



18443 - Unraveling the Mysteries of ASASSN-15lh: How do the Brightest Tidal Disruption Events Evolve?

Cycle: 34, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
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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) ASASSN-15LH	WFC3/UVIS	2	18-Aug-2026 15:01:20.0	yes
02	(1) ASASSN-15LH	ACS/SBC	2	18-Aug-2026 15:01:20.0	yes

4 Total Orbits Used

ABSTRACT

When it was first discovered more than a decade ago, the enigmatic nuclear transient ASASSN-15lh was interpreted as either the most luminous supernova ever seen or the most luminous tidal disruption event (TDE) ever seen. The ensuing decade of observations has favored, though not definitively proven, the TDE interpretation, in which the transient was produced by an unlucky star torn to shreds by a supermassive black hole. Leveraging the long baseline afforded by a 2019 HST UV epoch, we propose multi-band HST UV photometry to unambiguously settle the question of ASASSN-15lh's origins by searching for late-time evolution in a faint, slowly spreading accretion disk. If the TDE interpretation is confirmed, we will fit time-dependent general-relativistic disk models to the HST light curve in order to test key modeling assumptions and probe decades-old

questions in accretion theory related to the stress at the inner boundary of accretion disks. ASASSN-15lh's unique combination of high black hole mass, extreme peak luminosity, and long temporal baseline with multi-wavelength coverage gives it exquisite potential to test and calibrate existing models for late-time disk emission in TDEs. This is an urgently needed stress test for TDE parameter inference prior to the arrival of thousands of TDEs from the Vera Rubin Observatory and ULTRASAT samples, the immense volumes of which make us increasingly sensitive to rare and extreme transients like ASASSN-15lh.

OBSERVING DESCRIPTION

This program is designed to obtain late-time imaging in 3 UV filters for the enigmatic TDE candidate ASASSN-15lh. These UV data will (1) search for temporal evolution from earlier WFC3/UVIS UV imaging in 2019 from HST Program 15499 to differentiate between SLSN and TDE origins for the transient and (2) if evolution is detected, supporting the TDE interpretation, measure the properties of a late-time accretion disk. We will obtain NUV imaging with WFC3/UVIS F225W and F336W and FUV imaging with ACS/SBC F125LP. The choice of WFC3/UVIS filters is designed to leverage previous exposures in HST Program 15499. The ACS/SBC F125LP imaging will provide an important higher energy constraint on the SED to aid in differentiating between a star formation and accretion disk origin.

Constraining temporal evolution and disentangling transient and host-galaxy emission at faint UV fluxes requires high-precision photometry. Our baseline exposure time estimates

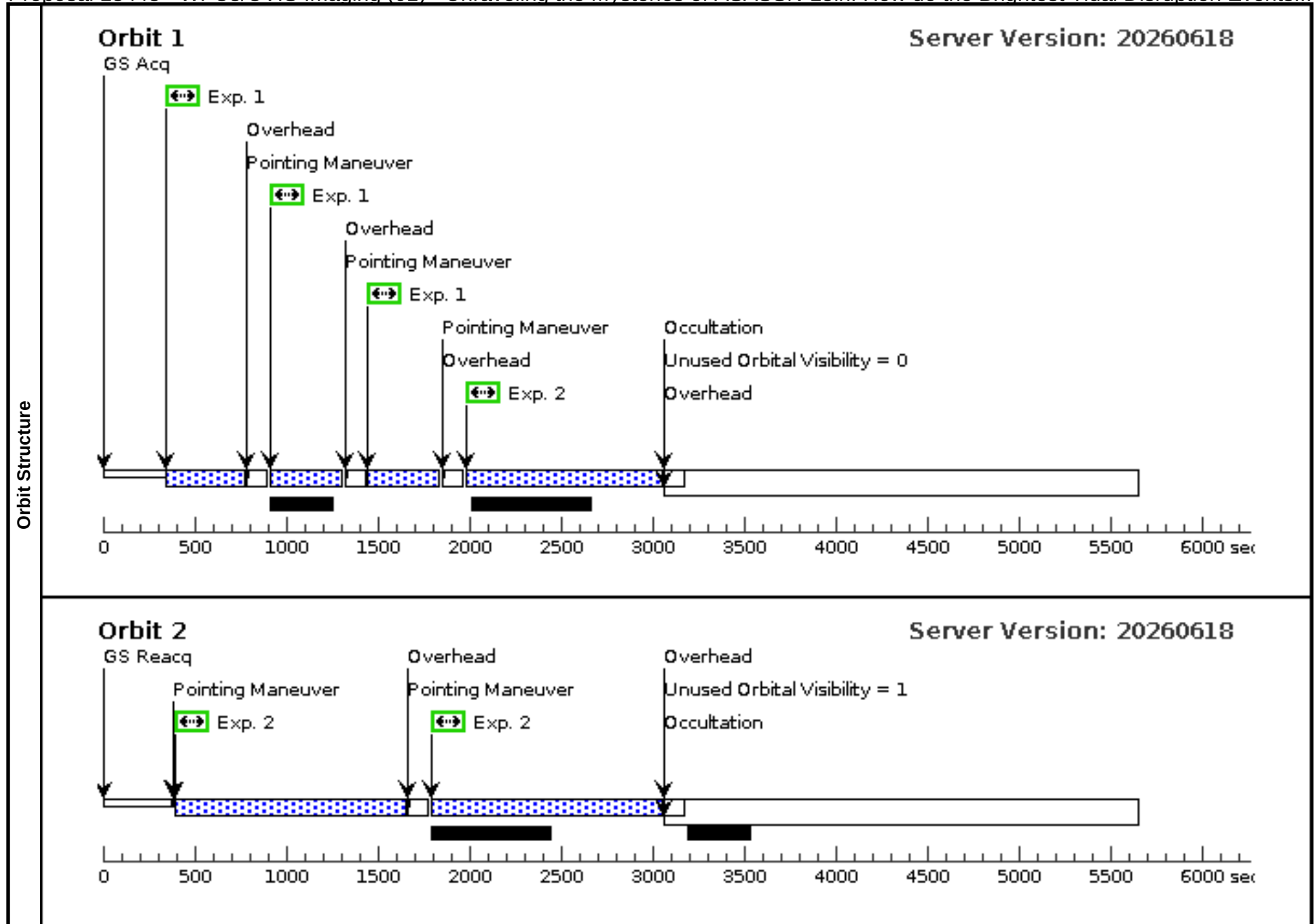
assume no evolution from the measured total fluxes of $m_{F225W} = 22.816 \pm 0.014$ mag and $m_{F336W} = 22.056 \pm 0.012$ in 2019 (calculated using a standard 10 pixel radius aperture).

