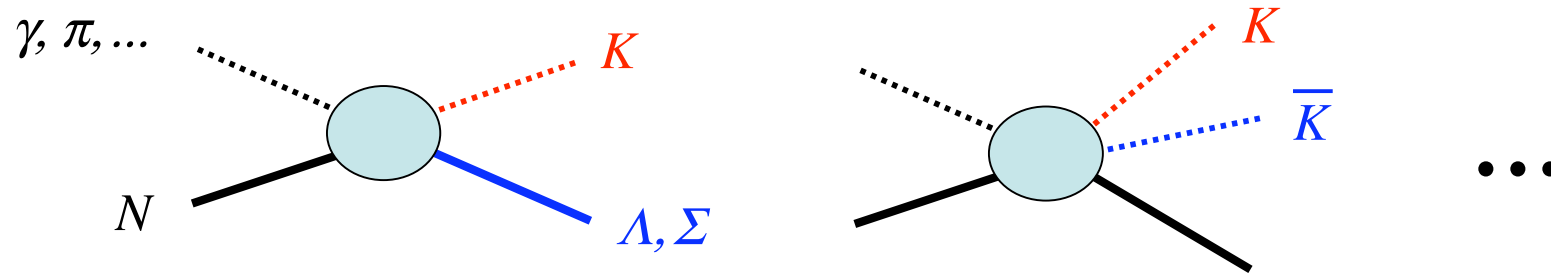


*Reaction mechanism for*  
***Photoproductions of kaons, hyperons***  
*and resonances*

S. Ozaki, H. Nagahiro and A. Hosaka  
RCNP, Osaka University

**Study of  $SU(3)$  flavor symmetry**  
**through  $K^*$ -coupling in**  
 **$\gamma N \rightarrow K\Lambda_{g.s.}$  with the use of polarization**

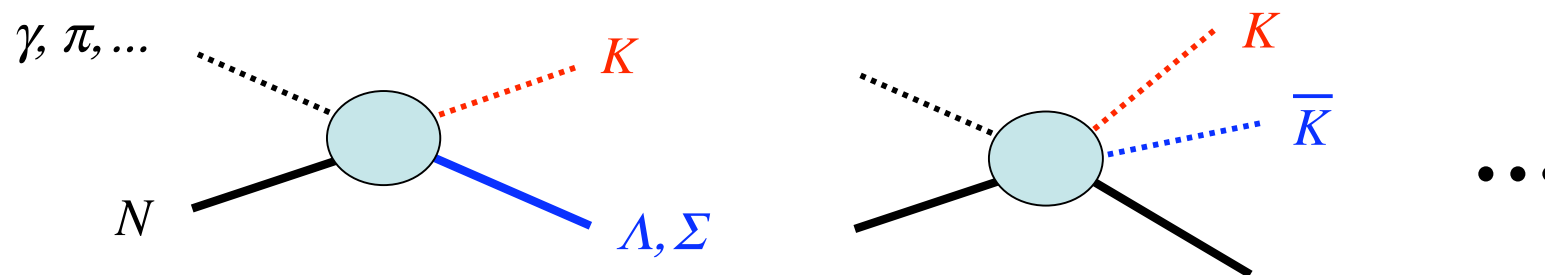
# Basic process of strangeness production



*Important for: Hyper nuclei, hadronic matter, exotics, ...*

**BUT: The nature of interactions are not well understood**

# Basic process of strangeness production



*Important for: Hyper nuclei, hadronic matter, exotics, ...*

BUT: The nature of interactions are not well understood

**Raise questions: Flavor/chiral symmetry  $\sim$  LET?**

SU(2):  $m_u, m_d \ll \Lambda_{\text{QCD}} \Rightarrow$  Good for light quarks:

