$K^- p \to K\,\Xi$ reaction in a Regge model

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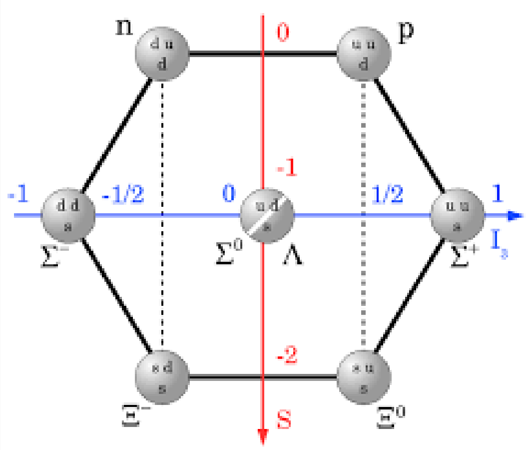
- SU(3) flavor symmetry allows as many S = -2 baryons, i.e. Ξ, but only 11 Ξ baryons are observed, whereas there are ~ 22 Λ^* or Σ^* resonances (S = -1).



Particle	J^P	Overall status
Ξ(1318)	1/2+	****
Ξ(1530)	3/2+	****
Ξ(1620)		*
Ξ(1690)		***
Ξ(1820)	3/2−	***
Ξ(1950)		***
Ξ(2030)		***
Ξ(2120)		*
Ξ(2250)		**
Ξ(2370)		**
Ξ(2500)		*

1. introduction

How to produce multistrangeness baryons in hadron physics?

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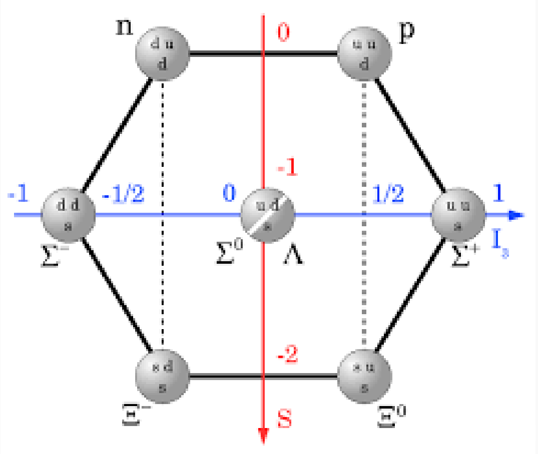
- This is mainly because multistrangeness hadron production have low cross sections relatively.

- Recently, the situation becomes better since more precise and abundant data are expected to be produced in the future experiments via various beams:

  a. photoproduction ($\gamma\, p \to K\, K\, \Xi$, $K\, K\, K\, \Omega$) at JLab
  b. $p\bar{p}$ interaction ($p\, \bar{p} \to \Xi\, \bar{\Xi}$, $\Omega\, \bar{\Omega}$) at GSI-FAIR
  c. K induced reaction ($K^-\, p \to K\, \Xi$) at J-PARC



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1. introduction

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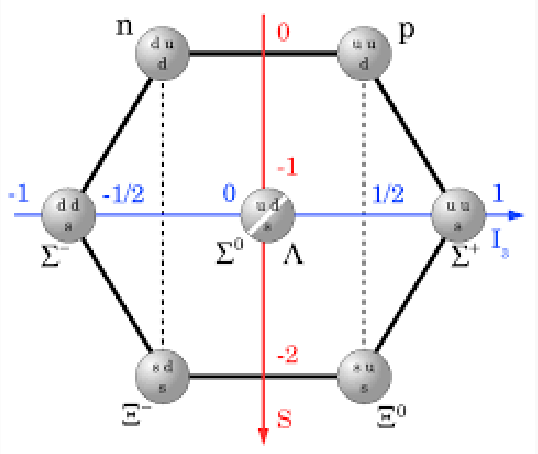

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❑ Multistrangeness production in hadron physics

a. photoproduction (γ p → K K Ξ)

> CLAS & GlueX Collaborations at JLab is producing the data.

> The production mechanism is a two-step process.

> The hadron coupling constants are not well known.

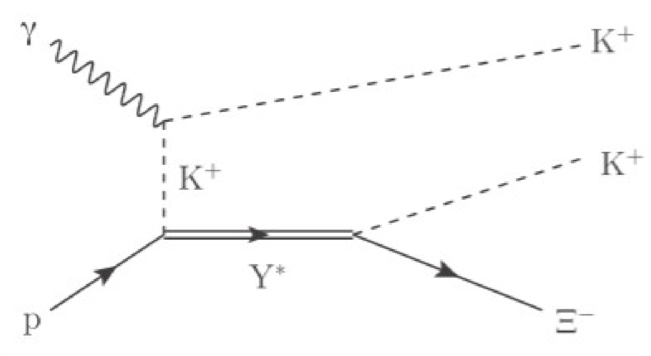
> Theoretical analyses

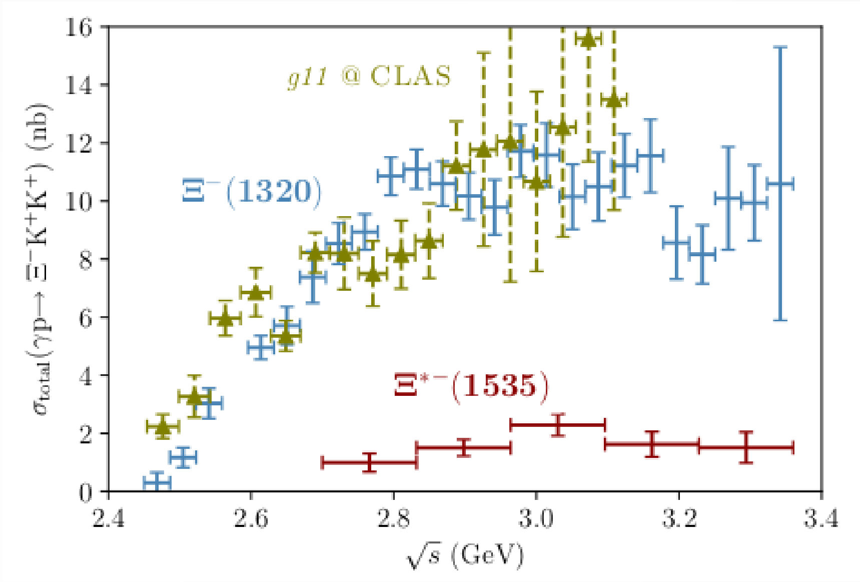
γ p → K K Ξ(1318)

Nakayama et al. PRC.74.035205 (2006)

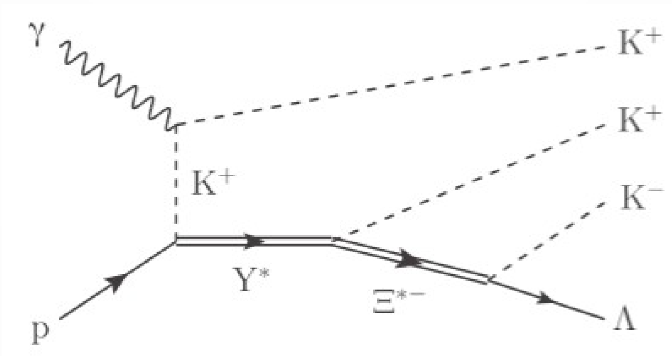
γ p → $K^+ K^+ \Xi^{*-}$(1530)

No analyses yet

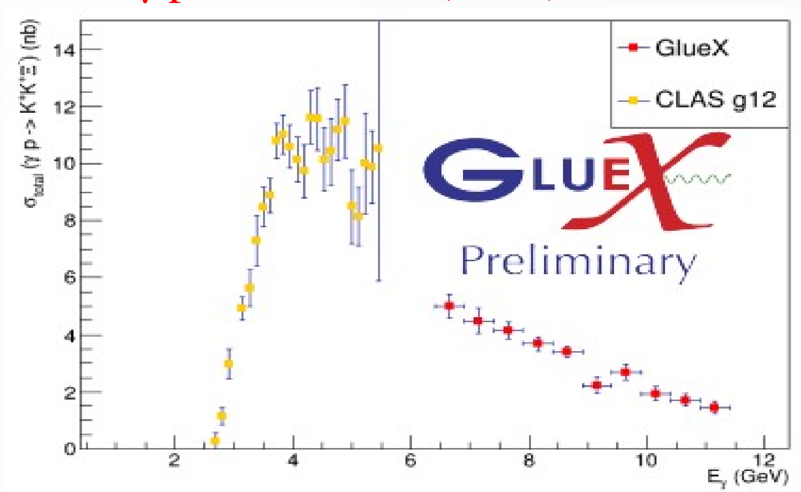




Goetz (CLAS) PRC.98.062201(R) (2018)



γ p → $K^+ K^+ \Xi^{*-}$(1535)



Ernst (GlueX) AIP.CP.2249.030041 (2020)

❏ Multistrangeness production in hadron physics

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$\gamma\, p \rightarrow K\, K\, \Xi(1318)$

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$\gamma\, p \rightarrow K^+ K^+ \Xi^{*-}(1530)$

No analyses yet

Ξ^0 $I(J^P) = 1/2(1/2^+)$

The parity has not actually been measured, but $^+$ is of course expected.

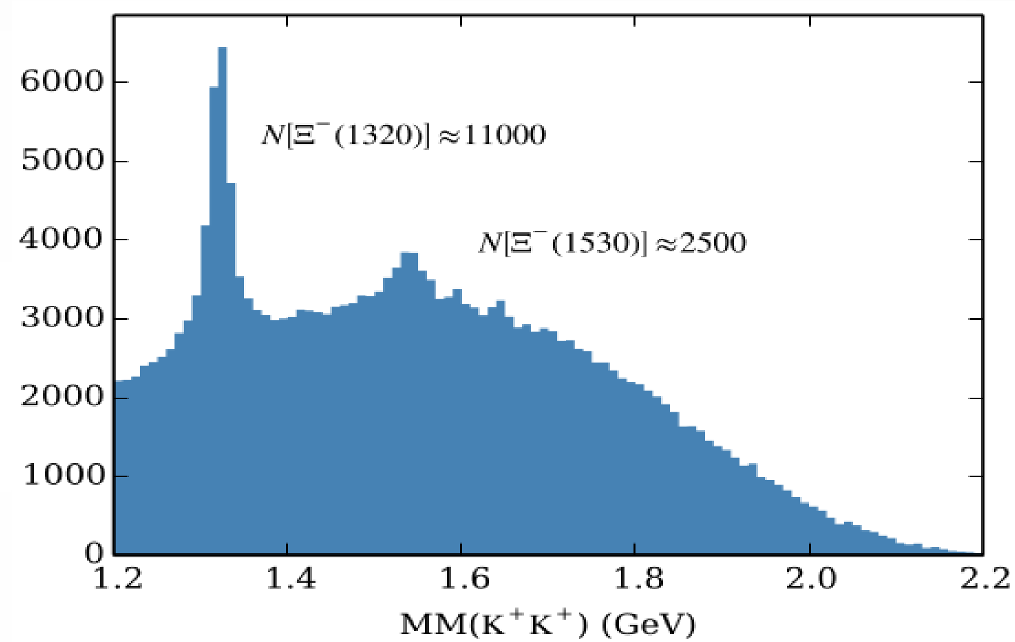


FIG. 2. Missing mass off of (K^+K^+) showing the Ξ spectrum above a smooth background, summed over all angles and all E_γ.

In the missing mass off of K^+K^+ (Fig. 2), the strong peak at 1.32 GeV corresponds to the Ξ ground state $(J^P = \frac{1}{2}^-)$, and the smaller peak at 1.53 GeV is the Ξ^* first excited state $(J^P = \frac{3}{2}^-)$. No other statistically significant structures are seen in this mass spectrum.

Goetz (CLAS) PRC.98.062201(R) (2018)

❑ Multistrangeness production in hadron physics

b. $p\bar{p}$ interaction ($p\,\bar{p} \rightarrow \Xi\,\bar{\Xi}$)

> FANDA Collaboration at GSI-FAIR will produce the data.

