



# 18261 - Confirming the First rpTDE in a Broad-Line AGN with the Rising Third Flare of AT 2021aeuk

Cycle: 33, Proposal Category: GO/DD

(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>
02	(1) AT2021AEUK	STIS/CCD STIS/NUV-MAMA	1	10-Jun-2026 15:00:53.0	yes
01	(1) AT2021AEUK	STIS/CCD STIS/FUV-MAMA	2	10-Jun-2026 15:00:54.0	yes
03	(1) AT2021AEUK	STIS/CCD	1	10-Jun-2026 15:00:54.0	yes

4 Total Orbits Used

## **ABSTRACT**

AT 2021aeuk is the first candidate repeating partial tidal disruption event (rpTDE) in a Narrow-Line Seyfert 1 AGN, with a recurrence time of  $\sim 3.5$  years between flares. Its third flare erupted in May 2026 as predicted and is still rising. Coordinated multi-wavelength observations of the previous second flare revealed an unusual anti-correlation between the X-ray and UV/optical evolution, unlike either a typical TDE or an AGN outburst, but supporting the interaction between the returning TDE stream and the pre-existing AGN accretion disk. We propose 4 orbits of HST/STIS UV/optical spectroscopy during this ongoing third flare to confirm the rpTDE nature of the recurrent eruptions through three diagnostics: (1) the UV-to-optical SED shape, (2) the UV emission-line ratios and their nitrogen enhancement, and (3) the kinematics of any high-velocity UV outflows. Successful confirmation would establish the first rpTDE in a pre-existing broad-line AGN, representing a population that has been largely overlooked in both TDE and AGN studies.

## **OBSERVING DESCRIPTION**

We propose four orbits of STIS UV/optical spectroscopic observations targeting the third flare of AT 2021aeuk. The observations will use the G140L (two orbits), G230L (one orbit), and G430L (one orbit) gratings, providing continuous wavelength coverage from 932 Å to 4620 Å in the rest frame. A slit width of 0.2" is adopted to minimize host galaxy contamination.

The third flare is currently rising in the latest ATLAS data, having reached 17.1 mag in the o band and approaching the peak brightness of the first flare. Given that the nearest HST visibility window falls on July 19, we predict the o-band magnitude will decrease to 17.2 at the time of observation. To estimate the UV brightness, we decompose the UV-to-optical SED into two components: a pre-existing AGN continuum and a blackbody TDE component with a temperature of 10,000 K, consistent with the second flare. This total SED yields an estimated FUV magnitude of 20.0, which we adopt as the basis for our ETC calculations. The resulting continuum S/N ratios are approximately 6, 15, and 50 for G140L, G230L, and G430L, respectively. The UV emission lines, which are generally prominent in both AGN and TDEs, are expected to be detected at a higher S/N ratio. The HST combined spectrum, in comparison with the pre-outburst SED, will enable us to distinguish between a blackbody and power-law transient SED. It will also detect and resolve key diagnostic emission lines of both TDE and AGN activity, such as C IV, N III], C III], and Mg II.

Proposal 18261 - NUV (02) - Confirming the First rpTDE in a Broad-Line AGN with the Rising Third Flare of AT 2021aeuk

