



# 8273 - Photometric Quasar Light Echo Tomography at $z=5.7$ with Subaru/HSC and NIRCam/WFSS

Cycle: 4, Proposal Category: GO

## INVESTIGATORS

<i>Name</i>	<i>Institution</i>
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## OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
Observation Folder				
	1	J0001+2650	NIRCam Wide Field Slitless Spectroscopy	(1) J0001+2650

## ABSTRACT

Episodes of luminous quasar activity are directly related to supermassive black hole growth. The ionizing radiation emitted over a quasar's lifetime alters the ionization state of the surrounding intergalactic medium, enhancing the Ly $\alpha$  forest transmission, which can be observed in absorption spectra of background sources. We propose a new technique to photometrically map these quasar light echoes through Ly $\alpha$  forest tomography, using high-redshift [OIII] emitter galaxies selected via NIRCam/WFSS with the F356W filter. By measuring their UV continua with the NIRCam F115W and F200W filters, and existing Subaru/HSC narrowband imaging, one can measure the Ly $\alpha$  forest transmission in the vicinity of a foreground quasar. In this proposal, we request NIRCam/WFSS observations to measure Ly $\alpha$  forest transmission values in the vicinity of a foreground quasar at  $z\sim 5.7$ , towards efficiently selected background [OIII] emitters at  $z\sim 5.8-7.0$ . This program will allow for unprecedented constraints of the quasar emission geometry, providing a new window for studying SMBH growth.

## **OBSERVING DESCRIPTION**

This proposal targets the J0001+2650 quasar field with the goal of identifying [OIII] emitters in the redshift range  $5.3 < z < 7$  using the NIRCam Wide Field Slitless Spectroscopy (WFSS) mode. We will perform a 10-pointing mosaic using the F356W filter to detect [OIII] emitters and simultaneously capture the UV continua of background galaxies using the F115W and F200W filters. The mosaic layout consists of pointings centered on both the quasar and nearby Lyman-alpha emitters (LAEs) identified in prior observations. This approach ensures broad coverage of the quasar's vicinity, where the light-echo signal is expected to be strongest, while also covering the regions where measurements along background LAEs are available.

We will use Grism R to minimize overheads while ensuring sufficient sensitivity to detect the expected [OIII] emission lines. The total exposure time for WFSS+F356W is 1800 seconds, split across 9 groups per integration, with four dithers using the SHALLOW4 readout and a two-point primary dither pattern. The F115W filter will be used for simultaneous short-wavelength imaging, while F200W imaging will help constrain the UV continuum shapes of the background galaxies. In total, the observation requires 9.2 hours of science time, with a total of 17.3 hours requested when including overheads.

Proposal 8273 - Targets - Photometric Quasar Light Echo Tomography at  $z=5.7$  with Subaru/HSC and NIRCam/WFSS

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(1)	J0001+2650	RA: 00 01 21.6272 (.3401133d) Dec: +26 50 9.17 (26.83588d) Equinox: J2000	Epoch of Position: 2000	
<i>Comments: <math>z=5.733</math>                      Category=Galaxy                      Description=[High-redshift galaxies, Quasars]</i>					

Proposal 8273 - Observation 1 - Photometric Quasar Light Echo Tomography at z=5.7 with Subaru/HSC and NIRCcam/WFSS

Fri Nov 28 21:00:08 GMT 2025

<b>Observation</b>	<b>Proposal 8273, Observation 1: J0001+2650</b> <b>Diagnostic Status: Warning</b> Observing Template: NIRCcam Wide Field Slitless Spectroscopy											
	(J0001+2650 (Obs 1)) Warning (Form): By selecting Target Placement = Module Gap the target coordinates will not fall on any detector unless an appropriate Mosaic, set of Dithers or Offset Special Requirement is specified. (J0001+2650 (Obs 1)) Warning (Form): Use of only one of GRISMR or GRISMC may result in spectral overlap from multiple sources that can't be corrected. Users should address this issue in their proposal text. (Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 1:2) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 1:3) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 1:4) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 1:5) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 1:6) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 1:7) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 1:8) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 1:9) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 1:10) Warning (Form): Overheads are provisional until the Visit Planner has been run.											
<b>Diagnostics</b>												
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>			<b>Targ. Coord. Corrections</b>			<b>Miscellaneous</b>			
	(1)	J0001+2650	RA: 00 01 21.6272 (.3401133d) Dec: +26 50 9.17 (26.83588d) Equinox: J2000			Epoch of Position: 2000						
<i>Comments: z=5.733</i> <i>Category=Galaxy</i> <i>Description=[High-redshift galaxies, Quasars]</i>												
<b>Template</b>	<b>Module</b>	<b>Subarray</b>			<b>Grism (Long Wavelength)</b>			<b>Target Placement</b>				
	ALL	FULL			GRISMR			Module gap (large extended source)				
<b>Mosaic</b>	<b>Rows</b>	<b>Columns</b>	<b>Row Overlap %</b>	<b>Column Overlap %</b>	<b>Row shift (deg)</b>	<b>Column shift (deg)</b>	<b>Tile Order</b>					
	5	2	10.0	10.0	0.0	0.0	DEFAULT					
<b>Dithers</b>	<b>#</b>	<b>Primary Dither Type</b>			<b>Primary Dithers</b>			<b>Subpixel Positions</b>				
	1	INTRAMODULEX			2			2-Point				
<b>Direct Image</b>	<b>#</b>	<b>Short Filter</b>	<b>Long Filter</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Exp</b>	<b>Total Integrations</b>	<b>Total Exposure Time</b>	<b>Optional ETC ID</b>	<b>Grism (Long Wavelength)</b>	<b>Exposure Type</b>	<b>Total Dithers</b>
	1	F200W	F356W	SHALLOW4	9	1	1	472.418		GRISMR	Direct Image	1

Proposal 8273 - Observation 1 - Photometric Quasar Light Echo Tomography at  $z=5.7$  with Subaru/HSC and NIRCam/WFSS

Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID	Grism (Long Wavelength)	Exposure Type	Total Dithers
		1	F115W	F356W	SHALLOW4	9	1	4	1889.672		GRISMR	Grism (Long Wavelength)
	2	F200W	F356W	SHALLOW4	9	1	2	944.836			Out of Field	2
Special Requirements	Sequence Visits within 53.0 Days Visits Same PA Offset 60.0 arcsec, 0.0 arcsec											