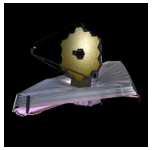

3596 - Time-dependent dust heating and reverberation in the disk of the highly accreting classical T Tauri star DR Tau

Cycle: 2, Proposal Category: GO

INVESTIGATORS

Name	*Institution*
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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
DT Tau NIRISS SOSS				
	1		NIRISS Single-Object Slitless Spectroscopy	(1) V-DR-TAU
	2		NIRISS Single-Object Slitless Spectroscopy	(1) V-DR-TAU

ABSTRACT

The innermost part of circumstellar disks around young stars, where terrestrial planets form, is a vigorous dynamical environment. The location of the inner radius of the dust disk is an important parameter which shapes the accretion process, the amplitude and timescale variability processes, and even the efficiency of planet formation. Located at a fraction of an au, measuring this radius is very challenging, even for infrared interferometers. Here, we propose a novel method, the dust reverberation technique, to measure the inner dust disk radius in the highly accreting, highly variable classical T Tauri star DR Tau. Taking advantage of the supreme cadence and precision of NIRISS for spectrophotometric time series, we will make a pioneering reverberation experiment, one of the first of this kind on a young star. We will obtain 0.8-2.8 um spectra with 7 sec cadence uninterruptedly for 2 hours. In this data stream, we will look for optical brightness fluctuations due to the variable stellar/accretion radiation, and search for their reverberation signal in the infrared domain, emitted by dust particles whose temperature changes due to the varying irradiation. We will repeat the observations a few months later, sampling a different brightness state of the star/disk system. Our experiment will enable us to

measure the inner radius of the dust disk in a model-independent way. We will also determine the variations of the accretion rate, the dust temperature, and the emitting surface in the disk. Our results will help to connect the accretion process and disk changes and may establish the reverberation technique as a standard tool of protoplanetary disk studies in the future.

OBSERVING DESCRIPTION

In this program, we will make a dust reverberation experiment to determine the inner radius of the dust disk around the pre-main sequence star DR Tau. For this purpose, we will obtain time series of NIRISS spectra in the Single-Object Slitless Spectroscopy (SOSS) mode. Our target can be used for target acquisition in the SOSSBRIGHT mode with the default F480M filter using 3 groups and 1 integration. For the spectroscopy, we will use the SUBSTRIP96 subarray and 2 groups per integration, chosen to provide the shortest possible cadence, 6.66 sec. After a half hour of detector settling, we will observe our target for 2 hours, to ensure enough time for significant variability to be used as a reverberation signal. We will use the GR700XD+CLEAR filter configuration to cover the 0.8-2.8 um wavelength range. With this setup, we will have S/N between 100 and 310 in each spectrum of DR Tau. At the end of the monitoring, we will also make a short GR700XD+F277W exposure as well to isolate the 1st order spectrum and estimate the magnitude of contamination in the 2.4-2.8 um range. We will repeat the spectrophotometric monitoring of DR Tau one more time curing Cycle 2, preferably in another visibility window in order to maximize the chances that we observe sufficiently high variability of our target and also to reveal geometrical changes in the inner disk with unprecedented precision.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	V-DR-TAU	RA: 04 47 6.2208 (71.7759200d) Dec: +16 58 42.60 (16.97850d) Equinox: J2000	Proper Motion RA: 3.6295285040981303E-4 sec of time/yr Proper Motion Dec: -0.013888999978917127 arcsec/yr Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[Circumstellar disks, Pre-main sequence stars, Protoplanetary disks, Young stellar objects]
Extended=NO

Observation

Proposal 3596, Observation 1

Thu Jun 01 23:00:28 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRISS Single-Object Slitless Spectroscopy

Diagnostics

(Visit 1:1) 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.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	V-DR-TAU	RA: 04 47 6.2208 (71.7759200d) Dec: +16 58 42.60 (16.97850d) Equinox: J2000	Proper Motion RA: 3.6295285040981303E-4 sec of time/yr Proper Motion Dec: -0.013888999978917127 arcsec/yr Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[Circumstellar disks, Pre-main sequence stars, Protoplanetary disks, Young stellar objects]
Extended=NO

Acquisition

#	Target	Acquisition Mode	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	1 V-DR-TAU	SOSSBRIGHT	F480M	NISRAPID	3	1	1	0.202	144138

Template

Subarray	Include F277W Exposure?
SUBSTRIP96	true

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	NISRAPID	2	1350	1	1350	8994.348	144138
2	NISRAPID	2	2	1	2	13.325	144138

Special Requirements

Between Dates 21-SEP-2023:00:00:00 and 20-OCT-2023:00:00:00
Time Series Observation
No Parallel Attachments

2 After 1 by 91 Days to <None specified>

Observation

Proposal 3596, Observation 2

Thu Jun 01 23:00:28 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRISS Single-Object Slitless Spectroscopy

Diagnostics

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	V-DR-TAU	RA: 04 47 6.2208 (71.7759200d) Dec: +16 58 42.60 (16.97850d) Equinox: J2000	Proper Motion RA: 3.6295285040981303E-4 sec of time/yr Proper Motion Dec: -0.013888999978917127 arcsec/yr Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Star
Description=[Circumstellar disks, Pre-main sequence stars, Protoplanetary disks, Young stellar objects]
Extended=NO

Acquisition

#	Target	Acquisition Mode	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	1 V-DR-TAU	SOSSBRIGHT	F480M	NISRAPID	3	1	1	0.202	144138

Template

Subarray	Include F277W Exposure?
SUBSTRIP96	true

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	NISRAPID	2	1350	1	1350	8994.348	144138
2	NISRAPID	2	2	1	2	13.325	144138

Special Requirements

Time Series Observation
No Parallel Attachments

2 After 1 by 91 Days to <None specified>