



7404 - How I wonder what you are -- do JWST's Little Red Dots twinkle? Testing broad-line and continuum variability on week, month, and six-month timescales

Cycle: 4, Proposal Category: GO

INVESTIGATORS

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Prof. Anna-Christina Eilers (CoI)	Massachusetts Institute of Technology
Dr. Minghao Yue (CoI)	University of Arizona
Prof. Danilo Marchesini (CoI)	Tufts University
Dr. Rongmon Bordoloi (CoI)	North Carolina State University
Dr. Lukas Jonathan Furtak (CoI)	University of Texas at Austin

OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
GN-GrismR				
	1	NIRCam Grism GN	NIRCam Wide Field Slitless Spectroscopy	(1) GOODS-N-CENTER
	2	NIRCam Grism GN	NIRCam Wide Field Slitless Spectroscopy	(1) GOODS-N-CENTER
	3	NIRCam Grism GN	NIRCam Wide Field Slitless Spectroscopy	(1) GOODS-N-CENTER

ABSTRACT

JWST's ubiquitous Little Red Dots (LRDs) have been called the "biggest discovery in physics in 2023", and yet there is little consensus about what these compact, reddened objects with broad Balmer lines at $z > 5$ actually are. If they are a new class of obscured AGN, what explains their peculiar SEDs, weak x-rays, and self-absorption in Balmer(!) lines? Do their apparent Balmer breaks mean they are massive galaxies that may one day end up as dense cores of ellipticals? Even with large samples and spectra in hand, no unified model is in sight -- we desperately need independent constraints.

Here we propose TWINKLE, JWST's first systematic LRD monitoring campaign. AGN are variable on all observed timescales, whereas star-forming galaxies are steady, thereby allowing us to disentangle the LRD SED. We will revisit, thrice, the very first spectroscopic sample reported in Cycle 1 and exploit this long baseline to probe sustained changes as well as short-term stochasticity. With simultaneous NIRCam grism+imaging (the same setup as Cycle 1) we will directly probe the mysterious Balmer lines, as well as the perplexing rest-UV to optical continuum. Our efficient visits capturing 9 LRDs clustered on-sky in the GOODS-North legacy field are expected to guarantee at least 1 source with a $>15\%$ flux change in the AGN scenario, delivering a much needed breakthrough in the LRD puzzle.

TWINKLE will collect grism spectra for every single source in its field of view from $z \sim 0-8$, doubling the depth of the Cycle 1 data in a critical JWST legacy field, while piloting a unique spectroscopic time-domain survey that may reveal phenomena such as peculiar high- z supernovae and LRDs coming to life.

OBSERVING DESCRIPTION

This is a monitoring campaign that will visit the GOODS-N field thrice across this cycle to collect grism spectra of broad Balmer lines in the objects of interest (Little Red Dots), and simultaneously image them in three different filters (F444W, i.e., the direct image; and F210M+F182M simultaneous to the grism exposures). We wish to seek differences with respect to earlier existing data from GO 1895, and so we maintain our setup overall as close to that program as possible. We will mosaic the entire GOODS-N field covered by GO 1895 thrice across the cycle, but the key difference is we do this with the F410M medium band filter for the grism spectra -- this is because all the targets of interest happen to have their

JWST Proposal 7404 (Created: Friday, January 9, 2026, 12:00:26PM Eastern Standard Time) - Overview

Balmer lines falling in this medium-band. This lets us proceed roughly 2x faster than GO 1895. The paired imaging is also then shallower per visit, but the objects of interest are extremely bright (<25.5 mag) and so this is acceptable. We wish to spread out our three visits across the entire observing cycle, while also acquiring background limited spectra. This imposes relatively tight constraints on the scheduling, but we have verified in the visit planner that there are viable windows available nonetheless.

Proposal 7404 - Targets - How I wonder what you are -- do JWST's Little Red Dots twinkle? Testing broad-line and continuum variability...

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(1) <i>Comments:</i> <i>Category=Unidentified</i> <i>Description=[Blank field]</i>	GOODS-N-CENTER	RA: 12 36 45.9293 (189.1913721d) Dec: +62 14 45.70 (62.24603d) Equinox: J2000		

Proposal 7404 - Observation 1 - How I wonder what you are -- do JWST's Little Red Dots twinkle? Testing broad-line and continuum v...

Fri Jan 09 17:00:27 GMT 2026

Observation	Proposal 7404, Observation 1: NIRCam Grism GN Diagnostic Status: Warning Observing Template: NIRCam Wide Field Slitless Spectroscopy																				
	(NIRCam Grism GN (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. (NIRCam Grism GN (Obs 1)) Warning (Form): This observation is split across multiple visits using multiple filters. Not selecting the sequence option may result in execution of the visits in a non-numerical order and is not recommended. (NIRCam Grism GN (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 1:1) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements. (Visit 1:2) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements. (Visit 1:3) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements. (Visit 1:4) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements. (Visit 1:5) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements.																				
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Proposal 7404 - Observation 1 - How I wonder what you are -- do JWST's Little Red Dots twinkle? Testing broad-line and continuum v...

