



13736 - Contemporaneous Mid-UV Spectral Coverage of Pluto and Charon Coincident With the New Horizons Encounter

Cycle: 22, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

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) PLUTO-ACQ (2) PLUTO-CHAR	STIS/CCD STIS/NUV-MAMA	2	12-Mar-2015 21:03:57.0	yes

2 Total Orbits Used

ABSTRACT

The New Horizons spacecraft will perform the first-ever, and the only planned flyby of the Pluto System, in July 2015. It will observe Pluto and its moons from Far-Ultraviolet (FUV) to radio wavelengths. However, between 1870 and 4200 Angstroms there is no spectral coverage aboard New Horizons. The Mid-Ultraviolet (MUV, 2000 - 3000 Angstroms), which cannot be observed from the ground, contains numerous useful indicators of surface and atmospheric composition that can provide additional constraints about Pluto. Since Pluto's MUV spectrum is known to change over time, it is scientifically important to capture such data at the unique New Horizons encounter epoch. We propose here a focused, 2-orbit STIS G230L

observation of Pluto at the same sub-Earth longitude where New Horizons will obtain its best FUV spectra during its closest approach to Pluto. We note that these HST observations need not occur on the same day as the New Horizons encounter, only during the same observing season. In two orbits, STIS yields higher-SNR spectra of Pluto than have ever been obtained to date in the MUV. This will bridge the gap in New Horizons' spectral coverage, placing the FUV spectra in context with longer wavelength data and contributing new information to augment the New Horizons results with those from HST. Our main science objective is MUV spectroscopy of Pluto, however if scheduling allows for the correct roll angle to also capture Charon in the STIS 52"x2" slit, MUV surface reflectance spectra of Charon would also complement New Horizons FUV data.

OBSERVING DESCRIPTION

We propose a 2-orbit STIS program to obtain the UV spectrum of Pluto and Charon from 1850-3200 Å at the same Pluto central meridian longitude (164 deg) that NH will be observing Pluto with the Alice instrument near closest approach. Although Pluto and Charon are fairly bright in the visible ($V=14.2$ with Charon $V=16$ mean rotational brightness during the NH encounter), they are relatively faint in the MUV. Our best estimate for the flux of Pluto and Charon is derived using the HST CALSPEC solar spectrum, scaled by Pluto and Charon's heliocentric distance, geocentric distance, and phase angle during the 2015 opposition and the albedo spectra from Stern et al. (2012). For background levels we assumed high zodiacal and Earthshine light normalizations. We will operate the STIS NUV MAMA in TIME-TAG mode with buffer times 988 and 822s for the two orbits, respectively. The global count rate estimate from the ETC for Pluto of 1947 counts/s is well below the bright object limits.

Avoiding the solar exclusion zone from mid-November 2014 to Feb 24, 2015, we limit the observations from Feb 24, 2015 through the end of Cycle 22. We target Pluto's CML to be a window extending ± 10 deg from 164E deg. This is changed from the 180 deg in Phase I to observe Pluto and Charon to coordinate with NH FUV observations near closest approach. This constrains the position angle of Charon relative to Pluto to be 251 deg and constrains the projected separation of Charon from Pluto on the plane of the sky to be 0."67 or 27 MAMA pixels. We use the 52x2 aperture instead of the 52x0.2 aperture to better capture the spectra of Pluto and Charon simultaneously, as suggested by the TAC, and to allow telescope roll angle consistent with the roll angle limitations. The spectroscopic ETC shows higher S/N with this aperture for both objects.

The position angle of Charon corresponds to ORIENT=296 deg. We use a range for ORIENT that allows a deviation between the position angles of the STIS slit and the Charon-Pluto line up to 45 deg. The Visit Planner identifies 5 usable scheduling opportunities preceding Pluto opposition with this ORIENT range. A partial window on Jun 5, 2015 is not usable because it is only 1:08 wide. The observing window of 20 deg longitude is wide enough to accommodate 4.8 HST orbits. So we schedule our observations as a pair of back-to-back orbits in the same visit. Guide Star reacquisition is used for the second orbit to provide a longer Pluto exposure, with the auto-wavecal being done in occultation instead of before the science exposure,

Proposal 13736 (STScI Edit Number: 3, Created: Thursday, March 12, 2015 8:03:58 PM EST) - Overview

as in the first orbit due to target acquisition. The ACQ is done on Pluto with ACQTYPE=POINT with $S/N > 400$. Any bias towards Charon due to the flux centroid would be beneficial in better centering the pair in the aperture. The separation of the spectra of Pluto and Charon would vary between 0."47 and 0."67 or 19 to 27 pixels, depending on roll angle. This is satisfactory for extracting separate 1-D spectra of each object.

Accounting for the time to configure the instrument and target acquisition, there are 82 minutes in two orbits available for integration. With a binning of 10 A, the two orbits will yield a S/N ratio of 12.5 on Pluto over most of the MUV bandpass, with a peak S/N of 38 (ID# STIS.sp.622376).

Proposal 13736 - First visit (01) - Contemporaneous Mid-UV Spectral Coverage of Pluto and Charon Coincident With the New Horizon...

