



# 1621 - Testing the emerging paradigm of wind-driven accretion with NIRSpec spectro-imaging

Cycle: 1, Proposal Category: GO

## INVESTIGATORS

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## OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
NIRSpec IFU				
	1	HH30	NIRSpec IFU Spectroscopy	(1) HH30
	2	TAU042021	NIRSpec IFU Spectroscopy	(2) TAU042021
	3	IRAS04302	NIRSpec IFU Spectroscopy	(3) IRAS04302

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
	4	HKTAUB	NIRSpec IFU Spectroscopy	(4) HKTAUB
	5	FSTAUB	NIRSpec IFU Spectroscopy	(5) FSTAUB

## ABSTRACT

We may be at the brink of a paradigm shift in our understanding of how protoplanetary disks evolve, a shift that would have major implications for planet formation. Departing from MRI-driven turbulence, the emerging theoretical scenario relies on MHD disk winds to vertically extract angular momentum and thus enable accretion of disk gas onto the star. However, wind-driven accretion requires that: i) MHD winds are radially extended out to tens of au; and ii) wind mass loss rates are an order of magnitude higher than in jets, i.e. comparable to mass accretion rates. Here, we propose to carry out deep NIRSpec/IFU spectro-imaging from  $\sim 1$  to 5 micron to simultaneously cover multiple jet, wind, and accretion diagnostics and specifically test these key theoretical predictions. With an IFU spaxel of 0.1", our sample of five well-characterized edge-on disks in Taurus, with no or minimal envelope, is ideally suited to map the radial and vertical extent of MHD disk winds. By setting the sensitivity to detect over ten H<sub>2</sub> rovibrational lines and three critical [FeII] lines, we will measure densities and temperatures in the wind and jet, respectively. In combination with the first direct measurements of the wind vertical extent, we will estimate mass loss rates. Through the first sensitive high-resolution thermal images in the CO fundamental we will also probe the wind closer to its launch height and reveal to what extent volatiles are depleted from the disk. Finally, by covering the stellar masses over which jets and winds have been inferred from ground-based data, our spatially resolved images will guide mass loss rate estimates for all sources that have slow wind signatures.

## OBSERVING DESCRIPTION

These observations aim at spatially resolving jets and disk winds with NIRSpec/IFU. We have selected 5 edge-on disks (IRAS 04302, HKTauB, FSTauB, HH30, and Tau042021) so that the vertical & radial extent of the wind can be well mapped. We have selected 3 high-resolution grating-filter combinations (G140H/F100LP, G235H/F170LP, and G395H/F290LP) to detect multiple jet and wind diagnostics, as well as stellar accretion rate tracers. The G395H for HKTauB is covered by the MIRI/GTO program 1282 (PI, Th. Henning), hence not included here.

Proposal 1621 - Targets - Testing the emerging paradigm of wind-driven accretion with NIRSpec spectro-imaging

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	HH30	RA: 04 31 37.4719 (67.9061329d) Dec: +18 12 24.48 (18.20680d) Equinox: J2000	Epoch of Position: 2015.5	
<p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>  <i>Category=Star</i>  <i>Description=[Circumstellar matter, Herbig-Haro objects, T Tauri stars, Young stellar objects]</i>  <i>Extended=YES</i></p>				
(2)	TAU042021	RA: 04 20 21.4428 (65.0893450d) Dec: +28 13 49.17 (28.23032d) Equinox: J2000	Epoch of Position: 2015.5	
<p><i>Comments:</i>  <i>Category=Star</i>  <i>Description=[Circumstellar matter, Herbig-Haro objects, T Tauri stars, Young stellar objects]</i>  <i>Extended=YES</i></p>				
(3)	IRAS04302	RA: 04 33 16.5010 (68.3187542d) Dec: +22 53 20.40 (22.88900d) Equinox: J2000	Epoch of Position: 2015.5	
<p><i>Comments:</i>  <i>Category=Star</i>  <i>Description=[Circumstellar matter, Herbig-Haro objects, T Tauri stars, Young stellar objects]</i>  <i>Extended=YES</i></p>				
(4)	HKTAUB	RA: 04 31 50.5800 (67.9607500d) Dec: +24 24 16.40 (24.40456d) Equinox: J2000	Epoch of Position: 2015.5	
<p><i>Comments:</i>  <i>Category=Star</i>  <i>Description=[Circumstellar matter, Herbig-Haro objects, T Tauri stars, Young stellar objects]</i>  <i>Extended=YES</i></p>				
(5)	FSTAUB	RA: 04 22 0.6974 (65.5029058d) Dec: +26 57 32.49 (26.95903d) Equinox: J2000	Epoch of Position: 2015.5	
<p><i>Comments:</i>  <i>Category=Star</i>  <i>Description=[Circumstellar matter, Herbig-Haro objects, T Tauri stars, Young stellar objects]</i>  <i>Extended=YES</i></p>				

