University of Dayton
School of Engineering

**Master's Thesis Defense**
**Electro-Optics and Photonics**
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All are welcome to attend.

# FOURIER FILTER INTEGRATION ON IN-HOUSE FABRICATED P-N PHOTODETECTORS

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Abstract

Spectroscopy is used in many applications, such as in medical and engineering fields. Spectrometers can provide information about objects by characterizing their reflection or transmission in the spectral domain. Traditional spectrometers, even compact ones, utilize a grating, lenses and mirrors. Therefore, they are bulky and cannot be integrated into ultra-compact platforms like cell phones and other portable electronics. There is currently no single-chip solution, except through the use of bandpass filters on each pixel. The goal of this project is to investigate an ultra miniature spectrometer by mimicking a Fourier transform spectroscopy. Whereas normal Fourier spectroscopy is based on taking a continuous Fourier transform of the signal, our concept is based on taking the Fourier transform at discrete intervals through the use of sinusoidal optical filters. Earlier attempts to create such spectrometers was based on fabricating filter arrays and mechanically hybridizing them with commercially available image sensors. This was a difficult and unreliable process. The work being reported in this thesis is an attempt at constructing this spectrometer by fabricating the photodetectors in-house and then directly patterning the sinusoidal filters on top of them. In this thesis, the process and results for fabricating silicon photodetectors is presented. This is followed by studying the Fabry-Perot transmission function from several dielectric materials to examine the best dielectric material for these filters that is also compatible with the photodiode fabrication process. Finally, measurement results from photodetectors integrated with these filters is presented.