



7085 - Dust Evolution in Molecular Cores

Cycle: 4, Proposal Category: GO

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
Dr. Roberta Paladini (PI)	California Institute of Technology
Dr. Joao Alves (CoI) (ESA Member)	University of Vienna
Dr. Matthew L. N. Ashby (CoI)	Smithsonian Institution Astrophysical Observatory
Dr. Abraham C. Boogert (CoI)	University of Hawaii
Dr. Laurent Cambresy (CoI) (ESA Member)	Observatoire Astronomique de Strasbourg
Dr. Laurie E Chu (CoI)	Eureka Scientific Inc.
Dr. Emmanuel Dartois (CoI) (ESA Member)	Universite Paris-Saclay
Dr. Marjorie Decleir (CoI) (ESA Member)	Space Telescope Science Institute - ESA
Dr. Karine Demyk (CoI) (ESA Member)	Institut de Recherche en Astrophysique et Planetologie
Dr. Bruce T. Draine (CoI)	Princeton University
Dr. Yasuhiro Hasegawa (CoI)	Jet Propulsion Laboratory
Dr. Brandon S. Hensley (CoI)	California Institute of Technology
Dr. Klaus Werner Hodapp (CoI)	University of Hawaii
Dr. Tracy L. Huard (CoI)	University of Maryland
Dr. Mika Juvela (CoI) (ESA Member)	University of Helsinki
Dr. Wanggi Lim (CoI)	California Institute of Technology
Dr. Alberto Noriega-Crespo (CoI)	Space Telescope Science Institute
Dr. Laurent Pagani (CoI) (ESA Member)	Observatoire de Paris
Dr. Yvonne Jean Pendleton (CoI)	University of Central Florida Board of Trustees
Dr. Klaus M. Pontoppidan (CoI)	Jet Propulsion Laboratory
Dr. Isabelle Ristorcelli (CoI) (ESA Member)	Institut de Recherche en Astrophysique et Planetologie
Prof. Jonathan Charles Tan (CoI) (ESA Member)	Chalmers University of Technology
Dr. Nathalie Ysard (CoI) (ESA Member)	Institut de Recherche en Astrophysique et Planetologie

OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
Observation Folder				
	1	b68 plan v9	NIRSpec MultiObject Spectroscopy	(4) B68-MSA-Update-4
	2	b335 plan v1	NIRSpec MultiObject Spectroscopy	(2) B335-MASTER
	3	l694 v2	NIRSpec MultiObject Spectroscopy	(3) SELECTION-L694

ABSTRACT

We propose to constrain the initial stages of grain growth in early sites of star formation. This objective will be achieved by obtaining NIRSpec MSA spectroscopic observations of background stars behind three dense molecular cores of different evolutionary stages. By employing background stars, we will avoid uncertainties arising when embedded sources, with uncertain IR excesses, are used. The proposed observations will provide unprecedented spectroscopic information on the systematic variation of the extinction curve with depth into the cloud, at levels of extinction that were not possible to probe before JWST.

OBSERVING DESCRIPTION

We propose to perform NIRSpec Multi-Shutter Array (MSA) spectroscopic observations of background stars as seen behind three Galactic cores (B68, L694-2, B335) at different evolutionary stages. Our catalogs of background stars contain large numbers of stars through which we can study the three cores (427, 387 and 331 stars behind the B68, L694-2 and B335 cores, respectively). The observations will be executed in the G140H/F100LP, G235H/F170LP and the G395H/F290LP filters in the high-spectral resolution mode.

Given the astrometric accuracy of our source catalogs, we selected the MSATA Target Acquisition method. In addition, the aperture PA is set to 50.0 (B68) and 0.0 (B335/L694-2). We will use 13 groups per integration and 1 integration per exposure, with a NRSIRS2 readout pattern, which allows optimizing data volume. In order to obtain a uniform spatial and spectral coverage for the targets in each of the molecular cores, as well as to mitigate leakage signal through the MSA, we will use two configurations per core with the recommended 3-shutter slitlet nod pattern.

Finally, using the imaging mirror of NIRSpec, we will take confirmation images, in the Target Acquisition and New MSA Config mode, with 10 groups per integration, 1 integration per exposure, and by using the NRSIRS2RAPID readout pattern. These confirmation images will be used to analyze the position of science sources through the open shutter slitlets.

The total requested time is 24.10 hrs, with 14.48 hrs of science time, for a corresponding efficiency of 60%.