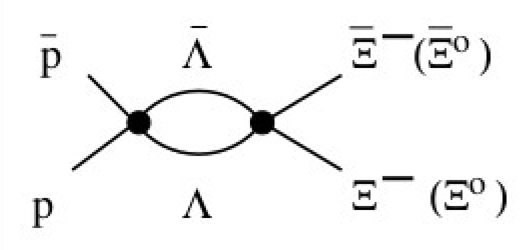
> The production mechanism is a two-step process.

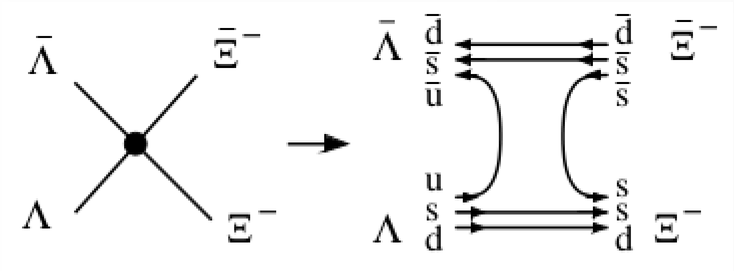
> The amplitudes are described by the loop diagrams within a modified Regge type model.
Titov et al. 1105.3847 (2011)

> More rigorous analyses are called for.

Titov et al. 1105.3847 (2011)

❑ Loop diagrams





> K & K* exchanges are possible.

❑ Scattering amplitude

$$T^{\bar{p}p\to\bar{\Xi}\Xi} \simeq T^{\bar{p}p\to\bar{\Xi}\Xi}_{\rm cut}$$
$$= i\,\frac{Q_\Lambda}{8\pi\sqrt{s}}\int\frac{d\Omega_\Lambda}{4\pi}\sum_{\text{spins }\bar{\Lambda}\Lambda} T^{\bar{p}p\to\bar{\Lambda}\Lambda}\,T^{\bar{\Lambda}\Lambda\to\bar{\Xi}\Xi}$$

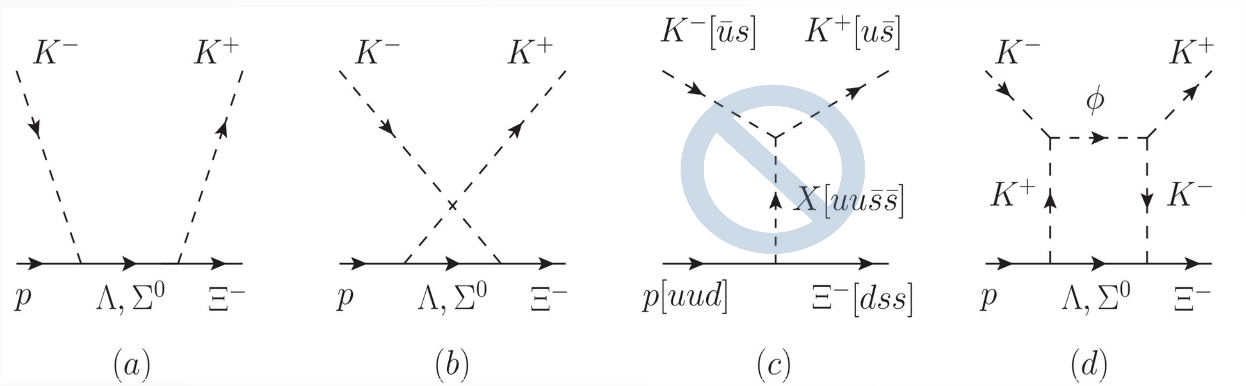
2. $K^- p \to K\,\Xi$ (theoretical framework)

❑ Multistrangeness production in hadron physics: $K^- p \to K\,\Xi$

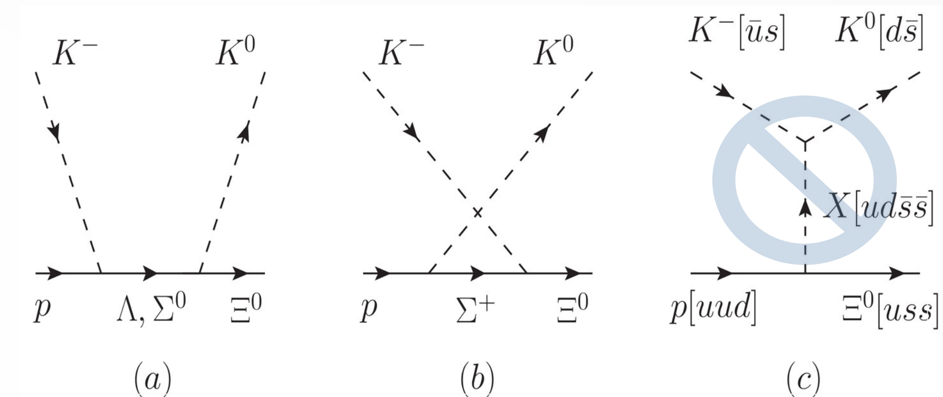
> Only ($\Lambda^{(*)}$ & $\Sigma^{(*)}$) hyperons mediate in the Born diagrams.

> *t*-channel meson exchanges are not possible because no meson of strangeness two exists.

(a) $K^- p \to K^+ \Xi^-$



(b) $K^- p \to K^0 \Xi^0$



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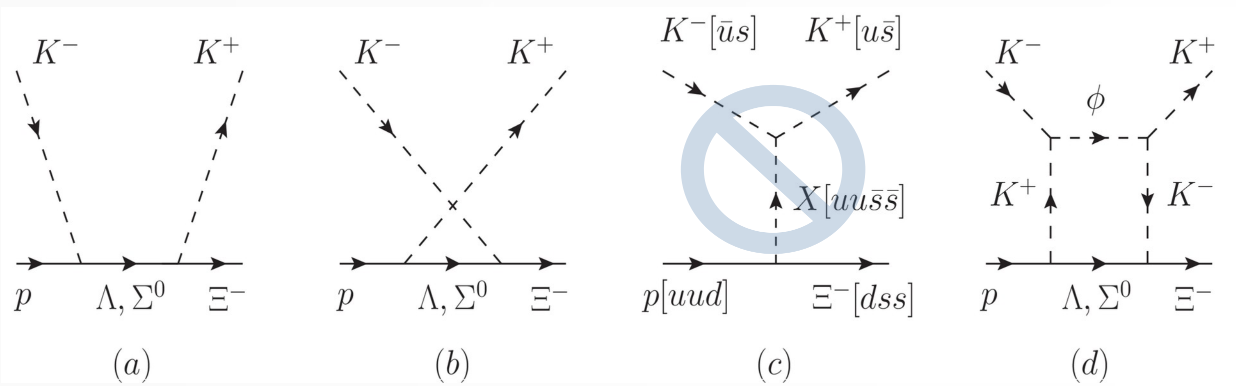

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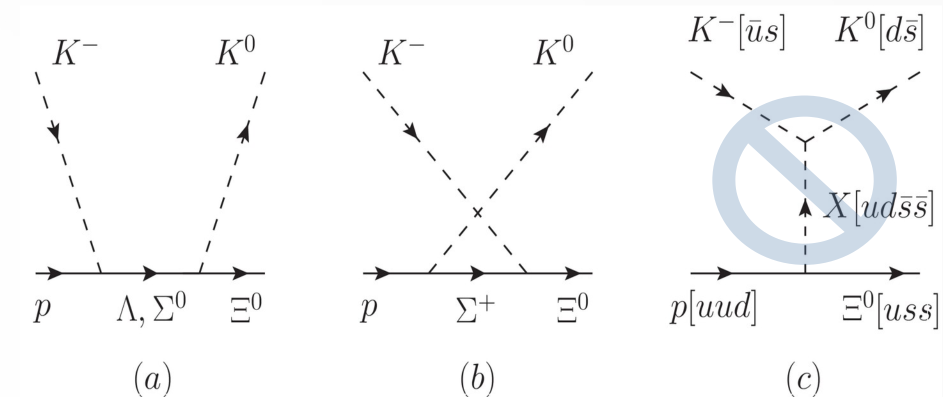

- Effective Lagrangians

$$\mathcal{L}^{1/2(\pm)}_{\Lambda NK} \equiv g_{\Lambda NK}\,\bar{\Lambda}\left(D^{1/2(\pm)}_{\Lambda NK}\bar{K}\right)N + \text{H.c.}$$

$$\mathcal{L}^{3/2(\pm)}_{\Lambda NK} = \frac{g_{\Lambda NK}}{m_K}\,\bar{\Lambda}^{\nu}\left(D^{3/2(\pm)}_{\nu}\bar{K}\right)N + \text{H.c.}$$

$$\mathcal{L}^{5/2(\pm)}_{\Lambda NK} = \frac{g_{\Lambda NK}}{m_K^2}\,\bar{\Lambda}^{\mu\nu}\left(D^{5/2(\pm)}_{\mu\nu}\bar{K}\right)N + \text{H.c.}$$

$$\mathcal{L}^{7/2(\pm)}_{\Lambda NK} = \frac{g_{\Lambda NK}}{m_K^3}\,\bar{\Lambda}^{\mu\nu\rho}\left(D^{7/2(\pm)}_{\mu\nu\rho}\bar{K}\right)N + \text{H.c.}$$

$$D^{1/2(\pm)}_{B'BM} \equiv -\Gamma^{(\pm)}\left(\pm i\lambda + \frac{1-\lambda}{m_{B'} \pm m_B}\,\partial\!\!\!/\right),$$

$$D^{3/2(\pm)}_{\nu} \equiv \Gamma^{(\mp)}\partial_\nu\,,$$

$$D^{5/2(\pm)}_{\mu\nu} \equiv -i\,\Gamma^{(\pm)}\partial_\mu\partial_\nu\,,$$

$$D^{7/2(\pm)}_{\mu\nu\rho} \equiv -\Gamma^{(\mp)}\partial_\mu\partial_\nu\partial_\rho\,,$$

($\lambda = 1$) Pseudoscalar (PS) form
($\lambda = 0$) Pseudovector (PV) form

- Coupling constants

Y	g_{NYK}	$g_{\Xi YK}$
$\Lambda(1116)\frac{1}{2}^+$	**−13.24**	**3.52**
$\Sigma(1193)\frac{1}{2}^+$	**3.58**	**−13.26**

2. $K^- p \rightarrow K\,\Xi$ (theoretical framework)

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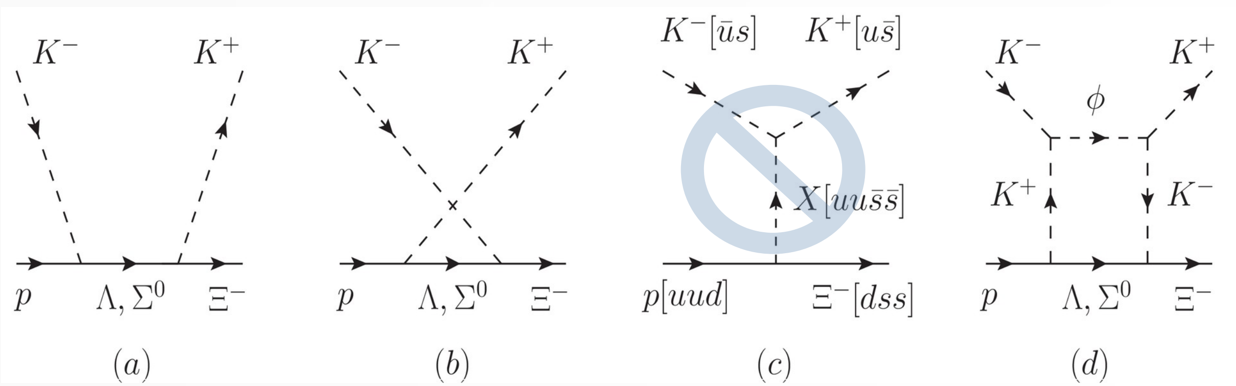

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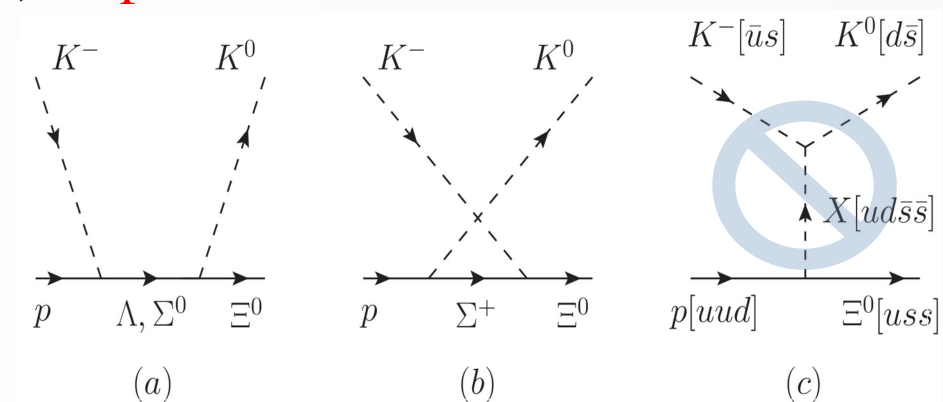

❑ (Fig. b) We employ a hybridized Regge model to describe the backward angles in the *u* channel.