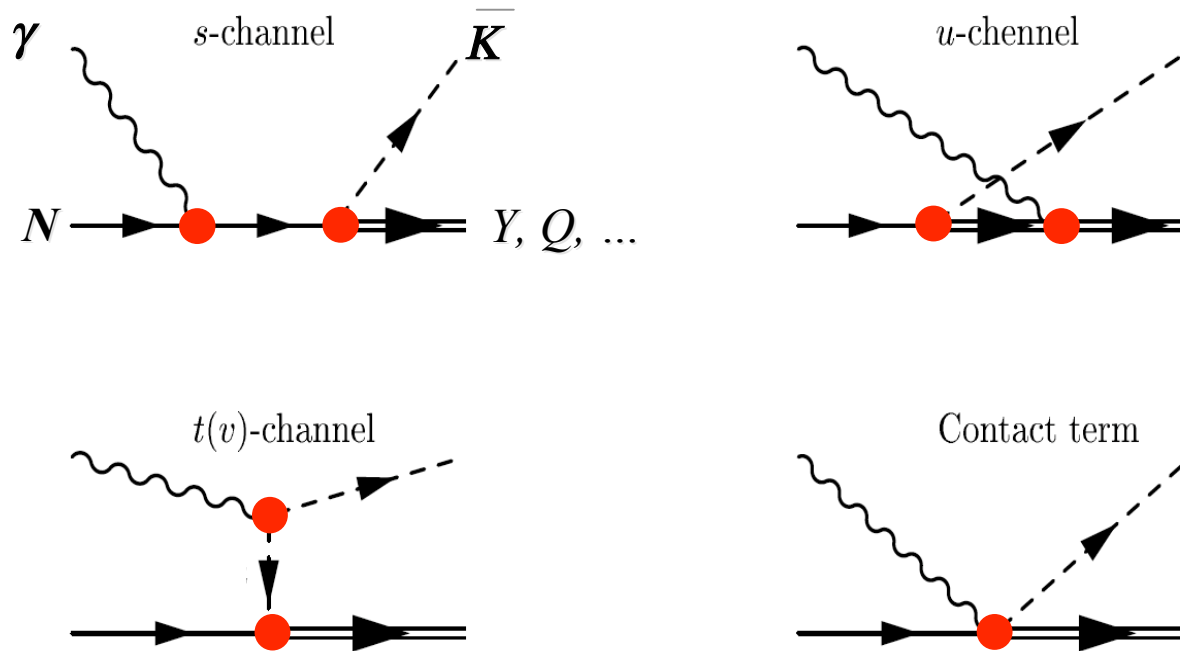
SU(3):  $m_s \sim \Lambda_{\text{QCD}}$

$\pi N$ : a few hundred MeV,  $K\Lambda$ :  $< 1$  GeV

**How should symmetries be respected**

# Test of SU(3) symmetry *via* $\gamma N \rightarrow K \Lambda_{g.s.}$

*Effective Lagrangian approach  
 ~ also respecting chiral symmetry*



*Various  
 parameters*

$g_{K N \Lambda}$

$g_{K^* N \Lambda}$

...

# Strong or weak $K^*$

Bennhold et al.  
NPA695 (2001) 237

SU(3)

$g_{K\Lambda N} / \sqrt{4\pi}$	-3.80	-4.09
$g_{K\Sigma N} / \sqrt{4\pi}$	1.20	0.78
$g_{KK^*\gamma} \underline{g_{K^*\Lambda N}^V} / 4\pi$	-0.51	-0.07
$g_{K^*K\gamma} \underline{g_{K^*\Lambda N}^T} / 4\pi$	0.67	0.16
$g_{K^*K\gamma} \underline{g_{K^*\Sigma N}^V} / 4\pi$	-0.31	-0.11
$g_{K^*K\gamma} \underline{g_{K^*\Sigma N}^T} / 4\pi$	-0.61	-0.37

