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Approaches to the Inverse Fourier Transformation with Limited and Discrete Data

W e have investigated various approaches to address the potential inverse problem involved in the limited inverse Fourier transform of quasi-distributions. The methods explored include the Tikhonov regularization method, the Backus–Gilbert method, the Bayesian approach, and genetic algorithms coupled with artificial neural networks. Using both simulated data and actual lattice data, we tested the effectiveness of these methods and compared them with the λ-extrapolation method. Our study shows that the limited inverse Fourier transform constitutes a relatively tractable inverse problem; except for the Backus–Gilbert method, all the approaches considered are capable of correctly reconstructing the quasi-distributions in momentum space. Depending on the specific behavior of the quasi-distribution data, adopting different strategies for processing and carefully estimating the associated systematic uncertainties is essential.

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