Fixed Targets

Proposal 1621 - Observation 1 - Testing the emerging paradigm of wind-driven accretion with NIRSpec spectro-imaging

Wed Mar 31 00:02:45 GMT 2021

<b>Observation</b>	<p><b>Proposal 1621, Observation 1: HH30</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Observing Template: NIRSpec IFU Spectroscopy</p>											
<b>Diagnostics</b>	(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.											
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>			<b>Targ. Coord. Corrections</b>			<b>Miscellaneous</b>			
	(1)	HH30	RA: 04 31 37.4719 (67.9061329d) Dec: +18 12 24.48 (18.20680d) Equinox: J2000			Epoch of Position: 2015.5						
	<p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i></p> <p><i>Category=Star</i></p> <p><i>Description=[Circumstellar matter, Herbig-Haro objects, T Tauri stars, Young stellar objects]</i></p> <p><i>Extended=YES</i></p>											
<b>Template</b>	<b>TA Method</b>											
	NONE											
<b>Dithers</b>	<b>#</b>	<b>Dither Type</b>		<b>Size</b>	<b>Starting Point</b>			<b>Number of Points</b>	<b>Points</b>			
	1	4-POINT-DITHER										
<b>Spectral Elements</b>	<b>#</b>	<b>Grating/Filter</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Exp</b>	<b>Leakcal</b>	<b>Dither</b>	<b>Autocal</b>	<b>Total Dithers</b>	<b>Total Integrations</b>	<b>Total Exposure Time</b>	<b>ETC Wkbk.Calc ID</b>
	1	G140H/F100LP	NRSIRS2RAPI D	30	1	false	true	WAVECAL	4	4	1809.022	
	2	G235H/F170LP	NRSIRS2RAPI D	30	1	false	true	WAVECAL	4	4	1809.022	
	3	G395H/F290LP	NRSIRS2RAPI D	30	1	false	true	WAVECAL	4	4	1809.022	
<b>Special Requirements</b>	No Parallel											

Proposal 1621 - Observation 2 - Testing the emerging paradigm of wind-driven accretion with NIRSpec spectro-imaging

Wed Mar 31 00:02:45 GMT 2021

<b>Observation</b>	<p><b>Proposal 1621, Observation 2: TAU042021</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Observing Template: NIRSpec IFU Spectroscopy</p>											
<b>Diagnostics</b>	(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.											
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>			<b>Targ. Coord. Corrections</b>			<b>Miscellaneous</b>			
	(2)	TAU042021	RA: 04 20 21.4428 (65.0893450d) Dec: +28 13 49.17 (28.23032d) Equinox: J2000			Epoch of Position: 2015.5						
	<p><i>Comments:</i>  <i>Category=Star</i>  <i>Description=[Circumstellar matter, Herbig-Haro objects, T Tauri stars, Young stellar objects]</i>  <i>Extended=YES</i></p>											
<b>Template</b>	<b>TA Method</b>											
	NONE											
<b>Dithers</b>	<b>#</b>	<b>Dither Type</b>		<b>Size</b>	<b>Starting Point</b>			<b>Number of Points</b>	<b>Points</b>			
	1	4-POINT-DITHER										
<b>Spectral Elements</b>	<b>#</b>	<b>Grating/Filter</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Exp</b>	<b>Leakcal</b>	<b>Dither</b>	<b>Autocal</b>	<b>Total Dithers</b>	<b>Total Integrations</b>	<b>Total Exposure Time</b>	<b>ETC Wkbk.Calc ID</b>
	1	G140H/F100LP	NRSIRS2RAPI D	30	1	false	true	WAVECAL	4	4	1809.022	
	2	G235H/F170LP	NRSIRS2RAPI D	30	1	false	true	WAVECAL	4	4	1809.022	
	3	G395H/F290LP	NRSIRS2RAPI D	30	1	false	true	WAVECAL	4	4	1809.022	
<b>Special Requirements</b>	No Parallel											

Proposal 1621 - Observation 3 - Testing the emerging paradigm of wind-driven accretion with NIRSpec spectro-imaging

