Conventional and gauge couplings with the Δ field

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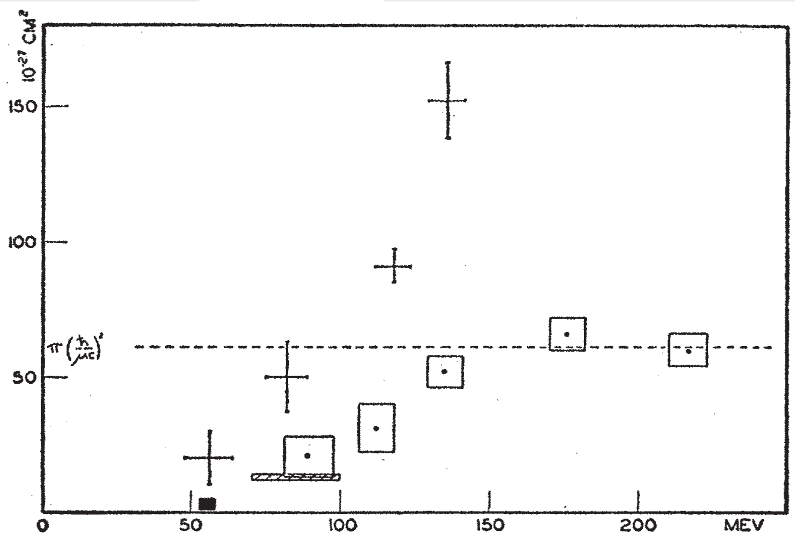

FIG. 1. Total cross sections of negative pions in hydrogen (sides of the rectangle represent the error) and positive pions in hydrogen (arms of the cross represent the error). The cross-hatched rectangle is the Columbia result. The black square is the Brookhaven result and does not include the charge exchange contribution.

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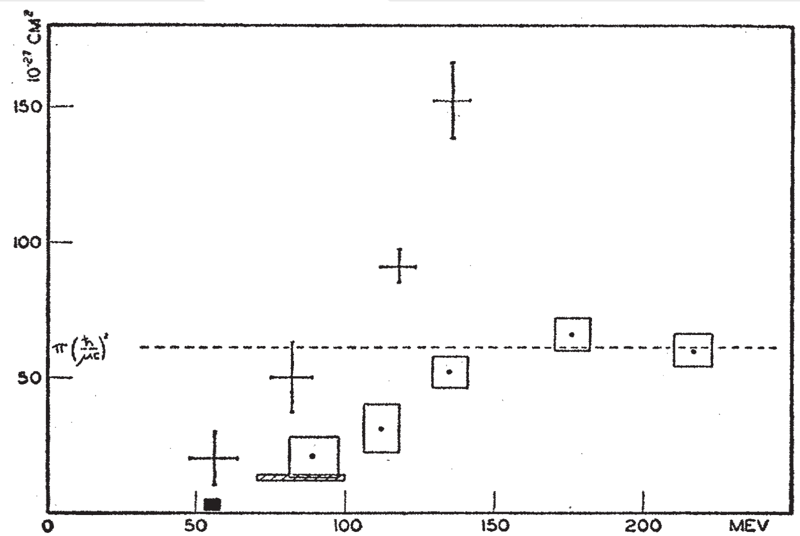

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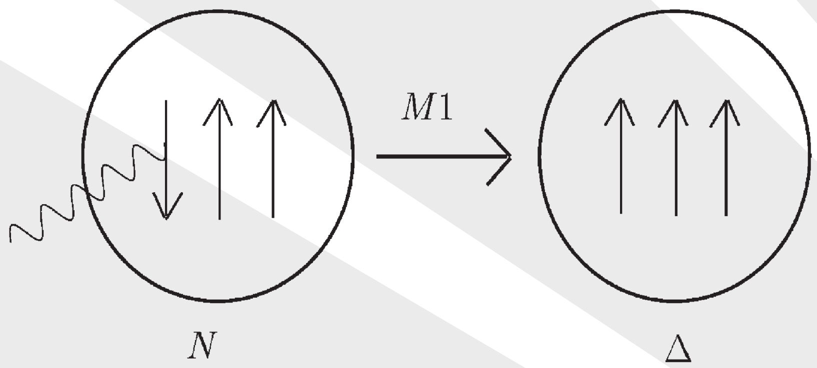

