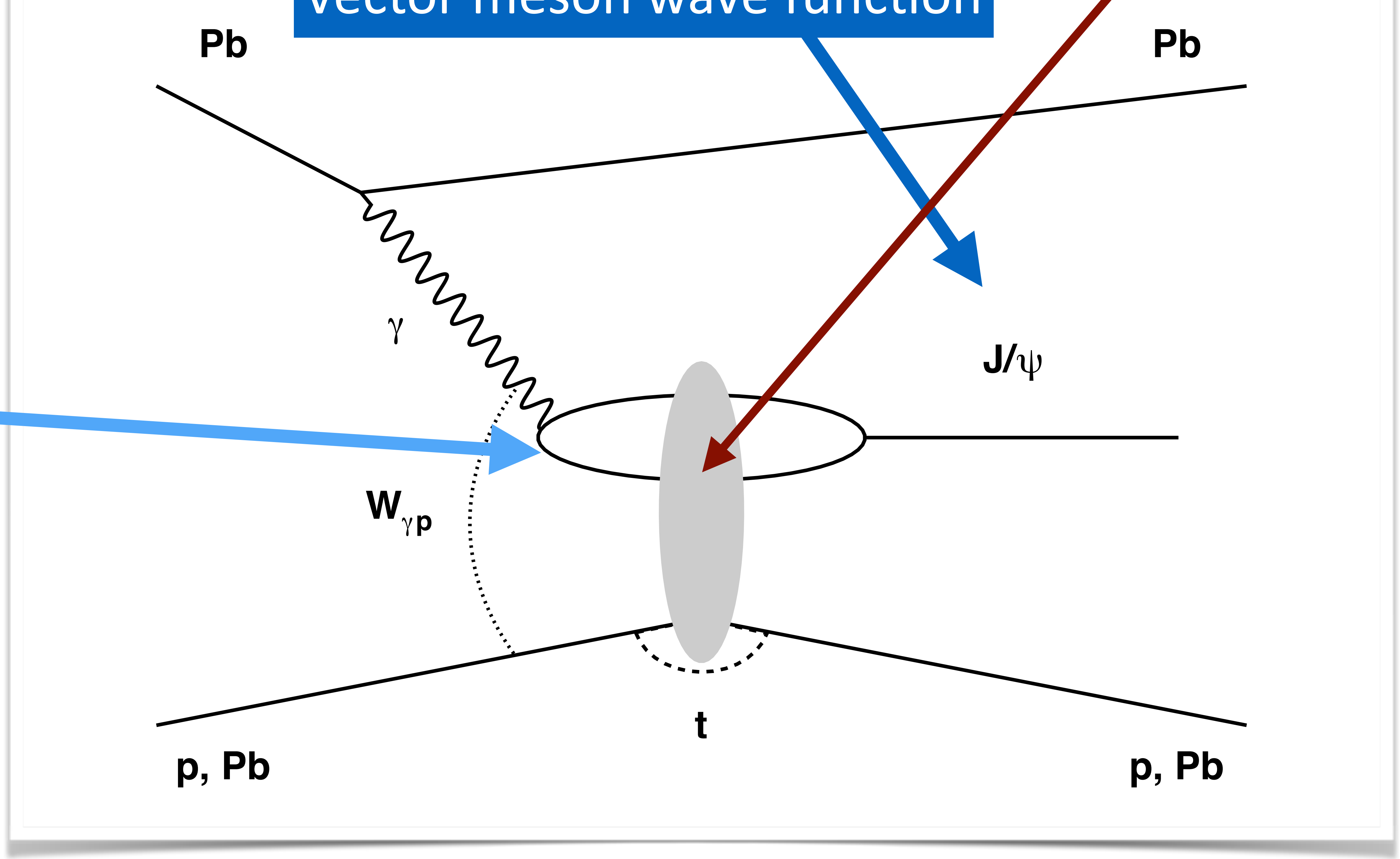

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