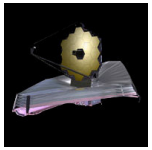

4757 - Using water to test for variation in the stellar initial mass function

Cycle: 3, Proposal Category: GO

INVESTIGATORS

Name	*Institution*
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Prof. Charlie Conroy (CoI)	Harvard University

OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1	NGC1407 IFU	NIRSpec IFU Spectroscopy	(1) NGC1407
	2	NGC1277 IFU	NIRSpec IFU Spectroscopy	(2) NGC1277
	3	NGC1600 IFU	NIRSpec IFU Spectroscopy	(3) NGC1600
	4	NGC2695 IFU	NIRSpec IFU Spectroscopy	(4) NGC2695
	5	ESO325-G004 IFU	NIRSpec IFU Spectroscopy	(5) ESO325-G004
	6	B163-G217 IFU	NIRSpec IFU Spectroscopy	(6) B163-G217
	7	B193-G244 IFU	NIRSpec IFU Spectroscopy	(7) B193-G244

ABSTRACT

Despite many years of effort, the question whether the form of the stellar initial mass function (IMF) is universal or varies in different environments is still not settled. Of particular current relevance is the IMF in the central regions of the most massive galaxies: several lines of evidence suggest that it is bottom-heavy, with an excess of low mass stars, and this would have direct implications for the stellar masses that are assigned to JWST-discovered galaxies at the highest redshifts. The strongest and clearest spectral signature of low mass stars in the integrated light of old stellar populations is H2O absorption, with a sharp onset at 1.33 micron. So far H2O has not been used in IMF studies, as the strong absorption in our own atmosphere makes it impossible to observe this feature from the ground. Here we propose to measure the 1.33 micron H2O feature with the NIRSpec IFU to test whether the IMF varies with environment. The sample of seven objects includes several galaxies with a claimed extremely bottom-heavy

IMF as well as two metal-rich and old M31 globular clusters as a control to verify the method. A secondary goal is to measure the spatial variation of the 1.33 micron feature on 0.1" scales, and to determine whether radial gradients seen with other IMF indicators on much larger scales continue all the way into the center.

OBSERVING DESCRIPTION

The program has 7 targets, 5 early-type galaxies and 2 M31 globular clusters.

All observations are done with the NIRSpec IFU.
The early-type galaxies will be observed with the G140M/F100LP grating as well as short exposures with the Prism.
The globular clusters will only be observed with the G140M grating.

The S/N ratio will be high (~100 per r=0.1 aperture), and no background subtraction should be needed. There is some concern that leakage from open shutters impacts the observations, as the flux is fairly high even away from the centers of the galaxies. Short LEAKCAL exposures are therefore included in the G140M observations - mostly to identify spaxels that are badly affected so they can be masked.

No acquisition is needed as the pointing error can be tolerated.
We can reconstruct the exact pointing by comparing the flux distribution in the IFU field to existing HST images.

A 4-point dither pattern improves the sampling and mitigates the effects of bad pixels and other defects.

The S/N ratios in the workbook are calculated for the brightest pixel as saturation is a concern for some of the galaxies.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	NGC1407	RA: 03 40 11.8601 (55.0494171d) Dec: -18 34 48.40 (-18.58011d) Equinox: J2000	Parallax: 0" Epoch of Position: 2000	
Comments: *Category=Galaxy* *Description=[Elliptical galaxies]* *Extended=YES*				
(2)	NGC1277	RA: 03 19 51.4901 (49.9645421d) Dec: +41 34 24.70 (41.57353d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Epoch of Position: 2000	
Comments: *Category=Galaxy* *Description=[Elliptical galaxies]* *Extended=YES*				
(3)	NGC1600	RA: 04 31 39.9401 (67.9164171d) Dec: -05 05 10.50 (-5.08625d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Epoch of Position: 2000	
Comments: *Category=Galaxy* *Description=[Elliptical galaxies]* *Extended=YES*				
(4)	NGC2695	RA: 08 54 27.0701 (133.6127921d) Dec: -03 04 1.30 (-3.06703d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Epoch of Position: 2000	
Comments: *Category=Galaxy* *Description=[Lenticular galaxies]* *Extended=YES*				
(5)	ESO325-G004	RA: 13 43 33.1999 (205.8883329d) Dec: -38 10 33.60 (-38.17600d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Epoch of Position: 2000	
Comments: *Category=Galaxy* *Description=[Elliptical galaxies]*				
(6)	B163-G217	RA: 00 43 17.6400 (10.8235000d) Dec: +41 27 45.00 (41.46250d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Epoch of Position: 2000	
Comments: *Category=Stellar Cluster* *Description=[Globular star clusters]* *Extended=YES*				
(7)	B193-G244	RA: 00 43 45.5200 (10.9396667d) Dec: +41 36 57.60 (41.61600d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Epoch of Position: 2000	
Comments: *Category=Stellar Cluster* *Description=[Globular star clusters]* *Extended=YES*				

Observation

Proposal 4757, Observation 1: NGC1407 IFU

Thu Feb 29 21:02:39 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Diagnostics

