



2770 - Brown Dwarfs and Free-floating Planetary Mass Objects in Orion: Spectroscopy

Cycle: 2, Proposal Category: GTO

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
Dr. Mark J. McCaughrean (PI) (ESA Member)	European Space Agency - ESTEC
Dr. Samuel Pearson (CoI) (ESA Member)	European Space Agency - ESTEC

OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
Orion Nebula / Trapezium Cluster NIRSpec MSA spectroscopy				
	1	Combined_EastDeep4_ Mid1_West4	NIRSpec MultiObject Spectroscopy	(1) Catalogue_4
	2	Visit1_replanned_ver2	NIRSpec MultiObject Spectroscopy	(5) EastSide_HiConRefs

ABSTRACT

The origin of the stellar initial mass function (IMF) remains a mystery, despite many years of observational and theoretical work. One key issue is how far into the planetary-mass regime ‘free-floating objects’ can be found, and whether there is a cut-off in the IMF at the very lowest masses, deep into the brown dwarf regime. Embedded clusters in star-forming regions provide an excellent opportunity to search for such objects, as they are relatively warm and luminous when young. Models predict a minimum mass cut-off at a few M_{Jup}, and while ground- and space-based optical and near-infrared observations do show some objects at those limits, it is almost impossible to go any deeper in search of a cut-off without space-based thermal-IR imaging to catch cool (< 1000K) objects at ~1M_{Jup} and below (assuming a 1Myr age for the cluster).

In Cycle 1, we carried out a NIRCam imaging survey of the inner regions (~11 x 7.5 arcmin) of the Orion Nebula Cluster, where the density of cluster members is greatest and the background molecular cloud extinction (and thus shielding from field stars) is highest. In Cycle 2, we will obtain

spectroscopy for a range of photometrically-selected low-mass members of the cluster using the NIRSpec MSA and R~100 prism observations down to ~1Mjup and potentially lower.

Version 4: 2023-12-20 (reordered West4 configuration to reduce from 6 to 5 visits per suggestion in email from Dan Coe on 2023-12-18)

OBSERVING DESCRIPTION

We will carry out NIRSpec MSA spectroscopy in R~100 prism mode of very low-mass candidate brown dwarfs and free-floating planets in the inner ~11.5 x 7.5 arcmin of the Orion Nebula and Trapezium Cluster. The candidates will be selected from Cycle 1 NIRCам multi-filter imaging of the same region.

Six NIRSpec MSA pointings will be used to cover the region imaged, with specific pointings and object selections to be made once the Cycle 1 imaging has been obtained and analysed.

Proposal 2770 - Targets - Brown Dwarfs and Free-floating Planetary Mass Objects in Orion: Spectroscopy

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(1) <i>Comments:</i> <i>Description=[]</i>	Catalogue_4	RA: 05 35 14.5869 (83.8107787d) Dec: -05 23 13.43 (-5.38706d) Equinox: J2000		
(5) <i>Comments:</i> <i>Description=[]</i>	EastSide_HiConRefs	RA: 05 35 14.3266 (83.8096942d) Dec: -05 23 11.54 (-5.38654d) Equinox: J2000			

Proposal 2770 - Observation 1 - Brown Dwarfs and Free-floating Planetary Mass Objects in Orion: Spectroscopy