*Strong*

*Weak*

**Is SU(3) broken?**

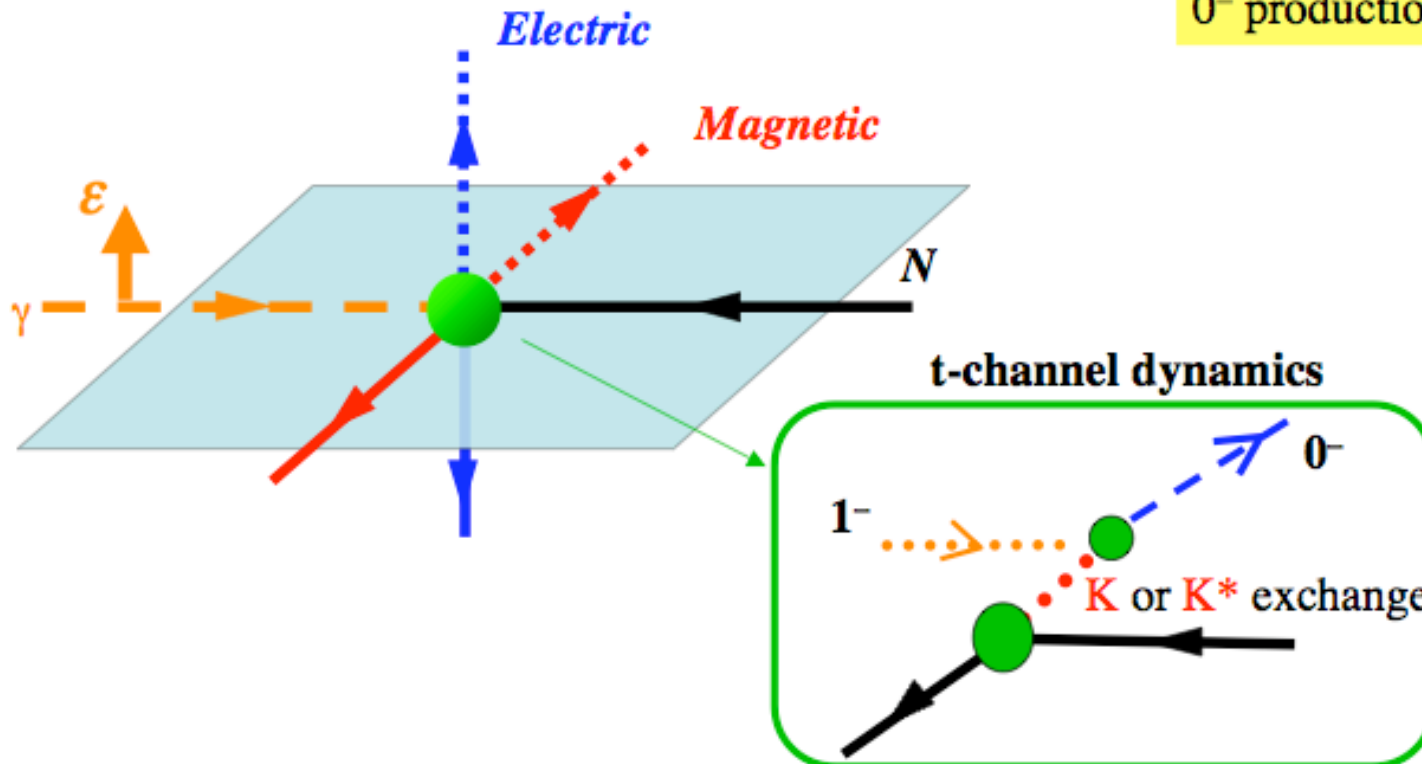
Also discussed by Guidal et al. NPA627 (1997) 645

# Evidence of strong $K^* \sim \text{Magnetic}$

## Use of *polarized gamma*

Spin 1  $(L, 1^-)J^P \rightarrow J, P = (-)^J$  Natural, **Magnetic**  
 $(-)^{J+1}$  Unnatural, **Electric**

