

Abstract Submitted  
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**Signal Processing Techniques for the HAYSTAC Experiment<sup>1</sup>**

SUKHMANPREET SINGH, Yale University — The HAYSTAC experiment is a quantum-enhanced search for cold dark matter axions at Yale University. By coupling the HAYSTAC cavity to a squeezed state receiver, this experiment has surpassed the quantum limit. A large component of the accompanying data analysis is the search for a weak putative axion signal buried in noise. As such, computationally efficient signal processing and filtering techniques that can easily operate in the time and frequency domains are a crucial analysis tool. We present simulations of several different maximum likelihood estimation algorithms and least squares analyses applied to data corrupted by additive white Gaussian noise. These methods aim to compute the original signal parameters and reconstruct clean sinusoidal signals. We compare these algorithms against each other to determine which method offers the optimal experimental sensitivity and examine their associated limits and constraints.

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