Proposal 7085 - Targets - Dust Evolution in Molecular Cores

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(2)	B335-MASTER	RA: 19 36 58.9344 (294.2455600d) Dec: +07 34 20.17 (7.57227d) Equinox: J2000		
	Comments: Description=[]				
	(3)	SELECTION-L694	RA: 19 41 5.7374 (295.2739058d) Dec: +10 58 59.39 (10.98316d) Equinox: J2000		
	Comments: Description=[]				
	(4)	B68-MSA-Update-4	RA: 17 22 39.4350 (260.6643125d) Dec: -23 49 43.00 (-23.82861d) Equinox: J2000		
	Comments: Description=[]				

Proposal 7085 - Observation 1 - Dust Evolution in Molecular Cores

Observation	Proposal 7085, Observation 1: b68 plan v9										Tue Jul 21 17:00:28 GMT 2026
	Diagnostic Status: Warning										
Observing Template: NIRSpect MultiObject Spectroscopy											
Diagnostics	(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.										
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections			Miscellaneous		
	(4)	B68-MSA-Update-4	RA: 17 22 39.4350 (260.6643125d) Dec: -23 49 43.00 (-23.82861d) Equinox: J2000								
Comments: Description=[]											
Acquisition	#	Reference Star Bin	Target	Filter	MSA Configuration	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID
	1	Filter: F110W; Readout: NRSRAPIDD6; 8 sources in 4 quads; [Reduced Accuracy]	SAME	F110W	Auto Acq MSA Config	NRSRAPIDD6	3	1	4	687.153	
	2	Filter: F110W; Readout: NRSRAPID; 8 sources in 2 quads; [Reduced Accuracy]	SAME	F110W	Auto Acq MSA Config	NRSRAPID	3	1	4	171.788	
Template	TA Method	HFF Readout Mode	Obtain Confirmation Images	Science Aperture	Primary Candidate List	Filler Candidate List	Spectral Overlap Map	Spectral Overlap Threshold			
	MSATA	false	After Target ACQ and New MSA Config	MSA Center	B68-MSA-Update-4 (372 sources)		jwst-nirspec-hr	1.5			
Reference Stars	Visit	ID	RA	Dec	Magnitude	Visit	ID	RA	Dec	Magnitude	
	1	15	260.667252	-23.831889	21.4759598	1	300	260.678443	-23.823331	21.9952583	
	1	20	260.670725	-23.832081	21.54846	1	314	260.662634	-23.812173	21.4525585	
	1	90	260.627863	-23.829888	23.4675598	1	316	260.676709	-23.821292	22.0000	
	1	274	260.650536	-23.839736	21.5998592	1	340	260.649508	-23.840185	21.6392593	
	Visit	ID	RA	Dec	Magnitude	Visit	ID	RA	Dec	Magnitude	
	2	15	260.667252	-23.831889	21.4759598	2	282	260.647932	-23.835440	21.6423588	
	2	65	260.656919	-23.821350	21.9209595	2	290	260.677346	-23.814520	21.4104595	
	2	100	260.653117	-23.821028	21.8167591	2	340	260.649508	-23.840185	21.6392593	
	2	192	260.647663	-23.836363	21.1141586	2	365	260.648899	-23.840770	21.2200584	

Proposal 7085 - Observation 1 - Dust Evolution in Molecular Cores

Confirmation											
	#	Confirmation Type		Conf. Readout Pattern	Conf. Groups/Int	Conf. Integrations/Exp		Conf. Total Integrations		Conf. Total Exposure Time	
Spectral Elements	1	c1		NRSIRS2RAPID	10	1		1		160.478	
	2	c2		NRSIRS2RAPID	10	1		1		160.478	
	#	Exposure Specification	MSA Configuration	Nod Pattern	Pointing	Aperture PA	Dispersion Offset (Shutters)	Cross-Dispersion Offset (Shutters)	Total Dithers	Total Integrations	Total Exposure Time
	1	1 (G140H/F100LP)	c1	3 Shutter Slitlet	260.65216525 Degrees - 23.831109444444 45 Degrees	231.59293353988 076			3	3	2888.6
	2	2 (G235H/F170LP)	c1	3 Shutter Slitlet	260.65216525 Degrees - 23.831109444444 45 Degrees	231.59293353988 076			3	3	2888.6
	3	3 (G395H/F290LP)	c1	3 Shutter Slitlet	260.65216525 Degrees - 23.831109444444 45 Degrees	231.59293353988 076			3	3	2888.6
Special Requirements	4	1 (G140H/F100LP)	c2	3 Shutter Slitlet	260.68118379166 67 Degrees - 23.832395833333 35 Degrees	231.58120970540 037			3	3	2888.6
	5	2 (G235H/F170LP)	c2	3 Shutter Slitlet	260.68118379166 67 Degrees - 23.832395833333 35 Degrees	231.58120970540 037			3	3	2888.6
	6	3 (G395H/F290LP)	c2	3 Shutter Slitlet	260.68118379166 67 Degrees - 23.832395833333 35 Degrees	231.58120970540 037			3	3	2888.6
Group Visits within 53.0 Days Visits Same PA MSA Scheduled Aperture PA 231.5880 to 231.5880 Degrees (V3 93.01345 to 93.01345)											

