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Imaging Freeze-Out Sources and Extracting Strong Interaction Parameters in Relativistic Heavy-Ion Collisions

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By combining femtoscopic interferometry with an optical deblurring algorithm, we present a novel method to image the source in heavy-ion collisions while simultaneously extracting the interaction strength between particle pairs. We apply this method to the published STAR data on Au+Au collisions at $\sqrt{s_{\mathrm{NN}}} = 200$ GeV, obtaining new fits for both the spatial distribution of the emission source and the strong interaction parameters for protons (p) and antiprotons ($\bar{p}$) from the respective pp and $\bar{p}\bar{p}$ correlation functions. Within uncertainties, p and $\bar{p}$ share the same freeze-out distribution, deviating from the widely assumed Gaussian shape. These results provide evidence for matter–antimatter symmetry at freeze-out, prior to full randomization of nucleons in the collision process.

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