16794 - Constraining the Physical Properties of a Candidate Dual QSO at Cosmic Noon

Cycle: 29, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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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) W2M-J1220+1126 CCDFLAT	STIS/CCD	1	16-Jul-2021 12:02:25.0	yes

1 Total Orbits Used

ABSTRACT

We propose to obtain high-resolution radio continuum emission observations with the VLBA at 1.4GHz (21-cm L band) to confirm a candidate dual QSO at z=1.87, a redshift that is nearer to "cosmic noon" than the current dual-AGN record holder by ~2 Gyr of lookback time. We identified the source based on HST WFC3/IR images showing two closely-separated point sources (at a projected separation of 0.26 arcsec, or ~2 kpc). The source in question is a dust-reddened quasar, which is a population typically hosted by major mergers. We also propose to obtain a spatially-resolved STIS spectrum of the system with HST, in the visible spectral range, in order to measure the CIII] and MgII line properties of each component. These

measurements will confirm the source as a bone-fide dual QSO, which would make it the highest redshift dual AGN reported to date -- at the era of peak AGN and merger activity. The measurements will also provide black hole masses, accretion rates, and radio loudnesses of each component, for comparison with models. These results will link dust-reddening and galaxy mergers to black hole mergers opening up a new population in which to search for samples of dual AGN.

OBSERVING DESCRIPTION

This program will obtain a spatially-resolved spectrum of a candidate dual AGN with the STIS instrument in a mode that covers a similar wavelength range to the SDSS spectrum, where the sources are brightest. The G750L mode covers a wavelength range of 5240 - 10270 Angstroms and thus includes coverage of the C III and Mg II line profiles.

This mode has an average dispersion of 4.92 A per pixel, and a resolving power of 535 -170, which is sufficient to measure AGN line profiles, corresponding to line widths of ~300 - 600 km/s as seen in Figure 2c. The STIS CCD has a plate scale of 0.05078 "/pixel, which will clearly resolve the two components as they will be separated by > 5 pixels.

We plan our visit starting with a target acquisition (ACQ). Because our target is brighter than V = 21 and we are using the 0.2" slit, an acquisition/peakup (ACQ/PEAK) is not required.

We use the STIS Exposure Time Calculator (ETC) to estimate signal-to-noise ratios for each component. Using the SDSS spectrum as an input, we scale the flux to reflect the F105W magnitude difference determined by our Galfit PSF fits and modeling the object as a point source. SDSS reports a combined magnitude for this source as zSDSS = 17.13, with each component thus having z = 17.5 and z = 18.5. We specify an extraction region of 5 pixels, which allows each component to be extracted separately, as they are ~ 5 pixels apart and the extraction region will straddle the centroid of each component. We choose a binning of 1 x1 pixels.

The orbit planner allows for 36 minutes (2206 s) of on-source exposure, which will yield a signal-to-noise ratio of 30 and 14, in the bright and faint components, respectively, at 7751 A in the G750L mode. Such a signal- to-noise ratio should allow for detailed line-profile modeling to understand the source kinematics and broad-line environments, as well as determine a black hole mass and deduce an Eddington ratio.

To obtain the spectrum of both sources simultaneously, we require a specific slit orientation with PA = 175 deg, with some tolerance given the close proximity of the pair and the chosen slit width.

To obtain the spatially resolved spectroscopy, we require that the STIS slit be oriented at a position angle that will capture both sources in the slit. Based on the positions determined from the F105W and F160W imaging, their very close proximity, and and the chosen slit width of 0.2", we request that the STIS slit be placed at a position angle of 175 deg (with some tolerance of 176.88 deg x 173.29 deg based on the positional uncertainty of the sources derived from Galfit). This corresponds to an ORIENT parameter range of 222.23 deg x 218.64 deg (as they are offset by 45.35 deg for the STIS 0.2" slit).

Visit

Proposal 16794, Visit 01 Fri Jul 16 16:02:26 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: SCHED 50%; ORIENT 218.64D TO 222.23 D

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	W2M-J1220+1126	RA: 12 20 16.8900 (185.0703750d) Dec: +11 26 27.89 (11.44108d) Equinox: J2000	Redshift: 1.871	V=19.07+/-0.01 F105W_AB = 18.5, 17.5; F160W_AB = 16.8, 17.1	Reference Frame: ICRS

Comments: The object is unresolved in ground based data, but is a dual source in HST WFC3/IR imaging.
Category=GALAXY
Description=[INTERACTING GALAXY, MULTIPLE NUCLEI, QSO, QUASAR, RADIO GALAXY]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	aquisition (STIS.ta.1522880)	(1) W2M-J1220+1126	STIS/CCD, ACQ, F28X50LP	MIRROR				10 Secs (10 Secs) *[==>]*	*[1]*
2	object spectrum (STIS.sp.1523842)	(1) W2M-J1220+1126	STIS/CCD, ACCUM, 52X0.2	G750L 7751 A				0 Secs (2126.2 Secs) *[==>1063.1 Secs (Split 1)]* *[==>1063.1 Secs (Split 2)]*	*[1]*
3	finge flat small aperture	CCDFLAT	STIS/CCD, ACCUM, 0.3X0.09	G750L 7751 A				*[==>(Copy 1)]* *[==>(Copy 2)]*	*[1]*
4	fringe flat long aperture	CCDFLAT	STIS/CCD, ACCUM, 52X0.1	G750L 7751 A				*[==>(Copy 1)]* *[==>(Copy 2)]*	*[1]*

Orbit Structure