The Importance of $\pi N \rightarrow K\Lambda$ Process for the Pole Structure of the P₁₁ Partial Wave T-matrix in the Coupled-Channel Pion-Nucleon Partial Wave Analysis

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Outline



Tools and data

- Our model
- Data sets



- Fitting only FA02
- Incorporating $\pi N \rightarrow K \Lambda$ data

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Our model Data sets

Toolbox

Cutkosky unitary, coupled channel multi resonance model

$$T = \sqrt{\operatorname{Im}\Phi} \gamma^{T} G \gamma \sqrt{\operatorname{Im}\Phi} \qquad \operatorname{Im}\phi = \frac{q^{2L+1}}{\sqrt{s} \cdot (Q_{1} + \sqrt{Q_{2}^{2} + q^{2}})^{2L}}$$
(1)
$$G = (s_{bare} - s - \gamma \Phi \gamma^{T})^{-1} \quad \phi(s) = \frac{s - s_{o}}{\pi} \int_{s_{o}}^{\infty} \frac{\operatorname{Im}\phi(s')}{(s' - s_{o})(s' - s)}$$
(2)

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Tools and data Our Results Summary

Our model Data sets

SES from Arndt et al. FA02.



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Tools and data Our Results Summary

Appendix

Our mode Data sets

T-matrix $\pi N \rightarrow K \wedge ZG05$



- We obtained this T-matrix in a single channel partial wave analysis from experimental data.
- We fitted data to three partial waves S₁₁, P₁₁ and P₁₃.
- We had a single resonance per wave, except in *P*₁₁, where we allowed for two.
- Error bars were put a posteriori, in order to make statistical weight of this PWD smaller.

Fitting only FA02 Incorporating $\pi N \rightarrow K\Lambda$ data

Two channel single resonance fit.



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Fitting only FA02 Incorporating $\pi N \rightarrow K\Lambda$ data

Two channel two resonance fit.



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Fitting only FA02 Incorporating $\pi N \rightarrow K\Lambda$ data

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Fitting only FA02 Incorporating $\pi N \rightarrow K\Lambda$ data

Fitting FA02 and $\pi N \rightarrow K \Lambda$ data on three channels and a single resonance.



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Fitting only FA02 Incorporating $\pi N \rightarrow K\Lambda$ data

Fitting FA02 and $\pi N \rightarrow K \Lambda$ data on three channels and a single resonance.



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Fitting only FA02 Incorporating $\pi N \rightarrow K\Lambda$ data

Fitting FA02 and $\pi N \rightarrow K \Lambda$ data on three channels and four resonances.



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Fitting FA02 and $\pi N \rightarrow K \Lambda$ data on three channels and four resonances.



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- The P₁₁ partial wave T-matrix from FA02 needs only Roper resonance.
- When we incorporate the $\pi N \to K \Lambda$ data, N(1710) appears.
- That means that, although FA02 has no need for any resonances except Roper, it does not forbid them to exist, and in this case, N(1710) is direct consequence of incorporation of πN → KΛ channel.
- Outlook
 - Inclusion of $\pi N \rightarrow K \Lambda$ experimental data into a full coupled channel partial wave analysis.
 - To be able to that, we need more, and more accurate experimental data. (πN to $K\Lambda$ and $K\Sigma$ differential cross sections)

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Total cross section data for $\pi N \rightarrow K \Lambda$



First step in amalgamation of $\pi N \rightarrow K \Lambda$ data



Second step in amalgamation of $\pi N \to K \Lambda$ data



 P_{11} partial wave and $\pi N \rightarrow K \Lambda$ data

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