Abstract

My thesis work is divided into two parts. In the first part, I detected Faraday rotation using a differential detection technique. In the second part, observation of elliptically polarized light was carried out.

The Faraday effect is a magneto-optical phenomenon. When a monochromatic, linearly polarized light beam is transmitted through an optically inactive medium placed under a magnetic field, it is rotated by an angle θ. The angle of rotation is given by

$$\theta = VBd$$

where **B** is the magnetic field, d is the length of the medium and **V** is the **Verdet constant**, which is a function of wavelength, temperature and refractive index of the medium. It is usually of the order of μrad/gauss cm.We observed the Faraday rotation in TGG crystal using differential detection technique with phase sensitive detection. This technique helps reducing the intensity fluctuations in the light source.

In the second half, an experiment is carried out to study the phenomenon of birefringence. A simple system consisting of a light source, a retarder (quarter-wave plate) and an analyzer was used. First the system was analyzed using Jones Calculus to find the final intensity of the system. Then the light intensity was measured using a photo detector and the theoretically obtained expression is validated through our experiment.

This combined work is useful in measuring ellipticity in Faraday rotation with accuracy.