

The left side of the slide features a vertical column of abstract, multi-colored light trails. These trails are composed of numerous thin, overlapping lines in shades of white, yellow, orange, and blue, creating a sense of motion and energy. The background is a solid black, which makes the light trails stand out prominently.

Yale Hackathon 2025: Alice & Bob

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Overview

01

Wigner Functions

Understanding and generation of Wigner Functions for Fock States, Coherent States, and Cat States.

02

Density Matrix

Reconstruction of the density matrix from the Wigner Function.

03

Shaping the Fit

Simulation of noisy data with Gaussian Noise.

04

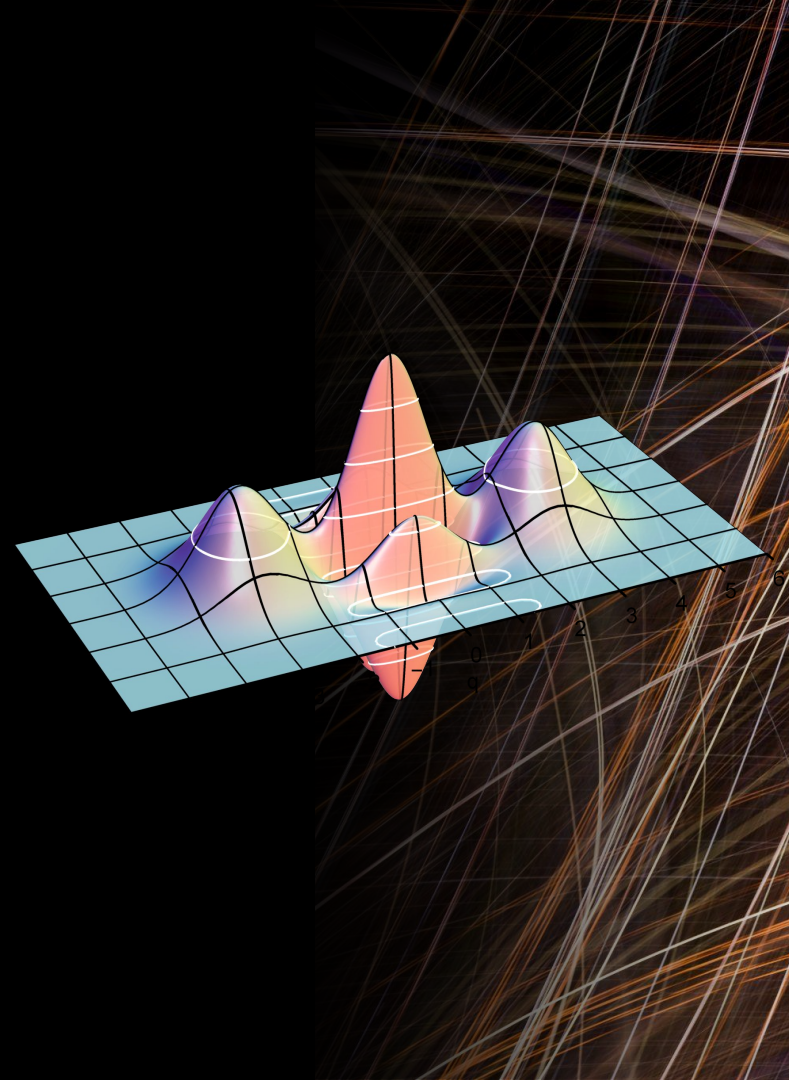
Denoising

Corrections of background noise.



The Wigner Function

We know the distinction between Classical Mechanics and Quantum Mechanics is the quantization of energy. Heisenberg's Uncertainty Principle also tells us that one cannot know both the position and momentum of a particle with complete precision. The Wigner Function allows us to visualize quantum states in phase space, allowing for negative probability values that reflect non-classical behavior.



