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Birefringence measurements on crystalline silicon

Crystalline Silicon cooled to cryogenic temperatures is a promising material for next-generation gravitational-wave detector optics. Crystalline Silicon has low mechanical loss, so it enables low thermal noise at low temperatures, and it also has two points of zero thermal expansion at 123 K and 10 K and high thermal conductivity, so it does not get easily deformed by thermal loads. One of the sources of noise in GW interferometers is the birefringence present in both the substrate and the coatings of the optics. The goal of this experiment is to map the birefringence in a crystalline silicon sample at 2 μm laser wavelength using an optical cavity. The measurement will first be done at room temperature to verify its operation. Then it will be set up in a cryogenic testbed to make the measurement at low temperatures. This talk will present the design concept and early testing of the experiment.

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