



## 12800 - Velocity measurement of the interplanetary hydrogen

Cycle: 19, Proposal Category: GO/DD

(Availability Mode: AVAILABLE)

### INVESTIGATORS

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### VISITS

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(1) IPH	STIS/FUV-MAMA	1	27-Mar-2012 21:05:55.0	yes

1 Total Orbits Used

### ABSTRACT

We are proposing to use HST/STIS over a single orbit to make Lyman-alpha observations of the interplanetary hydrogen during the March-April period of this year (2012). This special request is driven by a recent reanalysis of HST data (Vincent et al. 2011, published after the last call for proposals).

The heliospheric interface results from the interaction of the solar wind and the interstellar medium (ISM). Within the heliosphere, the interplanetary hydrogen (IPH) flows at an average speed of about 23 km/sec, carrying the signature of the ISM and the heliospheric interface. The IPH has been observed for decades through the backscattering of solar Lyman-alpha photons and solar cycle 23 provided the first partial temporal map of the IPH velocity. It is now well established that the IPH velocity depends on solar activity. Moreover some analyses suggested that it may be also affected by

the obliquity of the interstellar magnetic field, yielding a change of 1-2 km/sec.

However a combination of the uncertainty of some measurements (e.g. GHRS) and the clustering of others near points on the cycle make it difficult to identify an unambiguous trend. Only one limited set is able to show a cycle dependence, but these represent an annual average and do not match the existing models. The best approach to address these issues is a new set of yearly spectroscopic measurements for at least a half solar cycle. Since we are currently just leaving a solar maximum, it is essential to start immediately in order to have an adequate baseline for temporal measurements.

### **OBSERVING DESCRIPTION**

We propose to obtain 1 high-resolution profile of the background emission at Ly-alpha, in the upwind direction ( $\lambda = 252.71^\circ$ ,  $\beta = -15.43^\circ$  in celestial coordinates), with the echelle E140H grating associated with the long slit 52" x 0.5" and the FUV MAMA detectors. These observations will be the first in a multi-cycle series to explore IPH properties, going from solar maximum toward the next minimum, tracking both long and short-term variations with a single-instrument as a baseline.

This is an unsupported mode that blends spectral features from different orders of the echelle grating but greatly increases the signal-to-noise ratio in the resulting spectrum. We have already made a detailed analysis of STIS observations made in 2001 with similar conditions, so we have a pipeline to process the data : it performs dark subtraction and flat field correction, then corrects a geometric distortion which affects the vertical alignment of spectral features by using the procedure developed by Malamuth (1997, 1998) and Welsh et al. (2001). Moreover we have identified contaminations by geocoronal oxygen and their locations in the orders of interest.

Malamuth, E., 1997, HST Proposal ID # 7788

Malamuth, E., et al. 1998, AAS, 193, 0815

Walsh, J.R., Goudfrooij, P., Malamuth, E. 2001, Instrument Science Report STIS 2001-02

### **REAL TIME JUSTIFICATION**

We desire to obtain the maximum Doppler shift between the interplanetary and geocoronal emissions in order to maximize the separation between the IPH emission and the geocoronal background Ly-alpha contribution. This requires that the Earth moves toward the upwind direction, so the observation should occur in a window of 2 months centred around 1st April 2012.

Proposal 12800 (STScI Edit Number: 1, Created: Tuesday, March 27, 2012 8:06:02 PM EST) - Overview

We are also planning to make coordinated observations with SOHO/SWAN for cross-calibration with the intensity maps provided by SWAN. Because of antenna problems which significantly degrades the quality of SWAN data, the period of April 4-15 should be avoided if possible.

**ADDITIONAL COMMENTS**

We need the time-tag mode in order to monitor the time-evolution of the signal, particularly the signal from the geocorona.

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Wed Mar 28 01:06:02 GMT 2012

**Proposal 12800, IPH\_2012 (01), implementation**  
**Diagnostic Status: Warning**  
 Scientific Instruments: STIS/FUV-MAMA  
 Special Requirements: BETWEEN 15-MAR-2012:00:00:00 AND 30-APR-2012:00:00:00  
 Comments: Please schedule as close as possible to 1st April 2012.  
 We desire to obtain the maximum Doppler shift between the interplanetary and geocoronal emissions in order to maximize the separation between the IPH emission and the geocoronal background Ly-alpha contribution. This requires that the Earth moves toward the upwind direction, so the observation should occur in a window of 2 months centred around 1st April 2012.  
 We are also planning to make coordinated observations with SOHO/SWAN for cross-calibration with the intensity maps provided by SWAN. Because of antenna problems which significantly degrades the quality of SWAN data, the period of April 4-15 should be avoided if possible. This has not been set as a timing requirement because we do not want to lose the opportunity of an observation during the first half of April.

(IPH\_2012 (01)) Warning (Form): A target acquisition should probably be performed before doing spectroscopy or coronagraphy with STIS or COS.  
 (IPH\_2012\_exp1 (01.001)) Warning (Form): Sensitive exposures should have an ETC run number provided.

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	IPH	RA: 16 50 46.4222 (252.6934258d) Dec: -15 25 24.93 (-15.42359d) Equinox: J2000		V=18 SURF-LINE(1216)=2./-1.e-12, W-LINE(1216)=0.15+/-0.1	Reference Frame: ICRS

Comments: Upwind direction of the interplanetary hydrogen. To be observed with no stars brighter than V-Magnitude=18 in the aperture.  
 The coordinates have been slightly modified since the phase 1, to make sure that there will be no star in the field of view, whatever is the orientation of the slit.

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	IPH_2012_e xp1	(1) IPH	STIS/FUV-MAMA, TIME-TAG, 52X0.5	E140H 1234 A	BUFFER-TIME=40 00			2529.0 Secs [==>]	[1]

Comments: ETC can not be run because we are using an unsupported mode: E140H grating with the 52" x 0.5" slit.  
 With a signal-to-noise of about 10, the background noise is a significant issue for the data analysis. This is why it is necessary to start the MAMA detectors just before the exposure, in order to reduce the background noise.

