Glaucoma is an incurable eye disease that is currently one of the leading causes of irreversible blindness. Known for causing permanent vision loss, glaucoma is often associated with elevated eye pressure and optic nerve deterioration. The objective of this project is to develop a novel passive optical-based pressure sensor that enables long term and frequent intraocular pressure (IOP) monitoring in order to improve patient care and treatment. The sensing mechanism used in this research employs a combination of material optical and mechanical properties and the principle of interferometry.

The sensor is comprised of a flexible silicon nitride (SiN) diaphragm, a spacer member and a rigid glass substrate as shown in Figure 1. As pressure is applied on the sensor, the diaphragm deflects and changes the gap distance, $d$. When mono or multi chromatic light is directed toward the sensor cavity, light waves reflected from the bottom surface of the SiN diaphragm and the top surface of the glass substrate interfere with each other to form fringe patterns. A high resolution camera is used to capture these interference patterns. The images showed that the number of fringes increased with increasing applied pressure. Post-processing was performed using ImageJ and MATLAB to quantitatively correlate the interference patterns with pressure. From preliminary prototype testing, a sensitivity as high as 1 mmHg has been obtained.

Future work includes optimizing coating material and miniaturizing the device for ex-vivo studies. This research ultimately aims to further advance glaucoma research and care by enabling researchers and physicians with the ability to track changing IOP to fit the needs and treatment plans for the patients.

**Fig. 1** Schematic for intraocular pressure sensor. Silicon nitride diaphragm deformation under (a) low pressure and (b) high pressure. Resulting concentric interference patterns (from top view) under monochromatic light for (c) low pressure and (d) high pressure.