Wed Mar 31 00:02:45 GMT 2021

<b>Observation</b>	<p><b>Proposal 1621, Observation 3: IRAS04302</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Observing Template: NIRSpec IFU Spectroscopy</p>											
<b>Diagnostics</b>	(Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.											
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>			<b>Targ. Coord. Corrections</b>			<b>Miscellaneous</b>			
	(3)	IRAS04302	RA: 04 33 16.5010 (68.3187542d) Dec: +22 53 20.40 (22.88900d) Equinox: J2000			Epoch of Position: 2015.5						
	<p><i>Comments:</i>  <i>Category=Star</i>  <i>Description=[Circumstellar matter, Herbig-Haro objects, T Tauri stars, Young stellar objects]</i>  <i>Extended=YES</i></p>											
<b>Template</b>	<b>TA Method</b>											
	NONE											
<b>Dithers</b>	<b>#</b>	<b>Dither Type</b>		<b>Size</b>	<b>Starting Point</b>			<b>Number of Points</b>	<b>Points</b>			
	1	4-POINT-DITHER										
<b>Spectral Elements</b>	<b>#</b>	<b>Grating/Filter</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Exp</b>	<b>Leakcal</b>	<b>Dither</b>	<b>Autocal</b>	<b>Total Dithers</b>	<b>Total Integrations</b>	<b>Total Exposure Time</b>	<b>ETC Wkbk.Calc ID</b>
	1	G140H/F100LP	NRSIRS2RAPI D	30	1	false	true	WAVECAL	4	4	1809.022	
	2	G235H/F170LP	NRSIRS2RAPI D	30	1	false	true	WAVECAL	4	4	1809.022	
	3	G395H/F290LP	NRSIRS2RAPI D	30	1	false	true	WAVECAL	4	4	1809.022	
<b>Special Requirements</b>	No Parallel											

Proposal 1621 - Observation 4 - Testing the emerging paradigm of wind-driven accretion with NIRSpec spectro-imaging

Wed Mar 31 00:02:45 GMT 2021

<b>Observation</b>	<p><b>Proposal 1621, Observation 4: HKTAUB</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Observing Template: NIRSpec IFU Spectroscopy</p>											
<b>Diagnostics</b>	(Visit 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.											
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>			<b>Targ. Coord. Corrections</b>			<b>Miscellaneous</b>			
	(4)	HKTAUB	RA: 04 31 50.5800 (67.9607500d) Dec: +24 24 16.40 (24.40456d) Equinox: J2000			Epoch of Position: 2015.5						
	<p><i>Comments:</i>  <i>Category=Star</i>  <i>Description=[Circumstellar matter, Herbig-Haro objects, T Tauri stars, Young stellar objects]</i>  <i>Extended=YES</i></p>											
<b>Template</b>	<b>TA Method</b>											
	NONE											
<b>Dithers</b>	<b>#</b>	<b>Dither Type</b>		<b>Size</b>	<b>Starting Point</b>			<b>Number of Points</b>	<b>Points</b>			
	1	4-POINT-DITHER										
<b>Spectral Elements</b>	<b>#</b>	<b>Grating/Filter</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Exp</b>	<b>Leakcal</b>	<b>Dither</b>	<b>Autocal</b>	<b>Total Dithers</b>	<b>Total Integrations</b>	<b>Total Exposure Time</b>	<b>ETC Wkbk.Calc ID</b>
	1	G140H/F100LP	NRSIRS2RAPI D	30	1	false	true	WAVECAL	4	4	1809.022	
	2	G235H/F170LP	NRSIRS2RAPI D	30	1	false	true	WAVECAL	4	4	1809.022	
<b>Special Requirements</b>	No Parallel											

Proposal 1621 - Observation 5 - Testing the emerging paradigm of wind-driven accretion with NIRSpec spectro-imaging

Wed Mar 31 00:02:45 GMT 2021

<b>Observation</b>	<p><b>Proposal 1621, Observation 5: FSTAUB</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Observing Template: NIRSpec IFU Spectroscopy</p>											
<b>Diagnostics</b>	(Visit 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.											
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>			<b>Targ. Coord. Corrections</b>			<b>Miscellaneous</b>			
	(5)	FSTAUB	RA: 04 22 0.6974 (65.5029058d) Dec: +26 57 32.49 (26.95903d) Equinox: J2000			Epoch of Position: 2015.5						
	<p><i>Comments:</i>  <i>Category=Star</i>  <i>Description=[Circumstellar matter, Herbig-Haro objects, T Tauri stars, Young stellar objects]</i>  <i>Extended=YES</i></p>											
<b>Template</b>	<b>TA Method</b>											
	NONE											
<b>Dithers</b>	<b>#</b>	<b>Dither Type</b>		<b>Size</b>	<b>Starting Point</b>			<b>Number of Points</b>	<b>Points</b>			
	1	4-POINT-DITHER										
<b>Spectral Elements</b>	<b>#</b>	<b>Grating/Filter</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Exp</b>	<b>Leakcal</b>	<b>Dither</b>	<b>Autocal</b>	<b>Total Dithers</b>	<b>Total Integrations</b>	<b>Total Exposure Time</b>	<b>ETC Wkbk.Calc ID</b>
	1	G140H/F100LP	NRSIRS2RAPI D	30	1	false	true	WAVECAL	4	4	1809.022	
	2	G235H/F170LP	NRSIRS2RAPI D	30	1	false	true	WAVECAL	4	4	1809.022	
	3	G395H/F290LP	NRSIRS2RAPI D	30	1	false	true	WAVECAL	4	4	1809.022	
<b>Special Requirements</b>	No Parallel											