17314 - HST/STIS spectroscopy of AT2020vdq: diagnosing fast outflows in a remarkably energetic partial tidal disruption event

Cycle: 30, Proposal Category: GO/DD

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*
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VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) AT2020VDQ	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	2	01-Jun-2023 12:00:12.0	yes

2 Total Orbits Used

ABSTRACT

When a star ventures close to a supermassive black hole, it is shredded and consumed in a tidal disruption event (TDE). In a poorly understood fraction of TDEs, the star is not fully consumed, but instead is only partially disrupted and continues orbiting the star. It is repeatedly partially disrupted each time it reaches pericenter, causing a periodic transient. Partial disruption events are key for understanding SMBH growth and feeding and the rate of tidal disruption events, among other subjects. However, only a handful of candidate partial TDEs are known. In the last few days, we have discovered a bonafide partial TDE, AT2020vdq. This event is remarkably energetic, with potential super-Eddington accretion during the present flare and evidence for fast wind launching. We propose two orbits of HST/STIS observations to obtain NUV and FUV spectra for this partial TDE. UV spectra of TDE are sensitive to the presence of outflows near the SMBH and will allow us to make the first strong statements on the evolution

and dynamics of partial TDEs.

OBSERVING DESCRIPTION

We aim to obtain FUV and NUV spectra for a UV-bright TDE. We were allocated two orbits for this program. We require that the observations occur before June 21 so that the TDE is sufficiently UV bright. We do not expect the TDE to be so UV bright as to require bright target acquisition procedures. Our observation begins with a 20 sec acquisition using the diffuse target procedure, as we aim to acquire a point source on top of diffuse emission from a galaxy. We then obtain a FUV spectrum of the source, split into to exposures so as to ensure no unused orbital visibility. We finally obtain a NUV of the source.

Visit

Proposal 17314, Visit 01, implementation Thu Jun 01 16:00:12 GMT 2023

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/NUV-MAMA, STIS/CCD, STIS/FUV-MAMA

Special Requirements: BEFORE 21-JUN-2023:00:00:00; TOO RESPONSE TIME 14.0D

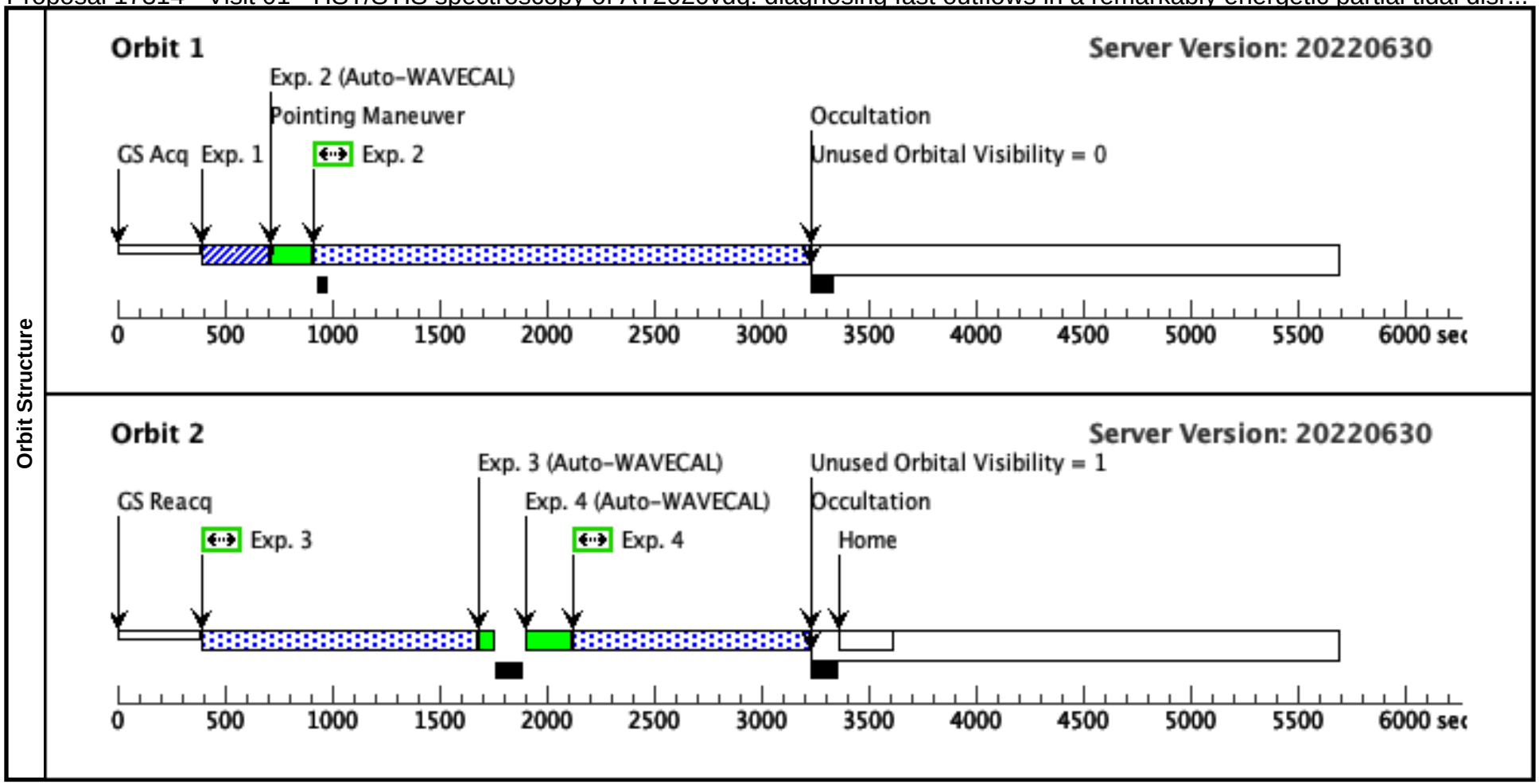
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	AT2020VDQ	RA: 10 08 53.4570 (152.2227375d) Dec: +42 43 0.20 (42.71672d) Equinox: J2000		V=18.2+/-0.2	Reference Frame: ICRS