(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)	NGC1407	RA: 03 40 11.8601 (55.0494171d) Dec: -18 34 48.40 (-18.58011d) Equinox: J2000	Parallax: 0" Epoch of Position: 2000	

Comments:
Category=Galaxy
Description=[Elliptical galaxies]
Extended=YES

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	4-POINT-DITHER				

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G140M/F100LP	NRSIRS2	8	1	false	true	NONE	4	4	2392.578	173046
2	G140M/F100LP	NRSIRS2	2	1	true	true	NONE	4	4	641.911	173046
3	PRISM/CLEAR	NRSRAPID	8	1	false	true	NONE	4	4	386.524	173046

Observation

Proposal 4757, Observation 2: NGC1277 IFU

Thu Feb 29 21:02:39 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec IFU 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
(2)	NGC1277	RA: 03 19 51.4901 (49.9645421d) Dec: +41 34 24.70 (41.57353d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Epoch of Position: 2000	

Comments:
Category=Galaxy
Description=[Elliptical galaxies]
Extended=YES

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	4-POINT-DITHER				

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G140M/F100LP	NRSIRS2	8	1	false	true	NONE	4	4	2392.578	173046
2	G140M/F100LP	NRSIRS2	2	1	true	true	NONE	4	4	641.911	173046
3	PRISM/CLEAR	NRSRAPID	8	1	false	true	NONE	4	4	386.524	173046

Observation

Proposal 4757, Observation 3: NGC1600 IFU

Thu Feb 29 21:02:39 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Diagnostics

(Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(3)	NGC1600	RA: 04 31 39.9401 (67.9164171d) Dec: -05 05 10.50 (-5.08625d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Epoch of Position: 2000	

Comments:
Category=Galaxy
Description=[Elliptical galaxies]
Extended=YES

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	4-POINT-DITHER				

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G140M/F100LP	NRSIRS2	12	1	false	true	NONE	4	4	3559.689	173046
2	G140M/F100LP	NRSIRS2	2	1	true	true	NONE	4	4	641.911	173046
3	PRISM/CLEAR	NRSRAPID	8	1	false	true	NONE	4	4	386.524	173046

Observation

Proposal 4757, Observation 4: NGC2695 IFU

Thu Feb 29 21:02:39 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Diagnostics

(Visit 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(4)	NGC2695	RA: 08 54 27.0701 (133.6127921d) Dec: -03 04 1.30 (-3.06703d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Epoch of Position: 2000	

Comments:
Category=Galaxy
Description=[Lenticular galaxies]
Extended=YES

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	4-POINT-DITHER				

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G140M/F100LP	NRSIRS2	6	1	false	true	NONE	4	4	1809.022	173046
2	G140M/F100LP	NRSIRS2	2	1	true	true	NONE	4	4	641.911	173046
3	PRISM/CLEAR	NRSRAPID	4	1	false	true	NONE	4	4	214.735	173046

Observation

Proposal 4757, Observation 5: ESO325-G004 IFU

Thu Feb 29 21:02:39 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Diagnostics

(Visit 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(5)	ESO325-G004	RA: 13 43 33.1999 (205.8883329d) Dec: -38 10 33.60 (-38.17600d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Epoch of Position: 2000	

Comments:
Category=Galaxy
Description=[Elliptical galaxies]

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	4-POINT-DITHER				

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G140M/F100LP	NRSIRS2	10	1	false	true	NONE	4	4	2976.134	173046
2	G140M/F100LP	NRSIRS2	2	1	true	true	NONE	4	4	641.911	173046
3	PRISM/CLEAR	NRSRAPID	8	1	false	true	NONE	4	4	386.524	173046

Observation

Proposal 4757, Observation 6: B163-G217 IFU

Thu Feb 29 21:02:39 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Diagnostics

(Visit 6:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(6)	B163-G217	RA: 00 43 17.6400 (10.8235000d) Dec: +41 27 45.00 (41.46250d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Epoch of Position: 2000	

Comments:
Category=Stellar Cluster
Description=[Globular star clusters]
Extended=YES

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	4-POINT-DITHER				

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G140M/F100LP	NRSIRS2RAPID	15	1	false	true	NONE	4	4	933.689	173046
2	G140M/F100LP	NRSIRS2RAPID	2	1	true	true	NONE	4	4	175.067	173046

Observation

Proposal 4757, Observation 7: B193-G244 IFU

Thu Feb 29 21:02:39 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Diagnostics

(Visit 7:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(7)	B193-G244	RA: 00 43 45.5200 (10.9396667d) Dec: +41 36 57.60 (41.61600d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Epoch of Position: 2000	

Comments:
Category=Stellar Cluster
Description=[Globular star clusters]
Extended=YES

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	4-POINT-DITHER				

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G140M/F100LP	NRSIRS2RAPID	15	1	false	true	NONE	4	4	933.689	173046
2	G140M/F100LP	NRSIRS2RAPID	2	1	true	true	NONE	4	4	175.067	173046