PREFACE

Since it is experimentally realization in 2004, Graphene has been growing very rapidly in recent years due to its unique electronic structure and massless Dirac-fermion behaviour. Many of the interesting physical properties like high electrical conductivity and wide range tuning of plasmon spectrum opens the door to fabricate whole new class of Graphene based nanoelectronic and optoelectronic devices. The physics of Graphene at fundamental level is therefore now becoming one of the most interesting as well as the most fast-moving topics in the field of material science. In view of that I carried theoretical investigations on transport driven by electron-impurity scattering rate and collective excitation for Graphene based systems that include monolayer as well as bilayer graphene. The experimental study show that the intrinsic parameters like quasi particle energy, temperature, impurity concentration, and energy gap highly influences transport and optical properties of graphene. The intrinsic parameters that mainly govern electron-impurity scattering rate and collective excitation in Monolayer Graphene (MLG), Bilayer Graphene (BLG) and Monolayer Gapped Graphene (MLGG) are quasi particle energy, temperature and impurity concentration, and energy gap in MLGG. Electron-impurity scattering rate including screening effect has been calculated within the framework of Boltzmann transport theory. Screening effect has been defined within standard approximation called Random Phase Approximation (RPA).

The thesis is organized in 5 chapters. Chapter 1 is an introduction to the fundamental electronic properties of Graphene systems: Monolayer, Bilayer and Gapped graphene. Chapter 1 also introduces the methods, like Random Phase Approximation (RPA) that will describe the screening and Boltzmann transport Theory used to calculate the screened electronic transport and collective excitations (Plasmons) in Graphene systems in forthcoming chapters. Review of work done in past on the electronic transport and plasmon in Graphene is also presented in chapter 1.

Chapter 2 deals with the electronic transport in Graphene based systems at zero temperature. In this chapter, electron-impurity scattering rate as a function of different parameters, like quasi-particle energy, impurity concentration and energy gap, is reported.

In chapter 3 reports electronic transport in Graphene systems at finite temperature. It is shown that conductivity computed as a function of temperature by averaging over quasi-particle energy significantly differs from that computed at Fermi energy.

Chapter 4 deals with the plasmons and electron energy loss spectrums in gapped Graphene at finite temperature. The effect of temperature, coupling constant (or different substrate) and energy gap on plasmon dispersion have been discussed in detail.

Finally, in Chapter 5 the conclusions of all the chapters are summarized, and future studies are suggested.