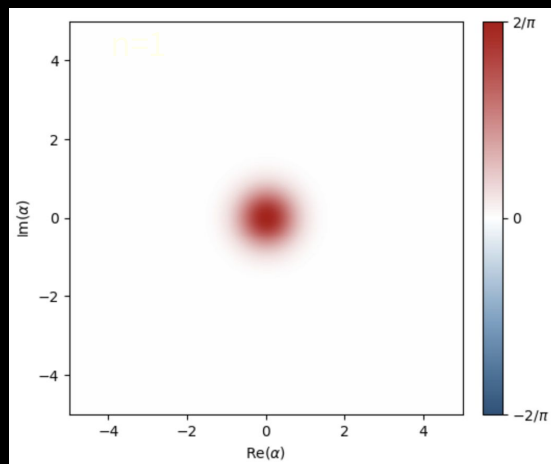
01 Wigner Functions

Computation and Visualizations

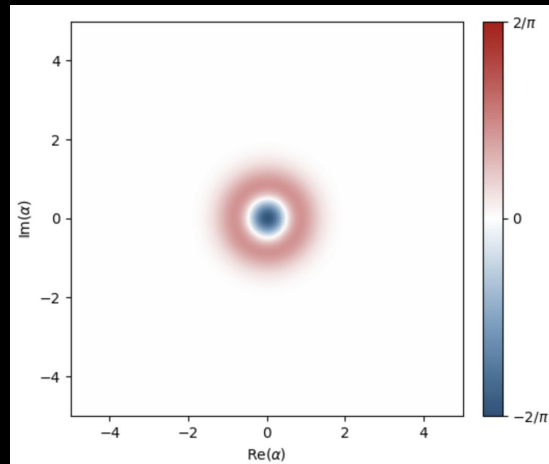


Fock States

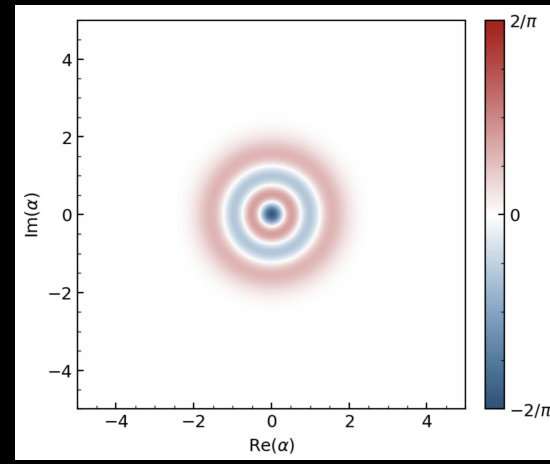
