

Theoretical analysis of the K^-p and meson-baryon correlation functions from high-energy collisions



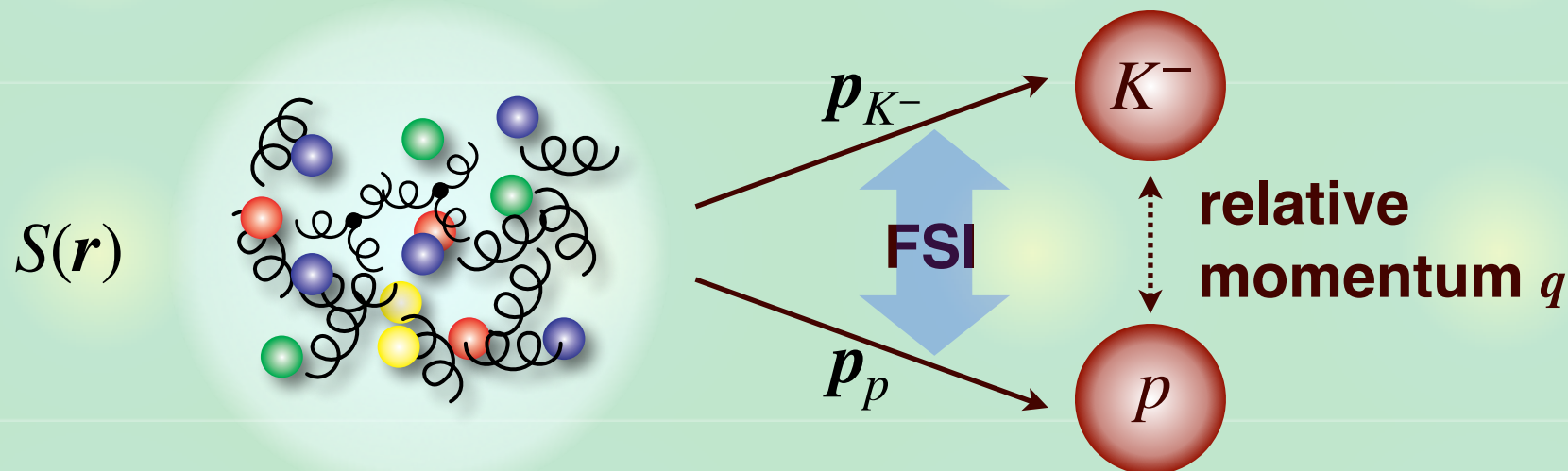
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2021, Sep. 16th 1

Correlation function and hadron interaction

High-energy collision: chaotic source $S(\mathbf{r})$ of hadron emission



- Experiment

$$C(q) = \frac{N_{K^-p}(\mathbf{p}_{K^-}, \mathbf{p}_p)}{N_{K^-}(\mathbf{p}_{K^-})N_p(\mathbf{p}_p)} \quad (= 1 \text{ in the absence of FSI})$$

- Theory

$$C(q) \simeq \int d^3\mathbf{r} S(\mathbf{r}) |\Psi_q^{(-)}(\mathbf{r})|^2$$

Source function $\longleftrightarrow$ two-body wave function (FSI)

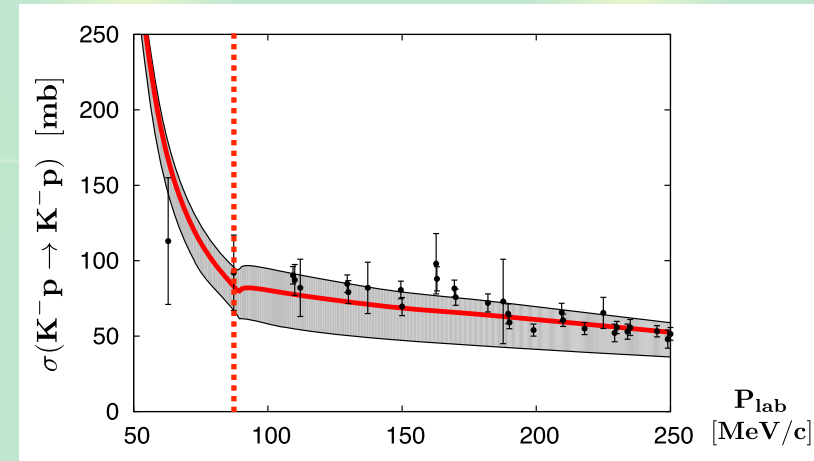
ALICE collaboration, *Nature* **588**, 232 (2020); ...

