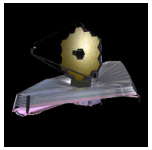

2441 - An Investigation of Claimed Silicate Dust Crystallinity in a z=0.9 Spiral Galaxy

Cycle: 1, Proposal Category: GO

INVESTIGATORS

Name	*Institution*
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Dr. Varsha Purushottam Kulkarni (CoI)	University of South Carolina

OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1	PKS1830-SightlineB-Science Observation	MIRI Medium Resolution Spectroscopy	(1) QSO-B1830-211-SIGHTLINEB
	2	PKS1830-SightlineB-Background Observation	MIRI Medium Resolution Spectroscopy	(3) QSO-B1830-211-BACKGROUND

ABSTRACT

Silicate grains comprise ~70% of Galactic interstellar dust by mass. In the diffuse interstellar medium (ISM), amorphous olivine grains produce broad spectral features at 9.7 and 18 microns, while in circumstellar environments, narrower spectral features at >9 microns reveal grain crystallinity. The absence of ISM grain crystallinity supports dust evolution models in which processsing mechanisms rapidly amorphize grains. Higher (5-15%) interstellar silicate crystallinity has been observed in galaxies with very high star formation rates, where it is attributed to newly formed grains. Thus, the discovery of a visually-normal, late-type, face-on spiral galaxy at z=0.9 with significant (>95%) silicate crystallinity challenges established models. This detection was based on Spitzer IRS spectra showing structure in the galaxy's 10 micron silicate absorption feature along lensed sightlines to the PKS 1830-211 blazar. Given that the absorber sightline also exhibits a large diversity of molecules, grain processing mechanisms may differ in this galaxy region. In order to investigate whether the IR spectral structure results from extremely high silicate crystallinity, or whether

the structure is an artifact due to scattered light contamination of the IRS spectrum, we propose to observe the sightlines with MIRI-MRS to robustly establish the silicate crystallinity, and to investigate the silicate grain chemistry. If confirmed, this system may reveal variations in dust grain processing at higher redshift and/or in grains located in dense molecular clouds, which may be more prevalent in high redshift star forming galaxies, impacting dust corrections in those systems.

OBSERVING DESCRIPTION

We request observations of the gravitationally-lensed PKS 1830-211 quasar absorber field with the JWST MIRI Medium Resolution Spectrograph in the short, medium, and long segments, to investigate the structure of the silicate absorption feature in the z=0.886 absorber galaxy along the lensed blazar sightlines. These data will span the full available spectral range of 4.9-28.3 microns in the observed frame. We propose to obtain 4 dithered exposures of the field, which contains the lensing galaxy absorber, 2 lensed AGN sightlines separated by 1 arcsec, as well as two stellar sources. Although the blazar sightlines are point sources, the combination of multiple sightlines and the lensing galaxy results in an extended source structure, which neccessitates the adopted 4-point extended source dither pattern and associated dedicated background exposures. We identified the location of the background frames by offsetting from the blazar field and inspecting the location to ensure it contains no catalogued galaxies or stars. We also inspected the footprint of the MIRI background images through Aladdin using 2MASS imaging, to ensure that, even when dithered, the frames will not fall on any nearby luminous IR objects. The requested dedicated background observations have been matched in observing setup to the science exposures, and linked with a non-interruptable sequence. Target acquisition will be performed on the brighter NE quasar sightline (A), using the FND filter for which no saturation occurs, but for which there is sufficient (>20) signal-to-noise for successful target acquisition. We have centered the science observations on the dimmer SW sightline (B), along which we expect more significant dust absorption.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	QSO-B1830-211-SIGHTLINEB	RA: 18 33 39.8824 (278.4161767d) Dec: -21 03 40.46 (-21.06124d) Equinox: J2000	Epoch of Position: 2015.5	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. The coordinates are based on Subrahmanyan et al. 1990, MNRAS, 246, 263. *Category=Galaxy* *Description=[Active galactic nuclei]*				
(2)	QSO-B1830-211-SIGHTLINEA	RA: 18 33 39.9311 (278.4163796d) Dec: -21 03 39.75 (-21.06104d) Equinox: J2000	Epoch of Position: 2015.5	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. The coordinates are based on Subrahmanyan et al. 1990, MNRAS, 246, 263 *Category=Galaxy* *Description=[Active galactic nuclei]*				
(3)	QSO-B1830-211-BACKGROUND	RA: 18 33 39.5500 (278.4147917d) Dec: -21 03 53.00 (-21.06472d) Equinox: J2000	Epoch of Position: 2015.5	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *This source is a background source for the PKS 1830-211 observation. Following the recommendation of the instrument scientist, Isha Nayak, we have not linked this as a non-interruptable sequenced background observation to prevent a severe data excess.* *Category=Galaxy* *Description=[Active galactic nuclei]*				

