Femtoscopy, production, and some recent results

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Content

We present recent theoretical advances in the study of femtoscopic correlation functions (CFs) as tools to probe hadron interactions and the nature of hadronic resonances. First, we establish a formal connection between femtoscopic CFs and invariant mass distributions, showing their equivalence in the limit of vanishing source size and analyzing deviations arising from finite-size effects. A modified Koonin–Pratt formalism and an improved Lednicky–Lyuboshits (LL) model are developed, incorporating a Lorentzian ultraviolet regulator to correct pathologies in the small source-size regime.

Secondly, we analyze $\pi^{\pm}K_S$ correlations using realistic πK scattering amplitudes obtained from dispersive analyses, emphasizing the role of chiral dynamics, isospin interference, and the broad $\kappa/K_0^*(700)$ resonance. These effects lead to a suppression of the CF and challenge simplistic source or interaction models, particularly for systems involving light mesons.

Finally, we incorporate Coulomb interactions into CF calculations through a practical formalism combining strong and electromagnetic potentials. This approach avoids numerical Schrödinger equation solutions and allows a direct comparison with Effective Field Theory amplitudes. Using the proton–proton system as a benchmark, we validate our framework against ALICE data and highlight the importance of finite-range corrections and off-shell effects.

These developments improve the reliability of femtoscopy as a precision tool for studying hadron–hadron interactions and extracting resonance properties in high-energy collisions.

Reference

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[2] M. Albaladejo *et al.*, *Phys.Lett.,* **B866** (2025), 139552
[3] M. Albaladejo *et al.*, 2503.18710 (PTEP, in press)

Field of Research: Production, structure and decay of hypernuclei / Multi-strange systems / Interactions of mesons and baryons with strangeness / Strangeness in hadron structure / Strange mesons in nuclei / Strangeness in astrophysics and in extreme forms of matter / Heavy flavor systems / Hypernuclei in heavy ion collisions / Future experiments and facilities

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