$n=0$



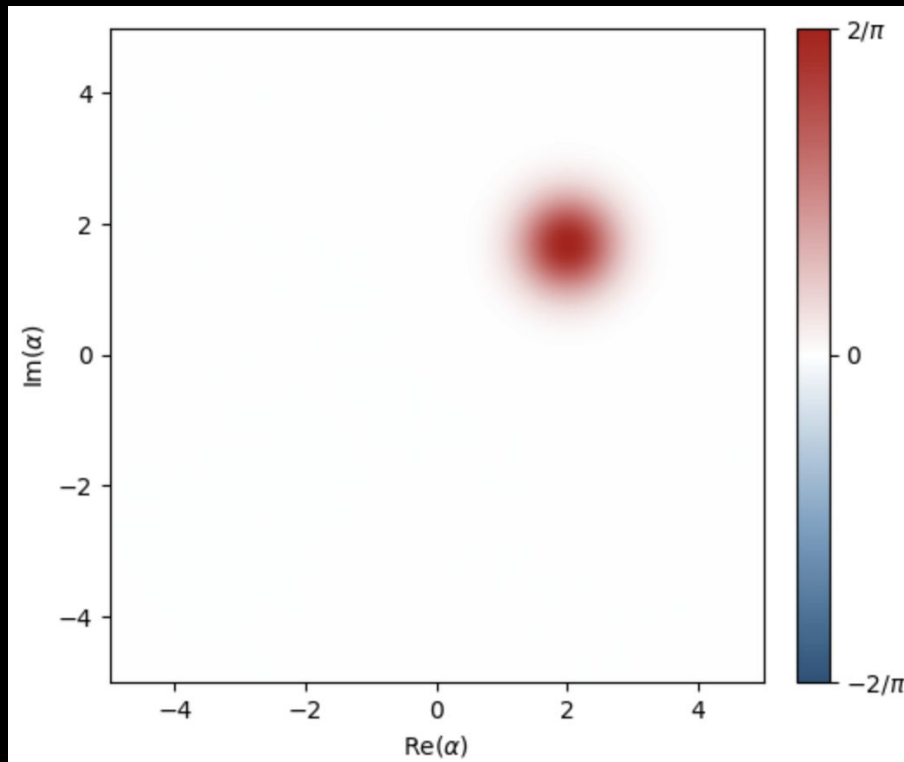
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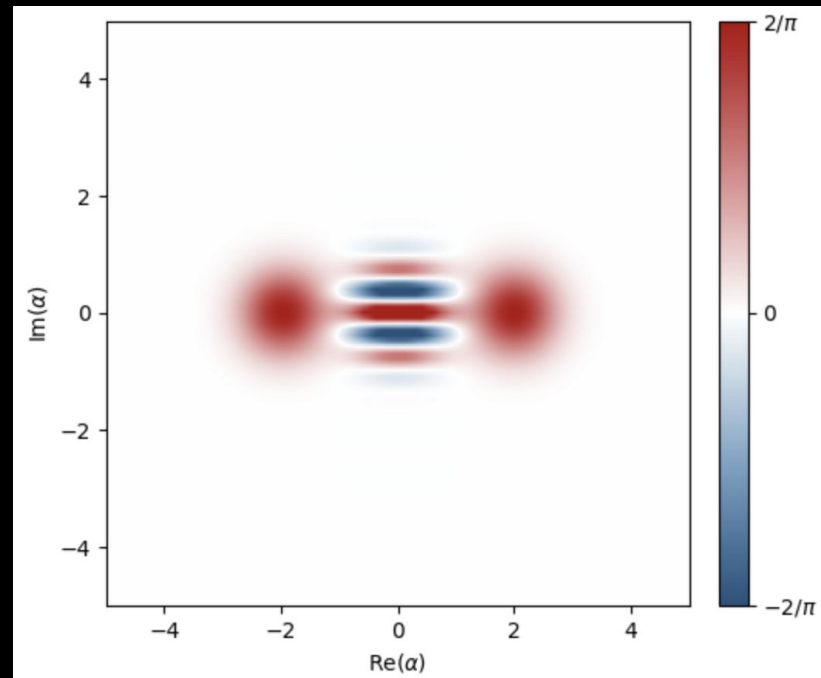
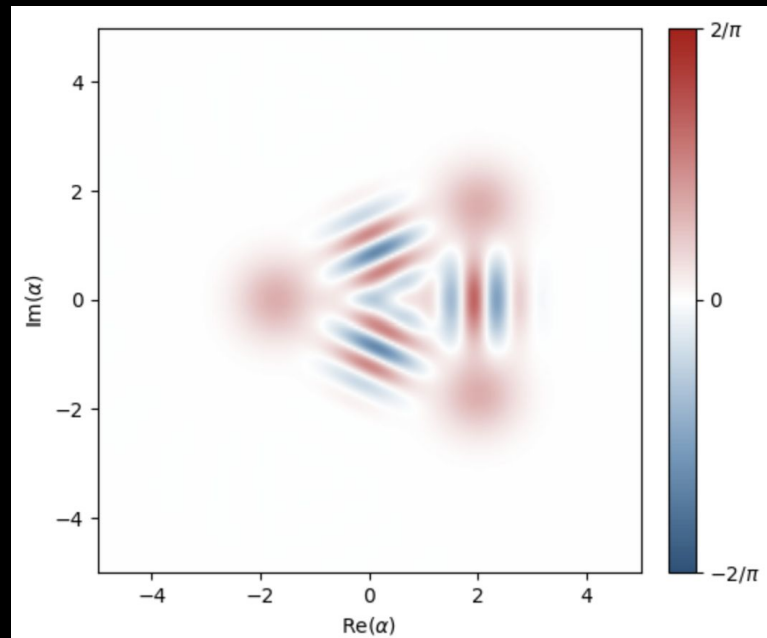
$n=3$



