



11253 - Fluffy or Flashy? Resolving the Mystery of the Coldest-Known Super Puff

Cycle: 5, Proposal Category: GO

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
Ben Cassese (PI)	Columbia University in the City of New York
Tiger Lu (CoI)	Flatiron Institute Center for Computational Astrophysics
Prof. Malena Rice (CoI)	Yale University
Mr. Daniel A. Yahalomi (CoI)	Columbia University in the City of New York
Soichiro Hattori (CoI)	Columbia University in the City of New York
Dr. Shreyas Vissapragada (CoI)	Carnegie Institution of Washington
Dr. Aarynn L Carter (CoI)	Space Telescope Science Institute

OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
Observation Folder				
	1	Transit observation	NIRISS Single-Object Slitless Spectroscopy	(1) BD+10-1799
	2	F277W exposure	NIRISS Single-Object Slitless Spectroscopy	(1) BD+10-1799
	3	Background 1	NIRISS Single-Object Slitless Spectroscopy	(1) BD+10-1799
	4	Background 2	NIRISS Single-Object Slitless Spectroscopy	(1) BD+10-1799
	5	Background 3	NIRISS Single-Object Slitless Spectroscopy	(1) BD+10-1799
	6	Background 4	NIRISS Single-Object Slitless Spectroscopy	(1) BD+10-1799
	7	Background 5	NIRISS Single-Object Slitless Spectroscopy	(1) BD+10-1799
	8	Background 6	NIRISS Single-Object Slitless Spectroscopy	(1) BD+10-1799

ABSTRACT

"Super puff" planets, or planets with densities comparable to cotton candy or Styrofoam, are already outliers among the catalog of known exoplanets. Even among this select group, however, one in particular stands out: HIP-41378 f. Unlike every other known super puff, this low-mass but Saturn-

sized world orbits quite far from its host star (>1 AU), well beyond the reach of any theoretical mechanisms that could plausibly explain its inflated radius. This planet has consequently attracted considerable attention in the astronomy literature, which broadly agrees that one of two hypotheses is at work: either HIP-41378 f truly is a super puff, which would inspire a revision of our theoretical explanation of the class, or it is an interloper who only appears to be a super puff, but in reality is a more common sub-Neptune planet surrounded by the first opaque planetary ring observed outside the solar system. Both hypotheses offer falsifiable predictions that can be tested with JWST alone. We propose to observe one transit of this planet with NIRISS SOSS to conclusively settle the mystery of this cold, strange planet.

OBSERVING DESCRIPTION

We will observe one transit of HIP-41378 f as an unbroken 33.3 hour time series consisting of one exposure and 1638 integrations. Preceding the transit will collect six short dithered background exposures, and immediately following it we will collect an additional exposure with the F277W for calibration purposes. We accept the possibility of a high-gain antenna movement during these exposures.

Proposal 11253 - Targets - Fluffy or Flashy? Resolving the Mystery of the Coldest-Known Super Puff

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	BD+10-1799	RA: 08 26 27.8491 (126.6160379d) Dec: +10 04 49.33 (10.08037d) Equinox: J2000	Proper Motion RA: -48.002 mas/yr Proper Motion Dec: 0.062 mas/yr Parallax: 0.009436" Epoch of Position: 2000	
<p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i></p> <p><i>SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.</i></p> <p><i>Category=Star</i></p> <p><i>Description=[Exoplanet Systems, Exoplanets, F dwarfs]</i></p>				
(2)	N843000313	RA: 08 26 27.2549 (126.6135621d) Dec: +10 05 7.62 (10.08545d) Equinox: J2000	Proper Motion RA: -8.348645431273974 mas/yr Proper Motion Dec: -2.48690237207766 mas/yr Epoch of Position: 2016	
<p><i>Comments: This object was generated by the targetselector and retrieved from the GSC 2.4.3.1 database.</i></p> <p><i>Gaia DR3 600698184764496768</i></p> <p><i>Category=Star</i></p> <p><i>Description=[G dwarfs]</i></p>				