Thu Aug 15 18:00:36 GMT 2024

Observation	Proposal 2770, Observation 1: Combined_EastDeep4_Mid1_West4 Diagnostic Status: Warning Observing Template: NIRSpec MultiObject Spectroscopy				
	Diagnostics	(Combined_EastDeep4_Mid1_West4 (Obs 1)) Warning (Form): Config c1 : EastDeep3Fields (Obs 1) (#1) has 1 primary slits affected by failed closed shutters. (Combined_EastDeep4_Mid1_West4 (Obs 1)) Warning (Form): Config c1 : EastDeep3Fields (Obs 1) (#1) has 2 master background shutters affected by failed open or closed shutters. (Combined_EastDeep4_Mid1_West4 (Obs 1)) Warning (Form): Config c1 : Mid2 (#11) has 1 primary slit traces affected by failed open shutters. (Combined_EastDeep4_Mid1_West4 (Obs 1)) Warning (Form): Config c1 : West4 (#9) has 1 filler slits affected by failed closed shutters. (Combined_EastDeep4_Mid1_West4 (Obs 1)) Warning (Form): Config c1 : West4 (#9) has 1 master background shutters affected by failed open or closed shutters. (Combined_EastDeep4_Mid1_West4 (Obs 1)) Warning (Form): Config c2 : West4 (#7) has 1 master background shutters affected by failed open or closed shutters. (Combined_EastDeep4_Mid1_West4 (Obs 1)) Warning (Form): Config c3 : EastDeep3Fields (Obs 1) (#5) has 1 master background shutters affected by failed open or closed shutters. (Combined_EastDeep4_Mid1_West4 (Obs 1)) Warning (Form): Config c3 : West4 (#8) has 2 filler slits affected by failed closed shutters. (Combined_EastDeep4_Mid1_West4 (Obs 1)) Warning (Form): Config c4 : West4 (#10) has 3 filler slit traces affected by failed open shutters. (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. (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.			
Fixed Targets		#	Name	Target Coordinates	Targ. Coord. Corrections
		(1)	Catalogue_4	RA: 05 35 14.5869 (83.8107787d) Dec: -05 23 13.43 (-5.38706d) Equinox: J2000	
		Comments: Description=[]			

Proposal 2770 - Observation 1 - Brown Dwarfs and Free-floating Planetary Mass Objects in Orion: Spectroscopy

Acquisition	#	Reference Star Bin	Target	Filter	MSA Configuration	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
	1	Filter: F110W; Readout: NRSRAPIDD6; 8 sources in 4 quads; [Optimal TA Accuracy]	SAME	F110W	Auto Acq MSA Config	NRSRAPIDD6	3	1	4	687.153	
	2	Filter: F110W; Readout: NRSRAPIDD6; 8 sources in 4 quads; [Optimal TA Accuracy]	SAME	F110W	Auto Acq MSA Config	NRSRAPIDD6	3	1	4	687.153	
	3	Filter: F140X; Readout: NRSRAPIDD6; 8 sources in 4 quads; [Optimal TA Accuracy]	SAME	F140X	Auto Acq MSA Config	NRSRAPIDD6	3	1	4	687.153	
	4	Filter: F110W; Readout: NRSRAPIDD6; 8 sources in 4 quads; [Optimal TA Accuracy]	SAME	F110W	Auto Acq MSA Config	NRSRAPIDD6	3	1	4	687.153	
	5	Filter: F110W; Readout: NRSRAPID; 8 sources in 4 quads; [Optimal TA Accuracy]	SAME	F110W	Auto Acq MSA Config	NRSRAPID	3	1	4	171.788	
Template	TA Method	Obtain Confirmation Images	Science Aperture	Primary Candidate List	Filler Candidate List	Spectral Overlap Map	Spectral Overlap Threshold				
	MSATA	No	MSA Center	Primary (990 sources)	Filler (2267 sources)	jwst-nirspec-hr	1.5				

Proposal 2770 - Observation 1 - Brown Dwarfs and Free-floating Planetary Mass Objects in Orion: Spectroscopy