Direct Image	#	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	F182M	F444W	SHALLOW4	6	1	1	311.366		GRISMR	Direct Image

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	F210M	F410M	SHALLOW4	7	1	4	1460.201		GRISMR	Grism (Long Wavelength)	4
	2	F182M	F410M	SHALLOW4	7	1	4	1460.201		GRISMR	Grism (Long Wavelength)	4
	3	F182M	F444W	SHALLOW4	6	1	2	622.733			Out of Field	2

Special Requirements	Sequence Visits within 53.0 Days
	Visits Same PA Background Limited. Background no more than 50th percentile above minimum 2 After 1 by 40 Days to 100 Days

Proposal 7404 - Observation 2 - How I wonder what you are -- do JWST's Little Red Dots twinkle? Testing broad-line and continuum v...

Fri Jan 09 17:00:27 GMT 2026

Observation	Proposal 7404, Observation 2: NIRCam Grism GN Diagnostic Status: Warning Observing Template: NIRCam Wide Field Slitless Spectroscopy											
	(NIRCam Grism GN (Obs 2)) 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. (NIRCam Grism GN (Obs 2)) Warning (Form): This observation is split across multiple visits using multiple filters. Not selecting the sequence option may result in execution of the visits in a non-numerical order and is not recommended. (NIRCam Grism GN (Obs 2)) 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 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 2:2) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 2:3) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 2:4) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 2:5) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 2:6) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 2:7) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 2:8) Warning (Form): Overheads are provisional until the Visit Planner has been run.											
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Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections			Miscellaneous			
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Template	Module		Subarray			Grism (Long Wavelength)			Target Placement			
	ALL		FULL			GRISMR			Module gap (large extended source)			
Mosaic	Rows	Columns	Row Overlap %	Column Overlap %	Row shift (deg)	Column shift (deg)	Tile Order					
	4	2	3.0	64.7	0.0	0.0	DEFAULT					
Dithers	#	Primary Dither Type				Primary Dithers			Subpixel Positions			
	1	INTRAMODULEBOX				4			NONE			
Direct Image	#	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	F182M	F444W	SHALLOW4	6	1	1	311.366		GRISMR	Direct Image	1

Proposal 7404 - Observation 2 - How I wonder what you are -- do JWST's Little Red Dots twinkle? Testing broad-line and continuum v...

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	F210M	F410M	SHALLOW4	7	1	4	1460.201		GRISMR	Grism (Long Wavelength)	4
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	3	F182M	F444W	SHALLOW4	6	1	2	622.733			Out of Field	2
Special Requirements	Sequence Visits within 53.0 Days Visits Same PA Background Limited. Background no more than 50th percentile above minimum 2 After 1 by 40 Days to 100 Days 3 After 2 by 40 Days to 150 Days											

Proposal 7404 - Observation 3 - How I wonder what you are -- do JWST's Little Red Dots twinkle? Testing broad-line and continuum v...

Fri Jan 09 17:00:27 GMT 2026

Observation	Proposal 7404, Observation 3: NIRCam Grism GN Diagnostic Status: Warning Observing Template: NIRCam Wide Field Slitless Spectroscopy											
	(NIRCam Grism GN (Obs 3)) 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. (NIRCam Grism GN (Obs 3)) Warning (Form): This observation is split across multiple visits using multiple filters. Not selecting the sequence option may result in execution of the visits in a non-numerical order and is not recommended. (NIRCam Grism GN (Obs 3)) 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 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 3:2) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 3:3) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 3:4) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 3:5) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 3:6) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 3:7) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Visit 3:8) Warning (Form): Overheads are provisional until the Visit Planner has been run.											
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Template	Module		Subarray			Grism (Long Wavelength)			Target Placement			
	ALL		FULL			GRISMR			Module gap (large extended source)			
Mosaic	Rows	Columns	Row Overlap %		Column Overlap %		Row shift (deg)	Column shift (deg)		Tile Order		
	4	2	3.0		64.7		0.0	0.0		DEFAULT		
Dithers	#	Primary Dither Type				Primary Dithers			Subpixel Positions			
	1	INTRAMODULEBOX				4			NONE			
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	1	F182M	F444W	SHALLOW4	6	1	1	311.366		GRISMR	Direct Image	1

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	1	F210M	F410M	SHALLOW4	7	1	4	1460.201		GRISMR	Grism (Long Wavelength)	4
	2	F182M	F410M	SHALLOW4	7	1	4	1460.201		GRISMR	Grism (Long Wavelength)	4
	3	F182M	F444W	SHALLOW4	6	1	2	622.733			Out of Field	2
Special Requirements	Sequence Visits within 53.0 Days Visits Same PA Background Limited. Background no more than 50th percentile above minimum 3 After 2 by 40 Days to 150 Days											