Proposal 11253 - Observation 1 - Fluffy or Flashy? Resolving the Mystery of the Coldest-Known Super Puff

Fri Mar 13 21:03:24 GMT 2026

Observation	Proposal 11253, Observation 1: Transit observation Diagnostic Status: Warning Observing Template: NIRISS Single-Object Slitless Spectroscopy <i>Comments: Exposure duration is too long for the "Include short first exposure and F277W exposure?" option.</i>																													
	(Transit observation (Obs 1)) Warning (Form): Exposure Duration exceeds the limit of 10000.0 seconds. Above this limit it is possible that a High Gain Antenna move may occur during the exposure. (Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.																													
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Proposal 11253 - Observation 1 - Fluffy or Flashy? Resolving the Mystery of the Coldest-Known Super Puff

Special Requirements

Phase 0.998462 to 0.998616 with period 542.07975 Days and zero-phase 2460980.56325 HJD
Aperture PA Range 100 to 103 Degrees (V3 99.43873283 to 102.43873283)
Time Series Observation
No Parallel Attachments

Sequence Observations 3, 4, 5, 6, 7, 8, 1, 2 (reordered), Non-interruptible

Proposal 11253 - Observation 2 - Fluffy or Flashy? Resolving the Mystery of the Coldest-Known Super Puff

Fri Mar 13 21:03:24 GMT 2026

Observation	Proposal 11253, Observation 2: F277W exposure Diagnostic Status: Warning Observing Template: NIRISS Single-Object Slitless Spectroscopy <i>Comments: "Include short first exposure and F277W exposure?" option is not available on the transit observation, so taking this as its own observation. Not sure what implications this has for TA though.</i>																																													
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Proposal 11253 - Observation 2 - Fluffy or Flashy? Resolving the Mystery of the Coldest-Known Super Puff

Special Requirements

Aperture PA Range 100 to 103 Degrees (V3 99.43873283 to 102.43873283)
Time Series Observation
No Parallel Attachments

Sequence Observations 3, 4, 5, 6, 7, 8, 1, 2 (reordered), Non-interruptible

Proposal 11253 - Observation 3 - Fluffy or Flashy? Resolving the Mystery of the Coldest-Known Super Puff

Fri Mar 13 21:03:24 GMT 2026

Observation	Proposal 11253, Observation 3: Background 1 Diagnostic Status: Warning Observing Template: NIRISS Single-Object Slitless Spectroscopy <i>Comments: Used 30" spacings, but check to make sure that the target star doesn't fall in the subarray- super bright, will saturate on FULL readout.</i>																									
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1	NISRAPID	12	10	1	1	10	1395.78																			

Proposal 11253 - Observation 3 - Fluffy or Flashy? Resolving the Mystery of the Coldest-Known Super Puff

Special Requirements

Offset 0.0 arcsec, 90.0 arcsec
Time Series Observation
No Parallel Attachments

Sequence Observations 3, 4, 5, 6, 7, 8, 1, 2 (reordered), Non-interruptible

Proposal 11253 - Observation 4 - Fluffy or Flashy? Resolving the Mystery of the Coldest-Known Super Puff

Fri Mar 13 21:03:24 GMT 2026

Observation	<p>Proposal 11253, Observation 4: Background 2</p> <p>Diagnostic Status: Warning</p> <p>Observing Template: NIRISS Single-Object Slitless Spectroscopy</p> <p><i>Comments: Used 30" spacings, but check to make sure that the target star doesn't fall in the subarray- super bright, will saturate on FULL readout.</i></p>								
Diagnostics	<p>(Visit 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.</p>								
Fixed Targets	#	Name	Target Coordinates	Target, Coord. Corrections			Miscellaneous		
	(1)	BD+10-1799	RA: 08 26 27.8491 (126.6160379d) Dec: +10 04 49.33 (10.08037d) Equinox: J2000	Proper Motion RA: -48.002 mas/yr Proper Motion Dec: 0.062 mas/yr Parallax: 0.009436" Epoch of Position: 2000					
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Acquisition	#	Target							
	1	NONE							
Template	Subarray	Include Short First Exposure and F277W Exposure?							
	FULL	false							
Spectral Elements	#	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Dithers	Total Integrations	Total Exposure Time	Optional ETC ID
	1	NISRAPID	12	10	1	1	10	1395.78	

