

Large Scale 3-Dimensional Structure of the Solar Wind

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“There are two ways of looking at the universe; as it really is, or as we might wish it to be.” – Carl Sagan

Summary

This thesis discusses new observations made of large scale solar wind structure during solar minimum conditions. The phenomena of interplanetary radio scintillation (IPS) is exploited and used in conjunction with white light observations from the Heliospheric Imager instruments on the STEREO spacecraft. Methodologies for combining the two techniques are developed and then used in two case studies. The first case study is an observation and analysis of complex solar wind features in the presence of a co-rotating interaction region. The second is an observation and analysis of coronal mass ejections and their associated effects. In both studies, observations were supported by in situ data from the Venus Express spacecraft. Both cases represent the first time that such phenomena have been observed at interplanetary distances using these techniques.

Extremely long baseline IPS observations were also made in order to address the hypothesis that the fast solar wind flow is radial. Observations made over several years, at different times in the solar cycle and over both hemispheres demonstrate that, down to the level of sensitivity for this technique, the hypothesis still stands. Off radial flow characteristics were observed using this technique during the passage of non-ambient solar wind features across the raypath. These results demonstrate that this technique can detect off radial flow when it is present and hence reveal aspects of the behaviour of the interplanetary magnetic field under different solar wind conditions.

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Contents

Chapter 1: Introduction to Sun and Solar Wind	2
1.1 The Sun: General Characteristics	2
1.2 Internal Structure	4
1.2.1 The Core	4
1.2.2 The Radiative Zone	6
1.2.3 The Convection Zone	7
1.2.4 The Photosphere	8
1.3 The Solar Magnetic Field	12
1.3.1 The Solar Magnetic Cycle	13
1.4 Structure of the Sun above $1R_{\text{S}}$, the Solar Atmosphere	15
1.4.1 Nomenclature	15
1.4.2 The Chromosphere	15
1.4.3 The Transition Region	17
1.4.4 The Corona	18
1.4.5 Features of the Solar Corona	21
1.5 The Solar Wind	24
1.5.1 Physical Description	24
1.5.2 Sources	26
1.5.3 History of Solar Wind Research	28
1.5.4 The Parker Model	30
1.5.5 Co-rotating Interaction Regions	36
1.5.6 Coronal Mass Ejections	38

Chapter 2: Observational Techniques	42
2.1 In situ	42
2.2 Remote Sensing	43
2.2.1 X-ray	43
2.2.2 Ultraviolet	44
2.3 White Light	45
2.3.1 Wide Angle Imaging	50
2.4 Radio	51
2.4.1 Radio Emission from the Solar Wind	51
2.4.2 Interplanetary Scintillation	53
2.4.3 Measurements of Scintillation Level	56
2.4.4 IPS observations	61
2.4.5 Dual frequency observation	65
Chapter 3: Data Sources and Instrumentation	68
3.1 Chapter Summary	68
3.2 Interplanetary Scintillation Instruments: EISCAT	68
3.2.1 Relevance to IPS	69
3.2.2 Data Collection	70
3.3 Interplanetary Scintillation Instruments: MERLIN	72
3.3.1 Relevance to IPS	73
3.3.2 Data Collection	74
3.3.3 Extremely Long Baseline Observations	74

3.4	Nagoya STELab array	75
3.5	IPS data analysis	76
	3.5.1 Weak Scattering Model – sfit	78
	3.5.2 Running sfit	80
3.6	White Light Observation Instruments	83
	3.6.1 White Light Observation Instruments: LASCO	83
	3.6.2 Construction of White Light Carrington Maps	84
	3.6.3 White Light Observation Instruments: HI	85
	3.6.4 White Light Observation Instruments: COR1 & COR2	93
3.7	EIT & EUVI	93
3.8	In situ missions and experiments	94
Chapter 4: Multi data source geometry for observations of solar wind		98
Features		
4.1	Chapter Summary	98
	4.1.1 Definition of terms	98
4.2	Identifying CME launch point and propagation direction	99
4.3	Identifying the propagation and position of co-rotating interaction regions	103
4.4	Comparative geometry	105
	4.4.1 IPS and HI	105
	4.4.2 Geometry of P'	115
	4.4.3 Finding P' in the HI field of view	118

4.5	Evaluation of the position of P' in 3D vector space	121
4.6	Iso-scattering surfaces and the Thomson sphere	123
Chapter 5: Simultaneous Interplanetary Scintillation, Heliospheric Imager and Venus Express observations of a co-rotating interaction region		132
5.1	Chapter Summary	132
5.2	Co-rotating Interaction Regions	133
5.3	IPS observations	135
5.4	EIT observations 21 – 24 April 2007	144
5.5	Fitting the 25 th . April 2007 IPS results	146
5.6	Heliospheric Imager observations and geometry	148
5.7	Venus Express data	156
5.8	Discussion	158
5.8.1	IPS and HI observations of small scale transients and the CIR	158
5.8.2	Comet Encke	159
5.8.3	Venus Express	160
Chapter 6: Simultaneous Interplanetary Scintillation, Heliospheric Imager and Venus Express observations of a coronal mass ejection		162
6.1	Chapter Summary	162
6.2	Previous IPS observations of Coronal Mass Ejections	162

6.3	Comparison between the two techniques	164
6.4	Observations and geometry	165
6.5	HI-1A observations	167
6.6	IPS observations of the background solar wind on 15 May 2007	168
6.7	IPS observations of a CME on 16 May 2007	170
6.8	In situ observations at Venus	173
6.9	Discussion	176
Chapter 7: Examining off radial flow characteristics of the fast solar wind		180
7.1	Chapter Summary	180
7.2	Introduction	180
7.3	Observations	182
7.3.1	J0319+415 May 2002	183
7.3.2	J0319+415 May 2004	184
7.3.3	J0319+415 May 2005	185
7.3.4	J0521+166 June 2006	189
7.4	Discussion	191
7.5	Observation data tables	192
Chapter 8: Concluding discussion and future work		197
8.1	Chapter Summary	197
8.2	Simultaneous IPS and STEREO Heliospheric Imager observations of a CIR	197

8.3 Simultaneous IPS and STEREO Heliospheric Imager observations of a CME	198
8.4 Off radial flow characteristics of the fast solar wind	199
8.5 Unusual solar minimum?	200
8.6 Summary	202
Appendix i	203
Appendix ii	206
References	210