Experimental data of K^-p correlation

K^-p total cross sections

Y. Ikeda, T. Hyodo, W. Weise, PLB 706, 63 (2011)

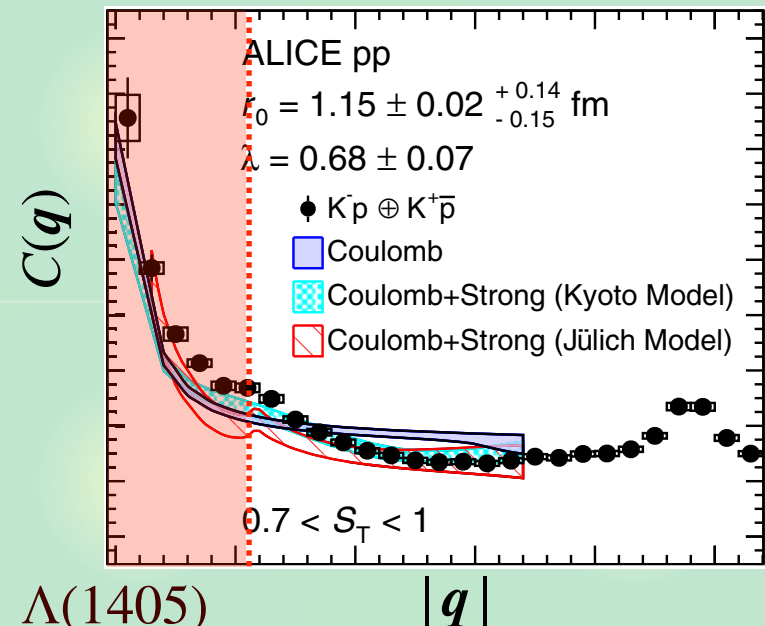
- Old bubble chamber data
- Resolution is not good
- Threshold cusp is not visible



K^-p correlation function

ALICE collaboration, PRL 124, 092301 (2020)

- Excellent **precision** ($\bar{K}^0_n$ cusp)
- Low-energy data **below** $\bar{K}^0_n$

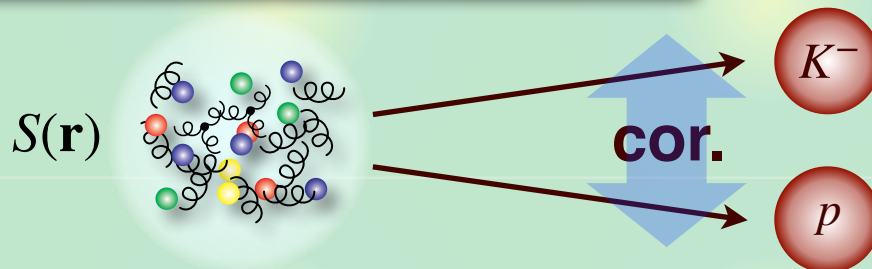


—> Important constraint on $\bar{K}N$ and $\Lambda(1405)$

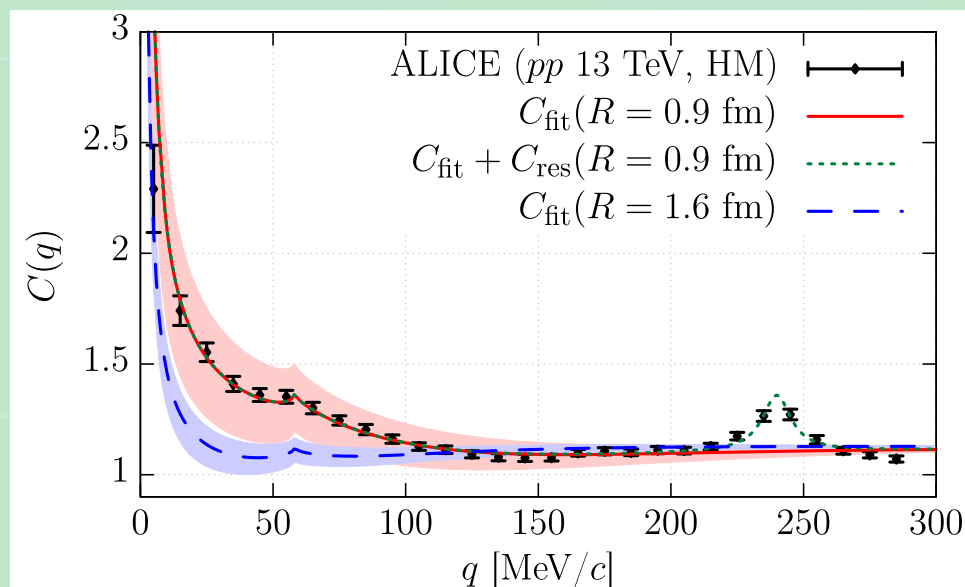
Prediction from chiral SU(3) dynamics

Theoretical calculation of $C(q)$

$$C(q) \simeq \int d^3r S(r) |\Psi_q^{(-)}(r)|^2$$



- wave function $\Psi_q^{(-)}(r)$: coupled-channel $\bar{K}N$ - $\pi\Sigma$ - $\pi\Lambda$ potential
- source function $S(r)$: estimated by K^+p data



