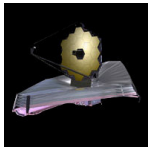

6714 - The evolving activity drivers in a newly discovered distant comet

Cycle: 2, Proposal Category: DD

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
C2024E1-7AU				
	2	epoch1	NIRSpec IFU Spectroscopy	(1) C2024E1
	3	epoch1-SKY	NIRSpec IFU Spectroscopy	(2) C2024E1-sky

ABSTRACT

We propose NIRSPEC IFU observations to map, for the first time, the gases driving cometary activity over a range of heliocentric distances. The newly discovered comet C/2024 E1 (Wierzchos) is currently over 7 au from the Sun, beyond the distance where water-ice sublimation dominates cometary activity, and is observable at three key epochs over the next 16 months, before it makes a relatively close perihelion passage at 0.6 au in

2026. We propose to observe it at around 7, 5, and 3 au inbound to map the gas species in the coma when the comet is outside, crossing, and within the water-ice sublimation boundary, respectively. NIRSPEC IFU is uniquely capable of simultaneously detecting the major species in cometary comae (H2O, CO2, CO) at these distances, giving us a first look at the evolution of activity in a primitive comet as it approaches the Sun. This new comet presents a rare opportunity to get such observations, which are crucial to study the poorly understood process of cometary activity, and also critical for planning for the ESA mission Comet Interceptor as it prepares to encounter a similar object.

OBSERVING DESCRIPTION

We propose to observe the newly discovered comet C/2024 E1 (Wierzchos) at three epochs as it approaches the Sun. This is a new long period comet that was discovered quite far from the Sun (8 au) but will approach to around 0.6 au at its perihelion in 2026, when it is expected to be highly active and easy to study from the ground. JWST is required to study it when it is further away, to measure how its activity evolves, and in particular to measure abundances of the main activity-driving gases in the coma, which cannot be observed from the ground. We will use NIRSpec IFU spectroscopy to cover the wavelength range 1-5 microns, which includes emission bands from all three key species in the activity of comets (H2O, CO2, CO). The IFU mode is useful for the extended cometary coma, allowing us to map its structure, and also to increase our total signal-to-noise by integrating over a larger area. Each observation is accompanied by an offset sky observation due to the extended nature of the comet coma (which will fill the IFU field of view). At the most distant epoch we will use the prism mode to achieve the necessary S/N in a reasonable integration time, and focus on the primary activity drivers. As the comet brightens as it gets closer we will use medium resolution gratings G235M and G395M to cover the necessary wavelength range with increased spectral resolution, to better separate emission features of the primary activity drivers from those of minor species in the coma such as CH4, which are expected to contribute more at closer distances.

We propose to observe the comet at around 7, 5, and 3 au from the Sun. These distances are outside, crossing, and within the point where water-ice sublimation is expected to dominate cometary activity, and are observable in the 2024 visibility window (May until July) and at the beginning and end of the 2025 window (March to August), respectively. Depending on exact scheduling, these observations fall within Cycle 2/3 (7 au, in 2024), in Cycle 3 (5 au, early 2025) and Cycle 3/4 (3 au, mid 2025).

Proposal 6714 - Targets - The evolving activity drivers in a newly discovered distant comet

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(1)	C2024E1	TYPE=COMET,Q=0.56500054458001,E=1.00002783 3288543,I=75.23273099428093 ,O=108.1235351870759,W=243.6581281999578,T=20 -JAN- 2026:16:52:44,TTimeScale=TDB,EQUINOX=J2000,E POCH=04-APR-2024:00:00:00,EpochTimeScale=TDB		
Comments: Extended=YES				
(2)	C2024E1-sky	TYPE=COMET,Q=0.56500054458001,E=1.00002783 3288543,I=75.23273099428093 ,O=108.1235351870759,W=243.6581281999578,T=20 -JAN- 2026:16:52:44,TTimeScale=TDB,EQUINOX=J2000,E POCH=04-APR-2024:00:00:00,EpochTimeScale=TDB	TYPE=POS_ANGLE,RAD=300,ANG=90,REF=SUN	
Comments: Extended=YES				

Observation

Proposal 6714, Observation 2: epoch1 Fri May 31 17:00:56 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Background Observations:[epoch1-SKY (Obs 3)]

Diagnostics

(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(epoch1 (Obs 2)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(1)	C2024E1	TYPE=COMET,Q=0.56500054458001,E=1.00002783 3288543,I=75.23273099428093 ,O=108.1235351870759,W=243.6581281999578,T=20 -JAN- 2026:16:52:44,TTimeScale=TDB,EQUINOX=J2000,E POCH=04-APR-2024:00:00:00,EpochTimeScale=TDB		

Comments: 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	PRISM/CLEAR	NRSIRS2RAPID	50	2	false	true	NONE	4	8	5952.267	

Special Requirements

Between Dates 01-JUN-2024:00:00:00 and 15-JUN-2024:00:00:00

Sequence Observations 2, 3, Non-interruptible

DEFAULT WINDOW: ANGULAR RATE C2024E1 FROM JWST LESS THAN 0.075

Observation

Proposal 6714, Observation 3: epoch1-SKY Fri May 31 17:00:56 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Background Observation For: [epoch1 (Obs 2)]

Diagnostics

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

(epoch1-SKY (Obs 3)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(2)	C2024E1-sky	TYPE=COMET,Q=0.56500054458001,E=1.00002783288543,I=75.23273099428093,O=108.1235351870759,W=243.6581281999578,T=20-JAN-2026:16:52:44,TTimeScale=TDB,EQUINOX=J2000,EPOCH=04-APR-2024:00:00:00,EpochTimeScale=TDB	TYPE=POS_ANGLE,RAD=300,ANG=90,REF=SUN	

Comments: Extended=YES

Template

TA Method
NONE

Dithers

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

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	PRISM/CLEAR	NRSIRS2RAPID	50	2	false	true	NONE	4	8	5952.267	

Special Requirements

Sequence Observations 2, 3, Non-interruptible

DEFAULT WINDOW: ANGULAR RATE C2024E1-sky FROM JWST LESS THAN 0.075