NASA SBIR/STTR Technologies

S1.09-9462 - Miniature Optical Isolator

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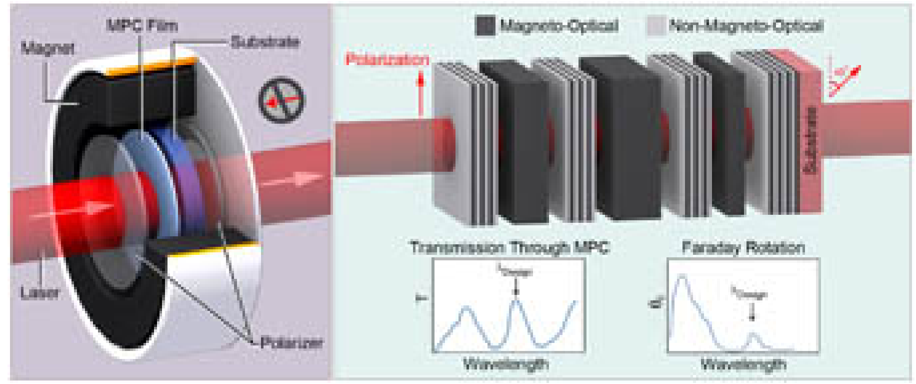
Identification and Significance of Innovation

To address NASA's need for miniature optical isolators in atom interferometry applications, Physical Optics Corporation (POC) proposes to develop a miniature optical isolator based on magnetic photonic crystals optimized at visible and NIR wavelengths. The proposed optical isolator design is based on enhanced magneto-optical effects in photonic crystals. With the proper lattice parameter and magnetic material, high optical transmission and large Faraday rotation can be achieved simultaneously at a target wavelength. A proposed device, occupying < 0.1 cc, is expected to achieve high optical transmittance (loss <2 dB) and excellent optical isolation (extinction >40 dB); therefore, it is suitable for applications in various compact atom interferometers. In Phase I, POC will demonstrate the feasibility of the technology in the visible range and provide a Phase II prototype design. In Phase II, the technology will be further optimized and tested in operational environments.

Estimated TRL at beginning and end of contract: (Begin: 3 End: 4)



Technical Objectives and Work Plan

Technical Objectives
Objective 1. Maturing the MPC design and MO material selection for various wavelengths of interest to NASA in the visible and NIR range (350 ~900 nm).
Objective 2. Fabrication of MOI samples.
Objective 3. Assembly and testing of the Phase I prototype.
Objective 4. Design of a fully packaged Phase II prototype.
Objective 5. Definition of the commercial market for the MOI.

Work Plan
1. Advance/Optimize MPC-Based Faraday Rotator Design at Various Target Wavelengths in the Visible and NIR Range
2. Fabricate and Characterize MPC Samples at the Design Wavelength
3. Assemble a Bench-Top Test Setup and Measure Faraday Rotation and Optical Absorption
4. Enhance the MPC Design and Fabrication Technique to Improve Its MO Performance and Finalize Phase II Prototype Design
5. Explore Commercial Potential and Product Viability
6. Manage Program and Submit Reports

NASA Applications

The primary NASA applications of the proposed MOI system are in metrology, magnetometry, and inertial navigation. NASA applications require miniaturization of all system components. Frequency stabilized lasers are currently used in atomic clocks. Next-generation magnetometers and inertial navigation sensors also need optical isolation. In any NASA application that requires frequency stabilized lasers, MOI devices can replace bulky optical isolators to reduce the volume by a factor of >100.

Non-NASA Applications

Metrology and inertial navigation are important in military and civilian applications. Cold-atom based technologies require compact optical systems, and miniature optical isolators are one of the key components. These optical isolators also have significant commercial applications in diverse fields, such as optical telecommunication, magneto-optic imaging, and gas sensing.

Firm Contacts

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