STRUCTURE OF THE THESIS

The results of the rocket experiments are discussed in the chapters to follow.

Chapter I deals with the instrumentation concentrating on Bennett type mass spectrometer built and used in the present study. The principle of operation, constructional details, the problems encountered in the measurements, limitations of the device etc., are discussed. The various electronic circuits that go along with the system are also presented.

Chapters II, III and IV, pertain to the actual measurements made in the positive ion and neutral composition. For ease of discussion the measurements are grouped in different chapters.

Chapter II deals with the night time positive ion composition measurements. Comparisons are also made with some of the night time measurements made at the same station on a different occasion. The role of the vertically downward drift due to Pedersen currents at the equatorial electrojet is brought out for the first time, by solving the continuity equation for the ions. The night time enhancement in ionization densities at 100 km and the
generation of a valley around 120 km are shown to be the consequences of the downward drift. Comparisons with actual measurements are also made.

Chapter III, essentially a continuation of the positive ion composition measurements, deals with the daytime observations. One of the important parameter namely the electron temperature \( T_e \) is derived from the ion composition measurements. This measurement is unique in that respect that it was performed during a counter electrojet event. The role of joule heating in enhancing the electron temperature \( T_e \) over that of the neutral temperature \( T_n \), at the equator, is estimated and shown to be significant in enhancing the electron temperatures over the neutrals.

The second part of this chapter III deals with the ion composition measurements at sunrise time. Comparison with IRI (International Reference Ionosphere 1981) model values are made and the deficiencies of the IRI model pertaining to the equatorial latitudes are brought out. The contribution of the downward transport, which was shown to be the cause of nighttime enhancement in ionization in chapter II is once again shown to be the cause of the discrepancy between the model and the measurements and also for the large day to day variability.

Chapter IV deals with the relative neutral composition measurements. The day to night and day to day variabilities of the ratios \( \left[ O \right] / \left[ O_2 \right] \), \( \left[ O \right] / \left[ N_2 \right] \) and \( \left[ O_2 \right] / \left[ N_2 \right] \) are
brought out. Their relative importance while studying long term variations are discussed.

The turbopause level, its variations and its importance are discussed. An empirical relation which essentially decides the distribution of neutral species, taking into account the turbopause level and the exospheric temperature is derived and applied to the \( \frac{[O_2]}{[N_2]} \) distribution.

Chapter V deals with the latitudinal variation in ion/neutral composition as obtained from near simultaneous measurements from equatorial and midlatitude stations. The author's measurements reveal no variation in the neutral composition at these two latitudes. The turbopause level is shown to be at the same altitude in both the stations.

In chapter VI measurements of one of the important minor constituent \( [NO] \) as derived from ion composition in the E-region (100-130 km) are presented. The day to night and day to day variation in this species are discussed. The day to day variability is shown to be very large and sometimes changing by an order of magnitude. Comparisons are made with earlier published results. The possible role of downward transport of ions thus enhancing the ion constituents and reflecting in \( [NO] \) densities is brought out. As the downward drift is a highly variable phenomenon, large day to day variations are attributed to this aspect. Derivation of \( [NO] \), purely on the basis of chemistry is shown to be erroneous at latitudes close to the dip equator.
Chapter VII deals with the other important minor constituents namely metallic ions.

Ionograms were used in studying ionospheric sublayers E_1 and E_2 and their possible affiliation to metallic ions is discussed. Some of the in-situ measurements of electron density during periods of peak meteor activity are used to study the formation of sharp layers of ionization due to the accretion of metallic ions due to transport. The role of metallic ions in sporadic E formation, the generation of irregularities and their sustenance are discussed.

Chapter VIII essentially lists the important conclusions arrived at the earlier chapters and the scope for further investigations.

This is followed by Appendices specifying the important chemical reactions and their rate coefficients, both for major and minor ionic/neutral species. Also a table depicting the periods of different meteor activities is included.

The references are listed alphabetically following the Appendices.