



## 5911 - Emergence of the Baryon Cycle in the First Billion Years

Cycle: 3, Proposal Category: GO

### INVESTIGATORS

<i>Name</i>	<i>Institution</i>
<b>Prof. Robert Andrew Simcoe (PI)</b>	<b>Massachusetts Institute of Technology</b>
Prof. Anna-Christina Eilers (CoI)	Massachusetts Institute of Technology
Dr. Jorryt Matthee (CoI) (ESA Member)	Institute of Science and Technology Austria
Dr. Rohan Naidu (CoI)	Massachusetts Institute of Technology
Dr. Daichi Kashino (CoI)	National Astronomical Observatory of Japan (NAOJ)
Dr. Rongmon Bordoloi (CoI)	North Carolina State University
Prof. Simon J. Lilly (CoI) (ESA Member)	Eidgenossische Technische Hochschule (ETH)
Dr. Ruari Mackenzie (CoI) (ESA Member)	ETH Zurich
Eduardo Banados (CoI) (ESA Member)	Max Planck Institute for Astronomy
Dr. Feige Wang (CoI)	University of Arizona
Dr. Minghao Yue (CoI)	Massachusetts Institute of Technology
Mr. Yunjing Wu (CoI)	Tsinghua University
Dr. Masafusa Onoue (CoI)	Kavli Inst for the Physics and Mathematics of the Universe
Dra. Sofia Rojas (CoI)	University of California - Los Angeles
Dr. Frederick Davies (CoI) (ESA Member)	Max Planck Institute for Astronomy
Dr. Sarah E. I. Bosman (CoI) (ESA Member)	Universitat Heidelberg
Prof. Xiaohui Fan (CoI)	University of Arizona
Dr. Bram Venemans (CoI) (ESA Member)	Universiteit Leiden
Dr. Emanuele Paolo Farina (CoI)	NOIRLab - Gemini North (HI)
Dr. Jinyi Yang (CoI)	University of Arizona
Dr. Siwei Zou (CoI)	Tsinghua University

**OBSERVATIONS**

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
Observation Folder				
	1	J1342+0928_WFSS	NIRCam Wide Field Slitless Spectroscopy	(2) QSO-J1342+0928
	2	J1342+0928_WFSS	NIRCam Wide Field Slitless Spectroscopy	(2) QSO-J1342+0928

**ABSTRACT**

We propose a dual-band blind search for [OIII]-emitting galaxies with the NIRCam slitless grism in the field of a  $z=7.5$  quasar, to search for companions of the earliest known metal absorption systems at  $5.3 < z < 7.5$  -- deep in the Epoch of Reionization (EoR). Existing high quality ground-based IR spectra and archival JWST observations of the central quasar allow detailed analysis of the chemical compositions for nine foreground heavy-element absorption systems. These include one that exhibits a CII\* fine structure cooling line, and another with MgII in the immediate foreground of this quasar whose HI damping wing has been interpreted as a constraint on the neutral fraction of intergalactic gas at  $z=7.5$ . JWST is the first observatory with the sensitivity to identify absorption line hosts in the EoR, via [OIII] emission. With deep grism observations and contemporaneous six-band photometry, we will be able to measure redshifts and impact parameters of foreground galaxies without pre-selection, and estimate their stellar masses, star formation rates, and ages from stellar population modeling. The same observations will also be used to measure the galaxy density and the projected galaxy-quasar cross correlation in the neighborhood of the background quasar, helping to constrain the host halo mass. These observations will add one of the most famous and important quasar sightlines discovered in the last 20 years to the growing body of legacy fields surveyed with the NIRCam slitless grism, complimenting existing NIRSpec IFU spectra already in the archive that cover the QSO over a very small field in great depth.

**OBSERVING DESCRIPTION**

We use the NIRCam WFSS mode with F356W and F430M blocking filters, targeting a single field that contains a  $z=7.5$  quasar with nine foreground absorption systems at  $5.5 < z < 7.5$ , including five of the six highest-redshift quasar absorption systems known. The WFSS integrations exclusively use the GrismR configuration with two overlapping visits yielding a mosaic of approximately 3:1 aspect ratio. Full depth is achieved along a central strip on the quasar boresight. Concurrently we will obtain deep images in F090W, F115W, F150W, and F200W in the SW channel. We employ INTRAMODULEX dithers to fill the SW detector gaps as well as 4-point subpixel dithers to better sample the PSF.

The central region features enhanced depth and "cross-dispersion" of spectra in opposite directions during alternating visits, which helps in resolving degeneracies for single line detections whose wavelength and spatial location are not known a priori. In practice, robust identifications are normally possible even in a single visit for sources at the redshifts of interest, because one may pattern match against the characteristic grouping of the

## JWST Proposal 5911 (Created: Tuesday, June 4, 2024 at 1:00:57 PM Eastern Standard Time) - Overview

[OIII]5008,4960 doublet + Hbeta. The relatively high resolution of the WFSS is leveraged to subtract contaminating foreground sources---which typically have slowly varying spectral continua---from the narrow emission lines of interest. Based on comparison with existing WFSS surveys, we expect to detect of order 60-80 [OIII] emitters in this single mosaic. These will be used to measure impact parameters, stellar masses, half-light radii, and star formation rate and age for stellar populations near  $z > 6$  absorption systems, tracing the early phases of circumgalactic enrichment. Measurements of Hbeta constrain the ionizing photon budget of each host, which we will examine in light of the extremely low ionization state of metal lines in many high redshift absorbers (including along this sightline).

The JWST program totals 12.9 hours of science observation, or 20.3 hours accounting for full overheads.

## Proposal 5911 - Targets - Emergence of the Baryon Cycle in the First Billion Years

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(2)	QSO-J1342+0928	RA: 13 42 8.1000 (205.5337500d) Dec: +09 28 38.36 (9.47732d) Equinox: J2000	Epoch of Position: 2015.5	
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> <i>Category=Galaxy</i> <i>Description=[Active galactic nuclei, High-redshift galaxies, Quasars]</i>					

# Proposal 5911 - Observation 1 - Emergence of the Baryon Cycle in the First Billion Years

Tue Jun 04 18:00:57 GMT 2024

<b>Observation</b>	<b>Proposal 5911, Observation 1: J1342+0928_WFSS</b> <b>Diagnostic Status: Warning</b> Observing Template: NIRCam Wide Field Slitless Spectroscopy																																																										
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Proposal 5911 - Observation 1 - Emergence of the Baryon Cycle in the First Billion Years

**Special Requirements**

Group Visits within 53.0 Days  
Visits Same PA  
Same Aperture PA 1, 2

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