STATEMENT

The work presented in this thesis was carried out by the author at Physical Research Laboratory, Ahmedabad, under the guidance of Professor R. Raghavarao.

An extensive experimental programme was taken up to investigate the role of neutral and plasma dynamics in the generation of nighttime irregularities in the equatorial F-region known as Equatorial Spread-F (ESF). Five rocket flight experiments were carried out from SHAR to measure neutral winds, temperatures, plasma drifts and densities using vapour cloud releases and plasma probes. The author had involved himself in these rocket flight experiments. In particular, he had participated in taking good quality photographs of the released clouds. He had taken part in analysing the data obtained from the vapour cloud release experiments and the interpretation of the same. The present study is based on the results obtained from these experiments. Further the experimental results were supported by theoretical and numerical exercises carried out by the author. Linear and nonlinear theories were developed to understand the role of dynamics in the ESF phenomenon.

The thesis consists of six chapters. The present day understanding of the processes involved in the F-region is briefly reviewed in Chapter 1. The details of the techniques of measurements made and the methods of analysis are presented in Chapter 2. The results obtained at the onset time of ESF
during geomagnetically quiet days are discussed in Chapter 3. Chapter 4 deals with the various physical mechanisms of plasma instabilities which are believed to generate the ESF irregularities. A linear theory which is developed to study the role of vertical winds of measured magnitudes is presented. It also contains the possible explanation for the observed irregularities in a localised height region. A numerical model to investigate the nonlinear processes of ESF is developed and the results obtained from this model are discussed in Chapter 5. Chapter 6 deals with the results obtained from co-ordinated measurements on a magnetically disturbed day at the onset time of ESF.

These investigations bring out the importance of neutral and plasma dynamics in the triggering of the ESF.

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