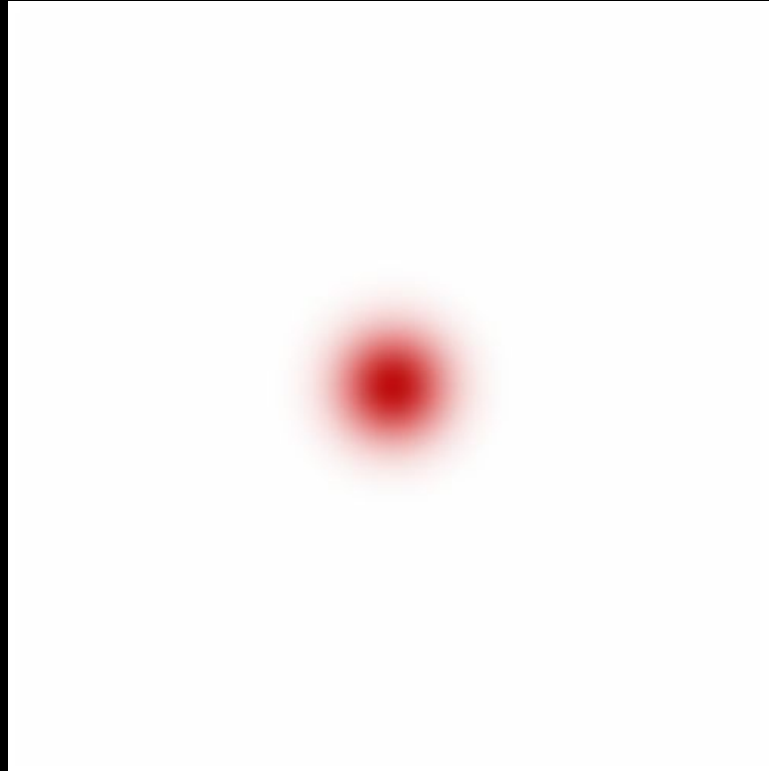
Coherent States



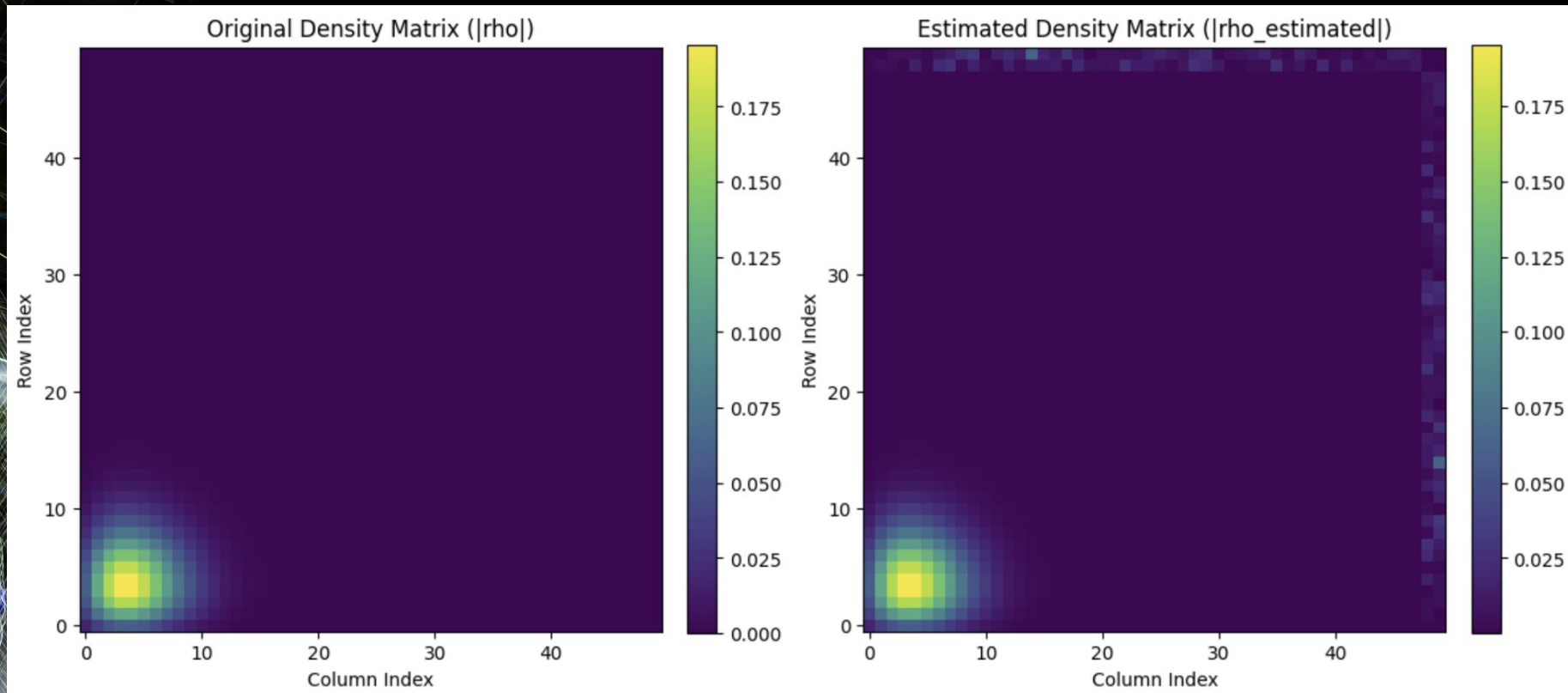
Cat States



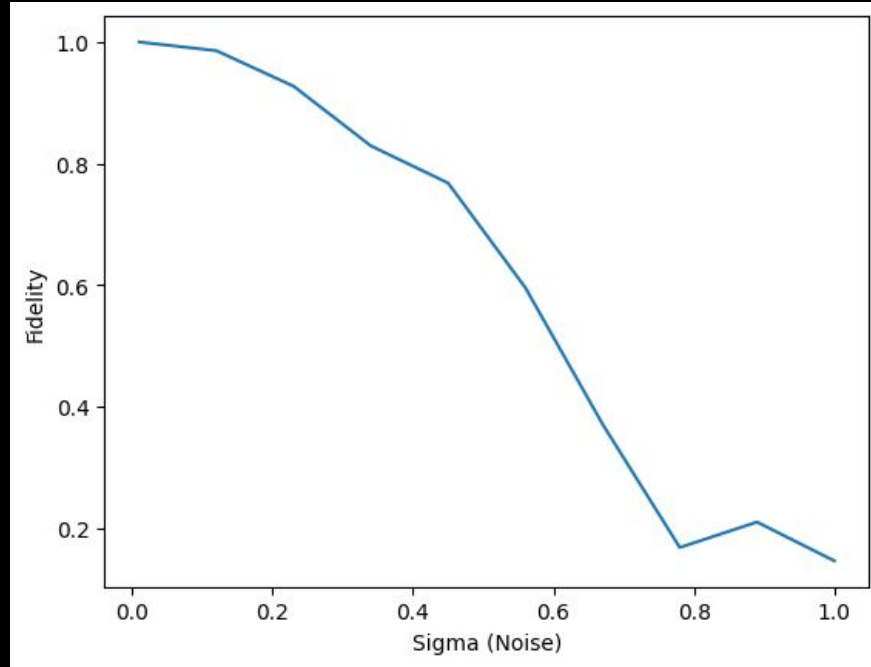