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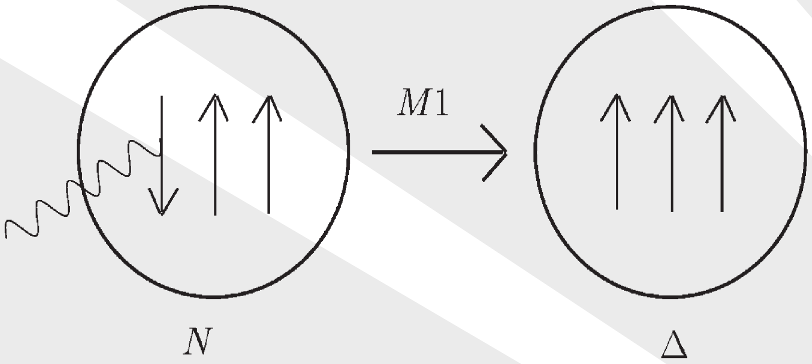

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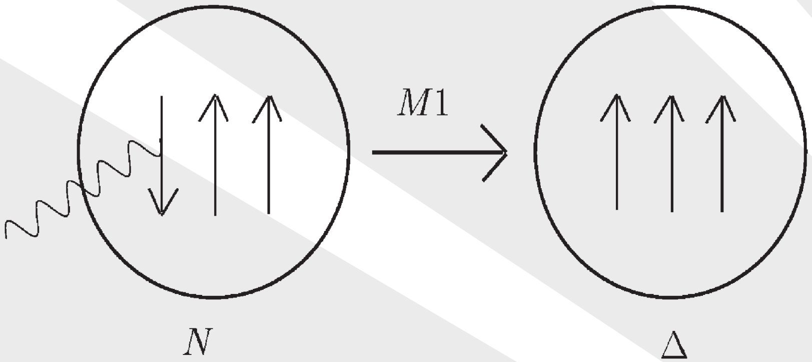

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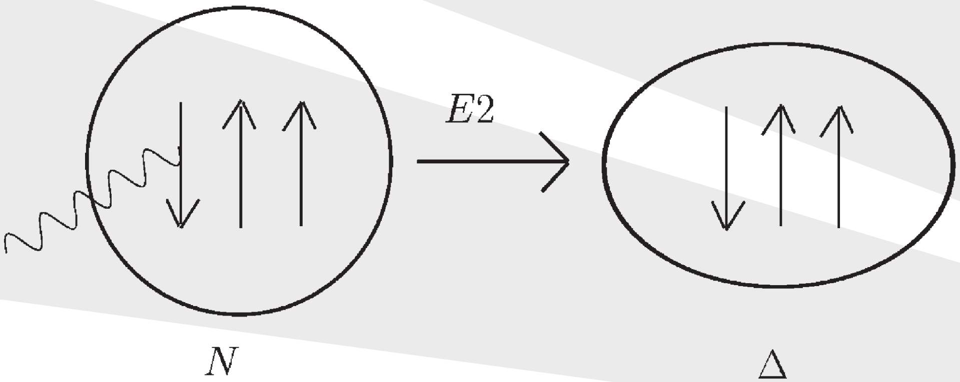

