Abstract

Ever since the beginning of quantum physics, physicists have proposed several thought experiments to explore the foundations of quantum physics. For the last few decades single photon experiments have been carried out to test the fundamentals of quan- tum physics. With our improved understanding of quantum optics, the usefulness of photons for testing the foundations of quantum physics is enhanced. Quantum entanglement in real physical systems has always been of interest and is one of the most important non-classical feature used for quantum technologies. This thesis deals with creation, detection, and characterization of quantum entangled photon pairs, which were produced using a nonlinear BBO crystal via Spontaneous Parametric Down Conversion (SPDC) process. Polarization entangled photons created by type-II SPDC process are used to perform the experiment of violation of CHSH inequality. This thesis also focuses on understanding the correlations of two-photon quantum entangled states produced via type-I SPDC. An experiment of ghost interference using position- momentum entangled photons, where the double slit is placed in the path of signal beam and interference pattern in coincidence counts is observed while scanning the idler beam is performed. In another experiment, quantum diffraction of position-momentum entangled photons from a straight sharp edge is demonstrated. Prior to studying the quantum diffraction of entangled photon pairs, an experiment of classical diffraction of mechanically chopped laser pulses is also performed. In this thesis we also present a three-dimensional imaging technique of a pattern localized in a phase space, which is delocalized in position space and in momentum space and hence the human eye cannot comprehend it.