Dissipative Cat State



Reconstruction from Wigner Data

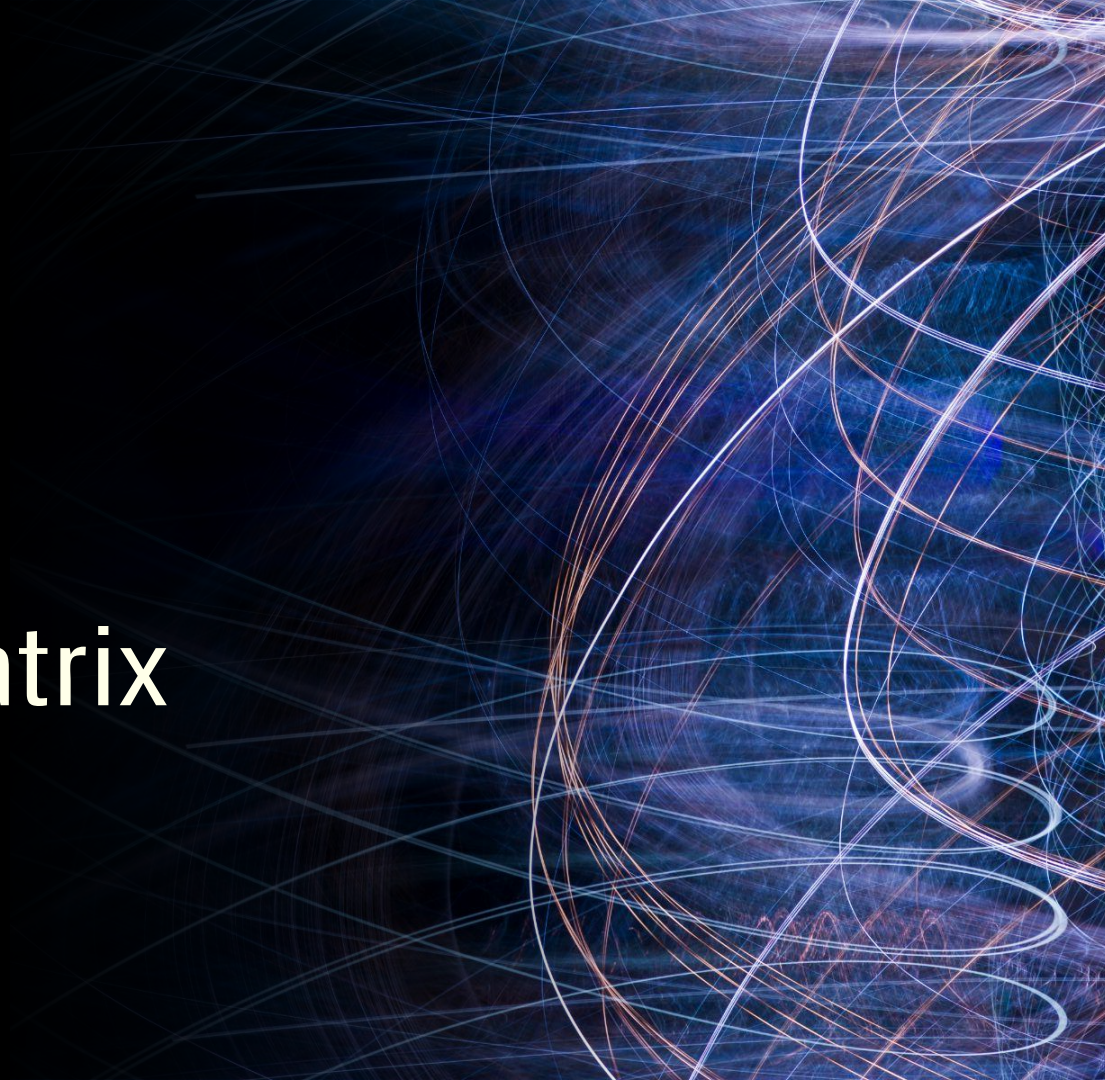


Fidelity Versus Sigma

