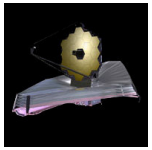

# 6932 - Bridging the generation gap with TOI-1801 b, a 700 Myr-old temperate sub-Neptune

Cycle: 4, Proposal Category: GO

**INVESTIGATORS**

| *Name* | *Institution* |
|---|---|
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**OBSERVATIONS**

| *Folder* | *Observation* | *Label* | *Observing Template* | *Science Target* |
|---|---|---|---|---|
| Visit1 | | | | |
| | 1 | NIRISS_toi1801 | NIRISS Single-Object Slitless Spectroscopy | (1) TOI-1801 |
| | 2 | NIRSpec_toi1801 | NIRSpec Bright Object Time Series | (1) TOI-1801 |
| Visit2 | | | | |
| | 3 | NIRISS_toi1801 | NIRISS Single-Object Slitless Spectroscopy | (1) TOI-1801 |
| | 4 | NIRSpec_toi1801 | NIRSpec Bright Object Time Series | (1) TOI-1801 |
| Visit3 | | | | |
| | 5 | NIRISS_toi1801 | NIRISS Single-Object Slitless Spectroscopy | (1) TOI-1801 |

| *Folder* | *Observation* | *Label* | *Observing Template* | *Science Target* |
|---|---|---|---|---|
| | 6 | NIRSpec_toi1801 | NIRSpec Bright Object Time Series | (1) TOI-1801 |

**ABSTRACT**

Exoplanets with sizes between Earth and Neptune (sub-Neptunes) are extremely common in the Milky Way, yet do not exist in the solar system. Little is known about their most fundamental properties, including their origin and nature. Mass and radius measurements are insufficient to uniquely ascertain their composition, making atmospheric observations necessary to advance their characterization. However, featureless transmission spectra of sub-Neptunes obtained in the past decade have shown the ubiquity of aerosols and metal-rich, high mean molecular weight atmospheres among the tested population.

To overcome these observational challenges, we request 6 JWST visits of the young sub-Neptune TOI-1801 b with NIRISS/SOSS and NIRSpec/G395H. Its age (700 Myr) and temperate equilibrium temperature (500 K) are ideal for mitigating the impact of aerosols and metal-enrichment processes that make these observations challenging for other planets. The planet is the coldest and smallest among the young sub-Neptune population (< 1 Gyr), and one of the few with a robust dynamical mass measurement. The observing strategy is designed to measure the abundances of C-, N-, and O-bearing species with high statistical confidence if present in the planet's atmosphere. With these observations, we will 1) bridge the gap between the young and mature sub-Neptune populations being currently probed by JWST and 2) determine the planet's status as a water world or gas dwarf, thus gaining insight into its bulk composition, formation, and evolution history. The unique properties of this object make it the perfect missing piece in the puzzle to understand the evolutionary processes at play in sub-Neptunes.

**OBSERVING DESCRIPTION**

We request three primary transits with NIRISS/SOSS and NIRSPEC/G395H each (six total time-series observations) of the planet TOI-1801 b. The broad wavelength coverage (from 0.8 to 5 microns) combining both modes is key to search for absorption from multiple C/N/O-bearing molecules, constrain the properties of any aerosols, and minimize the impact of stellar activity.

We use the online JWST ETC to compute exposure times that ensure the highest S/N in each instrument mode without surpassing 80% saturation. The optimal configuration is 5 groups per integration with NIRISS SOSS (S/N=598 at 1.57 microns) and 8 groups per integration with NIRSPEC G395H grating (S/N=185 at 4 microns). We avoid the use of G395M (even though it could accomplish our science goals) since the groups per integration in this mode reaches the maximum fraction of saturation (100%) in one group.

As these are time series observations requiring the capture of a transit, with sufficient baseline not to limit the maximum S/N of the desired transit

depth measurement, special requirements are needed. These include capture of adequate ingress/egress baseline and additional padding due to the phase constraints and detector settling. For TOI-1801 b (transit duration of 2.7h), the planned time prior to transit midpoint is to be 0.5h (detector settling) + 1.35h (pre-transit baseline) + 1.35h (half the transit duration), or 3.2h in total. Considering the egress half of the transit, and another 1.35h baseline post last contact, this results in 5.9 total hours per visit.