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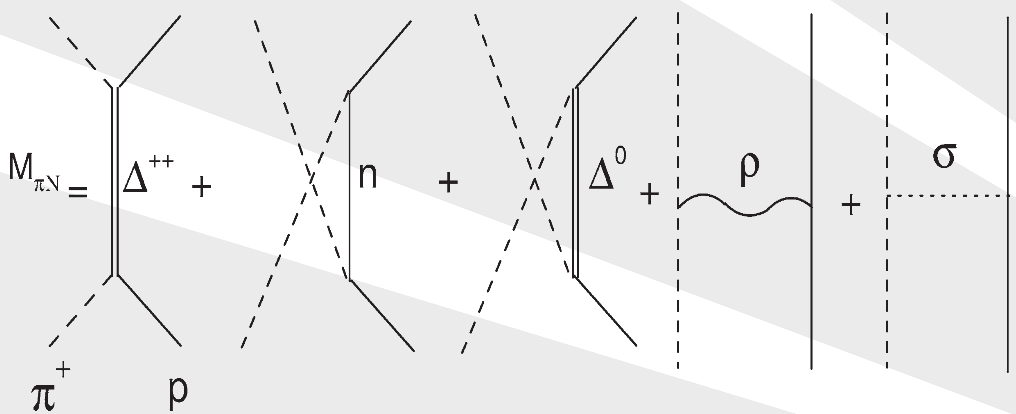

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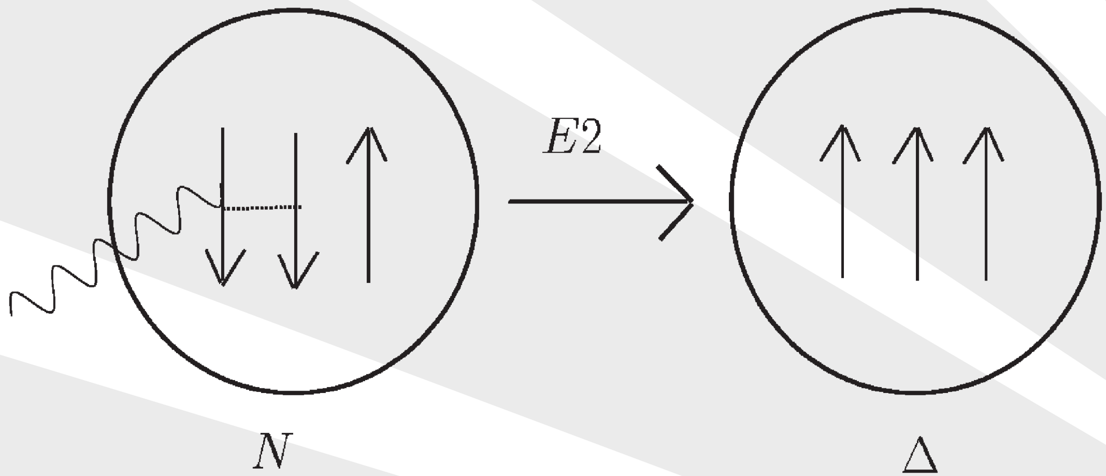

For all of them we need $\mathcal{L}_{\Delta}$ and $\mathcal{L}_{\pi N \Delta}$ Lagrangians

Spin 3/2 field

- Rarita Schwinger (RS) spinor ψ_μ is taken as an element of the NU representation of the LG
$[(1/2,0)\oplus(0,1/2)]\otimes[(1/2,1/2)=(1/2,0)\otimes(0,1/2)]$

- $D(1/2)\otimes D(0)=D(1/2)$
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  - $\psi_\mu(x)$ satisfies the Dirac eq.

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- These 8 '$3/2$ fields' represent physical on-shell $\Delta(1232)$ states and the remaining 8 are $1/2$ ones.

Lagrangian and contact transformations

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❖ theory?
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❖ Spin 3/2 field
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❖ Constraints and degrees of freedom
❖ Lagrangian and contact transformations
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❖ Is this situation exclusive of the RS field?
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$\mathcal{L}_{free}$ includes constraints and Γ, B do not mix $3/2$ with $1/2$ states $\Rightarrow$ only fix 3/2 component of $\psi_\mu(x)$.

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only affects $\psi_{1/2\mu}$ components of ψ_μ and let $\mathcal{L}_{free}$ invariant $\Rightarrow$ a whole family of valid one parameter Lagrangians.

