Measurement of Magneto-Optical Properties of a Specimen at Infrared Wavelengths *Via* Nonlinear Interferometry

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Magneto-optical properties of materials find numerous applications in various research fields. Investigating the novel properties of these materials through metrology in the infrared wavelength range can further expand their potential applications. However, current infrared metrology techniques can be challenging and non-efficiency or unavailability of suitable components. To address these challenges, we propose and demonstrate a set of measurements based on nonlinear interferometry method [1-3]. This approach allows us to investigate the polarization properties of materials in the infrared wavelength range through detection of the signal in the visible or near-infrared ranges [4].

In this work, we measure the Verdet constant of a bismuth-iron-garnet (BIG) crystal, which exhibits Faraday rotation at infrared wavelengths. We employ a nonlinear Michelson interferometry scheme with a single nonlinear crystal, generating idler photons in the 1500-2300 nm range, and signal photons in 810-700 nm range. When an optically active medium is introduced into the idler arm of the interferometer, the visibility of the interference pattern for signal phototns decreases with the application of a magnetic field due to the rotation of the photon polarization. Thus, by utilizing a nonlinear Michelson interferometry scheme combined with optical elements for polarization analysis, we measure the Verdet constant of a BIG crystal in the infrared wavelength range over 600 nm spectral bandwidth, through the detection of visible and near-infrared light.

References

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