STUDIES OF INTERPLANETARY MEDIUM USING INTERPLANETARY SCINTILLATION

by

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DEDICATED

TO

MY PARENTS

C E R T I F I C A T E

I hereby declare that the work presented in this thesis is original and has not formed the basis for the award of any degree or diploma by any University or Institution.

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STATEMENT

The work presented in this thesis was carried out by the author during 1983-1987. This is the first thesis comprising the results obtained by using Radio telescope at Thaltej near Ahmedabad (India), operating at 103 MHz.

This thesis contains seven chapters in all.

An introduction to the thesis is given in Chapter 1. This contains, in brief, a description of Interplanetary Medium (IPM), cometary studies, etc. The other two problems regarding change in apparent position of a quasar by the large-scale irregularities and IPS observation of PSR 0531+21, discussed in the thesis, are also mentioned in this chapter.

Chapter 2 describes briefly Interplanetary Scintillation (IPS) phenomenon and its use in carrying out the studies presented in this thesis. A relevant theory of IPS is given in the same Chapter. Effects of sourcesize and receiver band-width on scintillations are also described.

Description of radio telescope used for the present investigations is given in Chapter 3. This system consists of a fullwave dipole antenna, correlation receiver, scintillometer and analog and digital data recording devices. Salient features of these devices and their calibrations are discussed in the same Chapter.

Chapter 4 presents the observations of the radio source 3C459 occulted by the ion-tail of Comet Halley. These observations were made in December 1985. Plasma density irregularities in the tail and their scale-size are calculated to be ~2/c.c. and 100 Km respectively. Plasma density is estimated to be ~200/c.c. in the ion-tail. Here, the main assumption has been that the ratio of ambient solar plasma density and its irregularity is same as that of in the case of the cometary plasma at any heliocentric distance. These observations have contributed significantly to the cometary studies. Similar other studies reported elsewhere are also discussed.

During the observations of a quasar 3C 298 an apparent sinusoidal variation on recording was noted. It was believed to be due to refraction effect caused by large-scale plasma density irregularities across the line of sight. An attempt is made to understand the origin of the same. From the present study, change in apparent position of the quasar is estimated to be ~5 arcmin. This is described in Chapter 5.

The last important problem, which is presented in Chapter 6, is about the use of IPS technique for the study of the compact source PSR 0531+21 in the Crab Nebula. Using this technique its angular size and scintillating flux are estimated to be ~0.16 arcsec and ~100 Jy respectively.

In the last Chapter studies for future, using IPS technique, are outlined as follows:

(i) Co-ordinated observations should be made regarding occultation of a radio source by an ion-tail of a comet and

(ii) A catalogue of scintillating radio sources at 103 MHz should be made. This will be useful for interplaentary weather studies,etc.

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LIST OF PUBLICATIONS

1. 103 MHz Interplanetary Scintillation Observation of PSR0531+21
(S.K. Alurkar, H.O. Vats, R.V. Bhonsle and A.K. Sharma)
Presented at Recent Advances in the Understanding of Structure and Dynamics of the Heliomagnetosphere; Joint US-Japan Seminar, Kyoto, Japan, 1984.

2. Detection of Large Scale Electron Density Irregularities During IPS Observations at 103 MHz
(S.K. Alurkar, H.O. Vats, R.V.Bhonsle and A.K. Sharma)
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3.* Exploration of Heliosphere by Interplanetary Scintillation
(R.V. Bhonsle, S.K. Alurkar, S.S. Degaonkar, H.O. Vats and A.K. Sharma)
Proceedings of the 19th ESLAB Symposium on the Sun and the Heliosphere in Three Dimensions, Les Diablerets, Switzerland, June 4-6, 1985. Edited by R.G. Marsden, p.153, 1986.

4.* The Great Solar Flare of 24 April, 1985 and Associated Interplanetary and Ionospheric Effects Observed at Ahmedabad
(R.V. Bhonsle, S.K. Alurkar, H.O. Vats, A.K. Sharma, Harish Chandra and G.D. Vyas)
Presented at the STIP Symposium on Retrospective Analysis and Future Coordinated Intervals, Les Diablerets, Switzerland, 10-12 June 1985,

5. Radio Observations of PKS 2314+03 During Occultation by Comet Halley
(S.K. Alurkar, R.V. Bhonsle and A.K. Sharma)
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6. Interplanetary Scintillation of PKS 2314+03 During Occultation by Comet Halley
(S.K. Alurkar, R.V. Bhonsle and A.K. Sharma)
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7. Occultation of Compact Radio Sources by the Ion-Tail of Halley's Comet
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Presented at the STIP Symposium on Physical Interpretation of Solar/Interplanetary and Cometary Intervals, Huntsville, Alabama, USA, 12-15 May, 1987.

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* The work presented in this paper is not included in the thesis.

8. Enhanced Scintillations Caused by Cometary Plasma Tails
(S.K. Alurkar, A.K. Sharma, P. Janardhan and R.V. Bhonsle)
(Communicated)

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