Abstract Submitted
for the APR20 Meeting of
The American Physical Society

Linear Optimum Filtering for Axion Dark Matter Search[1]
SUKHMANPREET SINGH, Yale University — The Haloscope At Yale Sensitive To Axion CDM (HAYSTAC) Experiment is a microwave cavity search for cold dark matter (CDM) axions in the galactic halo. It attempts to detect a resonant photon signal produced by axion conversion in a magnetic field, the detection of which would provide useful insights on dark matter. The data acquisition for this experiment necessitates efficient filtering out of noise and interfering signals.

We present the theory/applications of two linear optimal filters: the Wiener and matched filters. The Wiener filter is based on the minimization of the mean squared error between the desired and output signals. The matched filter is based on the maximization of the signal-to-noise ratio. By injecting random noise into a known signal, we present linear filtering techniques that allow us to perform the following things: first, obtaining the best linear estimate of the desired signal d(n) from noisy data x(n); second, predicting a signal d(n+m) for m>0 from data x(n); and lastly, carrying out an a posteriori estimation of d(n+m) for m<0 from x(n). Using principles of optimization theory, this project helps speed up data analysis for HAYSTAC.

[1]I would like to thank Steve Lamoreaux for funding this research.

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Date submitted: 09 Jan 2020 Electronic form version 1.4