$0^-$  production



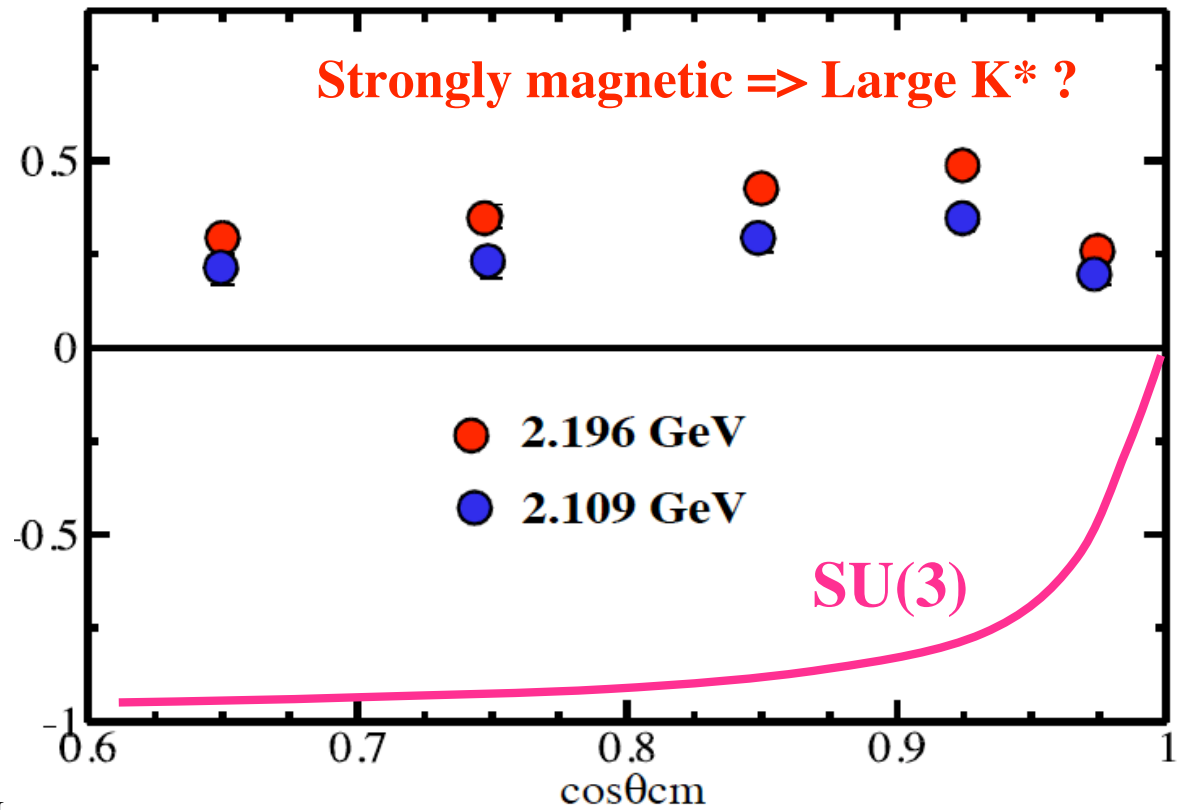
# Asymmetry

$$A = \frac{\sigma_{\perp} - \sigma_{\parallel}}{\sigma_{\perp} + \sigma_{\parallel}} = \begin{cases} + \text{Magnetic} \\ - \text{Electric} \end{cases}$$

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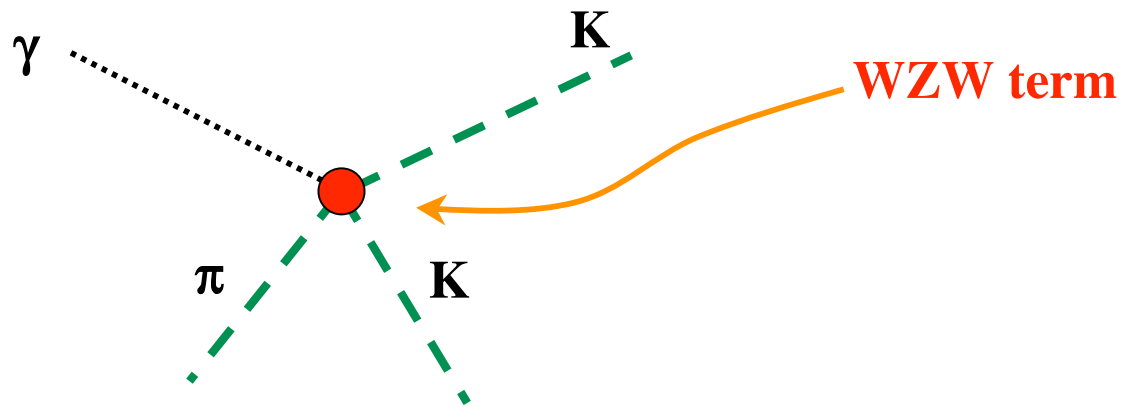
$\gamma p \rightarrow K^{-} \Lambda$  photon asymmetry





