

# A Frequency-based SU(1,1) Interferometer based on a Josephson Parametric Amplifier

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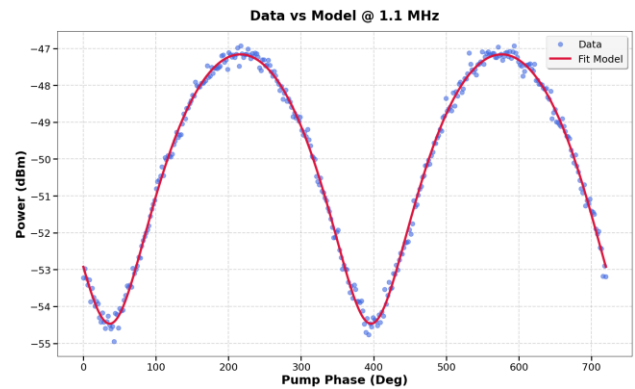
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Interferometry is a cornerstone of precision measurement, and its role in emerging quantum technologies demands sensitivities beyond the standard quantum limit. While conventional SU(2) interferometers are quantum-limited, SU(1,1) interferometers can achieve sub-quantum-limit sensitivity by harnessing quantum states such as squeezed light. We report the experimental realization of a microwave SU(1,1) interferometer based on a flux-pumped Josephson Parametric Amplifier (JPA). The JPA operates as a spontaneous parametric down-conversion source to generate two entangled microwave beams. Critically, our design is frequency-multiplexed: the entangled beams co-propagate along a single spatial path at two distinct frequencies, rather than on different paths. The beams are subsequently interfered by using a digital mixer for readout. We investigate the quantum nature of our interferometer and discuss its potential for advanced quantum sensing and quantum-limited qubit readout.

## Figures



**Figure 1:** (blue) Data of the interference pattern given by the frequency based interferometer after digital recombination. (red) Theoretical fit to the data.