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for $A = -1/3 \rightarrow$ RS.

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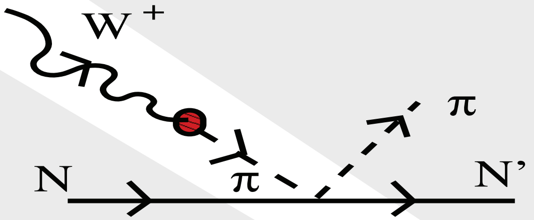

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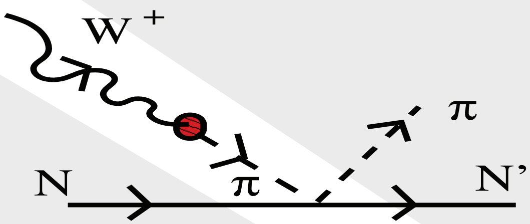

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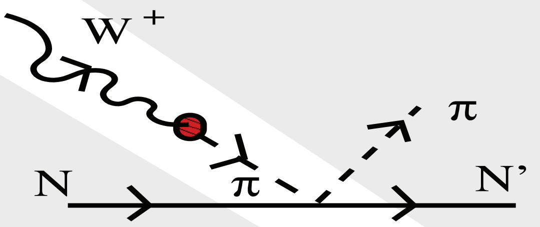

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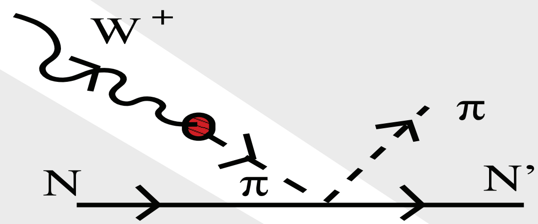

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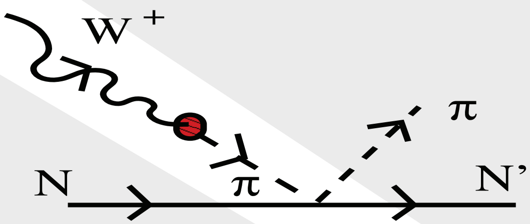

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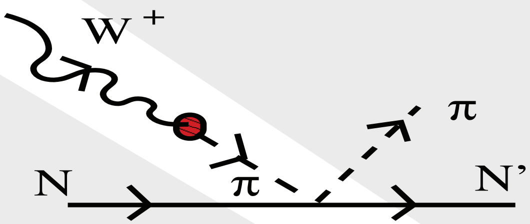

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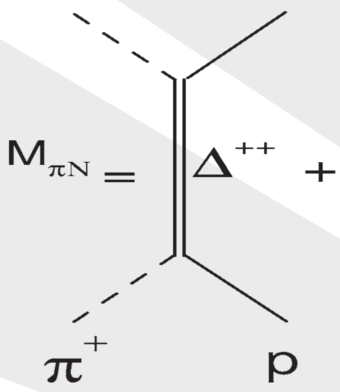

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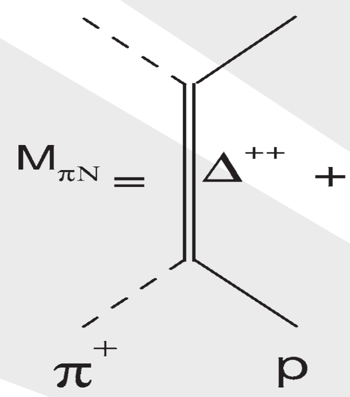

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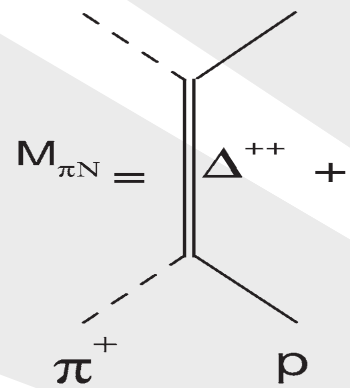

