**Preface**

The thesis has the aim of presenting some experimental study regarding control of plasma parameters such as plasma density, plasma potential, electron temperature, sheath thickness by low energetic charged particle flux or beam in a multi-dipole discharge plasma. In addition to that, transition of an ion rich sheath to a weak ion sheath formed at a mesh grid is also demonstrated experimentally.

These kinds of study are essential since the beam-plasma system and the sheath conditions determine the processing performance. Again sheath or boundaries are a key feature of any confinement device because plasma parameters are very sensitive to plasma loss at the device boundaries, to boundary potentials and to a variety of other effects.

The experiments are carried out in a double plasma device, where plasma is produced in multi-dipole device by hot filament discharge method. A double plasma is a versatile device to study both low energy ion and electron beam related phenomena. Although, we are interested in the basic physics issues, but some of our study may help the plasma processing community in controlling certain plasma parameters to create suitable plasma environment.

Gist of different chapters of the thesis will be as follows:

Chapter 1 is the building block of the thesis, which includes brief description on plasma, dc discharge plasmas such as glow discharge and filament discharge. This chapter also provides basic information on beam-plasma system and plasma sheath. Review of some earlier works is also included.
Chapter 2 deals with the description of the double plasma device. The experimental arrangement to produce ion and electron beam in a double plasma device is also described. Besides, this chapter presents the description on diagnostics used such as Langmuir probe and Ion energy analyzer, which are used for the estimation of plasma parameters.

In Chapter 3, the effect of plasma potential in the main discharge region on the dual temperature nature of electrons in the diffusion region of a double plasma device has been discussed.

In chapter 4, we investigate the effect of charged particle extraction on background plasma parameters in a double plasma device. Charged particles (ions and electrons) from the discharge region (source) are extracted by suitably biasing the grid and the target anode.

Chapter 5 deals with the behaviour of a negatively biased grid on multi-dipole discharge plasma. The transition from an ion rich sheath to a weak ion sheath is demonstrated experimentally.

In chapter 6, we made a comparative study on ion beam modes of a double plasma device. In double plasma device, an ion beam can be generated by two methods. We have investigated the variations of target plasma parameters by injecting ion beams from the source region in both the modes.

Chapter 7 contains the overall summary of the thesis and scope for future study.