Proposal 7085 - Observation 2 - Dust Evolution in Molecular Cores

Observation	Proposal 7085, Observation 2: b335 plan v1											Tue Jul 21 17:00:28 GMT 2026	
	Diagnostic Status: Error												
	Observing Template: NIRSpec MultiObject Spectroscopy												
Diagnostics	(b335 plan v1 (Obs 2)) Error (Form): This observation was created with an Aperture PA of 0.0000 but it has been assigned an Aperture PA of 239.3175												
	(Aperture PA) Error (Form): This observation was created with an Aperture PA of 0.0000 but it has been assigned an Aperture PA of 239.3175												
	(Visit 2:1) Error (Form): Reference stars are required but none were found for this visit												
	(b335 plan v1 (Obs 2)) Warning (Form): Config c1 (#1) has 9 master background shutters affected by failed open or closed shutters.												
	(b335 plan v1 (Obs 2)) Warning (Form): Config c1 (#2) has 9 master background shutters affected by failed open or closed shutters.												
	(b335 plan v1 (Obs 2)) Warning (Form): Config c1 (#3) has 9 master background shutters affected by failed open or closed shutters.												
	(b335 plan v1 (Obs 2)) Warning (Form): Config c2 (#4) has 9 master background shutters affected by failed open or closed shutters.												
	(b335 plan v1 (Obs 2)) Warning (Form): Config c2 (#5) has 9 master background shutters affected by failed open or closed shutters.												
	(b335 plan v1 (Obs 2)) Warning (Form): Config c2 (#6) has 9 master background shutters affected by failed open or closed shutters.												
Fixed Targets	(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.												
	#	Name		Target Coordinates		Targ. Coord. Corrections			Miscellaneous				
	(2)	B335-MASTER		RA: 19 36 58.9344 (294.2455600d) Dec: +07 34 20.17 (7.57227d) Equinox: J2000									
Acquisition	Comments: Description=[]												
	#	Reference Star Bin	Target	Filter	MSA Configuration	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID		
	1		SAME	F140X	Auto Acq MSA Config	NRSRAPID	3	1	4	171.788			
Template	TA Method		HFF Readout Mode		Obtain Confirmation Images	Science Aperture		Primary Candidate List		Filler Candidate List		Spectral Overlap Map	Spectral Overlap Threshold
	MSATA		false		After Target ACQ and New MSA Config	MSA Center		B335-high extinction (331 sources)		B335-MASTER (2448 sources)		jwst-nirspec-hr	1.5
Reference Stars													
Confirmation	#	Confirmation Type			Conf. Readout Pattern		Conf. Groups/Int		Conf. Integrations/Exp		Conf. Total Integrations		Conf. Total Exposure Time
	1	c1			NRSIRS2RAPID		10		1		1		160.478
	2	c2			NRSIRS2RAPID		10		1		1		160.478

Proposal 7085 - Observation 2 - Dust Evolution in Molecular Cores

	#	Exposure Specification	MSA Configuration	Nod Pattern	Pointing	Aperture PA	Dispersion Offset (Shutters)	Cross-Dispersion Offset (Shutters)	Total Dithers	Total Integrations	Total Exposure Time
Spectral Elements	1	1 (G140H/F100LP)	c1	3 Shutter Slitlet	294.25719183333 337 Degrees 7.5809111111111 11 Degrees	239.31905037172 098			3	3	2888.6
	2	2 (G235H/F170LP)	c1	3 Shutter Slitlet	294.25719183333 337 Degrees 7.5809111111111 11 Degrees	239.31905037172 098			3	3	2888.6
	3	3 (G395H/F290LP)	c1	3 Shutter Slitlet	294.25719183333 337 Degrees 7.5809111111111 11 Degrees	239.31905037172 098			3	3	2888.6
	4	1 (G140H/F100LP)	c2	3 Shutter Slitlet	294.25214779166 663 Degrees 7.5909111111111 11 Degrees	239.31836780918 58			3	3	2888.6
	5	2 (G235H/F170LP)	c2	3 Shutter Slitlet	294.25214779166 663 Degrees 7.5909111111111 11 Degrees	239.31836780918 58			3	3	2888.6
	6	3 (G395H/F290LP)	c2	3 Shutter Slitlet	294.25214779166 663 Degrees 7.5909111111111 11 Degrees	239.31836780918 58			3	3	2888.6
Special Requirements	MSA Scheduled Aperture PA 239.3175 to 239.3175 Degrees (V3 100.74297 to 100.74297)										