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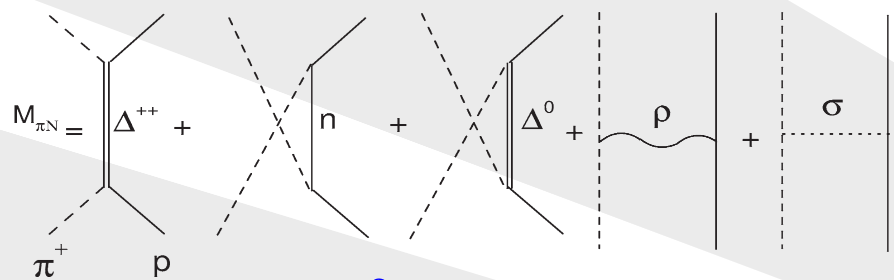

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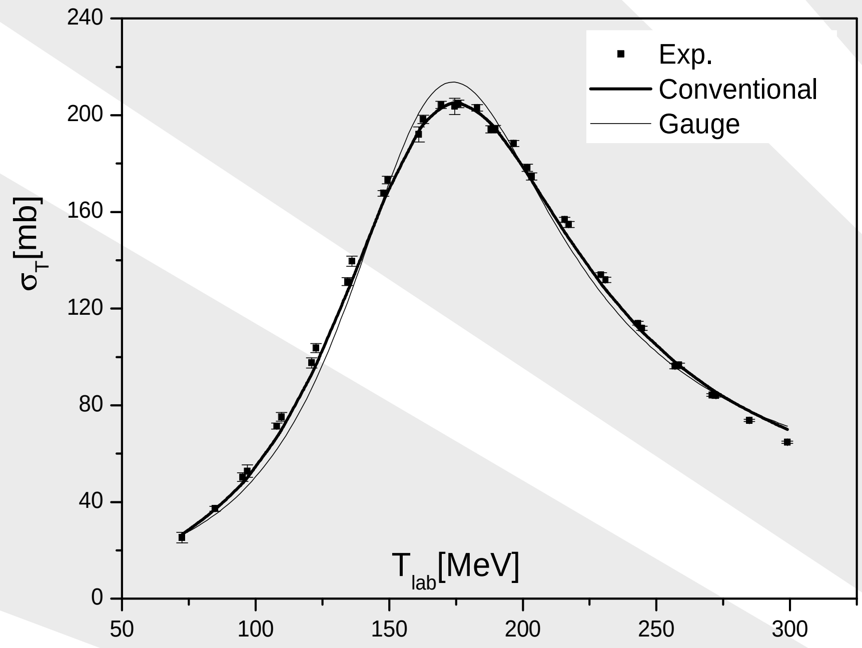

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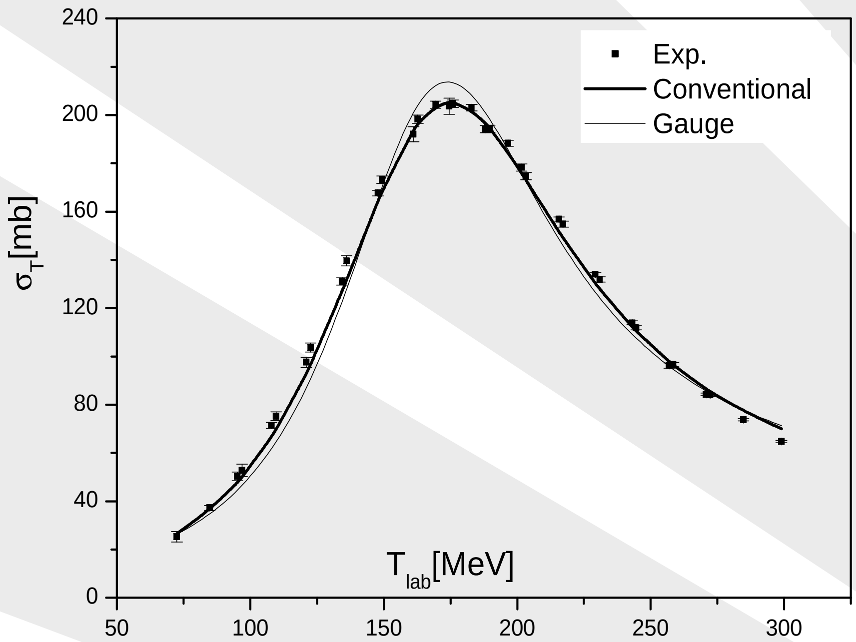