"Baryon exchange processes" Storrow, Phys.Rept.103.317 (1984)

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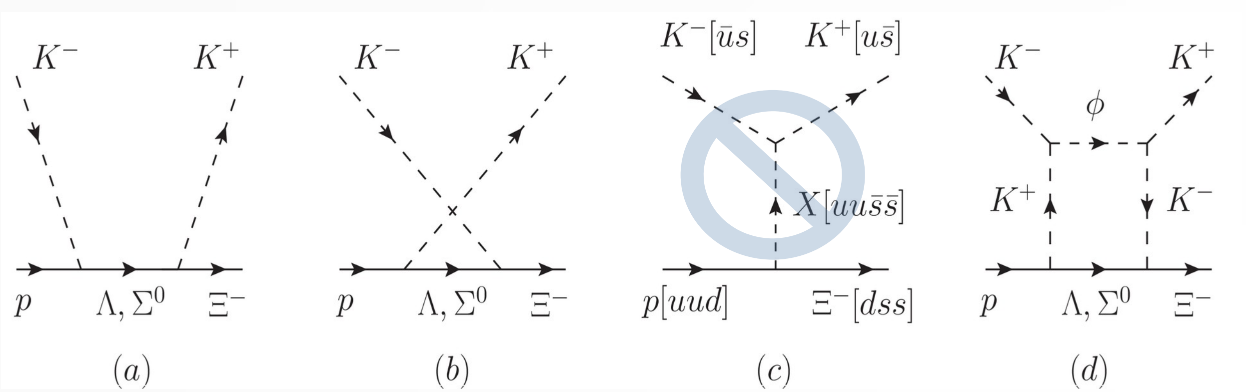

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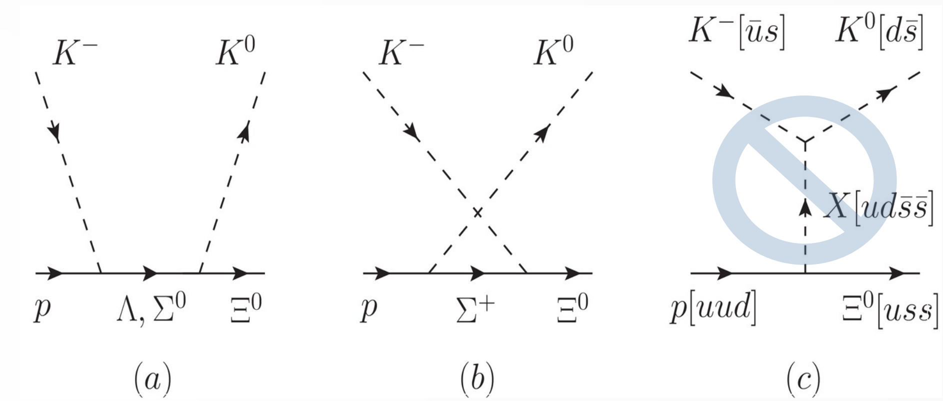

❑ (Fig. b) We employ a hybridized Regge model to describe the backward angles in the *u* channel.
"Baryon exchange processes" Storrow, Phys.Rept.103.317 (1984)

❑ (Fig. a) Additionally, in the *s* channel, we include various (Λ^* & Σ^*) resonances which couple strongly to $\overline{K}N$ & $K\Xi$ channels.

2. K⁻ p → K Ξ (theoretical framework)

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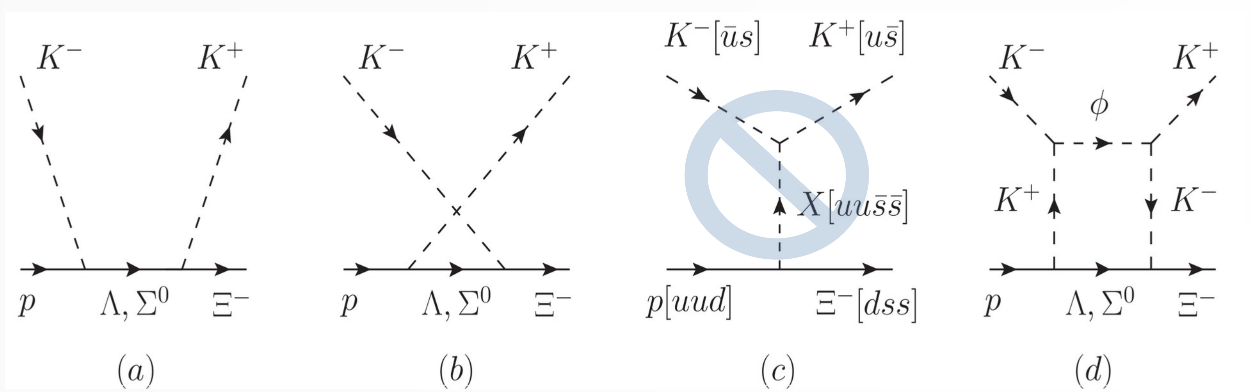
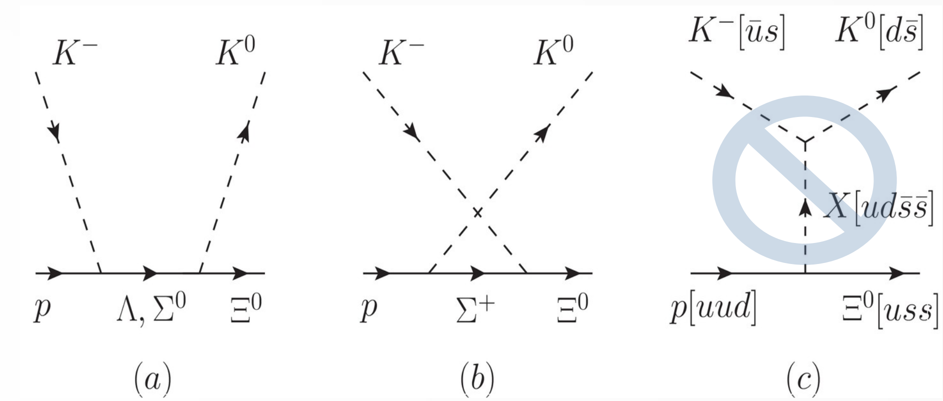


1(1) 1(1) 1(1) 1(1)

(b) $K^- p \to K^0 \Xi^0$



1(1) 1(-1) √2 √2 → isospin factors

❑ Isospin factors

Λ exchange: $$\begin{pmatrix} \bar{K}^+ & \bar{K}^0 \end{pmatrix} \Lambda \begin{pmatrix} p \\ n \end{pmatrix} = 1\bar{K}^+\Lambda p + 1\bar{K}^0\Lambda n$$

Σ exchange: $$\begin{pmatrix} \bar{K}^+ & \bar{K}^0 \end{pmatrix} \begin{pmatrix} \Sigma^0 & \sqrt{2}\Sigma^+ \\ \sqrt{2}\Sigma^- & -\Sigma^- \end{pmatrix} \begin{pmatrix} p \\ n \end{pmatrix} = 1\bar{K}^+\Sigma^0 p + \sqrt{2}(\bar{K}^+\Sigma^+ n + \bar{K}^0\Sigma^- p) - 1\bar{K}^0\Sigma^0 n.$$

❑ *u*-channel Σ exchange: σ ($K^- p \to K^+ \Xi^-$) $*$ 4 = σ ($K^- p \to K^0 \Xi^0$)

❑ We consider two different isospin channels simultaneously: useful to constrain model parameters.

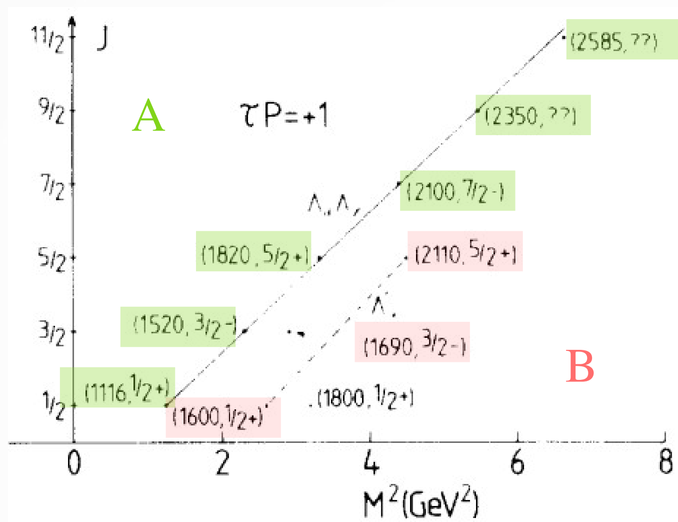
2. $K^- p \to K \Xi$ (theoretical framework)

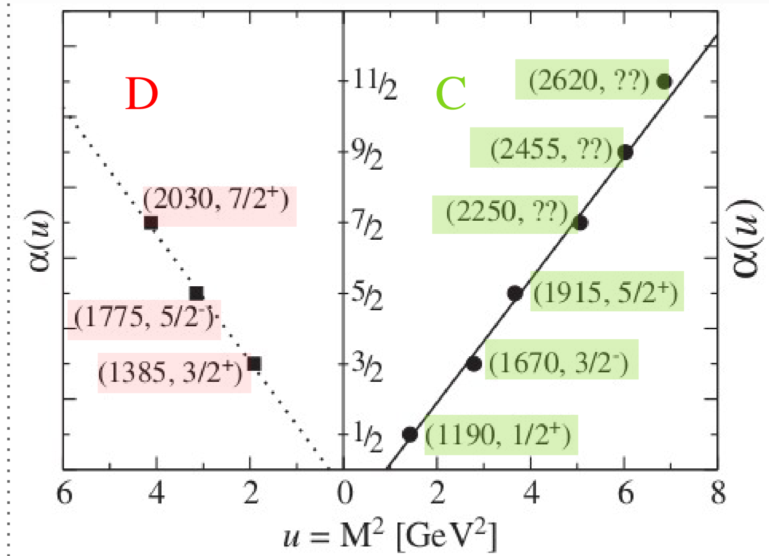
Λ hyperons

Λ	1/2⁺	****	A
Λ(1380)	1/2⁻	**	
Λ(1405)	1/2⁻	****	
Λ(1520)	3/2⁻	****	
Λ(1600)	1/2⁺	****	B
Λ(1670)	1/2⁻	****	
Λ(1690)	3/2⁻	****	
Λ(1710)	1/2⁺	*	
Λ(1800)	1/2⁻	***	
Λ(1810)	1/2⁺	***	s_{th}
Λ(1820)	5/2⁺	****	
Λ(1830)	5/2⁻	****	
Λ(1890)	3/2⁺	****	
Λ(2000)	1/2⁻	*	
Λ(2050)	3/2⁻	*	
Λ(2070)	3/2⁺	*	
Λ(2080)	5/2⁻	*	
Λ(2085) was Λ(2020)	7/2⁺	**	
Λ(2100)	7/2⁻	****	
Λ(2110)	5/2⁺	***	
Λ(2325)	3/2⁻	*	
Λ(2350)	9/2⁺	***	
Λ(2585)		**	