Reference Stars	Visit	ID	RA	Dec	Magnitude	Visit	ID	RA	Dec	Magnitude
	1	2155	83.846859	-5.399544	22.755764	1	2286	83.856732	-5.387897	22.086668
	1	2200	83.849486	-5.361987	22.151584	1	2442	83.871289	-5.389813	22.791837
	1	2218	83.850660	-5.401783	21.568399	1	2493	83.876944	-5.412868	22.534191
	1	2242	83.852633	-5.358972	22.350105	1	2736	83.898859	-5.381844	22.534224
	Visit	ID	RA	Dec	Magnitude	Visit	ID	RA	Dec	Magnitude
	2	422	83.745547	-5.378204	21.933062	2	875	83.780814	-5.377065	22.671231
	2	527	83.755245	-5.372179	22.255301	2	900	83.782534	-5.376599	22.463046
	2	561	83.757385	-5.328089	22.598953	2	1003	83.791264	-5.356243	21.787154
	2	573	83.758292	-5.370867	21.41158	2	1007	83.791354	-5.360448	22.234818
Visit	ID	RA	Dec	Magnitude	Visit	ID	RA	Dec	Magnitude	
3	59	83.721459	-5.375579	23.002214	3	426	83.745792	-5.384327	23.134691	
3	155	83.726742	-5.387249	22.498981	3	497	83.752848	-5.386061	22.972316	
3	287	83.736105	-5.369308	22.798115	3	507	83.753739	-5.386075	22.321212	
3	288	83.736113	-5.347691	22.981047	3	519	83.754718	-5.363193	22.3221	
Visit	ID	RA	Dec	Magnitude	Visit	ID	RA	Dec	Magnitude	
4	136	83.725688	-5.425247	21.486993	4	424	83.745642	-5.440088	22.419733	
4	252	83.733365	-5.382444	23.467046	4	504	83.753572	-5.443789	22.385162	
4	265	83.734444	-5.374750	23.315256	4	592	83.759602	-5.437783	22.540515	
4	386	83.743388	-5.442038	22.500379	4	771	83.773340	-5.410936	23.101712	
Visit	ID	RA	Dec	Magnitude	Visit	ID	RA	Dec	Magnitude	
5	959	83.787578	-5.423859	20.278736	5	1658	83.819937	-5.437317	20.039207	
5	967	83.788291	-5.425495	19.57569	5	1661	83.820097	-5.408835	19.611809	
5	1066	83.794535	-5.392454	19.855121	5	1725	83.822687	-5.400604	19.91801	
5	1130	83.798565	-5.393959	20.286019	5	1815	83.826304	-5.399939	20.364293	

Proposal 2770 - Observation 1 - Brown Dwarfs and Free-floating Planetary Mass Objects in Orion: Spectroscopy

#	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 (PRISM/CLEAR)	c1 : EastDeep3Fields (Obs 1)	3 Shutter Slitlet	83.869812875 Degrees - 5.38099611111111 31 Degrees	210.15109383531 427			3	30	3939.0
2	1 (PRISM/CLEAR)	ALLCLOSED : EastDeep3Fields (Obs 1)	3 Shutter Slitlet	83.869812875 Degrees - 5.38099611111111 31 Degrees	210.15109383531 427			3	30	3939.0
3	1 (PRISM/CLEAR)	c2 : EastDeep3Fields (Obs 1)	3 Shutter Slitlet	83.879872833333 34 Degrees - 5.36818194444444 73 Degrees	210.15013484364 55			3	30	3939.0
4	1 (PRISM/CLEAR)	ALLCLOSED copy : EastDeep3Fields (Obs 1)	3 Shutter Slitlet	83.879872833333 34 Degrees - 5.36818194444444 73 Degrees	210.15013484364 55			3	30	3939.0
5	1 (PRISM/CLEAR)	c3 : EastDeep3Fields (Obs 1)	3 Shutter Slitlet	83.881300958333 33 Degrees - 5.38121611111110 87 Degrees	210.15002719541 01			3	30	3939.0
6	1 (PRISM/CLEAR)	ALLCLOSED copy 2 : EastDeep3Fields (Obs 1)	3 Shutter Slitlet	83.881300958333 33 Degrees - 5.38121611111110 87 Degrees	210.15002719541 01			3	30	3939.0
7	2 (PRISM/CLEAR)	c2 : West4	3 Shutter Slitlet	83.770062166666 66 Degrees - 5.3614663888889 14 Degrees	210.16034634089 13			3	27	3545.1
8	2 (PRISM/CLEAR)	c3 : West4	3 Shutter Slitlet	83.744844333333 33 Degrees - 5.36486944444444 23 Degrees	210.16271078313 12			3	27	3545.1
9	2 (PRISM/CLEAR)	c1 : West4	3 Shutter Slitlet	83.748327708333 33 Degrees - 5.38101916666666 47 Degrees	210.16241976767 867			3	27	3545.1
10	2 (PRISM/CLEAR)	c4 : West4	3 Shutter Slitlet	83.7439625 Degrees - 5.41061916666666 63 Degrees	210.16288855922 49			3	27	3545.1
11	2 (PRISM/CLEAR)	c1 : Mid2	3 Shutter Slitlet	83.803027083333 33 Degrees - 5.41808611111111 085 Degrees	210.15738186459 527			3	27	3545.1
Special Requirements	Group Visits within 53.0 Days Visits Same PA MSA Scheduled Aperture PA 210.1566 to 210.1566 Degrees (V3 71.582 to 71.582)									