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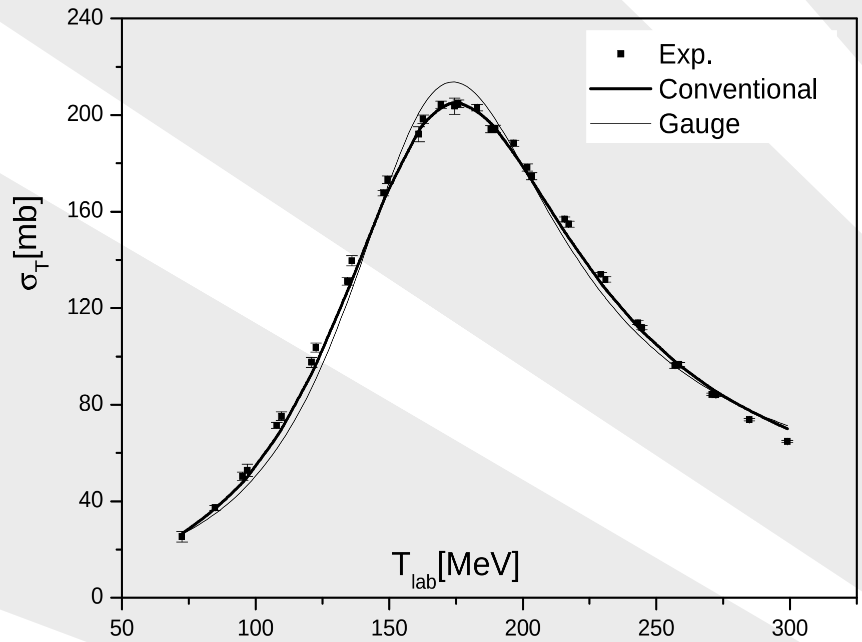
- C coupling $m_\sigma = 650$ MeV, and we get : $f^2_{\Delta N\pi}/4\pi = 0.317 \pm 0.003$, $m_\Delta = 1211.2 \pm 0.4$ MeV, $\Gamma = 88.2 \pm 0.4$ MeV, $g_\sigma/4\pi = 1.50 \pm 0.12$, and $\chi^2/dof = 4.5$



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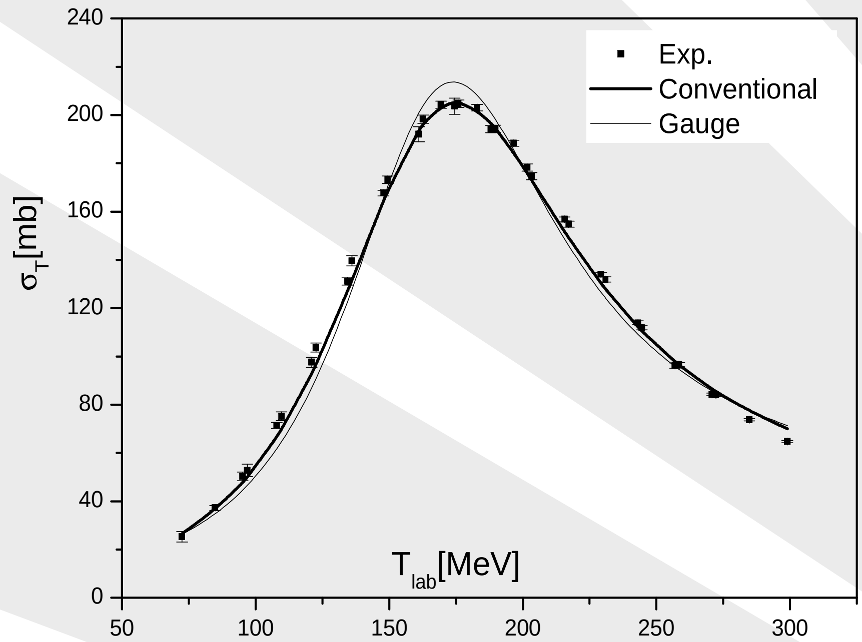