Y. Kamiya, T. Hyodo, K. Morita, A. Ohnishi, W. Weise. PRL124, 132501 (2020)

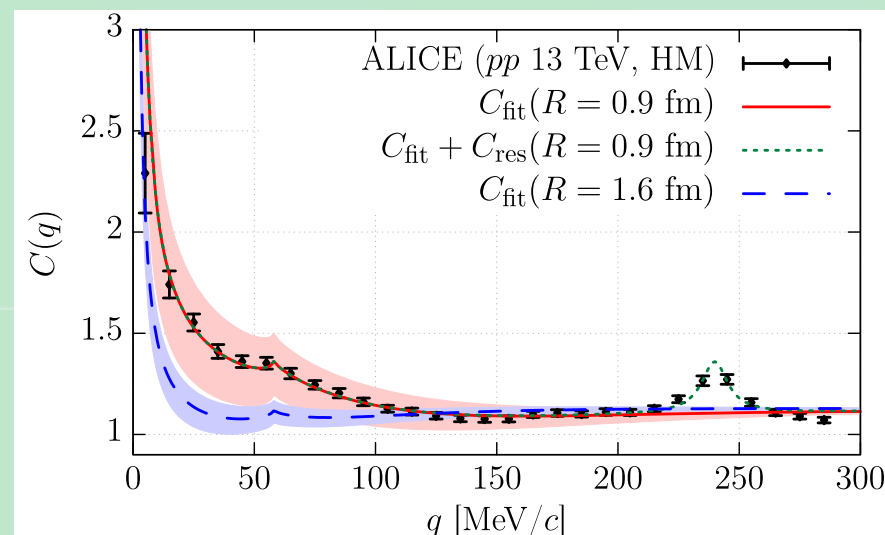
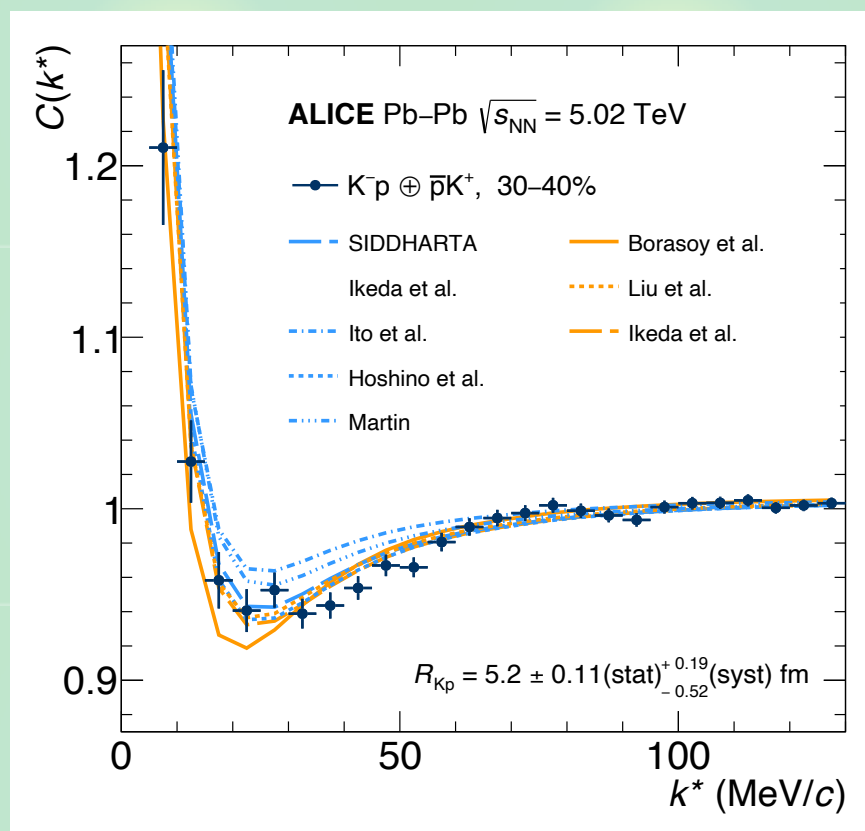
Correlation function is well reproduced

New data with larger systems

New data of Pb-Pb collisions at 5.02 TeV

ALICE collaboration, arXiv:2105.05683 [nucl-ex]

- scattering length $a_{K^-p} = -0.91 + 0.92i$ fm



Correlation is suppressed at larger R , as predicted