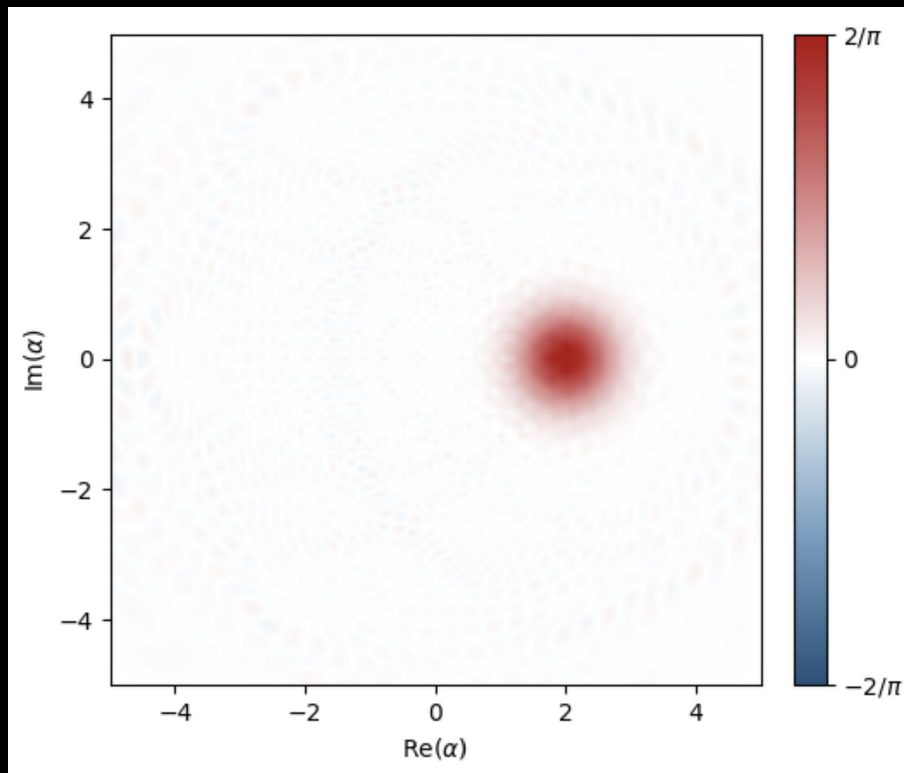


02

Density Matrix



Wigner estimated from ρ

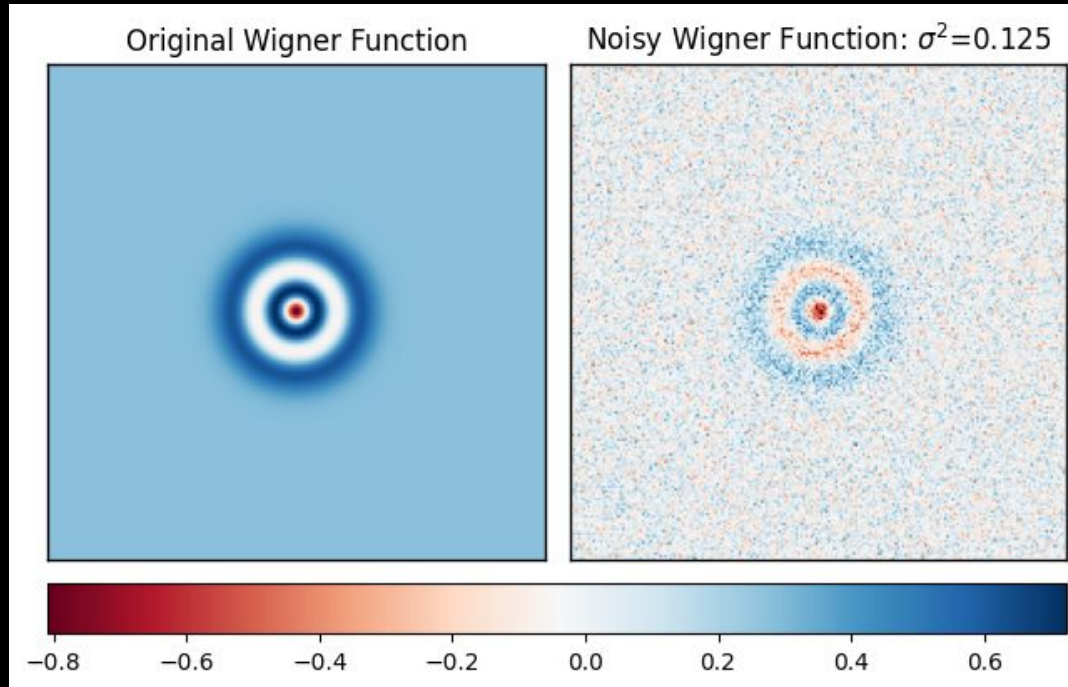




03

Shaping The Fit