To constrain UV temporal evolution at the $<2\%$ level, we need a precision matching that of the 2019 epochs. The expected F225W and F336W backgrounds are low, so we have added 20 electrons of post-flash exposure to mitigate CTE issues. We estimate the exposure time for the F125LP imaging based on a S/N of 50 for the host-galaxy only flux.

The WFC3/UVIS and ACS/SBC visits can be scheduled separately, provided that they are taken within 1 month, probing the disk on timescales much shorter than the dynamical time at 9-10 years post disruption.

Proposal 18443 - WFC3/UVIS Imaging (01) - Unraveling the Mysteries of ASASSN-15lh: How do the Brightest Tidal Disruption Events...

Visit	Proposal 18443, WFC3/UVIS Imaging (01)										Tue Aug 18 19:01:21 GMT 2026	
	Diagnostic Status: No Diagnostics											
	Scientific Instruments: WFC3/UVIS											
	Special Requirements: GROUP 01,02 WITHIN 30D											
	Comments: WFC3/UVIS F225W and F336W imaging of ASASSN-15lh.											
Patterns	#	Primary Pattern					Secondary Pattern				Exposures	
	(1)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=			Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false						(1), (2)	
Fixed Targets	#	Name		Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(1)	ASASSN-15LH		RA: 22 02 15.4510 (330.5643792d) Dec: -61 39 34.60 (-61.65961d) Equinox: J2000		Epoch of Position: 2000 Redshift: 0.2326		V=18.60+/-0.05 The V-band magnitude includes the entire host galaxy flux and is estimated from pre-flare ASAS-SN V-band photometry.		Reference Frame: ICRS		
	Comments: Category=GALAXY Description=[ACCRETION DISK, ELLIPTICAL]											
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture		Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1	(WFC3UVIS.im.232562)	(1) ASASSN-15LH	WFC3/UVIS, ACCUM, UVIS2		F336W	FLASH=20		Pattern 1, Exps 1-1 in WFC3/UVIS Imaging (01) (1)	396 Secs (1191 Secs)		
										[==>397.0 Secs (Pattern 1)] [==>397.0 Secs (Pattern 2)] [==>397.0 Secs (Pattern 3)]		[1]
	2	(WFC3UVIS.im.232561)	(1) ASASSN-15LH	WFC3/UVIS, ACCUM, UVIS2		F225W	FLASH=20		Pattern 1, Exps 2-2 in WFC3/UVIS Imaging (01) (1)	1067 Secs (3564 Secs)		
										[==>1048.0 Secs (Pattern 1)] [==>1258.0 Secs (Pattern 2)] [==>1258.0 Secs (Pattern 3)]		[1] [2]



Proposal 18443 - ACS/SBC Imaging (02) - Unraveling the Mysteries of ASASSN-15lh: How do the Brightest Tidal Disruption Events E...

Visit	Proposal 18443, ACS/SBC Imaging (02)										Tue Aug 18 19:01:21 GMT 2026	
	Diagnostic Status: No Diagnostics											
	Scientific Instruments: ACS/SBC											
	Special Requirements: GROUP 02,01 WITHIN 30D											
	Comments: ACS/SBC F125LP Imaging of ASASSN-15lh											
Patterns	#	Primary Pattern				Secondary Pattern				Exposures		
	(2)	Pattern Type=ACS-SBC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.179 Line Spacing=0.116		Coordinate Frame=POS-TARG Pattern Orientation=20.02 Angle Between Sides=63.65 Center Pattern=false						(1)		
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous			
	(1)	ASASSN-15LH	RA: 22 02 15.4510 (330.5643792d) Dec: -61 39 34.60 (-61.65961d) Equinox: J2000		Epoch of Position: 2000 Redshift: 0.2326		V=18.60+/-0.05 The V-band magnitude includes the entire host galaxy flux and is estimated from pre-flare ASAS-SN V-band photometry.		Reference Frame: ICRS			
	Comments:											
	Category=GALAXY											
Description=[ACCRETION DISK, ELLIPTICAL]												
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture		Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1	(ACS.im.23 25753)	(1) ASASSN-15LH	ACS/SBC, ACCUM, SBC		F125LP			Pattern 2, Exps 1-1 in ACS/SBC Imaging (02) (2)	1508 Secs (5106 Secs)		
										[==>1271.0 Secs (Pattern 1)]		[1]
										[==>1271.0 Secs (Pattern 2)]		
										[==>1282.0 Secs (Pattern 3)]		[2]
									[==>1282.0 Secs (Pattern 4)]			

