Introduction

What is optical frequency comb?
Optical frequency combs (OFCs) are a sequence of equidistant laser frequencies and provide extremely accurate measurements of light.

![Diagram showing basic OFC](image)

Generating OFC in integrated photonic chip
This is a very small and compact method of generating OFC.

Research & Learning Process

Research flow
- Design
- Fabrication
- Measurement
- Analysis

![CAD of ring resonator used for microcomb generation](image)

**Research flow**

**Design**
In the image on the right, there is a ring resonator with a radius of 80 μm and a bus waveguide through which the light travels through. Although they are not directly connected, light is still able to be coupled into the ring resonator due to the small gap size of 800 nm.

**Fabrication**
There are many steps to fabricate a chip of this type; however, there is extensive training needed to be able to use the machines needed for fabrication, so I shadowed my mentor as he used the e-beam lithography machine.

**Measurement**
- Transmission and comb spectrum

![Diagram of on-chip microring based microcomb generation. In this case, you need continuous wave(CW) laser to excite target optical resonance in the ring](image)

**Design**
- Second harmonic generation

![Setup for SHG](image)

**Second harmonic generation**
Nonlinear light generation such as SHG requires pulsed laser source with high peak power.

**Analysis**
I learned how to use OriginPro, an analysis software, in order to process data and get comprehensible results.

Results

- Free spectral range (FSR) of target resonance is fixed by radius of the ring resonator to be 2 nm.
- Second order transverse electric (TE) modes on the left of the fundamental (F) modes.
- To generate OFC, we pump the laser at the target resonance indicated by the red arrow.

![Transmission spectrum from ring resonator](image)

![OFC generation on the ring resonator](image)

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Citations


Next Steps

I can use the knowledge and skills that I have gained during my time in Shine to help me in any research that I do in the future, whether it be undergraduate or beyond.