❑ Hyperon Regge trajectories

Storrow, Phys.Rept.103.317 (1984)





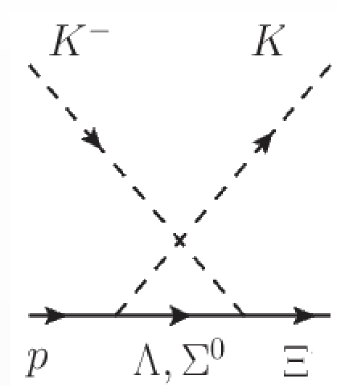
A Λ: $\alpha(u) = -0.65 + 0.94u$

C Σ : $\alpha(u) = -0.79 + 0.87u$

D Σ^* : $\alpha(u) = -0.27 + 0.9u$

$K^- p \to K \Xi$

s_{th}=1.81 GeV



Σ hyperons

D	Σ(1385)	3/2⁺	****
	Σ(1580)	3/2⁻	*
	Σ(1620)	1/2⁻	*
	Σ(1660)	1/2⁺	***
C	Σ(1670)	3/2⁻	****
	Σ(1750)	1/2⁻	***
	Σ(1775)	5/2⁻	****
s_{th}	Σ(1780) was Σ(1730)	3/2⁺	*
	Σ(1880)	1/2⁺	**
	Σ(1900)	1/2⁻	**
	Σ(1910) was Σ(1940)	3/2⁻	***
	Σ(1915)	5/2⁺	****
	Σ(1940)	3/2⁺	*
	Σ(2010)	3/2⁻	*
	Σ(2030)	7/2⁺	****
	Σ(2070)	5/2⁺	*
	Σ(2080)	3/2⁺	*
	Σ(2100)	7/2⁻	*
	Σ(2160)	1/2⁻	*
	Σ(2230)	3/2⁺	*
	Σ(2250)		***
	Σ(2455)		**
	Σ(2620)		**
	Σ(3000)		*
	Σ(3170)		*

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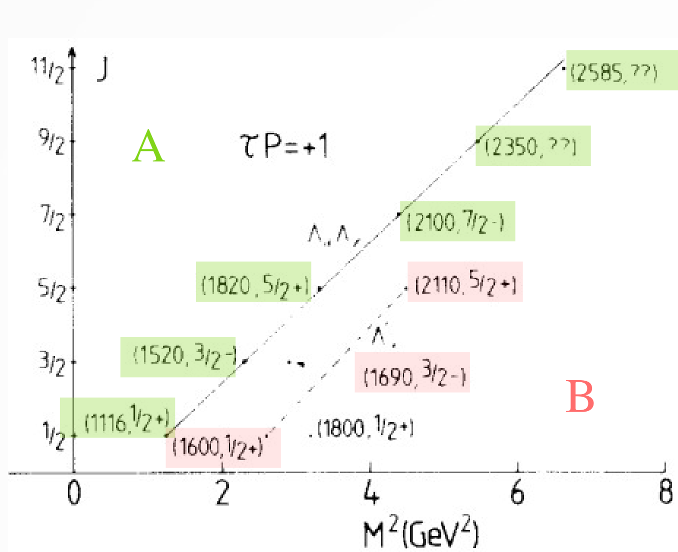

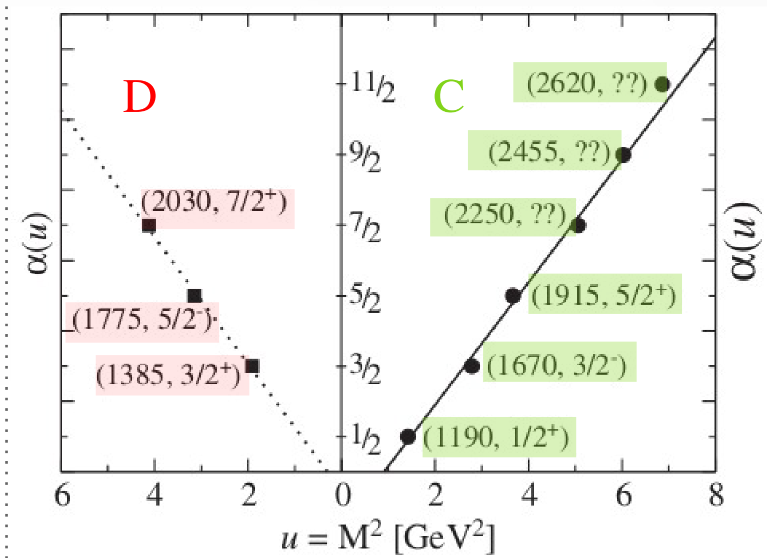

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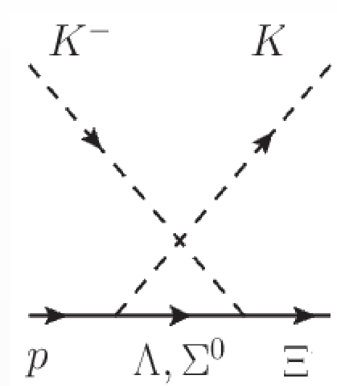

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	Σ(1750)	1/2⁻	***
	Σ(1775)	5/2⁻	****
	Σ(1780) was Σ(1730)	3/2⁺	*
s_{th}	Σ(1880)	1/2⁺	**
	Σ(1900)	1/2⁻	**
	Σ(1910) was Σ(1940)	3/2⁻	***
	Σ(1915)	5/2⁺	****
	Σ(1940)	3/2⁺	*
	Σ(2010)	3/2⁻	*
	Σ(2030)	7/2⁺	****
	Σ(2070)	5/2⁺	*
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	Σ(2160)	1/2⁻	*
	Σ(2230)	3/2⁺	*
	Σ(2250)		***
	Σ(2455)	7/2⁻	**
	Σ(2620)	9/2⁺	**
	Σ(3000)	11/2⁻	*
	Σ(3170)		*

❑ As seen, hyperon Regge trajectories involve most of 3 & 4 star resonances.

2. $K^- p \rightarrow K\,\Xi$ (theoretical framework)

❑ Regge amplitude

$$T_{Y(\Lambda,\Sigma)}(s,u) = \mathcal{M}_Y(s,u)\left(\frac{s}{s_Y}\right)^{\alpha_Y(u)-\frac{1}{2}}\Gamma\left(\frac{1}{2}-\alpha_Y(u)\right)\alpha'_Y,$$

$$T_{\Sigma^*}(s,u) = \mathcal{M}_{\Sigma^*}(s,u)\left(\frac{s}{s_{\Sigma^*}}\right)^{\alpha_{\Sigma^*}(u)-\frac{3}{2}}\Gamma\left(\frac{3}{2}-\alpha_{\Sigma^*}(u)\right)\alpha'_{\Sigma^*},$$

> $s_{Y(\Lambda,\Sigma)} = s_{\Sigma^*} = 1\ [\mathrm{GeV}^2] \simeq 1/\alpha'$

❑ Hyperon Regge trajectories

Λ : $\alpha(u) = -0.65 + 0.94u$
Σ : $\alpha(u) = -0.79 + 0.87u$
Σ^* : $\alpha(u) = -0.27 + 0.9u$

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$$T_{\Sigma^*}(s,u) = \mathcal{M}_{\Sigma^*}(s,u)\left(\frac{s}{s_{\Sigma^*}}\right)^{\alpha_{\Sigma^*}(u)-\frac{3}{2}}\Gamma\left(\frac{3}{2}-\alpha_{\Sigma^*}(u)\right)\alpha'_{\Sigma^*},$$

> $s_{Y(\Lambda,\Sigma)} = s_{\Sigma^*} = 1$ [GeV^2] $\simeq 1/\alpha'$

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Λ : $\alpha(u) = -0.65 + 0.94u$
Σ : $\alpha(u) = -0.79 + 0.87u$
Σ^* : $\alpha(u) = -0.27 + 0.9u$

❑ The Regge propagators reduce to the Feynman propagators $1/(u - M_Y^2)$ if one approaches the first pole on the trajectory (i.e. $u \rightarrow M_Y^2$).

$$\Gamma[0.5-\alpha(u)] = \frac{\Gamma[1.5-\alpha(u)]}{0.5-\alpha(u)} = \frac{\Gamma[1-(u-M_Y^2)\alpha']}{-(u-M_Y^2)\alpha'} \simeq \frac{-1}{\alpha'}\frac{1}{t-M_Y^2}$$

↑ $\alpha(u) = 0.5 + (u-M_Y^2)\alpha'$

↑ $u \rightarrow M_Y^2$

❑ Additional form factor is chosen to reproduce the experimental data.

$$F(u) = \left[\eta_Y \frac{\Lambda_Y^2}{\Lambda_Y^2 - u}\right]^2$$

, where Λ_Y= 1 [GeV] & (η_Λ=4.5, η_Σ=1.2, η_{Σ^*}=0.22)

2. $K^- p \rightarrow K\,\Xi$ (theoretical framework)

- PDG 2020
- We include (Λ^* & Σ^*) resonances which couple strongly to $\overline{K}N$ & $K\Xi$ channels.
- Partial decay width

$$\Gamma_{Y^*\to\bar{K}N} = \frac{1}{8\pi}\frac{q_K}{M_{Y^*}^2}\sum_{2J_{Y^*}+1}\left|\mathcal{M}_{Y^*\to\bar{K}N}\right|^2$$

$$\mathcal{L}^{1/2(\pm)}_{\Lambda NK} \equiv g_{\Lambda NK}\,\bar{\Lambda}\,(D^{1/2(\pm)}_{\Lambda NK}\bar{K})N + \text{H.c.}$$

$$\mathcal{L}^{3/2(\pm)}_{\Lambda NK} = \frac{g_{\Lambda NK}}{m_K}\,\bar{\Lambda}^{\nu}\,(D^{3/2(\pm)}_{\nu}\bar{K})N + \text{H.c.}$$

$$\mathcal{L}^{5/2(\pm)}_{\Lambda NK} = \frac{g_{\Lambda NK}}{m_K^2}\,\bar{\Lambda}^{\mu\nu}\,(D^{5/2(\pm)}_{\mu\nu}\bar{K})N + \text{H.c.}$$

$$\mathcal{L}^{7/2(\pm)}_{\Lambda NK} = \frac{g_{\Lambda NK}}{m_K^3}\,\bar{\Lambda}^{\mu\nu\rho}\,(D^{7/2(\pm)}_{\mu\nu\rho}\bar{K})N + \text{H.c.}$$

(Λ^*, J^P)	Γ_{Λ^*} [MeV]	status	$\mathrm{Br}_{\Lambda^*\to N\bar{K}}$ [%]	$\lvert g_{KN\Lambda^*}\rvert$	$\mathrm{Br}_{\Lambda^*\to \Xi K}$ [%]	$\lvert g_{K\Xi\Lambda^*}\rvert$
$\Lambda(1820, 5/2^+)$	80	****	$55-65$	8.41	$-$	$-$
$\Lambda(1830, 5/2^-)$	90	****	$4-8$		$-$	$-$
$\Lambda(1890, 3/2^+)$	120	****	$24-36$	1.19	$-$	$-$
$\Lambda(2000, 1/2^-)$	190	*	27 ± 6		$-$	$-$
$\Lambda(2050, 3/2^-)$	493	*	19 ± 4		$-$	$-$
$\Lambda(2070, 3/2^+)$	370	*	12 ± 5	1.01	7 ± 3	1.38
$\Lambda(2080, 5/2^-)$	181	*	11 ± 3	0.71	4 ± 1	1.18
$\Lambda(2085, 7/2^+)$	200	**	$-$	$-$	$-$	$-$
$\Lambda(2100, 7/2^-)$	200	****	$25-35$	3.40	<3	<8.45
$\Lambda(2110, 5/2^+)$	250	***	$5-25$		$-$	$-$
$\Lambda(2325, 3/2^-)$	168	*	$-$	$-$	$-$	$-$
$\Lambda(2350, 9/2^+)$	150	***	~ 12		$-$	$-$
$\Lambda(2585, ?^?)$		**	$-$	$-$	$-$	$-$