Fri Mar 13 01:03:58 GMT 2015

Visit	<p>Proposal 13736, First visit (01), implementation</p> <p>Diagnostic Status: No Diagnostics</p> <p>Scientific Instruments: STIS/CCD, STIS/NUV-MAMA</p> <p>Special Requirements: ORIENT 251D TO 336 D; BETWEEN 20-MAR-2015:20:43:00 AND 21-MAR-2015:04:47:00; BETWEEN 27-MAR-2015:06:23:00 AND 27-MAR-2015:14:02:00; BETWEEN 02-APR-2015:15:38:00 AND 03-APR-2015:00:03:00; BETWEEN 09-APR-2015:00:54:00 AND 09-APR-2015:08:34:00; BETWEEN 15-APR-2015:10:10:00 AND 15-APR-2015:17:50:00; BETWEEN 21-APR-2015:19:28:00 AND 22-APR-2015:03:08:00; BETWEEN 28-APR-2015:04:44:00 AND 28-APR-2015:12:24:00; BETWEEN 04-MAY-2015:14:02:00 AND 04-MAY-2015:21:42:00; BETWEEN 10-MAY-2015:23:20:00 AND 11-MAY-2015:07:00:00; BETWEEN 17-MAY-2015:08:35:00 AND 17-MAY-2015:16:18:00; BETWEEN 23-MAY-2015:17:57:00 AND 24-MAY-2015:01:38:00; BETWEEN 30-MAY-2015:03:18:00 AND 30-MAY-2015:10:57:00; BETWEEN 05-JUN-2015:12:12:00 AND 05-JUN-2015:20:17:00; BETWEEN 11-JUN-2015:21:57:00 AND 12-JUN-2015:05:38:00; BETWEEN 18-JUN-2015:07:18:00 AND 18-JUN-2015:14:58:00; BETWEEN 24-JUN-2015:16:39:00 AND 25-JUN-2015:00:19:00; BETWEEN 01-JUL-2015:01:09:00 AND 01-JUL-2015:10:31:00; BETWEEN 07-JUL-2015:11:21:00 AND 07-JUL-2015:19:01:00; BETWEEN 13-JUL-2015:20:42:00 AND 14-JUL-2015:04:22:00; BETWEEN 20-JUL-2015:06:02:00 AND 20-JUL-2015:13:43:00; BETWEEN 26-JUL-2015:15:25:00 AND 26-JUL-2015:23:05:00</p> <p><i>Comments: NUV spectrum of Pluto+Charon in two orbits</i></p> <p><i>Reversing Charon and Pluto in the slit would also be okay (i.e., adding or subtracting 180 deg from ORIENT).</i></p> <p><i>The desired ORIENT range of 251 deg to 336 deg is accessible with the requested East longitudes but is unscheduable in the APT with them because the APT is currently misinterpreting CML as West longitudes. The above BETWEEN requirements work around this problem by selecting the desired 156-174 E longitude range from the JPL HORIZONS ephemeris at available dates through the end of July 2015. If needed for schedulability, this list may be extended through Sep 30, 2015.</i></p>
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Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	PLUTO-ACQ	STD=PLUTO					EARTH
<p><i>Comments: Charon (V=16) will be at a distance of 0."67 from Pluto during the acquisition and exposures.</i></p> <p><i>Both Pluto and Charon will be acquired into the 52x2 aperture using Pluto for the ACQTYPE=POINT object. This geometry accomodates a wide range in roll angles without spectra overlapping.</i></p> <p><i>NOTE: The CML is in East longitude for the new IAU definition of North in the Pluto system (i.e. right hand rule North).</i></p>							
(2)	PLUTO-CHAR	STD=PLUTO					EARTH
<p><i>Comments: NUV Spectrum of Pluto and Charon for Pluto CML between 154 E and 174 E deg near New Horizons closest approach longitude.</i></p> <p><i>NOTE: The CML is in East longitude for the new IAU definition of North in the Pluto system (i.e. right hand rule North).</i></p> <p><i>Need to complete both orbits in same visit.</i></p>							

Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	PLUTO-ACQ (STIS.ta.623579)	(1) PLUTO-ACQ	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT	GS ACQ SCENARI O BASE1B3			2 Secs (2 Secs) [==>]	[1]
<i>Comments: Acquisition of Pluto</i>										
2	Pluto+Charon (sp.624229)	(2) PLUTO-CHAR	STIS/NUV-MAMA, TIME-TAG, 52X2	G230L 2376 A	BUFFER-TIME=98 8	GS ACQ SCENARI O BASE1B3			1966 Secs (1966 Secs) [==>]	[1]
<i>Comments: First orbit spectrum of Pluto and Charon</i>										
3	Pluto+Charon (sp.624231)	(2) PLUTO-CHAR	STIS/NUV-MAMA, TIME-TAG, 52X2	G230L 2376 A	BUFFER-TIME=82 2				2963 Secs (2963 Secs) [==>]	[2]
<i>Comments: Second orbit spectrum of Pluto and Charon</i>										