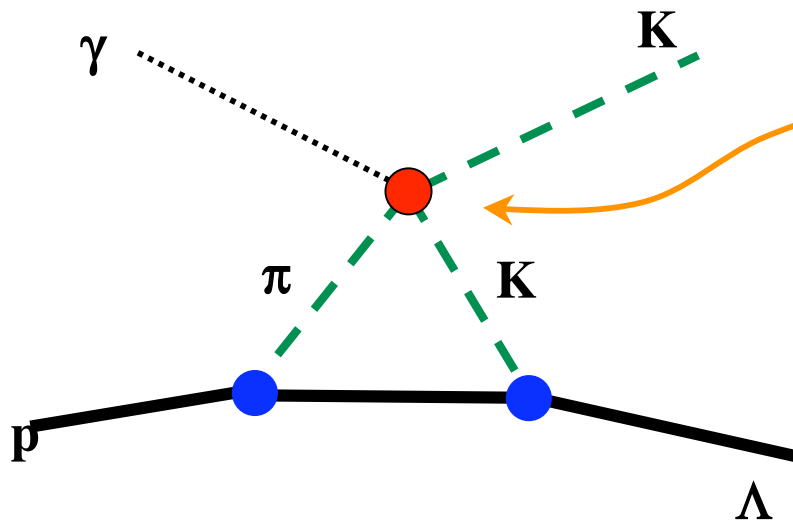
# WZW induced process

*A higher order contribution to be added to Born diagrams*



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*A higher order contribution to be added to Born diagrams*



**WZW term**

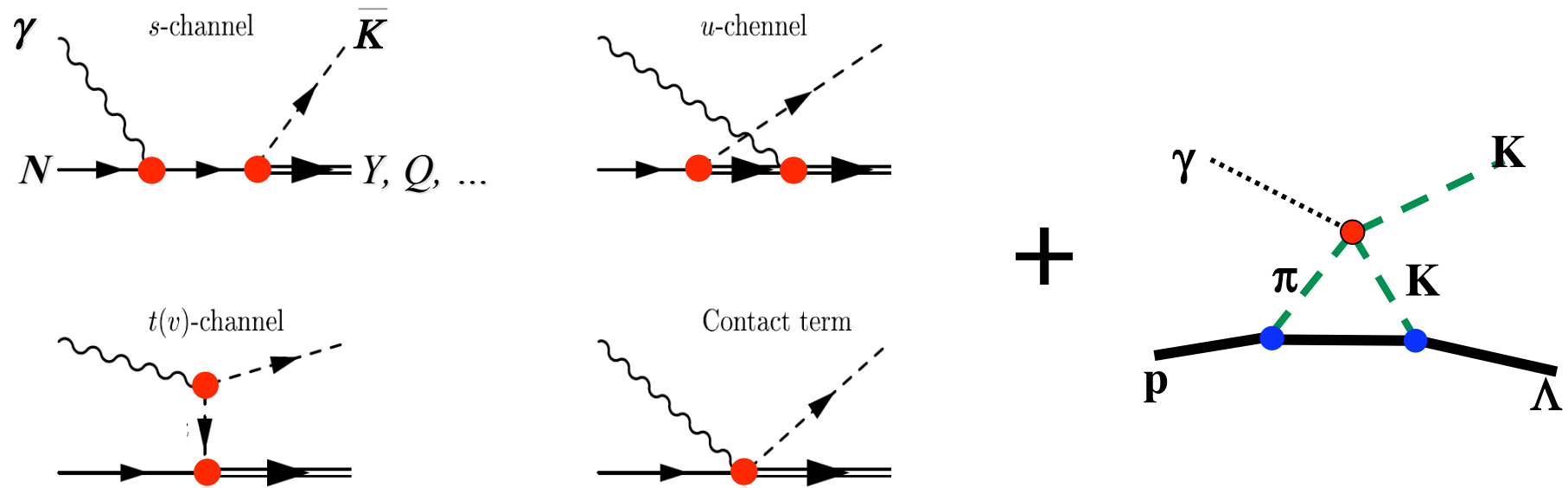
- Strength is determined by QCD
- Contains  $\epsilon_{\mu\nu\alpha\beta} \Rightarrow$  **Magnetic**
- Triangle can not be  $K^*$
- Energy dependent, raising

