Abstract

High harmonic generation(HHG) is a process in which a noble gas is irradiated by an intense femtosecond laser pulse at frequency ω0 and the gas atoms emit radiation of higher frequencies which are odd multiples of ω0. We can achieve upto more than 200th harmonics in this process. In the first part of this thesis we will discuss about the different aspects and the theory behind the phenomenon and focus on the 'Three step model' which is an intuitive approach towards the explanation of the mechanism of this process. In the second and the major part of this thesis we will reproduce so called 'Semiclassical calculations' which provide validation to the 'Three step model' also known as the 'Common man model'. These calculations can not only determine the cutoff on the frequencies of the harmonics which are generated but can also predict the temporal characteristics of the emitted light and its frequency modulation in time. The third and the final chapter of the thesis focuses on the designing of an experimental setup for the process. We will discuss in particular how to separate different wavelengths(of the harmonics), the use of diffraction grating for the same purpose and the issues involved. Finally after determining all the physical attributes of the different components of the setup, namely the converging mirror, the vacuum chamber, the grating and the detection unit we will demonstrate a preliminary design for the setup.