



## 3168 - Ultracool White Dwarfs: Cool or Not So Cool?

Cycle: 2, 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>
Ultracool White Dwarfs Low-R Spectroscopy				
	1	LHS3250 - NIRSpec Prism	NIRSpec Fixed Slit Spectroscopy	(1) LHS3250
	2	LHS3250 - MIRI LRS	MIRI Low Resolution Spectroscopy	(1) LHS3250
	3	LHS1126 - NIRSpec Prism	NIRSpec Fixed Slit Spectroscopy	(2) LHS1126
	7	LHS1126 - NIRSpec Prism (repeat visit)	NIRSpec Fixed Slit Spectroscopy	(2) LHS1126
	4	LHS1126 - MIRI LRS	MIRI Low Resolution Spectroscopy	(2) LHS1126
	5	WDJ1922 - NIRSpec Prism	NIRSpec Fixed Slit Spectroscopy	(3) J1922+0233
	6	WDJ1922 - MIRI LRS	MIRI Low Resolution Spectroscopy	(3) J1922+0233

### ABSTRACT

Ultracool white dwarfs (WDs) display peculiar energy distributions with very strong collision-induced absorption (CIA) features in the infrared. They are generally thought to be among the coolest, oldest WDs of our Galaxy, and therefore crucial objects for WD cosmochronology. Despite their

importance, the very nature of ultracool WDs remains unknown. Some model atmosphere analyses suggest that they have extremely low temperatures and masses ( $T_{\text{eff}} \sim 3500\text{K}$ ,  $M \sim 0.2M_{\text{sun}}$ ) while others suggest more moderate temperatures and normal masses ( $T_{\text{eff}} \sim 4500\text{K}$ ,  $M \sim 0.6M_{\text{sun}}$ ), implying multi-Gyr discrepancies for their inferred ages. The key difference between these widely diverging assessments is the choice of CIA opacities. JWST can decidedly settle this debate by directly revealing CIA features for the first time through infrared spectroscopy of ultracool WDs. We propose to use NIRSpec and MIRI to obtain low-resolution spectroscopy of three ultracool WDs that we selected for their unique potential to yield the most stringent constraints on competing models.

### **OBSERVING DESCRIPTION**

We will observe 3 WDs within 40 pc of the Sun, with precise positions, parallaxes, and proper motions from Gaia DR3. We will use NIRSpec Prism and MIRI LRS to obtain low-resolution spectroscopy from 0.6 to 12 microns. Observations for each target can be split; this would not impact our science goals.