Actual computation (Ozaki, M2 student)

Covariant loop integral

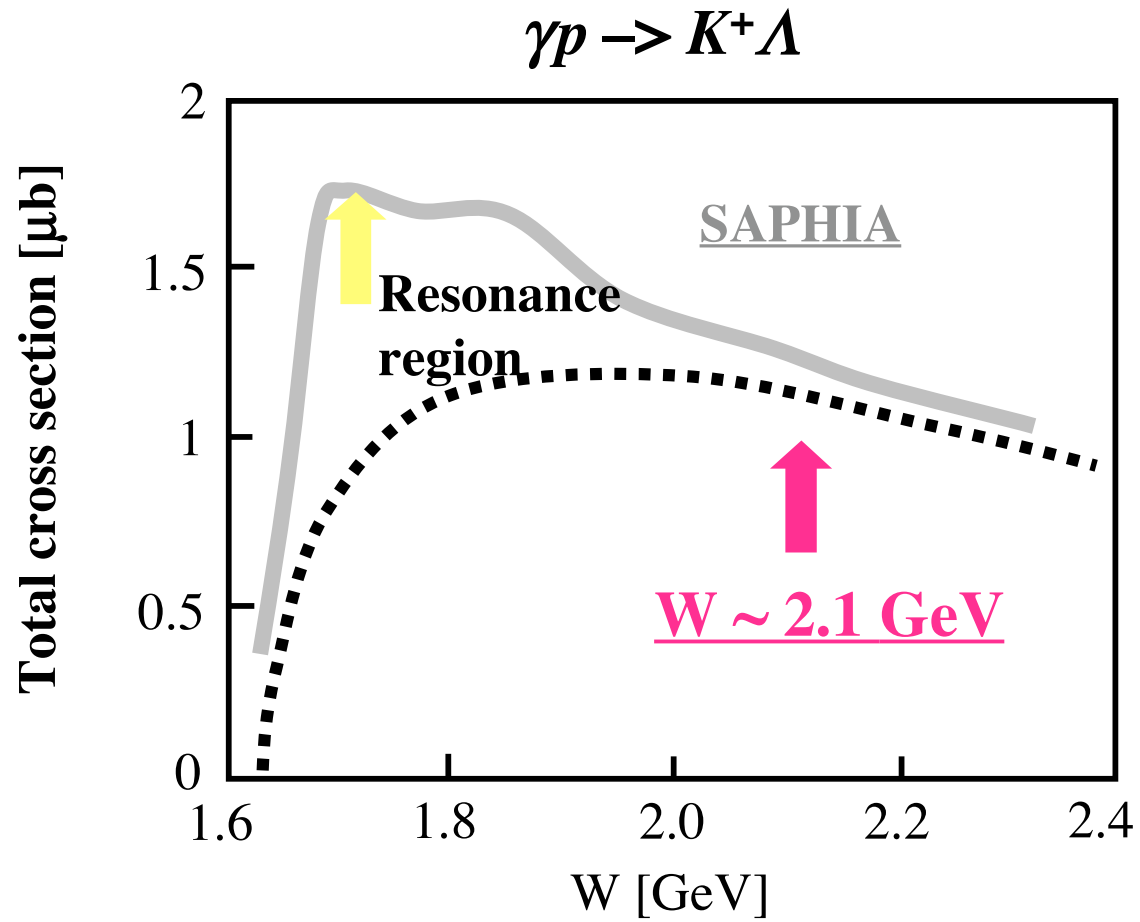