(Σ^*, J^P)	Γ_{Σ^*} [MeV]	status	$\mathrm{Br}_{\Sigma^*\to N\bar{K}}$ [%]	$\lvert g_{KN\Sigma^*}\rvert$	$\mathrm{Br}_{\Sigma^*\to \Xi K}$ [%]	$\lvert g_{K\Xi\Sigma^*}\rvert$
$\Sigma(1880, 1/2^+)$	200	**	$10-30$		$-$	$-$
$\Sigma(1900, 1/2^-)$	165	**	$40-70$	0.93	3 ± 2	0.1
$\Sigma(1910, 3/2^-)$	220	***	$1-5$		$-$	$-$
$\Sigma(1915, 5/2^+)$	120	****	$5-15$	1.97	$-$	
$\Sigma(1940, 3/2^+)$	250	*	13 ± 2		$-$	$-$
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$\Sigma(2080, 3/2^+)$	170	*	$-$	$-$	$-$	$-$
$\Sigma(2100, 7/2^-)$	260	*	8 ± 2		$-$	$-$
$\Sigma(2160, 1/2^-)$	313	*	29 ± 7		$-$	$-$
$\Sigma(2230, 3/2^+)$	345	*	6 ± 2	0.41	2 ± 1	0.34
$\Sigma(2250, ?^?)$	100	***	<10	<0.59	$-$	$-$
$\Sigma(2455, ?^?)$	120	**	$-$	$-$	$-$	$-$
$\Sigma(2620, ?^?)$	200	**	$-$	$-$	$-$	$-$

2. $K^- p \to K\,\Xi$ (theoretical framework)

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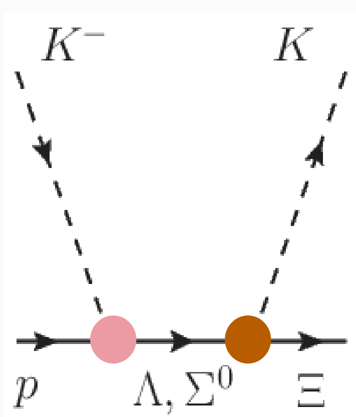

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$\Lambda(2325, 3/2^-)$	168	*	–	–	–	–
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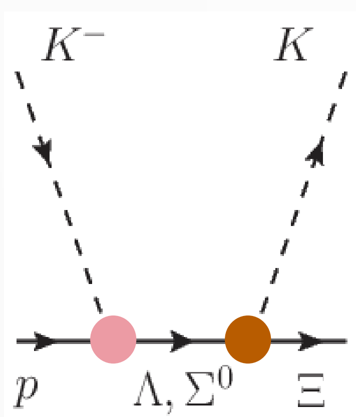

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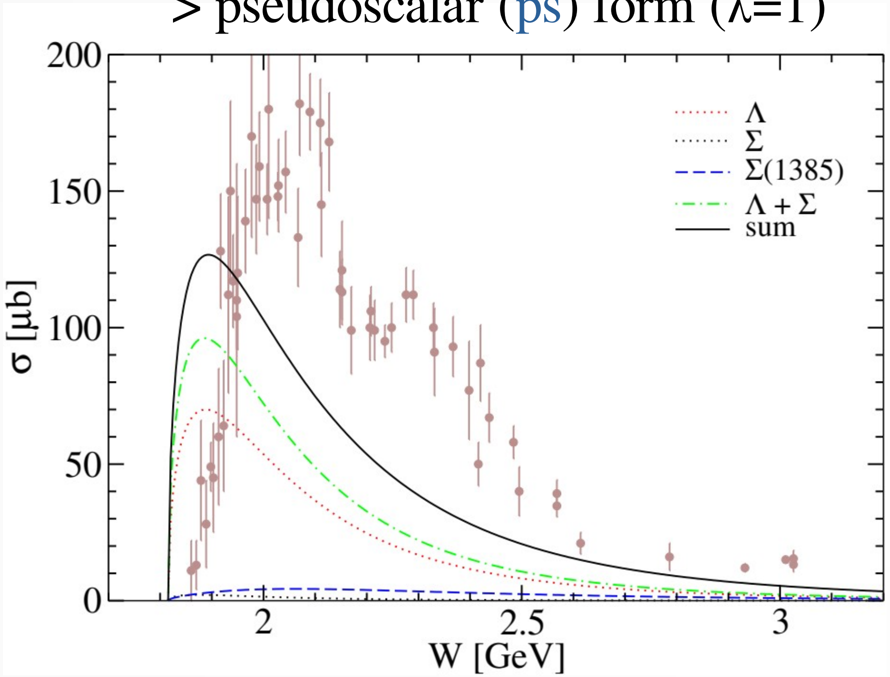
✓ Jackson,Oh, et al. PRC.91.065208 (2015)

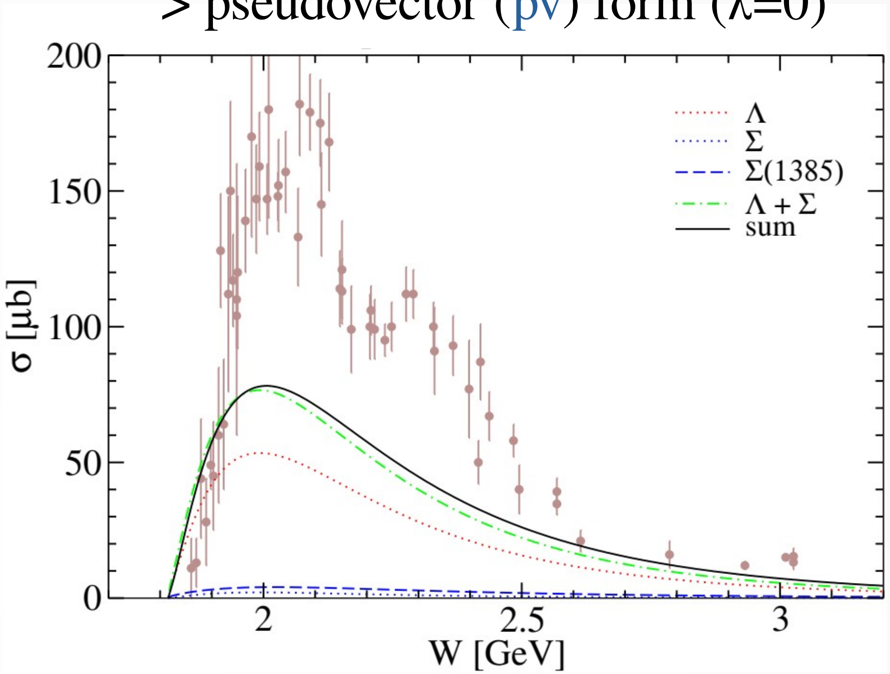
3. K⁻ p → K Ξ (results)

❑ Total cross section ($K^- p \to K^+ \Xi^-$) [*u*-channel background contribution]

> pseudoscalar (ps) form (λ=1)

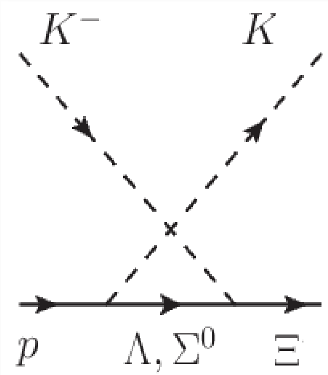


> pseudovector (pv) form (λ=0)



$$\mathcal{L}^{1/2(\pm)}_{\Lambda N K} \equiv g_{\Lambda N K}\,\bar{\Lambda}\left(D^{1/2(\pm)}_{\Lambda N K}\bar{K}\right)N + \text{H.c.}$$

$$D^{1/2(\pm)}_{B'BM} \equiv -\Gamma^{(\pm)}\left(\pm i\lambda + \frac{1-\lambda}{m_{B'} \pm m_B}\,\partial\!\!\!/\right)$$



3. K⁻ p → K Ξ (results)

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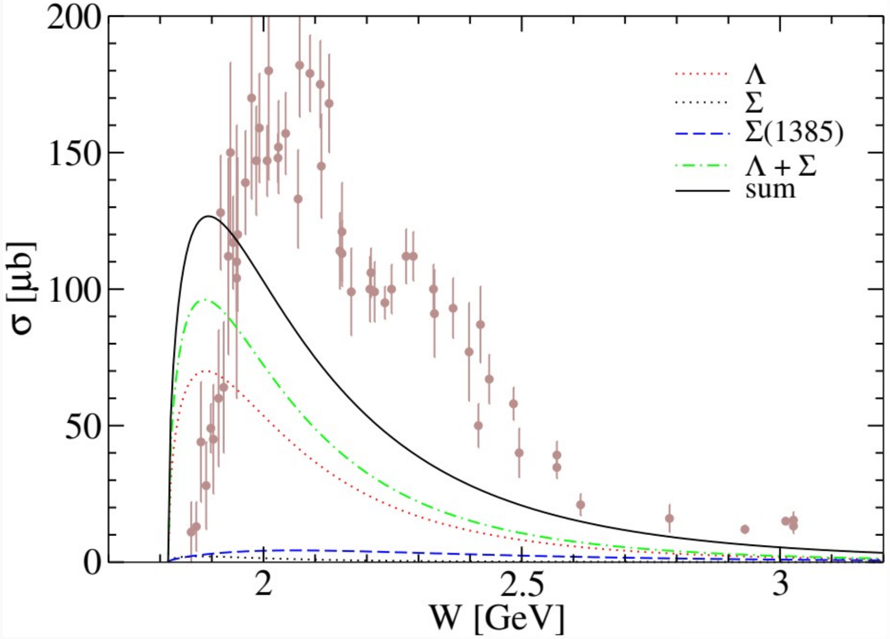
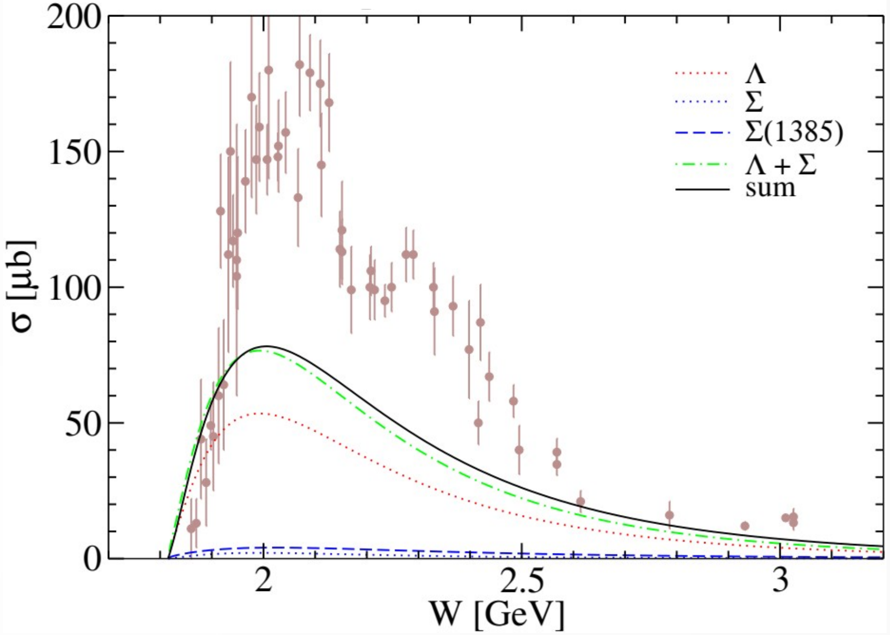


