Large Scale 3-Dimensional Structure of the Solar Wind

G. D. Dorrian MSc. BSc.

Solar System Physics Group

Institute of Mathematics and Physics

Aberystwyth University

SY23 3BZ

Supervisors:

Dr. A. R. Breen

Dr. R. Winter

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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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