Cutoff  $\sim 1$  GeV

# We consider

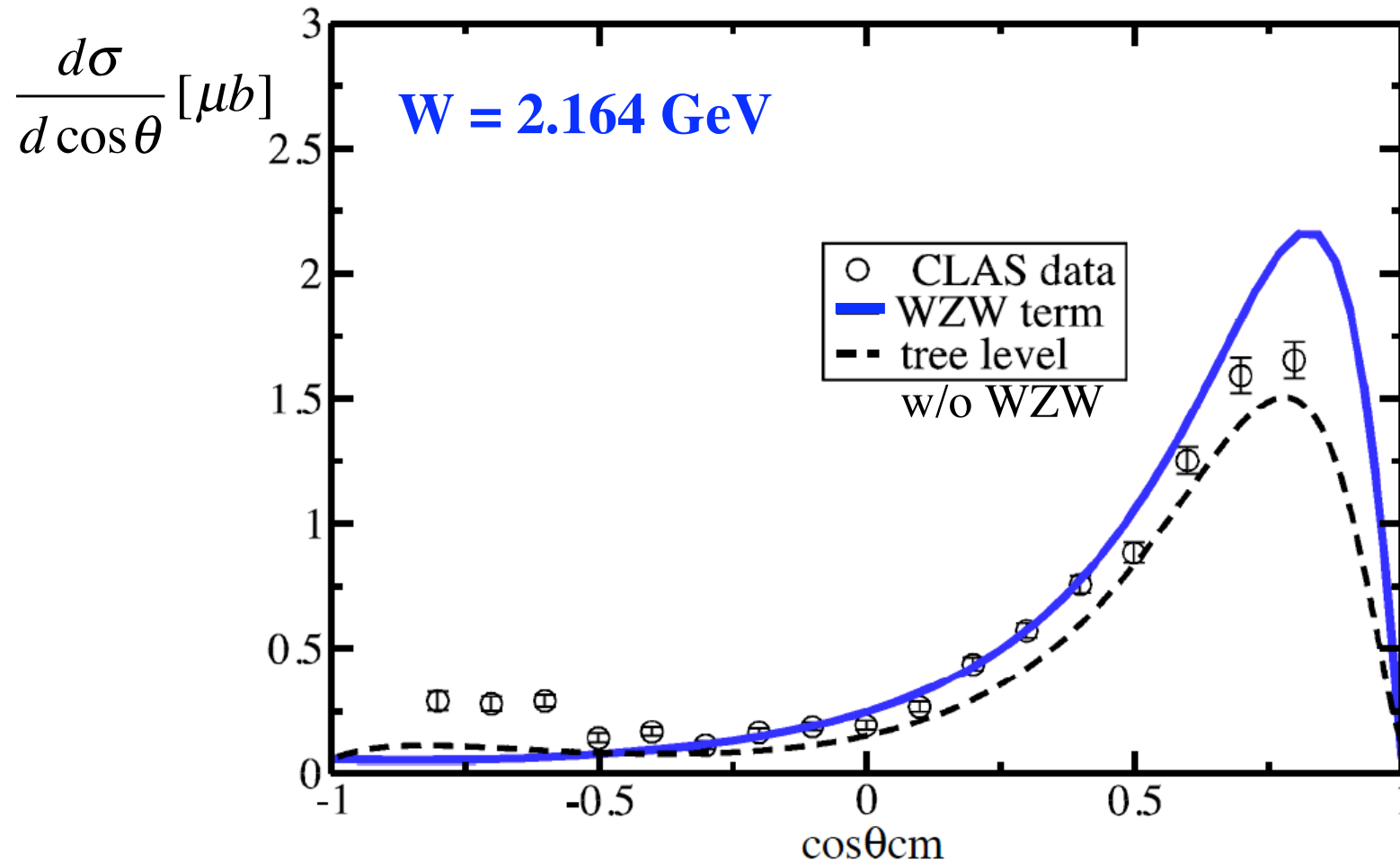
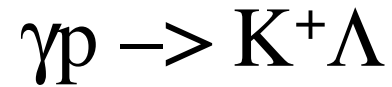