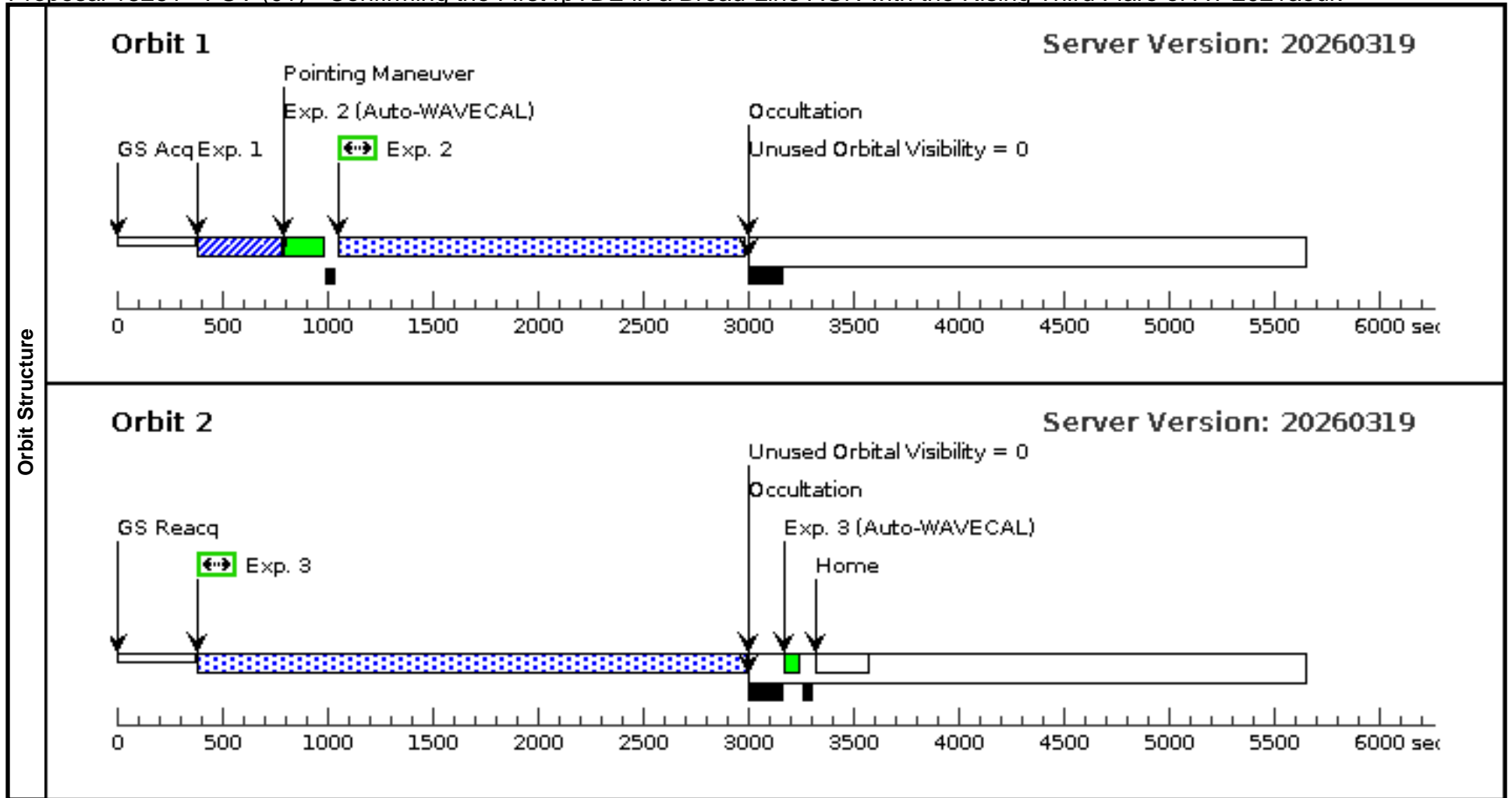
Wed Jun 10 19:00:55 GMT 2026

<b>Visit</b>	Proposal 18261, NUV (02) Diagnostic Status: No Diagnostics Scientific Instruments: STIS/NUV-MAMA, STIS/CCD Special Requirements: BEFORE 01-AUG-2026:00:00:00										
	<b>Fixed Targets</b>	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
(1)		AT2021AEUK	RA: 16 12 59.8424 (243.2493433d) Dec: +42 19 40.25 (42.32785d) Equinox: J2000	Redshift: 0.023	V=17.2+/-0.2	Reference Frame: ICRS					
Comments: Category=GALAXY Description=[ACCRETION DISK, SEYFERT]											
<b>Exposures</b>	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
	1	acquisition	(1) AT2021AEUK	STIS/CCD, ACQ, 50CCD	MIRROR				40 Secs (40 Secs)		
									[=>]	[1]	
2	science (2353837)	(1) AT2021AEUK	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=13 37				1917 Secs (1917 Secs)		
									[=>]	[1]	
<b>Orbit Structure</b>	Server Version: 20260319										
	<p>The diagram shows the timeline for Orbit 1. It starts at 0 seconds with GS Acq. Exp. 1 runs from 50 to 100 seconds. A Pointing Maneuver occurs at 100 seconds. Exp. 2 (Auto-WAVECAL) runs from 110 to 120 seconds. Exp. 2 then continues from 120 to 3000 seconds. An Occultation occurs from 3000 to 3100 seconds. The Home position is reached at 3100 seconds. The period from 3500 to 5500 seconds is marked as Unused Orbital Visibility = 0.</p>										

Proposal 18261 - FUV (01) - Confirming the First rpTDE in a Broad-Line AGN with the Rising Third Flare of AT 2021æuk

Wed Jun 10 19:00:55 GMT 2026

Visit	<b>Proposal 18261, FUV (01)</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: STIS/CCD, STIS/FUV-MAMA Special Requirements: BEFORE 01-AUG-2026:00:00:00									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
		(1)	AT2021AEUK	RA: 16 12 59.8424 (243.2493433d) Dec: +42 19 40.25 (42.32785d) Equinox: J2000	Redshift: 0.023	V=17.2+/-0.2	Reference Frame: ICRS			
	<i>Comments:</i> Category=GALAXY Description=[ACCRETION DISK, SEYFERT]									
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	acquisition	(1) AT2021AEUK	STIS/CCD, ACQ, 50CCD	MIRROR				40 Secs (40 Secs)	
									[==>]	[1]
	2	(2353836)	(1) AT2021AEUK	STIS/FUV-MAMA, TIME-TAG, 52X0.2	G140L 1425 A	BUFFER-TIME=13 37			1917 Secs (1917 Secs)	
									[==>]	[1]
3	(2353836)	(1) AT2021AEUK	STIS/FUV-MAMA, TIME-TAG, 52X0.2	G140L 1425 A	BUFFER-TIME=13 37			2593 Secs (2593 Secs)		
								[==>]	[2]	



Proposal 18261 - G430L (03) - Confirming the First rpTDE in a Broad-Line AGN with the Rising Third Flare of AT 2021aek

Wed Jun 10 19:00:55 GMT 2026

<b>Visit</b>	Proposal 18261, G430L (03)				
	Diagnostic Status: No Diagnostics				
	Scientific Instruments: STIS/CCD				
	Special Requirements: BEFORE 01-AUG-2026:00:00:00				

<b>Fixed Targets</b>	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	AT2021AEUK	RA: 16 12 59.8424 (243.2493433d) Dec: +42 19 40.25 (42.32785d) Equinox: J2000	Redshift: 0.023	V=17.2+/-0.2	Reference Frame: ICRS
	<i>Comments:</i>					
	<i>Category=GALAXY</i>					
	<i>Description=[ACCRETION DISK, SEYFERT]</i>					

<b>Exposures</b>	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	acquisition	(1) AT2021AEUK	STIS/CCD, ACQ, 50CCD	MIRROR				40 Secs (40 Secs)	
	2	(2353838)	(1) AT2021AEUK	STIS/CCD, ACCUM, 52X0.2	G430L 4300 A	CR-SPLIT=3			1908 Secs (1908 Secs)	
									[==>]	[1]
									[==>(Split 1)]	
									[==>(Split 2)]	[1]
									[==>(Split 3)]	

