



9881 - The last pristine islands in the Universe - PopIII stars before cosmic noon

Cycle: 5, Proposal Category: GO

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
Prof. Roberto Maiolino (PI) (ESA Member)	University of Cambridge
Dr. Valentina D'Odorico (CoI) (ESA Member) (CoPI)	INAF - Osservatorio Astronomico di Trieste
Prof. Stefania Salvadori (CoI) (ESA Member) (CoPI)	Universita di Firenze
Dr. Francesco D'Eugenio (CoI) (ESA Member)	University of Cambridge, Kavli Institute for Cosmology
Prof. Stefano Carniani (CoI) (ESA Member)	Scuola Normale Superiore, Pisa
Dr. Mirko Curti (CoI) (ESA Member)	INAF - Osservatorio di Astrofisica e Scienza dello Spazio
Dr. Andrea Pallottini (CoI) (ESA Member)	Universita di Pisa
Andrea Saccardi (CoI) (ESA Member)	Observatoire de Paris
Dr. James Trussler (CoI) (US Admin CoI)	Harvard University
Dr. Hannah Uebler (CoI) (ESA Member)	Max Planck Institute for Extraterrestrial Physics
Dr. Jan Scholtz (CoI) (ESA Member)	University of Cambridge, Kavli Institute for Cosmology
Elka Rusta (CoI) (ESA Member)	Universita di Firenze
Dr. Viola Gelli (CoI) (ESA Member)	University of Copenhagen, Niels Bohr Institute
Ms. Irene Vanni (CoI) (ESA Member)	Universita di Firenze

OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
IFS observation of J1658				
	1	IFS observation of J1658	NIRSpec IFU Spectroscopy	(1) J1658-0739
		8		

ABSTRACT

Searching for the first generation of 'PopIII' stars is one of the primary goals of JWST, with enormous implications for our understanding of the physics of massive stars, of the first key stages of chemical enrichment and reionization, and the formation and seeding of black holes and galaxies. Yet three years into the mission, this prize still eludes us all, a testament to the challenge of detecting short-lived, faint proto-galaxies at cosmological distances. While models predict that PopIII stars can still form as late as $z=3$ (which would be much easier to detect), they are extremely rare at these more recent epochs. However, the novel discovery of carbon-enhanced, metal-poor absorbing systems at $z\sim 3$ implies that the exotic stellar populations responsible for these unique enrichment patterns cannot be far, providing indirect signatures of nearby PopIII. We propose to use NIRSpec/IFS to find direct evidence of exotic, possibly PopIII stars at $z=3.5$, around the most carbon-enhanced, metal-poor absorber known. With 16 hours on-source, we will be able to detect Ha and (lack of) [OIII] at the ~ 7 sigma level for PopIII clusters as small as 10^4 Msun, and much higher significance for more massive PopIII systems.

OBSERVING DESCRIPTION

This proposal aims at detecting nebular emission lines, and in particular Ha, associated with a the most carbon-enhanced meta-poor absorber at $z=3.546$ discovered along the line of sight of a background quasar.

The observation uses NIRSpec in its IFS mode with G235H with 39 dithers, centered on the background quasars, 21 NRSIRS2 groups each, resulting in an exposure of about 16h. This will provide a sensitivity adequate to detect the Ha line down a PopIII limiting mass of 10^4 Msun. The G235H grating will allow to cover simultaneously all potentially strong optical emission lines, from [OII]3727 to Ha+[NII].

Proposal 9881 - Targets - The last pristine islands in the Universe - PopIII stars before cosmic noon

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
	(1)	J1658-0739	RA: 16 58 44.0620 (254.6835917d) Dec: -07 39 17.69 (-7.65491d) Equinox: J2000	Epoch of Position: 2000	Comments: <i>The target is a quasar along whose line of sight the Carbon-enhanced very metal-poor absorber was detected. The quasar itself is not the target but the PopIII system that is expected to be (in projection) within 1" from this line of sight, and emitting nebular emission lines.</i> Category=Galaxy Description=[Quasars] Extended=YES

Proposal 9881 - Observation 1 - The last pristine islands in the Universe - PopIII stars before cosmic noon

Fri Mar 13 18:00:55 GMT 2026

Observation	<p>Proposal 9881, Observation 1: IFS observation of J1658</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRSpec IFU Spectroscopy</p>											
Diagnostics	(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.											
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Template	TA Method						HFF Readout Mode					
	NONE						false					
Dithers	#	Dither Type		Size	Starting Point		Number of Points		Points			
	1	CYCLING		MEDIUM	1		39					
Spectral Elements	#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	Optional ETC ID
	1	G235H/F170LP	NRSIRS2	21	1	false	true	NONE	39	39	60310.471	277735