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❖ Motivation
❖
❖ △ ?
❖
❖
❖ theory?
❖
❖ Spin 3/2 field
❖
❖ Constraints and degrees of freedom
❖ Lagrangian and contact transformations
❖
❖
❖
❖ Is this situation exclusive of the RS field?
❖
❖ Interactions
❖ Conventional and Gauge couplings
❖
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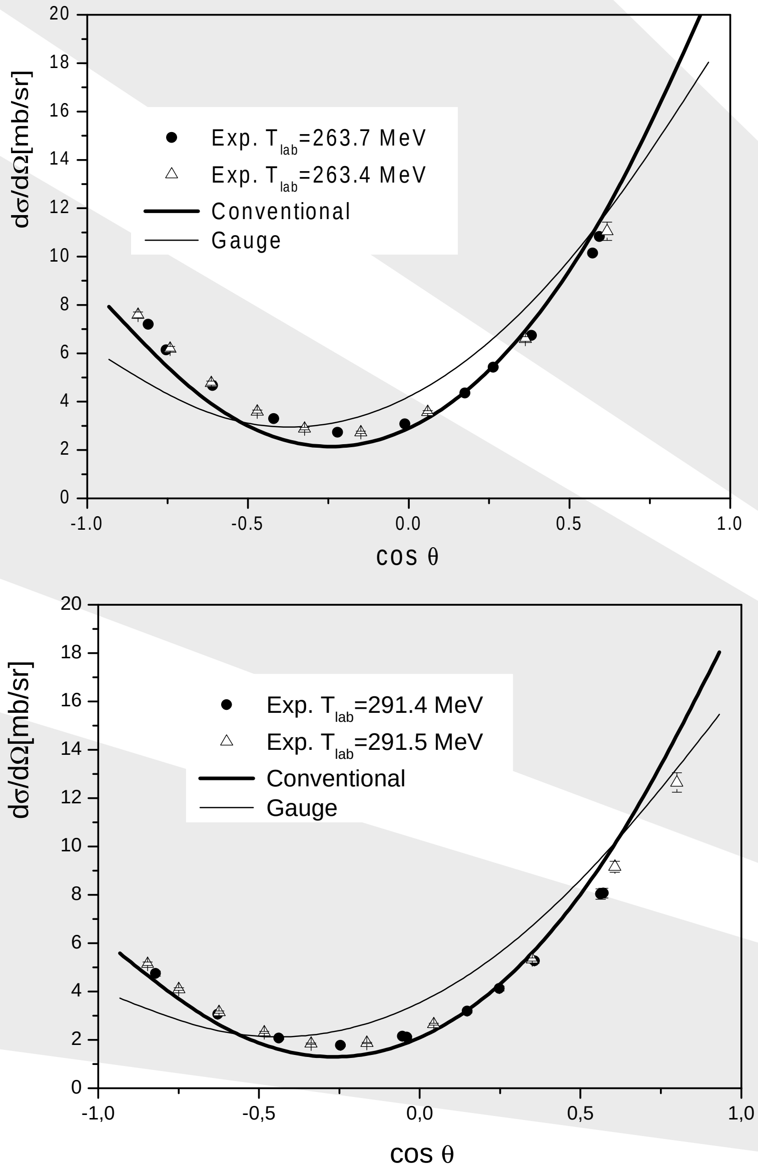
❖
❖



Conclusions

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