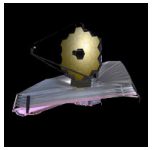

4627 - Deuterium in the outer solar system

Cycle: 3, Proposal Category: GO

INVESTIGATORS

Name	*Institution*
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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
2004NT33				
	2	2004NT33	NIRSpec IFU Spectroscopy	(1) 2004NT33
2002XV93				
	4	2002XV93	NIRSpec IFU Spectroscopy	(2) 2002XV93
2013LU28				
	5	2013LU28	NIRSpec IFU Spectroscopy	(3) 2013LU28

ABSTRACT

The deuterium-to-hydrogen ratio (D/H) of bodies in the solar system holds some of the key tracers of protoplanetary nebular history, including the mixing of protostellar gas and ice and the source of the Earth's water. The inner Solar System, including the Earth's water, is enriched in D/H compared to the initial gaseous nebula and so demands an additional enriched source. Bodies which formed beyond the frost line and accreted unvaporized interstellar ice are expected to have the significantly higher D/H values associated with the ice component of the nebula and thus could be plausible sources of the Earth's water. Measurements of D/H in hydrated asteroids are clearly affected by alteration processes and return ambiguous values, with some higher and some lower than terrestrial. Comets, likewise, show a wide range of values which can clearly be affected by the cometary activity itself. We propose to measure D/H in the solid ice of a small pilot sample of icy TNOs/Centaurs by measuring absorption due to the fundament D-H stretch at 4.13 microns (the analog to the 3 micron O-H stretch). By measuring D/H in the solid phase on bodies which have

presumably never had water sublimation, we will be making the first measurement of what should be the pristine D/H ratio in the outer solar nebula. If these pilot observations allow us to successfully measure D/H, they will open in new era in the exploration of the icy bodies of the outer solar system and their formation and evolutionary environments.

OBSERVING DESCRIPTION

We will observe three outer solar system bodies (two TNOs and one Centaur) at medium resolution and high signal-to-noise in order to detect and characterize the 4.13 micron feature due to the D-H stretch in HDO. Measurement of this feature, and comparison to the depth of the 2 micron feature from Cycle 1 data, will allow us to determine the D/H of the surface ice of these objects.

Proposal 4627 - Targets - Deuterium in the outer solar system

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(1)	2004NT33	TYPE=ASTEROID,A=43.80554906736249,E=0.156044154633889,I=31.22828679859977,O=240.9147036632266,W=39.82499878340703,M=42.98340684458967,EQUINOX=J2000,EPOCH=05-AUG-2020:00:00:00,EpochTimeScale=TDB		
Comments: Extended=NO				
(2)	2002XV93	TYPE=ASTEROID,A=39.43278730490403,E=0.1270403934011323,I=13.2798299646849,O=19.15886881986076,W=163.3088857980011,M=281.8936151162116,EQUINOX=J2000,EPOCH=03-OCT-2015:00:00:00,EpochTimeScale=TDB		
Comments: Extended=Unknown				
(3)	2013LU28	TYPE=ASTEROID,A=188.8333524149825,E=0.9537280816770922,I=125.3503245059518,O=275.9715008711167,W=152.9737788625947,M=359.4828246439482,EQUINOX=J2000,EPOCH=28-SEP-2020:00:00:00,EpochTimeScale=TDB		
Comments: Extended=NO				

Observation

Proposal 4627, Observation 2: 2004NT33

Thu Feb 29 18:02:36 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.

(2004NT33 (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)	2004NT33	TYPE=ASTEROID,A=43.80554906736249,E=0.156044154633889,I=31.22828679859977,O=240.9147036632266,W=39.82499878340703,M=42.98340684458967,EQUINOX=J2000,EPOCH=05-AUG-2020:00:00:00,EpochTimeScale=TDB		

Comments: Extended=NO

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	G395M/F290LP	NRSIRS2	20	5	false	true	NONE	4	20	29469.558	

Special Requirements

DEFAULT WINDOW: ANGULAR RATE 2004NT33 FROM JWST LESS THAN 0.075

Observation

Proposal 4627, Observation 4: 2002XV93

Thu Feb 29 18:02:36 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.

(2002XV93 (Obs 4)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(2)	2002XV93	TYPE=ASTEROID,A=39.43278730490403,E=0.1270403934011323,I=13.2798299646849,O=19.15886881986076,W=163.3088857980011,M=281.8936151162116,EQUINOX=J2000,EPOCH=03-OCT-2015:00:00:00,EpochTimeScale=TDB		

Comments: Extended=Unknown

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	G395M/F290LP	NRSIRS2	20	4	false	true	NONE	4	16	23575.646	

Special Requirements

DEFAULT WINDOW: ANGULAR RATE 2002XV93 FROM JWST LESS THAN 0.075

Observation

Proposal 4627, Observation 5: 2013LU28

Thu Feb 29 18:02:36 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.

(2013LU28 (Obs 5)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(3)	2013LU28	TYPE=ASTEROID,A=188.8333524149825,E=0.9537280816770922,I=125.3503245059518,O=275.9715008711167,W=152.9737788625947,M=359.4828246439482,EQUINOX=J2000,EPOCH=28-SEP-2020:00:00:00,EpochTimeScale=TDB		

Comments: Extended=NO

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	G395M/F290LP	NRSIRS2RAPID	75	1	false	true	NONE	4	4	4435.023	

Special Requirements

DEFAULT WINDOW: ANGULAR RATE 2013LU28 FROM JWST LESS THAN 0.075