Given the brightness of the target, the NIRISS observations have to use the SUBSTRIP96 subarray, while the NIRSPEC observations can use the full SUB2048 BOTS subarray. The NIRSPEC target acquisition has to be done on a nearby star because the target is too bright, saturating 7 pixels even in the most restricting configuration. There is no suitable target acquisition star within the visit's splitting distance. We will use the slightly farther away star Gaia DR3 3980043972982309504 (J=12.897 mag) instead. The NIRISS target acquisition can be done without saturating using TOI-1801 itself.

To avoid contamination from nearby stars, NIRISS observations should be scheduled when the position angle is between 128-143 or 273-286 degrees. The orbital period of the planet is 10.64 days. Uncertainties in the orbital ephemeris have a negligible impact on the primary transit timing. The system does not show any signs of transit timing variations.

# Proposal 6932 - Targets - Bridging the generation gap with TOI-1801 b, a 700 Myr-old temperate sub-Neptune

**Fixed Targets**

| # | Name | Target Coordinates | Targ. Coord. Corrections | Miscellaneous |
|---|---|---|---|---|
| (1) | TOI-1801 | RA: 11 42 18.1365 (175.5755687d)<br>Dec: +23 01 37.34 (23.02704d)<br>Equinox: J2000 | Proper Motion RA: -204.8915 mas/yr<br>Proper Motion Dec: 41.8389 mas/yr<br>Parallax: 0.0323697"<br>Epoch of Position: 2016.0 | |
| *Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.*<br>*Category=Star*<br>*Description=[Exoplanet Systems, Exoplanets, M dwarfs, M stars, Young stellar objects]*<br>*Extended=NO* | | | | |
| (2) | Gaia_DR3_3980043972982309504 | RA: 11 42 18.1051 (175.5754379d)<br>Dec: +23 01 13.79 (23.02050d)<br>Equinox: J2000 | Proper Motion RA: 0.7516 mas/yr<br>Proper Motion Dec: -4.4194 mas/yr<br>Parallax: 0.0001714"<br>Epoch of Position: 2016.0 | |
| *Comments:*<br>*Category=Star*<br>*Description=[M dwarfs]*<br>*Extended=NO* | | | | |

## Observation

**Proposal 6932, Observation 1: NIRISS_toi1801**

Wed Jan 07 21:00:18 GMT 2026

**Diagnostic Status: Warning**

Observing Template: NIRISS Single-Object Slitless Spectroscopy

## Diagnostics

(NIRISS_toi1801 (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.

(Visit 1:1) Informational (Form): Visit schedulable, but most scheduling windows are when JWST is pointed in direction of greatest micrometeoroid impact risk. This is likely due to scheduling special requirements.

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Miscellaneous |
|---|---|---|---|---|
| (1) | TOI-1801 | RA: 11 42 18.1365 (175.5755687d)<br>Dec: +23 01 37.34 (23.02704d)<br>Equinox: J2000 | Proper Motion RA: -204.8915 mas/yr<br>Proper Motion Dec: 41.8389 mas/yr<br>Parallax: 0.0323697"<br>Epoch of Position: 2016.0 | |

*Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.*
*Category=Star*
*Description=[Exoplanet Systems, Exoplanets, M dwarfs, M stars, Young stellar objects]*
*Extended=NO*

## Acquisition

| # | Target | Acquisition Mode | Filter | Readout Pattern | Groups/Int | Integrations/Exp | Total Integrations | Total Exposure Time | Optional ETC ID |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 TOI-1801 | SOSSFAINT | F480M | NISRAPID | 9 | 1 | 1 | 0.475 | 222915 |

## Template

| Subarray | Include Short First Exposure and F277W Exposure? |
|---|---|
| SUBSTRIP96 | false |

## Spectral Elements

| # | Readout Pattern | Groups/Int | Integrations/Exp | Exposures/Dith | Total Dithers | Total Integrations | Total Exposure Time | Optional ETC ID |
|---|---|---|---|---|---|---|---|---|
| 1 | NISRAPID | 5 | 1597 | 1 | 1 | 1597 | 21247.255 | 222915 |