Proposal 7085 - Observation 3 - Dust Evolution in Molecular Cores

Observation	Proposal 7085, Observation 3: I694 v2											Tue Jul 21 17:00:28 GMT 2026		
	Diagnostic Status: Error													
Observing Template: NIRSpec MultiObject Spectroscopy														
Diagnostics	(I694 v2 (Obs 3)) Error (Form): This observation was created with an Aperture PA of 0.0000 but it has been assigned an Aperture PA of 240.6146													
	(Aperture PA) Error (Form): This observation was created with an Aperture PA of 0.0000 but it has been assigned an Aperture PA of 240.6146													
	(Visit 3:1) Error (Form): Reference stars are required but none were found for this visit													
	(I694 v2 (Obs 3)) Warning (Form): Config c1 (#1) has 12 master background shutters affected by failed open or closed shutters.													
	(I694 v2 (Obs 3)) Warning (Form): Config c1 (#2) has 12 master background shutters affected by failed open or closed shutters.													
	(I694 v2 (Obs 3)) Warning (Form): Config c1 (#3) has 12 master background shutters affected by failed open or closed shutters.													
	(I694 v2 (Obs 3)) Warning (Form): Config c2 (#4) has 3 master background shutters affected by failed open or closed shutters.													
	(I694 v2 (Obs 3)) Warning (Form): Config c2 (#5) has 3 master background shutters affected by failed open or closed shutters.													
	(I694 v2 (Obs 3)) Warning (Form): Config c2 (#6) has 3 master background shutters affected by failed open or closed shutters.													
Fixed Targets	(Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.													
	#	Name		Target Coordinates		Targ. Coord. Corrections			Miscellaneous					
	(3)	SELECTION-L694		RA: 19 41 5.7374 (295.2739058d) Dec: +10 58 59.39 (10.98316d) Equinox: J2000										
Comments: Description=[]														
Acquisition	#	Reference Star Bin	Target	Filter	MSA Configuration	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID			
	1		SAME	F140X	Auto Acq MSA Config	NRSRAPID	3	1	4	171.788				
Template	TA Method	HFF Readout Mode		Obtain Confirmation Images	Science Aperture	Primary Candidate List	Filler Candidate List	Spectral Overlap Map		Spectral Overlap Threshold				
	MSATA	false		After Target ACQ and New MSA Config	MSA Center	SELECTION-L694 (387 sources)	SELECTION-L694 (387 sources)	jwst-nirspec-hr		1.5				
Reference Stars														
Confirmation	#	Confirmation Type			Conf. Readout Pattern		Conf. Groups/Int		Conf. Integrations/Exp		Conf. Total Integrations		Conf. Total Exposure Time	
	1	c1			NRSIRS2RAPID		10		1		1		160.478	
	2	c2			NRSIRS2RAPID		10		1		1		160.478	

Proposal 7085 - Observation 3 - Dust Evolution in Molecular Cores

	#	Exposure Specification	MSA Configuration	Nod Pattern	Pointing	Aperture PA	Dispersion Offset (Shutters)	Cross-Dispersion Offset (Shutters)	Total Dithers	Total Integrations	Total Exposure Time
Spectral Elements	1	1 (G140H/F100LP)	c1	3 Shutter Slitlet	295.281342125 Degrees 10.952416666666 666 Degrees	240.61606314546 756			3	3	2888.6
	2	2 (G235H/F170LP)	c1	3 Shutter Slitlet	295.281342125 Degrees 10.952416666666 666 Degrees	240.61606314546 756			3	3	2888.6
	3	3 (G395H/F290LP)	c1	3 Shutter Slitlet	295.281342125 Degrees 10.952416666666 666 Degrees	240.61606314546 756			3	3	2888.6
	4	1 (G140H/F100LP)	c2	3 Shutter Slitlet	295.27624929166 666 Degrees 10.947416666666 667 Degrees	240.61510596412 083			3	3	2888.6
	5	2 (G235H/F170LP)	c2	3 Shutter Slitlet	295.27624929166 666 Degrees 10.947416666666 667 Degrees	240.61510596412 083			3	3	2888.6
	6	3 (G395H/F290LP)	c2	3 Shutter Slitlet	295.27624929166 666 Degrees 10.947416666666 667 Degrees	240.61510596412 083			3	3	2888.6
Special Requirements	MSA Scheduled Aperture PA 240.6146 to 240.6146 Degrees (V3 102.040016 to 102.040016)										