ABSTRACT

Study of different configurations of Sagnac interferometer has been done by placing variety of optical elements inside the interferometer and with different states of polarization of the input beam. Of the configurations studied, some configurations show the nonlinear behaviour of Pancharatnam’s phase in a simple fashion. These have been chosen to develop three new applications. We have developed and demonstrated experimentally an interferometric switch and a double beam polarimeter to determine the optical activity of a medium. We have studied theoretically an N-bit signal generator with slowly relaxing nonlinear medium using Sagnac interferometer and nonlinear behaviour of Pancharatnam’s phase. Finally we have studied the effect of a lens in a Sagnac interferometer and demonstrate the effect of the difference in the Gouy phase accumulated by the counter propagating beams. This confirms the addition of Gouy phase accumulated in different sections of an optical system. Our Sagnac interferometer setup interestingly compares the addition of Gouy phase before and after a lens along two sequences of optical elements keeping the total path length constant. The question, which arises by looking at Collins chart, viz., "Is there a Gouy phase contribution due to movement on Collins chart by a thin lens transformation?" is also examined experimentally and answered in the thesis. Finally the solution of the propagation of Gaussian beam through a quadratic index medium is obtained by using a quantum mechanical disentangling procedure and Gouy phase from this solution is briefly discussed.