> pseudovector (pv) form (λ=0)



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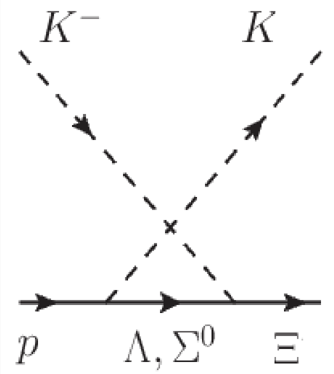
$$D^{1/2(\pm)}_{B'BM} \equiv -\Gamma^{(\pm)}\left(\pm i\lambda + \frac{1-\lambda}{m_{B'} \pm m_B}\,\partial\!\!\!/\right)$$

s_{th} : σ(ps) > σ(pv)

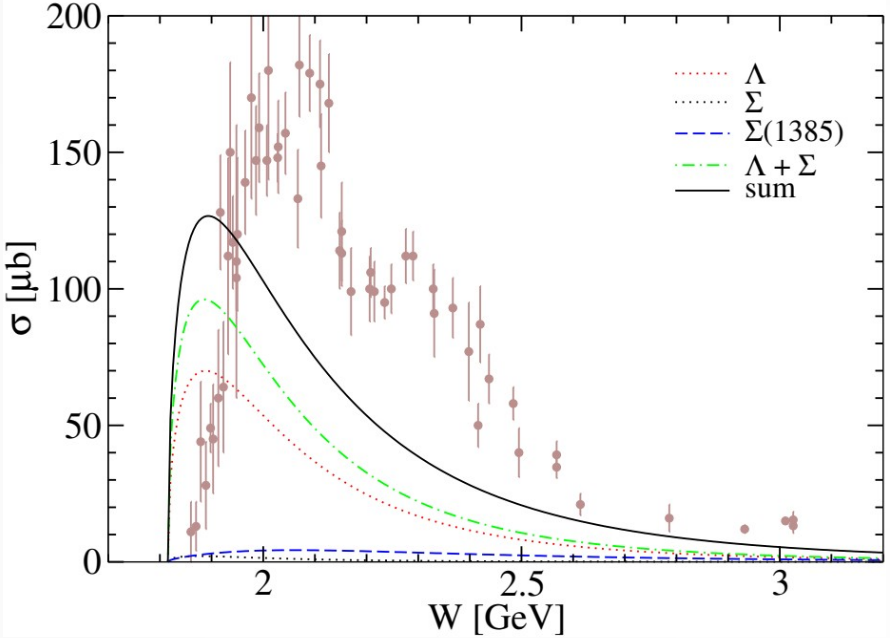
high energy: σ(ps) < σ(pv)

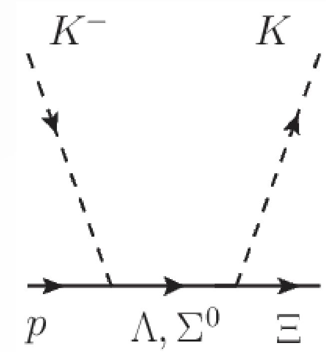


3. K$^-$ p → K Ξ (results)

❑ Total cross section (K$^-$ p → K$^+$ Ξ$^-$) [u-channel background contribution]

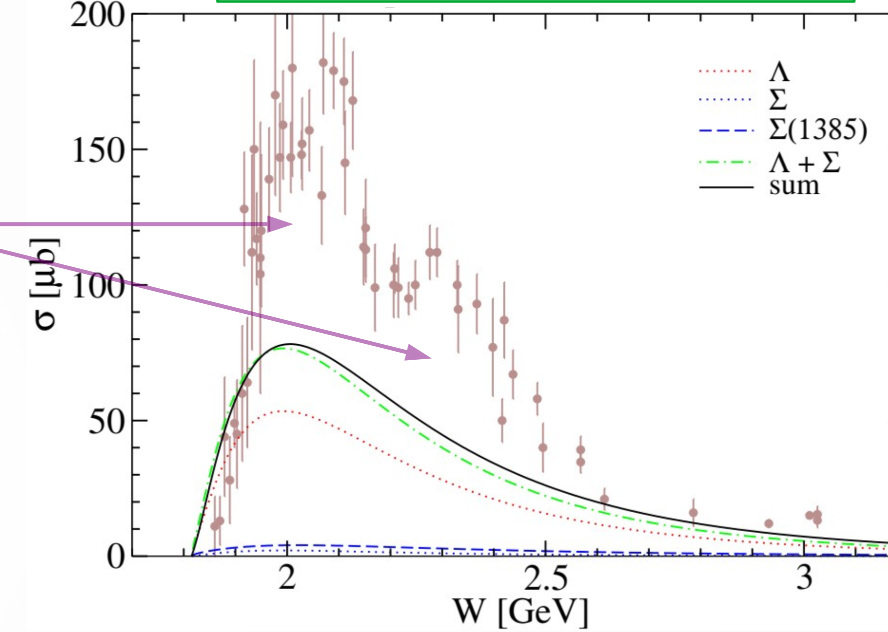
> pseudoscalar (ps) form (λ=1)





[s-channel resonant contribution]

> pseudovector (pv) form (λ=0)



$$\mathcal{L}^{1/2(\pm)}_{\Lambda N K} \equiv g_{\Lambda N K}\, \bar{\Lambda}\left(D^{1/2(\pm)}_{\Lambda N K}\bar{K}\right)N + \text{H.c.}$$

$$D^{1/2(\pm)}_{B'BM} \equiv -\Gamma^{(\pm)}\left(\pm i\lambda + \frac{1-\lambda}{m_{B'} \pm m_B}\,\partial\!\!\!/\right)$$

s_{th} : σ(ps) > σ(pv)

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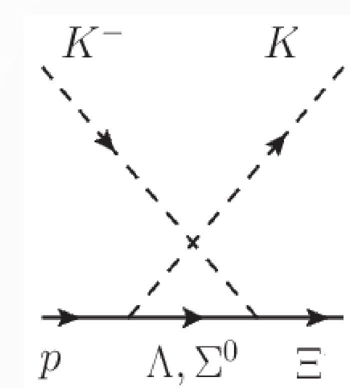
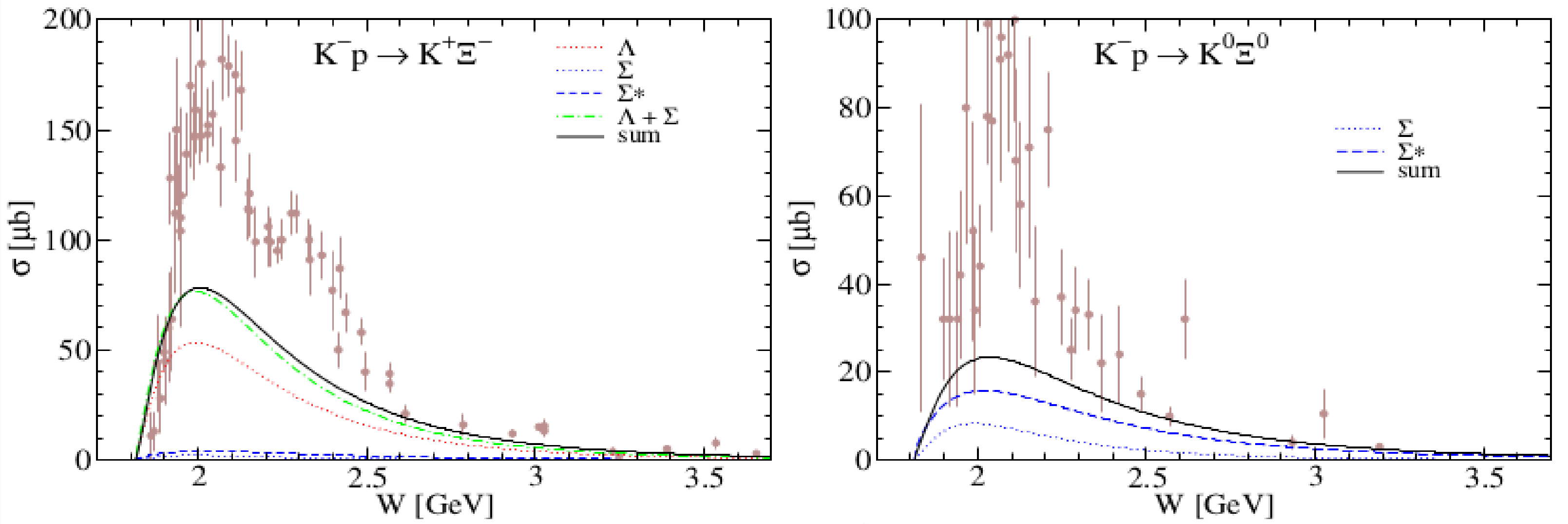


> We adopt the pv scheme rather than the ps scheme.

3. $K^- p \rightarrow K \Xi$ (results)

❑ Total cross section ($K^- p \rightarrow K^+ \Xi^-$ & $K^0 \Xi^0$) [*u*-channel background contribution, pv form]

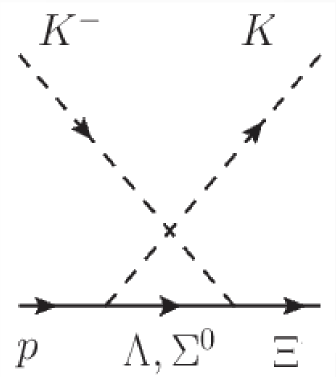


❑ Isospin rule

> *u*-channel Σ & Σ^* exchange

$\sigma(K^- p \rightarrow K^+ \Xi^-) * 4$

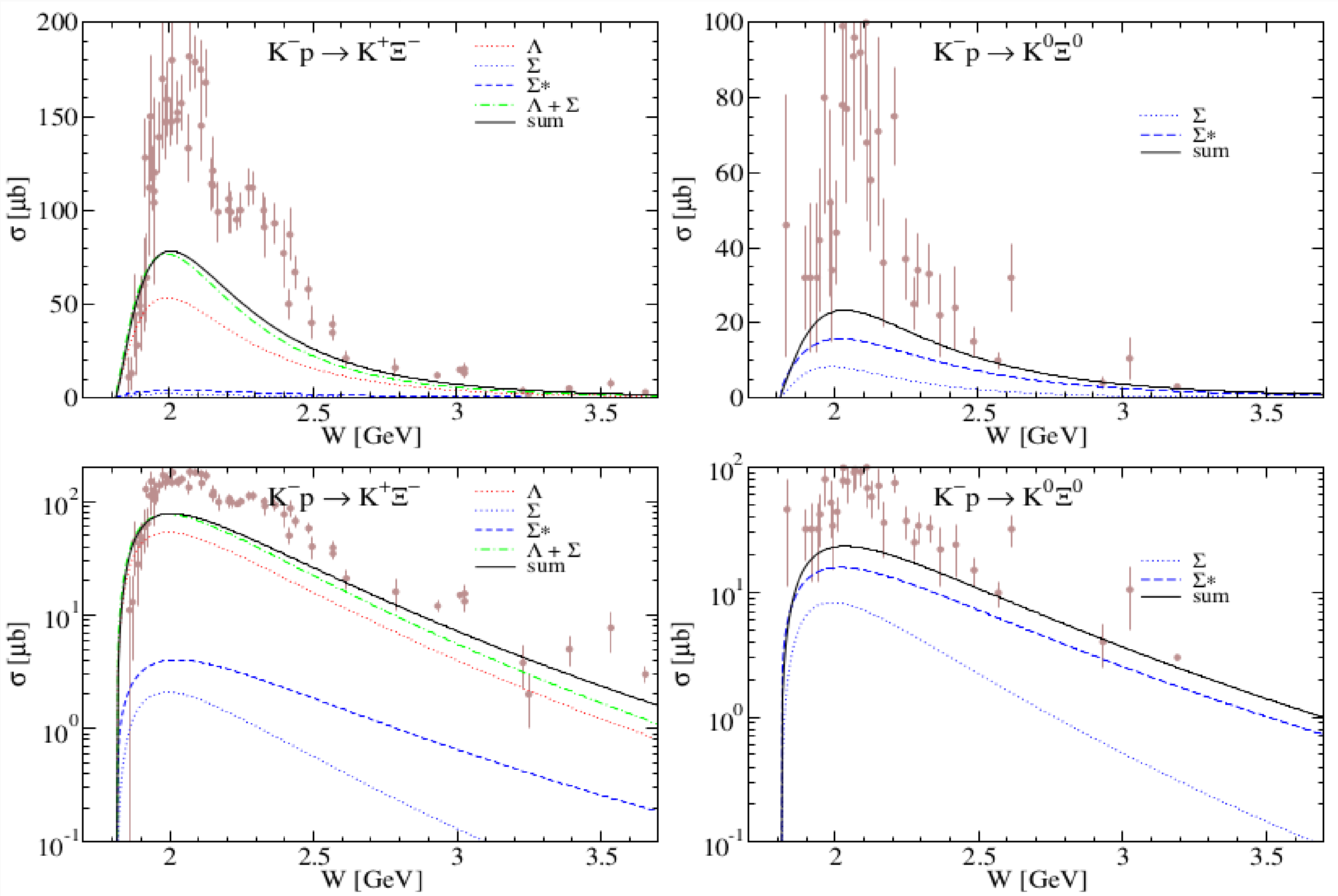
$= \sigma(K^- p \rightarrow K^0 \Xi^0)$



3. $K^- p \rightarrow K\,\Xi$ (results)