Comments: These coordinates are from TNS as reported by the ZTF survey and are the location of the transient optical flare. They are coincident with the location of the galactic nucleus from public optical imaging (e.g., Legacy survey; the offset from the reported coordinates of the galaxy nucleus is ~0.1"). We assume a uncertainty of 0.3" in both the ra and dec because this is the largest typical uncertainty reported by ZTF, although we expect that this estimate is conservative.
Category=GALAXY
Description=[ACCRETION DISK, BLR, NUCLEUS, WIND]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	acquisition	(1) AT2020VDQ	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT			20 Secs (20 Secs) *[==>]*	*[1]*
	Comments: Acquisition of TDE.								
2	FUV spectrum I (STIS.sp.1864597)	(1) AT2020VDQ	STIS/FUV-MAMA, ACCUM, 52X0.2	G140L 1425 A				2296 Secs (2296 Secs) *[==>2296 Secs]*	*[1]*
	Comments: FUV spectrum of UV-bright TDE. The ETC uses the most recent UV flux of this source from the Swift telescope, assuming that the source has faded according to typical TDE fade timescales. We have split this exposure into two exposures to optimally fill our two orbits.								
3	FUV spectrum II (STIS.sp.1864597)	(1) AT2020VDQ	STIS/FUV-MAMA, ACCUM, 52X0.2	G140L 1425 A				1264 Secs (1264 Secs) *[==>1264 Secs]*	*[2]*
	Comments: FUV spectrum of UV-bright TDE. The ETC uses the most recent UV flux of this source from the Swift telescope, assuming that the source has faded according to typical TDE fade timescales. We have split this exposure into two exposures to optimally fill our two orbits.								
4	NUV spectrum (STIS.sp.1864598)	(1) AT2020VDQ	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				1082 Secs (1082 Secs) *[==>1082 Secs]*	*[2]*
	Comments: NUV spectrum of UV-bright TDE. The ETC uses the most recent UV flux of this source from the Swift telescope, assuming that the source has faded according to typical TDE fade timescales.								


Orbit Structure
Orbit 1
Server Version: 20220630
Exp. 2 (Auto-WAVECAL)
Pointing Maneuver
Occultation
GS Acq
Exp. 1
Exp. 2
Unused Orbital Visibility = 0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec
Orbit 2
Server Version: 20220630
Exp. 3 (Auto-WAVECAL)
Unused Orbital Visibility = 1
GS Reacq
Exp. 4 (Auto-WAVECAL)
Occultation
Exp. 3
Exp. 4
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec