The discovery of Cosmic rays about 80 years ago, opened up a new window for astrophysics and added an additional dimension to our study of interplanetary space. Ground-based observations of Cosmic rays have formed a relatively inexpensive method of probing this interplanetary medium/space.

The real effective use of Cosmic rays for this purpose can be traced to the efforts of the late S. E. Forbush, he discovered three different kinds of time variations of primary Cosmic radiation operating over different scales of times, the solar flare increase over a period of minutes to an hour or more, the Forbush decrease lasting over a period of a fraction of a day and over days for the recovery and the long term (11 year/22 year) change in Cosmic ray intensity.

The work reported in this thesis consist mainly of long-term variation in the isotropic and anisotropic (diurnal) component of Cosmic ray intensity along with the polarity reversal of the solar polar magnetic field during the period 1963-87, which includes the solar activity cycle 20 and 21. Our results are based on the data of Deep-River (cut of rigidity $R_c = 1.02$ GV and latitude $\lambda = 46.10^\circ$N).

The author has also studied the effect of different types of streams on Cosmic ray intensity. The rigidity spectrum of the Cosmic ray decrease observed in association with flare associated streams, both before and after the polar field reversal in 1980, has been studied.
The galactic Cosmic radiation (GCR) is considered almost isotropic outside the heliosphere. The continuous outward flow of the solar wind, shocks and frozen-in magnetic field produces time variations in Cosmic ray intensity of different periodicities-22-years, 11-years, 27-days, 24-hours and 12 hours.

The aim of the modulation research at present is to identify the detailed physical mechanisms that are responsible for modulation during different periods and different solar cycles.

More than four decades have been passed since the ground based continuous observations of Cosmic ray intensity were started by Forbush and almost two decades have been passed since the initiation of satellite experiments. We are now in a position, which enables us to discuss the long term modulation of Cosmic rays in the heliosphere, such as the 11 year and 22-year variations.

The 11-year modulation of the Cosmic rays, in anticorrelation with the 11-year solar activity, is well established, although its origin is not yet fully understood. In addition to this 11-years cycle, our results presented in this thesis clearly indicate that a 22-year periodicity in this modulation is also important. Among the most important features that seem to have a 22-year periodicity (in addition to an 11-year periodicity) are the diurnal variation and the modulation effects that depend on the sign of the particle charge and the sign of solar polar magnetic field.

All the features of the diurnal variation, can not be explained on the basis of the existing models. Our results, discussed in this thesis, may provide some help and clues in developing theoretical models.
Now the Cosmic ray modulation is an experimental fact, but we do not yet understand exactly how and where this modulation occurs. To solve this riddle the long-term changes (22-years/11-years) in the isotropic and anisotropic components of the Cosmic ray intensity have been studied, both theoretically and experimentally along with the polarity reversal of the sun's magnetic field and other solar controlled parameters that effect the interplanetary medium.

For this purpose author has studied the long term variation in the isotropic and anisotropic component of the Cosmic ray intensity during different solar activity cycles and observed significant changes from one cycle to another, which might be related some way or the other to the conditions in the interplanetary space.

Since the Cosmic ray modulation is produced by solar magnetic fields which are carried out, into the interplanetary space by the solar wind and hence the nature of the long term modulation of Cosmic ray intensity is expected to depend upon the polarity of the solar poloidal magnetic fields also in addition to the sunspots and other solar activities. Our results presented here clearly indicate that the modulation characteristics are quite different from one sunspot cycle to another.

The thesis is divided into four chapters. The first chapter briefly reviews the subject, in particular, the present understanding of the modulation processes. The second chapter describes the method of analysing the Cosmic ray data
(Harmonic analysis) to determine the amplitude and phase of the diurnal component of the Cosmic ray daily variation. In the third chapter, the long-term variation in isotropic as well as in anisotropic component of the Cosmic ray intensity has been studied for the period 1963-1987 which includes the solar cycle 20 and 21, observed results are significant in terms of the three dimensional model of the heliosphere. Fourth chapter deals with the study of different types of high speed solar wind streams, i.e. coronal hole associated and solar flare associated, observed during the period 1972-84. A detailed study of their effects on Cosmic ray intensity, observed by three neutron monitors of different median rigidity of response, has been done.

Some of the important results that have emerged from the present study are listed below:

1. The Cosmic ray intensity variation shows the periodicity of 11-year as well as 22-years.

2. The variation of the phase of the diurnal anisotropy over the period 1963-87 shows the 22-years periodicity which is related to the polarity reversal of the solar polar magnetic field.

3. 22-year periodicity in the phase of the diurnal anisotropy is also observed on magnetically quiet and disturbed days.

4. Our observational results also shows that during both increasing/decreasing phases of solar cycle 20 and 21,
the diurnal anisotropy phase shifts to earlier hours for
period \( q_A \) when all days are taken into
consideration as well as on magnetically quiet and
disturbed days. Our results are in general agreement with
the curvature and gradient drift model.

5. The shape of the time profile of the Cosmic ray intensity
variation during odd solar cycles is different than the
even cycles. During odd cycles sharp peak maxima of
C.R. intensity are observed, while the maxima of Cosmic
ray intensity are broad during the even cycles.

6. The Cosmic ray intensity recovers very slowly during odd
cycles, while the recovery during even cycle is fast.

7. Systematic differences in the overall shape of successive
11-year modulation cycles and similarities in the shape
of the alternate 11-year modulation cycles are observed,
that indicate a 22-year periodicity in Cosmic ray intensity
variations, which seem to be related to the 22-year solar
magnetic cycle.

8. Our results, suggest that the accumulative effect of
Forbush decreases is not the only cause for producing the
long-term modulation of Cosmic ray intensity as suggested
earlier in several papers, but in addition to this some
other phenomena/mechanism, are operating in the
inner/outer heliosphere may be responsible for solar
modulation of Cosmic ray intensity.
9. The decrease in Cosmic ray intensity due to high speed streams from solar flares is much larger (and Forbush-type) than the streams due to coronal holes. The reason for this difference may be due to the fact that flare-associated streams are accompanied by more fluctuations in the magnitude and/or direction of the interplanetary magnetic field than coronal hole-associated streams.

10. The rigidity spectrum of Cosmic ray decreases associated with flare streams does not show dependence on the polarity of the solar polar magnetic field.

11. Our results show that the streams coming from the coronal hole (RHSSs) during the period 1965-74 produce significant decrease in Cosmic ray intensity (Forbush type).

12. Our results show that a combined effect of two important interplanetary parameters \( V \) and \( B \) is necessary to cause the reduction of Cosmic ray intensity and to reproduce the Cosmic ray intensity behaviour during RHSSs.