# Proposal 3168 - Targets - Ultracool White Dwarfs: Cool or Not So Cool?

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	LHS3250	RA: 16 54 1.2602 (253.5052508d) Dec: +62 53 54.90 (62.89858d) Equinox: J2000	Proper Motion RA: -545.79 mas/yr Proper Motion Dec: 150.4 mas/yr Epoch of Position: 2000	
<p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>            Category=Star            Description=[White dwarfs]            Extended=NO</p>				
(2)	LHS1126	RA: 00 41 26.0270 (10.3584458d) Dec: -22 21 2.29 (-22.35064d) Equinox: J2000	Proper Motion RA: -463.206 mas/yr Proper Motion Dec: -381.7840000237993 mas/yr Epoch of Position: 2000	
<p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>            Category=Star            Description=[White dwarfs]            Extended=NO</p>				
(3)	J1922+0233	RA: 19 22 6.2746 (290.5261442d) Dec: +02 33 12.83 (2.55356d) Equinox: J2000	Proper Motion RA: 69.659 mas/yr Proper Motion Dec: -29.157000039958803 mas/yr Parallax: 0.0253775" Epoch of Position: 2016.0	
<p><i>Comments: This object was entered manually</i>            We entered the position, epoch, PM, parallax by hand from the online simbad query of this star.            The ICRS coordinates in the ref J2000 are for the 2016.0 epoch</p> <p>Category=Star            Description=[White dwarfs]            Extended=NO</p>				
(4)	J1922reference	RA: 19 22 5.7741 (290.5240587d) Dec: +02 33 3.77 (2.55105d) Equinox: J2000	Proper Motion RA: 0.609 mas/yr Proper Motion Dec: 2.415 mas/yr Parallax: 0.0006235" Epoch of Position: 2016.0	
<p><i>Comments: Simbad would not resolve the name Gaia DR3 4288942938685005824 within the APT.</i>            We entered the position, epoch, PM, parallax by hand from the online simbad query of this star.            The ICRS coordinates in the ref J2000 are for the 2016.0 epoch</p> <p>Category=Star            Description=[A stars]            Extended=NO</p>				
(10)	LHS3250oldcoordinates	RA: 16 54 0.0222 (253.5000925d) Dec: +62 53 57.23 (62.89923d) Equinox: J2000	Proper Motion RA: -0.07987148028767692 sec of time/yr Proper Motion Dec: 0.1504 arcsec/yr Epoch of Position: 2015.5	
<p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>            Category=Star            Description=[White dwarfs]            Extended=NO</p>				
(20)	LHS1126oldcoordinates	RA: 00 41 25.5095 (10.3562896d) Dec: -22 21 8.21 (-22.35228d) Equinox: J2000	Proper Motion RA: -0.033389158093799574 sec of time/yr Proper Motion Dec: -0.3817840000237993 arcsec/yr Epoch of Position: 2015.5	
<p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>            Category=Star            Description=[White dwarfs]            Extended=NO</p>				

Fixed Targets

## Proposal 3168 - Targets - Ultracool White Dwarfs: Cool or Not So Cool?

(30)	J1922+0233oldcoordinates	RA: 19 22 6.2723 (290.5261346d) Dec: +02 33 12.84 (2.55357d) Equinox: J2000	Proper Motion RA: 0.004648549322059126 sec of time/yr Proper Motion Dec: -0.029157000039958803 arcsec/yr Epoch of Position: 2015.5
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*Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.*

*Category=Star*

*Description=[White dwarfs]*

*Extended=NO*

Proposal 3168 - Observation 1 - Ultracool White Dwarfs: Cool or Not So Cool?

Thu Dec 14 22:00:43 GMT 2023

<b>Observation</b>	<p><b>Proposal 3168, Observation 1: LHS3250 - NIRSpec Prism</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Observing Template: NIRSpec Fixed Slit 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)	LHS3250	RA: 16 54 1.2602 (253.5052508d) Dec: +62 53 54.90 (62.89858d) Equinox: J2000			Proper Motion RA: -545.79 mas/yr Proper Motion Dec: 150.4 mas/yr Epoch of Position: 2000						
	<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=[White dwarfs]</i></p> <p><i>Extended=NO</i></p>											
<b>Acquisition</b>	<b>#</b>	<b>Target</b>	<b>TA Method</b>	<b>Subarray</b>	<b>Filter</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Exp</b>	<b>Total Integrations</b>	<b>Total Exposure Time</b>	<b>ETC Wkbk.Calc ID</b>	
	1	SAME	WATA	SUB32	CLEAR	NRSRAPIDD6	3	1	1	0.26	58958.10	
<b>Template</b>	<b>Slit</b>					<b>Subarray</b>						
	S200A1					SUBS200A1						
<b>Dithers</b>	<b>#</b>	<b>Primary Dither Positions</b>					<b>Sub-Pixel Pattern</b>					
	1	2					NONE					
<b>Spectral Elements</b>	<b>#</b>	<b>Grating/Filter</b>	<b>Slit</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Ex #</b>	<b>Autocal</b>	<b>Total Dithers</b>	<b>Total Integrations</b>	<b>Total Exposure Time</b>	<b>ETC Wkbk.Calc ID</b>	
	1	PRISM/CLEAR	S200A1	NRSRAPID	195	5	1	NONE	2	10	3053.885	58958.9

Proposal 3168 - Observation 2 - Ultracool White Dwarfs: Cool or Not So Cool?

