

A study of K^-d and K^+d interactions via femtoscopy technique

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- A study of kaon-deuteron scattering parameters of the strong interaction (not measured before).
- A key piece of information in the field of the low-energy K^-N interactions.

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Femtoscopy



Femtoscopy: determination of the space-time characteristics of the particle-emitting source using correlation function (CF) in momentum space.

CF: convolution of the source function and wave function (the latter for non-identical particles combines strong and/or Coulomb forces).

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Data

- Pb-Pb collisions at \sqrt{s_NN} = 5.02 TeV.
 \$\mathcal{K}^{\pm}d/\mathcal{K}^{\pm}d}\$ correlation functions.
- 3 centrality intervals: 0–10%, 10–30%, 30–50%.
- Momentum reconstruction via TPC detector.
- Particle identification via TPC and TOF detectors.





Modeling correlation functions

- Theoretical CFs modeled with Lednický-Lyuboshitz approach [1]. Assumptions:

 □ gaussian source,
 - \Box zero effective-range approximation of the interaction, $d_0=0.0~{\rm fm}.$
- Numerical calculation of theoretical CFs (for different fit parameters) before the fitting.



Kd in Pb–Pb with L-L fit

- Simultaneous fit to 6 CFs.
 Source radii from likeand unlike-sign pairs.
 One R_{Kd} per centrality.
- Scattering lengths from three centralites at once.
 □ One f₀(𝔅,𝔅) for unlikesign pairs.

 $\label{eq:one_f_0(R)} \square \mbox{ One } f_0(\Re) \mbox{ for like-sign} \\ \mbox{ pairs.}$



Kd radii



- 3 radii for 3 centralities (the same radius for all particle pairs).
- A source size increases with multiplicity.

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K^-d scattering length



K^+d scattering length





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Summary

- First measurement of Kd correlation functions and 1D radii in heavy-ion collisions.
 First measurements of K⁻d and K⁺d scattering lengths
 - $\implies \text{In agreement (within uncertainties) with many K^-d predictions and with the two currently available K^+d calculations.}$
 - \Longrightarrow Obtained values constrain significantly possible scattering parameters for future theories.

Thank you for your attention!