Observation

Proposal 2441, Observation 1: PKS1830-SightlineB-Science Observation Tue Sep 05 21:00:43 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Diagnostics

(Visit 1:1) Warning (Form): Data Excess over lower threshold

(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	QSO-B1830-211-SIGHTLINEB	RA: 18 33 39.8824 (278.4161767d) Dec: -21 03 40.46 (-21.06124d) Equinox: J2000	Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. The coordinates are based on Subrahmanyan et al. 1990, MNRAS, 246, 263.
Category=Galaxy
Description=[Active galactic nuclei]

Acquisition

#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	2 QSO-B1830-211-SIGHTLINEA	FND	FAST	6	1	1	16.65	62164

Template

Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
All MRS	NO	FULL	NEUTRAL

Dithers

#	Dither Type	Optimized For	Direction
1	4-Point	EXTENDED SOURCE	NEGATIVE

Spectral Elements

#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	LONG(C)	MRSLONG		FASTR1	73	6	1	Dither 1	4	24	4917.371	
1	LONG(C)	MRSSHORT		FASTR1	73	6	1	Dither 1	4	24	4917.371	
2	MEDIUM(B)	MRSLONG		FASTR1	73	6	1	Dither 1	4	24	4917.371	
2	MEDIUM(B)	MRSSHORT		FASTR1	73	6	1	Dither 1	4	24	4917.371	
3	SHORT(A)	MRSLONG		FASTR1	73	6	1	Dither 1	4	24	4917.371	
3	SHORT(A)	MRSSHORT		FASTR1	73	6	1	Dither 1	4	24	4917.371	

Special Requirements	Sequence Observations 1, 2 within 3 Days

Observation

Proposal 2441, Observation 2: PKS1830-SightlineB-Background Observation Tue Sep 05 21:00:43 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Comments: This is the background observation for PKS 1830-211. We have removed the "companion background observations" link from the science target, which necessitates a non-interruptable sequence for scheduling, because it results in a severe data excess. Following the advice of the instrument scientist, Isha Nayak, we have instead put in a sequenced observation to be scheduled within 3 days for this background field.

Diagnostics

(Visit 2:1) Warning (Form): Data Excess over lower threshold

(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(3)	QSO-B1830-211-BACKGROUND	RA: 18 33 39.5500 (278.4147917d) Dec: -21 03 53.00 (-21.06472d) Equinox: J2000	Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
This source is a background source for the PKS 1830-211 observation. Following the recommendation of the instrument scientist, Isha Nayak, we have not linked this as a non-interruptable sequenced background observation to prevent a severe data excess.
Category=Galaxy
Description=[Active galactic nuclei]

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
FND	All MRS	NO	FULL	NEUTRAL

Dithers

#	Dither Type	Optimized For	Direction
1	4-Point	EXTENDED SOURCE	NEGATIVE

Spectral Elements

#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	LONG(C)	MRSLONG		FASTR1	73	6	1	Dither 1	4	24	4917.371	
1	LONG(C)	MRSSHORT		FASTR1	73	6	1	Dither 1	4	24	4917.371	
2	MEDIUM(B)	MRSLONG		FASTR1	73	6	1	Dither 1	4	24	4917.371	
2	MEDIUM(B)	MRSSHORT		FASTR1	73	6	1	Dither 1	4	24	4917.371	
3	SHORT(A)	MRSLONG		FASTR1	73	6	1	Dither 1	4	24	4917.371	
3	SHORT(A)	MRSSHORT		FASTR1	73	6	1	Dither 1	4	24	4917.371	

Special Requirements	Sequence Observations 1, 2 within 3 Days