**Using SU(3) parameters**

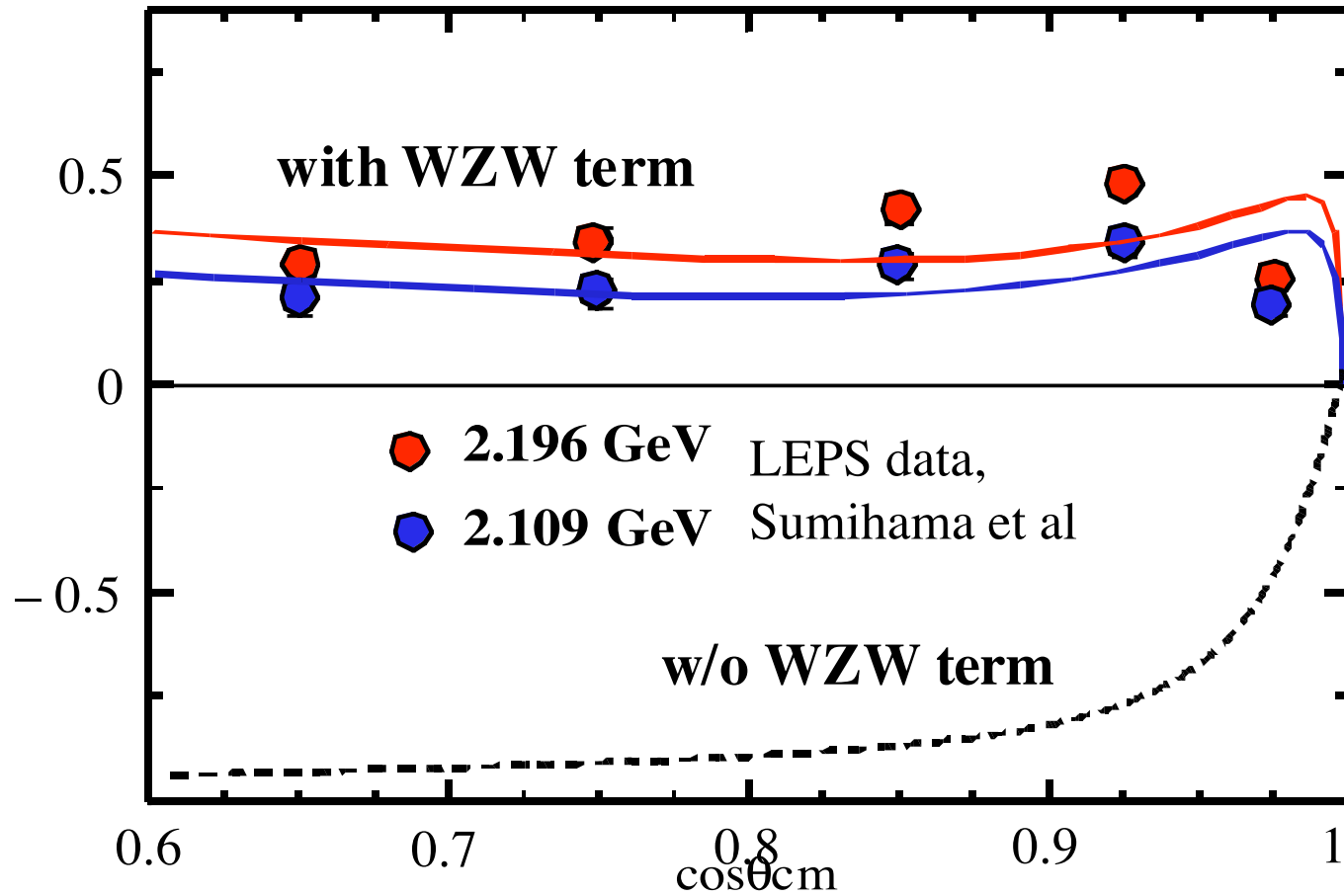
# Where to study



# Angular dependence



Asymmetry  $A = \frac{\sigma_{\perp} - \sigma_{\parallel}}{\sigma_{\perp} + \sigma_{\parallel}}$



# Summary

- We have investigated SU(3) flavor symmetry
- Strong magnetic force may be explained by meson clouds induced by the WZW anomaly
- Flavor symmetry should be respected
- Higher order processes may be relevant for some processes  
~ *near threshold of new channels*