Gaussian Noise on Fock State

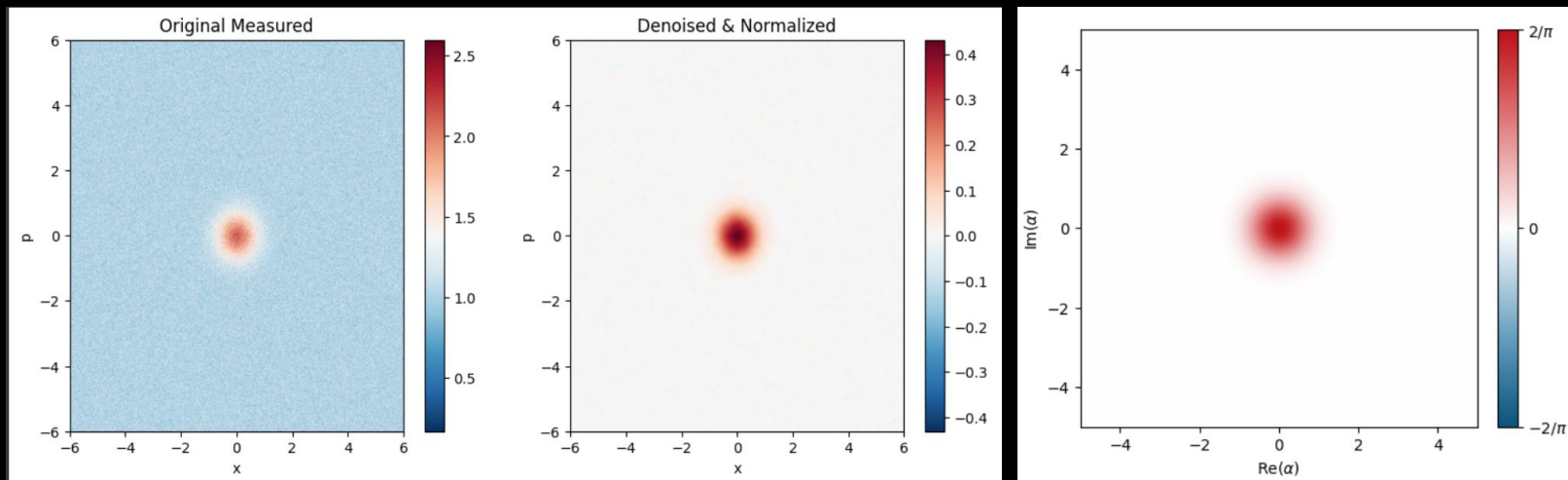


04

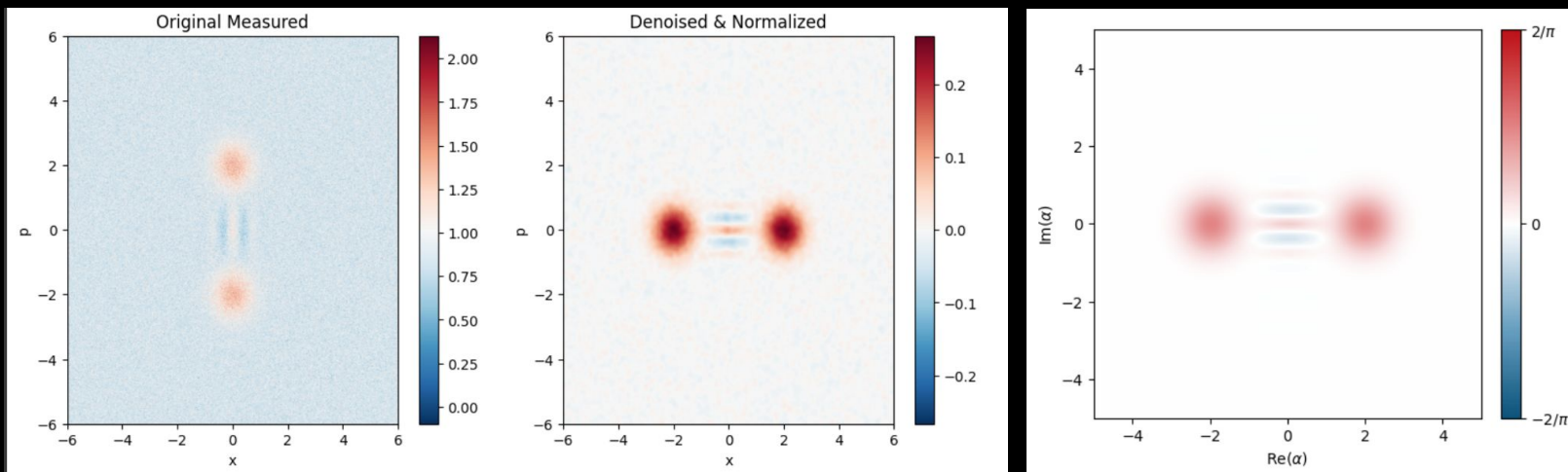
Denoising



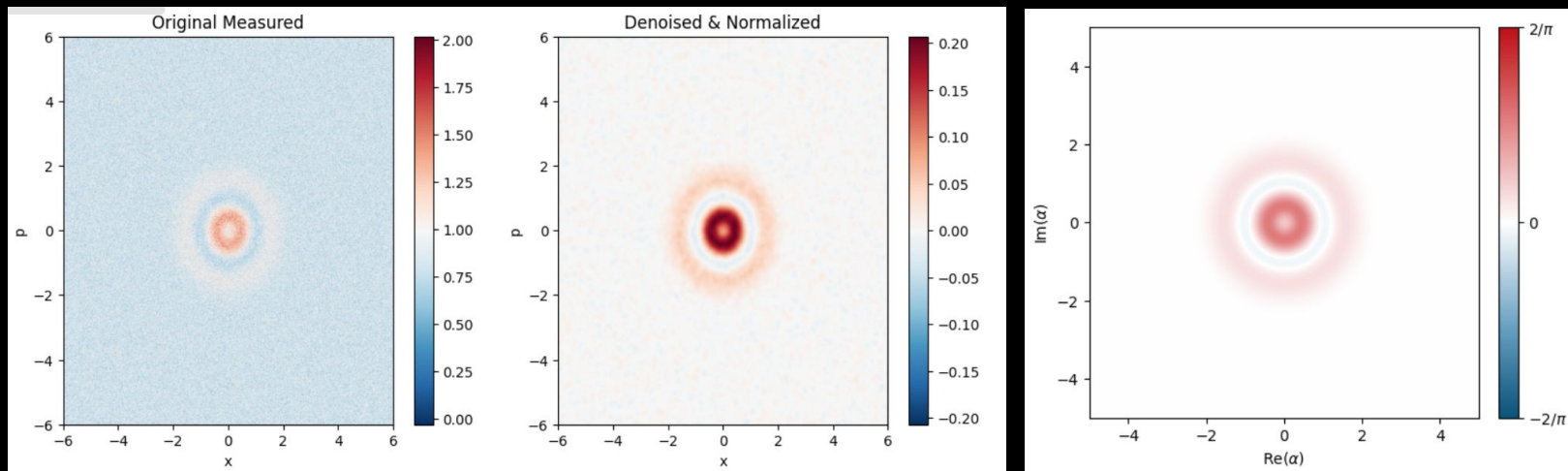
Denoising and Normalizing Vacuum State



Denoising and Normalizing Cat State



Denoising and Normalizing Fock State



Thank you!