Thu Dec 14 22:00:44 GMT 2023

<b>Observation</b>	<p><b>Proposal 3168, Observation 2: LHS3250 - MIRI LRS</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Observing Template: MIRI Low Resolution Spectroscopy</p>									
<b>Diagnostics</b>	(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.									
<b>Fixed Targets</b>	#	Name	Target Coordinates		Targ. Coord. Corrections		Miscellaneous			
	(1)	LHS3250	RA: 16 54 1.2602 (253.5052508d) Dec: +62 53 54.90 (62.89858d) Equinox: J2000		Proper Motion RA: -545.79 mas/yr Proper Motion Dec: 150.4 mas/yr Epoch of Position: 2000					
	<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=[White dwarfs]</i></p> <p><i>Extended=NO</i></p>									
<b>Acquisition</b>	#	Target	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID	
	1	SAME	F560W	FASTGRPAVG8	10	1	1	222.003	58958.12	
<b>Template</b>	Subarray				Obtain Verification Image?					
	FULL				true					
<b>Dithers</b>	#	Dither Type		No. Spectral Steps	Spectral Step Offset		No. Spatial Steps		Spatial Step Offset	
	1	ALONG SLIT NOD								
<b>Pointing Verification</b>	#	PV Readout Pattern	PV Groups/Int	PV Integrations/Exp	PV Total Integrations	PV Exposures/Dith	PV Total Dithers	PV Total Exposure Time	PV ETC Wkbk.Calc ID	Filter
	1	FASTR1	10	1	1	1	1	27.75		F560W

Proposal 3168 - Observation 2 - Ultracool White Dwarfs: Cool or Not So Cool?

Spectral Elements	#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
	1	FASTR1	200	5	10	1	2	5572.28	161135.11

Proposal 3168 - Observation 3 - Ultracool White Dwarfs: Cool or Not So Cool?

Thu Dec 14 22:00:44 GMT 2023

<b>Observation</b>	<p><b>Proposal 3168, Observation 3: LHS1126 - NIRSpec Prism</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Observing Template: NIRSpec Fixed Slit 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>			
	(2)	LHS1126	RA: 00 41 26.0270 (10.3584458d) Dec: -22 21 2.29 (-22.35064d) Equinox: J2000			Proper Motion RA: -463.206 mas/yr Proper Motion Dec: -381.7840000237993 mas/yr Epoch of Position: 2000						
	<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=[White dwarfs]</i></p> <p><i>Extended=NO</i></p>											
<b>Acquisition</b>	<b>#</b>	<b>Target</b>	<b>TA Method</b>	<b>Subarray</b>	<b>Filter</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Exp</b>	<b>Total Integrations</b>	<b>Total Exposure Time</b>	<b>ETC Wkbk.Calc ID</b>	
	1	SAME	WATA	SUB32	CLEAR	NRSRAPID	3	1	1	0.08	58958.2	
<b>Template</b>	<b>Slit</b>					<b>Subarray</b>						
	S200A1					SUBS200A1						
<b>Dithers</b>	<b>#</b>	<b>Primary Dither Positions</b>					<b>Sub-Pixel Pattern</b>					
	1	2					NONE					
<b>Spectral Elements</b>	<b>#</b>	<b>Grating/Filter</b>	<b>Slit</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Ex #</b>	<b>Autocal</b>	<b>Total Dithers</b>	<b>Total Integrations</b>	<b>Total Exposure Time</b>	<b>ETC Wkbk.Calc ID</b>	
	1	PRISM/CLEAR	S200A1	NRSRAPID	3	39	1	NONE	2	78	487.693	58958.1

