

Inelastic scattering of freely propagating electrons on light waves is currently a studied topic because of potential applications in advanced electron microscopy and diffraction. The interaction is typically described using an approximation, in which we assume that the electron's velocity nearly does not change during the interaction. In this thesis we aim to describe the dynamics of electrons in an interaction potential generated by an optical wave beyond this regime. In classical description we solve the nonlinear equation of motion and while addressing the problem using quantum mechanical description we first use parabolic approximation of the interaction potential and then we also study the evolution of a free electron wavefunction in a full periodic potential. Using numerical simulations we show the expected evolution of the electron spectra during the interaction, based on analytical solutions.