❑ Total cross section ($K^- p \rightarrow K^+ \Xi^-$ & $K^0 \Xi^0$) [*u*-channel background contribution, pv form]

log scale:



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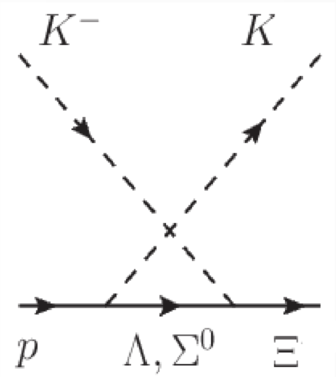
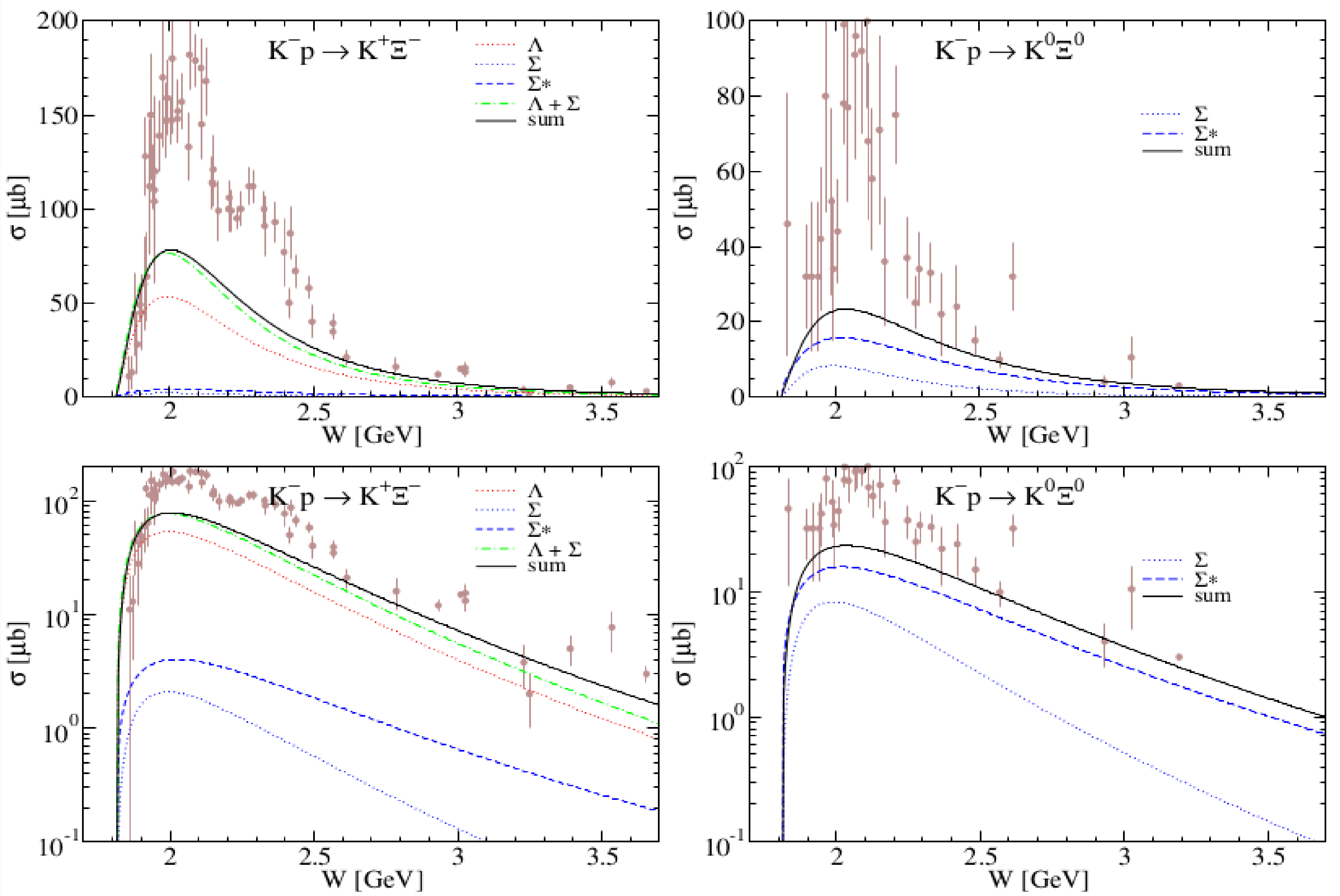
$= \sigma\,(K^- p \rightarrow K^0 \Xi^0)$



3. K⁻ p → K Ξ (results)

❑ Total cross section ($K^- p \to K^+ \Xi^-$ & $K^0 \Xi^0$) [*u*-channel background contribution, pv form]

log scale:



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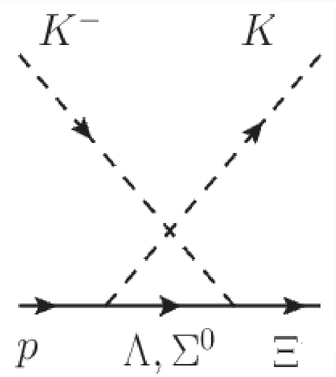
$\sigma\,(K^- p \to K^+ \Xi^-) * 4$

$= \sigma\,(K^- p \to K^0 \Xi^0)$



> Analytical behavior:

$$\lim_{s\to\infty} \sum_{s_i, s_f} |\mathcal{M}_\Sigma(s,u)|^2 \propto s$$

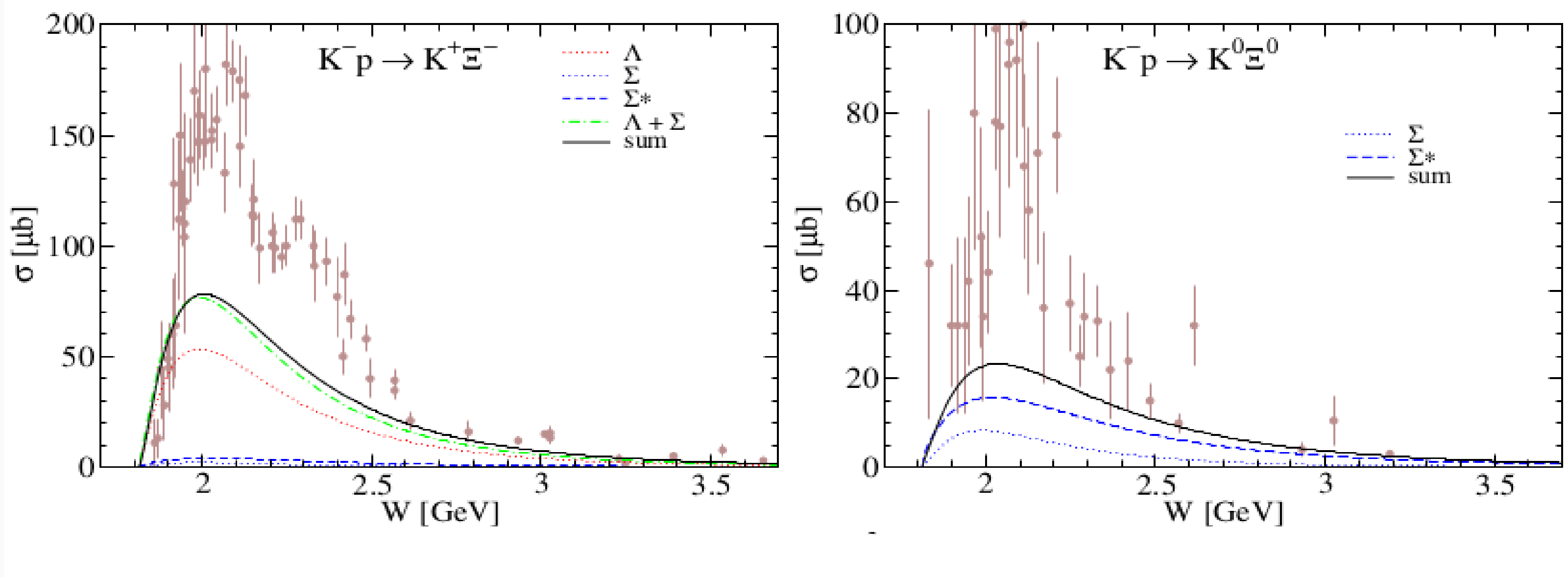
> Asymptotic behavior:

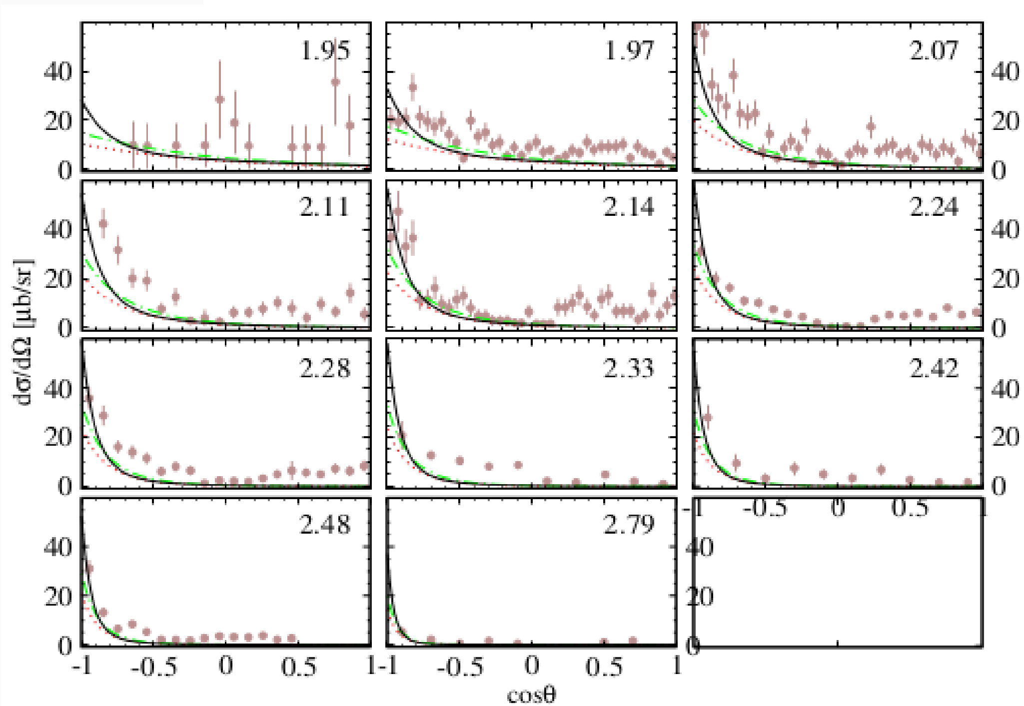
$$\frac{d\sigma}{du}(s\to\infty, u\to 0) \propto s^{2\alpha(u)-2}$$

