INTRODUCTION

The space between two stars is known as the interstellar space and the matter existing therein as the interstellar matter. Sturbe (1847) deduced the presence of such matter from star counts. Again, Baade's (1944) observational results indicated that there is strong correlation between young stars and the relatively dense concentrations of interstellar matter. From these and other information which gradually accumulated from subsequent investigation of interstellar matter, it becomes apparent that interstellar matter had a direct bearing on many problems of astrophysical and biological interests e.g. the evolution of stars and of the galaxy, the distribution of stellar masses, the formation of binaries, the origin of life and others. To obtain solutions of these problems the physical processes occurring in ISM should be known. These processes are different from the stellar atmospheric processes. The present investigation deals with certain aspects of phenomena related to interstellar molecules.

To begin with, one should know the present state of our knowledge of interstellar matter and collect its available information e.g. the dust-gas ratio, column density of interstellar molecules, radius, mass, temperature and other details of different

Sturve F G W, Etudes d'astronomie stellaire, Academic Imperial des sciences, St. Petersburg, 1847.
types of interstellar clouds. Again, one should know constituents, absorption, scattering, polarisation etc. of interstellar grains. These pieces of information obtained from various sources are collected in Chapter I.

The number density in the interstellar clouds are very low of the order of \((10^3 - 10^6)\) molecules/ c.c as compared to \(10^{19}\) molecules/c.c at the ground of the earth. Also, the temperature is only 80°K and the clouds are subjected to intense radiation fields of cosmic rays, ultraviolet rays of stars etc. Even then, under these unfavourable conditions for molecular formation a large number of molecules including eleven-atom molecule are formed and survive in interstellar clouds as detected by radio telescopes and other means. The chemistry of these molecules should be known viz whether they are formed by grain catalysis, and/or by various collisional processes involving atoms, molecules, ions or radicals present in ISM. These processes are investigated in Chapter II.

The abundances of interstellar molecules in the dark clouds should be known and if the calculated values agree well with the observed values, the selected formation and destruction processes of these molecules would obtain additional support. With this in view the calculation of abundances of interstellar molecules have been carried out in Chapter III.

The constituent molecules for the formation of life related molecules such as amino acids and higher complex molecules
are present in ISM. Also, energy needed for their formation are available. Hence the investigation of the synthesis of these molecules are carried out inorder to understand the origin of life in space (Chapter IV).

Once the formation of interstellar molecules is understood, the question arises what are their lifetimes. Should they be stable molecules having long life or they are destroyed by the ambient strong radiation field, immediately after formation or by reacting chemically with the constituents present in ISM. This problem has been investigated in Chapter V.

The different dynamical processes occuring in different stages of the ISM in investigated in Chapter VI.

Certain collisional processes involving interstellar molecules with atoms in the ground and excited state produced by r.f. discharge has been carried out and the resultant products are obtained. These experiments were carried out under laboratory conditions and not under conditions prevalent in the interstellar space, which is extremely difficult to realise in the present state of art. Even then, the results are expected to throw information about intermediate and final products of reacting gases present in ISM (Chapter VII - IX).

Finally, the main results obtained in the present investigations and their discssussions are presented in Chapter X.