Proposal 2770 - Observation 2 - Brown Dwarfs and Free-floating Planetary Mass Objects in Orion: Spectroscopy

Thu Aug 15 18:00:36 GMT 2024

Observation	Proposal 2770, Observation 2: Visit1_replanned_ver2 Diagnostic Status: Warning Observing Template: NIRSpec MultiObject Spectroscopy																																																											
	(Visit1_replanned_ver2 (Obs 2)) Warning (Form): Interleaving MSA configurations in a visit increases MSA shutter configuration changes. (Visit1_replanned_ver2 (Obs 2)) Warning (Form): NIRSpec MOS science exposures should not normally use the ALLOPEN or ALLCLOSED MSA configurations. (Visit1_replanned_ver2 (Obs 2)) Warning (Form): NIRSpec MOS science exposures should not normally use the ALLOPEN or ALLCLOSED MSA configurations. (Visit1_replanned_ver2 (Obs 2)) Warning (Form): NIRSpec MOS science exposures should not normally use the ALLOPEN or ALLCLOSED MSA configurations. (Visit 2:1) Warning (Form): Data Excess over middle threshold (Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.																																																											
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Acquisition	<table border="1"> <thead> <tr> <th>TA Method</th> <th>Obtain Confirmation Images</th> <th>Science Aperture</th> <th>Primary Candidate List</th> <th>Filler Candidate List</th> <th>Spectral Overlap Map</th> <th>Spectral Overlap Threshold</th> </tr> </thead> <tbody> <tr> <td>MSATA</td> <td>No</td> <td>MSA Center</td> <td>PriSub (895 sources)</td> <td>FillerSub (1142 sources)</td> <td>jwst-nirspec-prism</td> <td>1.5</td> </tr> </tbody> </table>										TA Method	Obtain Confirmation Images	Science Aperture	Primary Candidate List	Filler Candidate List	Spectral Overlap Map	Spectral Overlap Threshold	MSATA	No	MSA Center	PriSub (895 sources)	FillerSub (1142 sources)	jwst-nirspec-prism	1.5																																				
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Proposal 2770 - Observation 2 - Brown Dwarfs and Free-floating Planetary Mass Objects in Orion: Spectroscopy

	#	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 (PRISM/CLEAR)	c1 : RefStarVisit_8So urces3Quads	3 Shutter Slitlet	83.8674975 Degrees - 5.4019472222222 475 Degrees	49.275642893844 3			3	24	4551.734
	2	1 (PRISM/CLEAR)	ALLCLOSED	3 Shutter Slitlet	83.8674975 Degrees - 5.4019472222222 475 Degrees	49.275642893844 3			3	24	4551.734
	3	1 (PRISM/CLEAR)	c1 : 40_40window_2 Configs_4	3 Shutter Slitlet	83.861848291666 66 Degrees - 5.4039291666666 71 Degrees	49.276169023752 765			3	24	4551.734
	4	1 (PRISM/CLEAR)	ALLCLOSED	3 Shutter Slitlet	83.861848291666 66 Degrees - 5.4039291666666 71 Degrees	49.276169023752 765			3	24	4551.734
	5	1 (PRISM/CLEAR)	c2 : 40_40window_2 Configs_4	3 Shutter Slitlet	83.861689875 Degrees - 5.4034052777777 79 Degrees	49.276184978940 86			3	24	4551.734
	6	1 (PRISM/CLEAR)	ALLCLOSED	3 Shutter Slitlet	83.861689875 Degrees - 5.4034052777777 79 Degrees	49.276184978940 86			3	24	4551.734
Special Requirements	MSA Scheduled Aperture PA 49.2811 to 49.2811 Degrees (V3 270.7065 to 270.7065)										