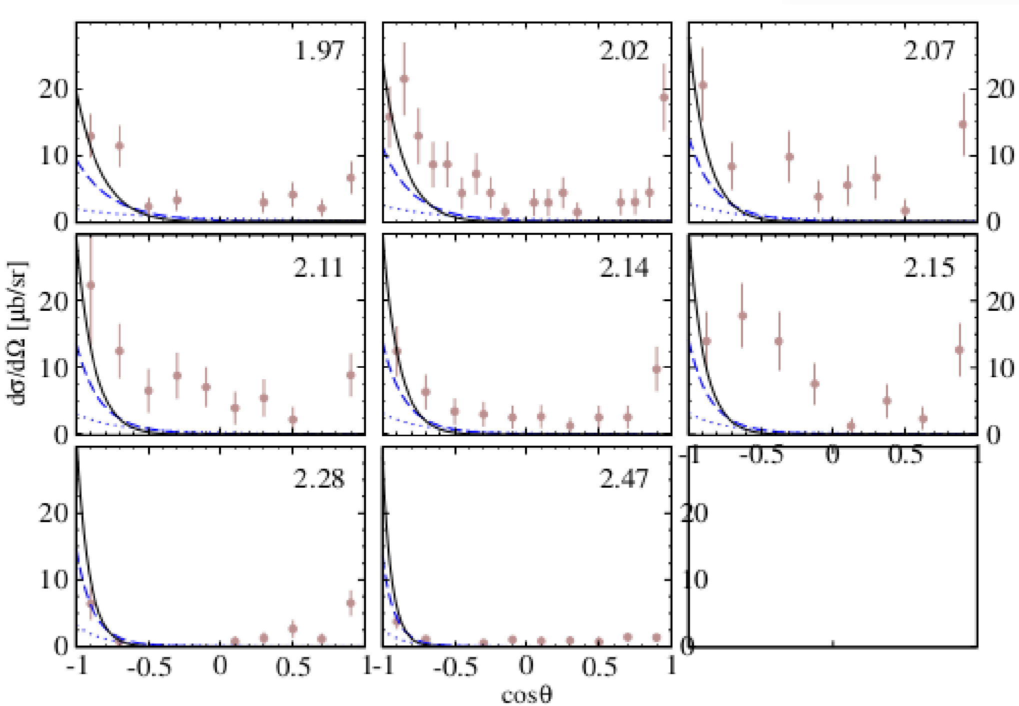
> *u*-channel Regge amplitudes describe high energies (W ≳ 2.5 GeV) very well.

3. K⁻ p → K Ξ (results)

❑ Total & Differential cross sections ($K^- p \to K^+ \Xi^-$ & $K^0 \Xi^0$) [*u*-channel background contribution, pv form]







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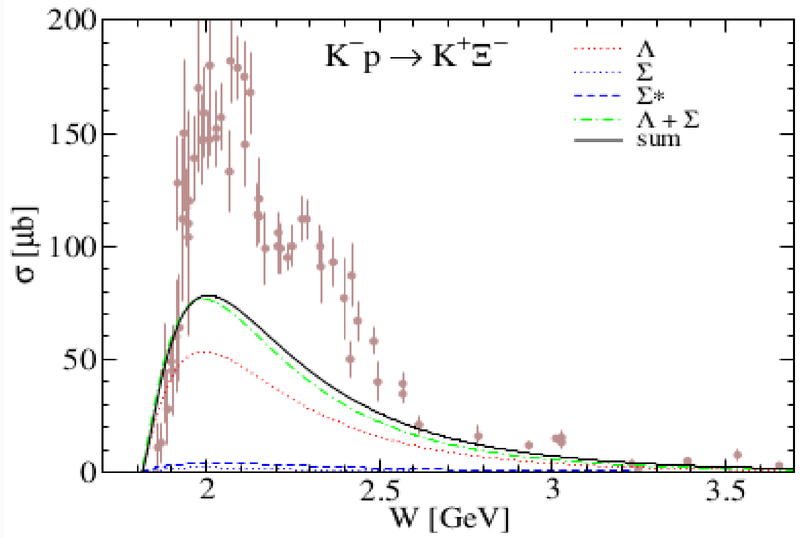
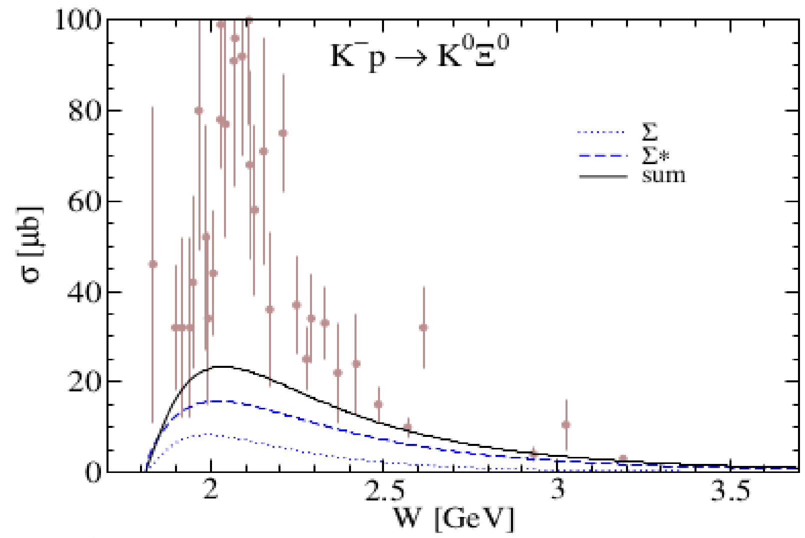
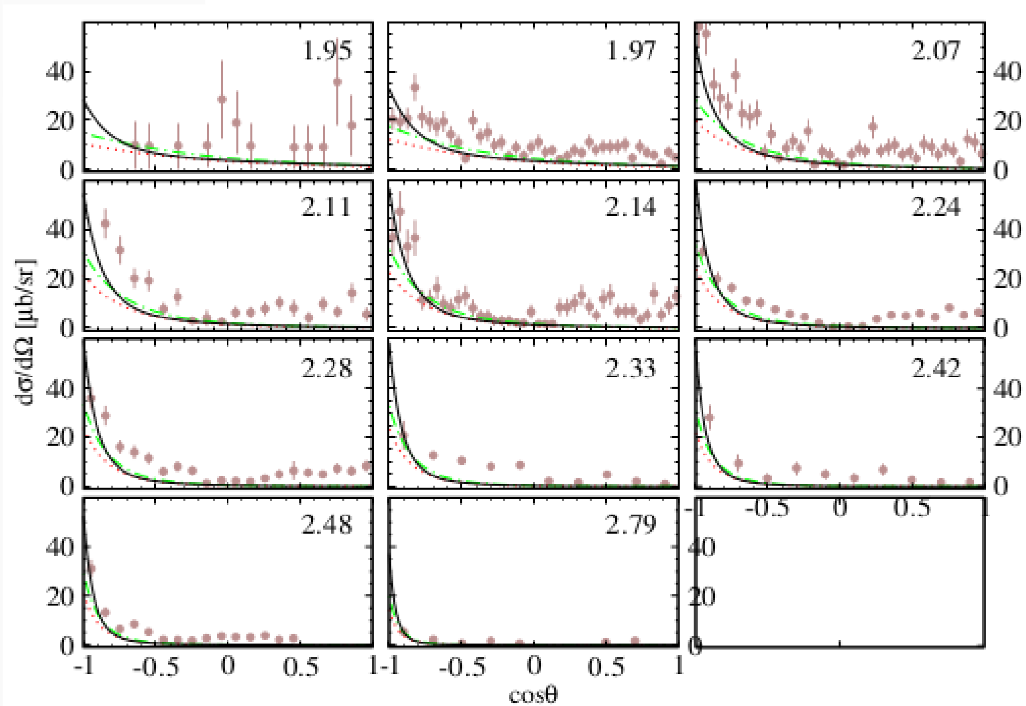
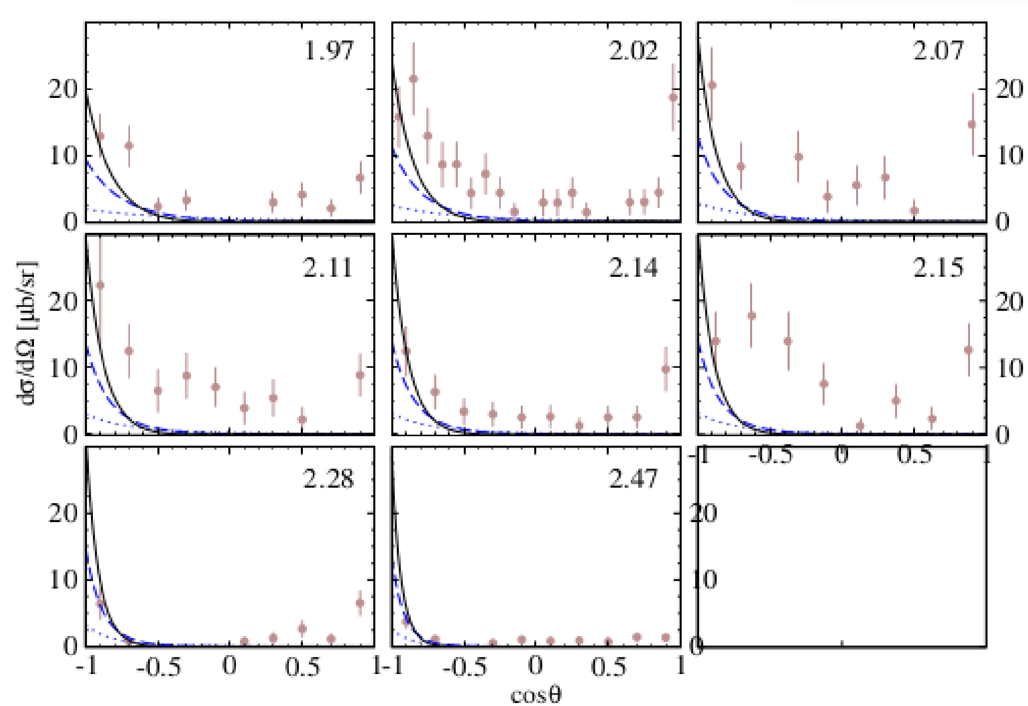




> Backward peaks due to a dominant *u*-channel contribution are clearly verified.
> next step: We should include *s*-channel diagrams.





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◇ Multistrangeness production, $K^- p \to K \Xi$, is investigated in a hybridized Regge model for two different isospin channels ($K^- p \to K^+ \Xi^-$ & $K^0 \Xi^0$).

◇ As for a background contribution, (Λ & Σ & Σ^*) hyperon Regge trajectories are considered in the u channel to describe the backward angles.

◇ We employ a "pseudovector" scheme for the KNY & KΞY vertices rather than a "pseudoscalar" scheme.

◇ For $K^- p \to K^0 \Xi^0$, only (Σ & Σ^*) Regge trajectories are possible and their relative contributions are well constrained.

◇ For $K^- p \to K^+ \Xi^-$, Λ Regge trajectory is more dominant than (Σ & Σ^*) ones.

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⇨ We should include (a) various (Λ^* & Σ^*) resonances in the *s* channel
(b) box diagrams.

⇨ Extension to reactions off nuclei targets [J-PARC (E05): 1.8 GeV K beams]
($K^- A \to K^- A$) A = (^2H, ^4He, ^{12}C, etc)
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Thank you very much for your attention