# Proposal 3168 - Observation 7 - Ultracool White Dwarfs: Cool or Not So Cool?

Thu Dec 14 22:00:44 GMT 2023

<b>Observation</b>	<p><b>Proposal 3168, Observation 7: LHS1126 - NIRSpec Prism (repeat visit)</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Observing Template: NIRSpec Fixed Slit Spectroscopy</p>											
<b>Diagnostics</b>	(Visit 7:1) 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)	LHS1126	RA: 00 41 26.0270 (10.3584458d) Dec: -22 21 2.29 (-22.35064d) Equinox: J2000			Proper Motion RA: -463.206 mas/yr Proper Motion Dec: -381.7840000237993 mas/yr Epoch of Position: 2000						
	<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=[White dwarfs]</i></p> <p><i>Extended=NO</i></p>											
<b>Acquisition</b>	<b>#</b>	<b>Target</b>	<b>TA Method</b>	<b>Subarray</b>	<b>Filter</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Exp</b>	<b>Total Integrations</b>	<b>Total Exposure Time</b>	<b>ETC Wkbk.Calc ID</b>	
	1	SAME	WATA	SUB32	CLEAR	NRSRAPID	3	1	1	0.08	58958.2	
<b>Template</b>	<b>Slit</b>					<b>Subarray</b>						
	S200A1					SUBS200A1						
<b>Dithers</b>	<b>#</b>	<b>Primary Dither Positions</b>					<b>Sub-Pixel Pattern</b>					
	1	2					NONE					
<b>Spectral Elements</b>	<b>#</b>	<b>Grating/Filter</b>	<b>Slit</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Ex #</b>	<b>Autocal</b>	<b>Total Dithers</b>	<b>Total Integrations</b>	<b>Total Exposure Time</b>	<b>ETC Wkbk.Calc ID</b>	
	1	PRISM/CLEAR	S200A1	NRSRAPID	3	39	1	NONE	2	78	487.693	58958.1

Proposal 3168 - Observation 4 - Ultracool White Dwarfs: Cool or Not So Cool?

Thu Dec 14 22:00:44 GMT 2023

<b>Observation</b>	<p><b>Proposal 3168, Observation 4: LHS1126 - MIRI LRS</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Observing Template: MIRI Low Resolution 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>			
	(2)	LHS1126	RA: 00 41 26.0270 (10.3584458d) Dec: -22 21 2.29 (-22.35064d) Equinox: J2000	Proper Motion RA: -463.206 mas/yr Proper Motion Dec: -381.7840000237993 mas/yr Epoch of Position: 2000						
	<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=[White dwarfs]</i></p> <p><i>Extended=NO</i></p>									
<b>Acquisition</b>	<b>#</b>	<b>Target</b>	<b>Filter</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Exp</b>	<b>Total Integrations</b>	<b>Total Exposure Time</b>	<b>ETC Wkbk.Calc ID</b>	
	1	SAME	F560W	FAST	10	1	1	27.75	58958.4	
<b>Template</b>	<b>Subarray</b>				<b>Obtain Verification Image?</b>					
	FULL				true					
<b>Dithers</b>	<b>#</b>	<b>Dither Type</b>	<b>No. Spectral Steps</b>	<b>Spectral Step Offset</b>	<b>No. Spatial Steps</b>	<b>Spatial Step Offset</b>				
	1	ALONG SLIT NOD								
<b>Pointing Verification</b>	<b>#</b>	<b>PV Readout Pattern</b>	<b>PV Groups/Int</b>	<b>PV Integrations/Exp</b>	<b>PV Total Integrations</b>	<b>PV Exposures/Dith</b>	<b>PV Total Dithers</b>	<b>PV Total Exposure Time</b>	<b>PV ETC Wkbk.Calc ID</b>	<b>Filter</b>
	1	FASTR1	10	1	1	1	1	27.75		F560W

Proposal 3168 - Observation 4 - Ultracool White Dwarfs: Cool or Not So Cool?

Spectral Elements	#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
	1	FASTR1	111	1	2	1	2	616.059	58958.3

Proposal 3168 - Observation 5 - Ultracool White Dwarfs: Cool or Not So Cool?