Proposal 11253 - Observation 4 - Fluffy or Flashy? Resolving the Mystery of the Coldest-Known Super Puff

Special Requirements

Offset 0.0 arcsec, 60.0 arcsec
Time Series Observation
No Parallel Attachments

Sequence Observations 3, 4, 5, 6, 7, 8, 1, 2 (reordered), Non-interruptible

Proposal 11253 - Observation 5 - Fluffy or Flashy? Resolving the Mystery of the Coldest-Known Super Puff

Fri Mar 13 21:03:24 GMT 2026

Observation	Proposal 11253, Observation 5: Background 3 Diagnostic Status: Warning Observing Template: NIRISS Single-Object Slitless Spectroscopy <i>Comments: Used 30" spacings, but check to make sure that the target star doesn't fall in the subarray- super bright, will saturate on FULL readout.</i>																									
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Proposal 11253 - Observation 5 - Fluffy or Flashy? Resolving the Mystery of the Coldest-Known Super Puff

Special Requirements

Offset 0.0 arcsec, 30.0 arcsec
Time Series Observation
No Parallel Attachments

Sequence Observations 3, 4, 5, 6, 7, 8, 1, 2 (reordered), Non-interruptible

Proposal 11253 - Observation 6 - Fluffy or Flashy? Resolving the Mystery of the Coldest-Known Super Puff

Fri Mar 13 21:03:24 GMT 2026

Observation	Proposal 11253, Observation 6: Background 4 Diagnostic Status: Warning Observing Template: NIRISS Single-Object Slitless Spectroscopy <i>Comments: Used 30" spacings, but check to make sure that the target star doesn't fall in the subarray- super bright, will saturate on FULL readout.</i>																									
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Proposal 11253 - Observation 6 - Fluffy or Flashy? Resolving the Mystery of the Coldest-Known Super Puff

Special Requirements

Offset 0.0 arcsec, -30.0 arcsec
Time Series Observation
No Parallel Attachments

Sequence Observations 3, 4, 5, 6, 7, 8, 1, 2 (reordered), Non-interruptible

Proposal 11253 - Observation 7 - Fluffy or Flashy? Resolving the Mystery of the Coldest-Known Super Puff

Fri Mar 13 21:03:24 GMT 2026

Observation	Proposal 11253, Observation 7: Background 5 Diagnostic Status: Warning Observing Template: NIRISS Single-Object Slitless Spectroscopy <i>Comments: Used 30" spacings, but check to make sure that the target star doesn't fall in the subarray- super bright, will saturate on FULL readout.</i>																									
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Proposal 11253 - Observation 7 - Fluffy or Flashy? Resolving the Mystery of the Coldest-Known Super Puff

Special Requirements

Offset 0.0 arcsec, -60.0 arcsec
Time Series Observation
No Parallel Attachments

Sequence Observations 3, 4, 5, 6, 7, 8, 1, 2 (reordered), Non-interruptible

Proposal 11253 - Observation 8 - Fluffy or Flashy? Resolving the Mystery of the Coldest-Known Super Puff

Fri Mar 13 21:03:24 GMT 2026

Observation	Proposal 11253, Observation 8: Background 6 Diagnostic Status: Warning Observing Template: NIRISS Single-Object Slitless Spectroscopy <i>Comments: Used 30" spacings, but check to make sure that the target star doesn't fall in the subarray- super bright, will saturate on FULL readout.</i>																									
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Proposal 11253 - Observation 8 - Fluffy or Flashy? Resolving the Mystery of the Coldest-Known Super Puff

Special Requirements

Offset 0.0 arcsec, -90.0 arcsec
Time Series Observation
No Parallel Attachments

Sequence Observations 3, 4, 5, 6, 7, 8, 1, 2 (reordered), Non-interruptible