Thu Dec 14 22:00:44 GMT 2023

<b>Observation</b>	<b>Proposal 3168, Observation 5: WDJ1922 - NIRSpec Prism</b> <b>Diagnostic Status: Warning</b> Observing Template: NIRSpec Fixed Slit Spectroscopy											
<b>Diagnostics</b>	(Visit 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.											
<b>Fixed Targets</b>	#	Name	Target Coordinates			Targ. Coord. Corrections			Miscellaneous			
	(3)	J1922+0233	RA: 19 22 6.2746 (290.5261442d) Dec: +02 33 12.83 (2.55356d) Equinox: J2000			Proper Motion RA: 69.659 mas/yr Proper Motion Dec: -29.157000039958803 mas/yr Parallax: 0.0253775" Epoch of Position: 2016.0						
	<i>Comments: This object was entered manually</i> <i>We entered the position, epoch, PM, parallax by hand from the online simbad query of this star.</i> <i>The ICRS coordinates in the ref J2000 are for the 2016.0 epoch</i> Category=Star Description=[White dwarfs] Extended=NO											
<b>Acquisition</b>	#	Target	TA Method	Subarray	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID	
	1	SAME	WATA	SUB2048	CLEAR	NRSRAPID	3	1	1	3.628	58958.14	
<b>Template</b>	Slit				Subarray							
	S200A1				SUBS200A1							
<b>Dithers</b>	#	Primary Dither Positions					Sub-Pixel Pattern					
	1	2					NONE					
<b>Spectral Elements</b>	#	Grating/Filter	Slit	Readout Pattern	Groups/Int	Integrations/Ex #	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID	
	1	PRISM/CLEAR	S200A1	NRSRAPID	206	12	1	NONE	2	24	7740.636	58958.13

# Proposal 3168 - Observation 6 - Ultracool White Dwarfs: Cool or Not So Cool?

Thu Dec 14 22:00:44 GMT 2023

<b>Observation</b>	<b>Proposal 3168, Observation 6: WDJ1922 - MIRI LRS</b> <b>Diagnostic Status: Warning</b> Observing Template: MIRI Low Resolution Spectroscopy									
<b>Diagnostics</b>	(Visit 6:1) 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)	J1922+0233	RA: 19 22 6.2746 (290.5261442d) Dec: +02 33 12.83 (2.55356d) Equinox: J2000	Proper Motion RA: 69.659 mas/yr Proper Motion Dec: -29.157000039958803 mas/yr Parallax: 0.0253775" Epoch of Position: 2016.0						
	<i>Comments: This object was entered manually</i> <i>We entered the position, epoch, PM, parallax by hand from the online simbad query of this star.</i> <i>The ICRS coordinates in the ref J2000 are for the 2016.0 epoch</i> Category=Star Description=[White dwarfs] Extended=NO									
<b>Acquisition</b>	<b>#</b>	<b>Target</b>	<b>Filter</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Exp</b>	<b>Total Integrations</b>	<b>Total Exposure Time</b>	<b>ETC Wkbk.Calc ID</b>	
	1	4 J1922reference	F560W	FAST	10	1	1	27.75	161135.21	
<b>Template</b>	<b>Subarray</b>				<b>Obtain Verification Image?</b>					
	FULL				true					
<b>Dithers</b>	<b>#</b>	<b>Dither Type</b>	<b>No. Spectral Steps</b>	<b>Spectral Step Offset</b>	<b>No. Spatial Steps</b>	<b>Spatial Step Offset</b>				
	1	ALONG SLIT NOD								
<b>Pointing Verification</b>	<b>#</b>	<b>PV Readout Pattern</b>	<b>PV Groups/Int</b>	<b>PV Integrations/Exp</b>	<b>PV Total Integrations</b>	<b>PV Exposures/Dith</b>	<b>PV Total Dithers</b>	<b>PV Total Exposure Time</b>	<b>PV ETC Wkbk.Calc ID</b>	<b>Filter</b>
	1	FASTR1	100	1	1	1	1	277.504		F560W

Proposal 3168 - Observation 6 - Ultracool White Dwarfs: Cool or Not So Cool?

Spectral Elements	#	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Exposures/Dith	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
	1	FASTR1	238	7	14	1	2	9279.734	161135.15