## Special Requirements

Before Date 31-JAN-2026:00:00:00
Phase 0.98551592 to 0.98943054 with period 10.6440099046 Days and zero-phase 2461032.3428879734 HJD
Aperture PA Range 128 to 143 Degrees (V3 127.43873283 to 142.43873283)
Aperture PA Range 273 to 286 Degrees (V3 272.43873283 to 285.43873283)
Time Series Observation
No Parallel Attachments

## Observation

**Proposal 6932, Observation 2: NIRSpec_toi1801** Wed Jan 07 21:00:18 GMT 2026

**Diagnostic Status: Warning**

Observing Template: NIRSpec Bright Object Time Series

## Diagnostics

(NIRSpec_toi1801 (Obs 2)) 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 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Miscellaneous |
|---|---|---|---|---|
| (1) | TOI-1801 | RA: 11 42 18.1365 (175.5755687d)<br>Dec: +23 01 37.34 (23.02704d)<br>Equinox: J2000 | Proper Motion RA: -204.8915 mas/yr<br>Proper Motion Dec: 41.8389 mas/yr<br>Parallax: 0.0323697"<br>Epoch of Position: 2016.0 | |

*Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.*
*Category=Star*
*Description=[Exoplanet Systems, Exoplanets, M dwarfs, M stars, Young stellar objects]*
*Extended=NO*

## Acquisition

| # | Target | TA Method | Subarray | Filter | Readout Pattern | Groups/Int | Integrations/Exp | Total Integrations | Total Exposure Time | Optional ETC ID |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 Gaia_DR3_3980043972982309504 | WATA | SUB2048 | CLEAR | NRSRAPID | 3 | 1 | 1 | 3.628 | 222915 |

## Template

| Subarray |
|---|
| SUB2048 |

## Spectral Elements

| # | Grating/Filter | Readout Pattern | Groups/Int | Integrations/Exp | Exposures/Dith | Total Dithers | Total Integrations | Total Exposure Time | Optional ETC ID |
|---|---|---|---|---|---|---|---|---|---|
| 1 | G395H/F290LP | NRSRAPID | 8 | 2608 | 1 | 1 | 2608 | 21225.156 | 222915 |

## Special Requirements

Before Date 31-JAN-2026:00:00:00
Phase 0.98551592 to 0.98943054 with period 10.64387 Days and zero-phase 2458903.5435 HJD
Time Series Observation
No Parallel Attachments

## Observation

**Proposal 6932, Observation 3: NIRISS_toi1801** Wed Jan 07 21:00:18 GMT 2026

**Diagnostic Status: Warning**

Observing Template: NIRISS Single-Object Slitless Spectroscopy

## Diagnostics

(NIRISS_toi1801 (Obs 3)) 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 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Miscellaneous |
|---|---|---|---|---|
| (1) | TOI-1801 | RA: 11 42 18.1365 (175.5755687d)<br>Dec: +23 01 37.34 (23.02704d)<br>Equinox: J2000 | Proper Motion RA: -204.8915 mas/yr<br>Proper Motion Dec: 41.8389 mas/yr<br>Parallax: 0.0323697"<br>Epoch of Position: 2016.0 | |

*Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.*
*Category=Star*
*Description=[Exoplanet Systems, Exoplanets, M dwarfs, M stars, Young stellar objects]*
*Extended=NO*

## Acquisition

| # | Target | Acquisition Mode | Filter | Readout Pattern | Groups/Int | Integrations/Exp | Total Integrations | Total Exposure Time | Optional ETC ID |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 TOI-1801 | SOSSFAINT | F480M | NISRAPID | 9 | 1 | 1 | 0.475 | 222915 |

## Template

| Subarray | Include Short First Exposure and F277W Exposure? |
|---|---|
| SUBSTRIP96 | false |

## Spectral Elements

| # | Readout Pattern | Groups/Int | Integrations/Exp | Exposures/Dith | Total Dithers | Total Integrations | Total Exposure Time | Optional ETC ID |
|---|---|---|---|---|---|---|---|---|
| 1 | NISRAPID | 5 | 1597 | 1 | 1 | 1597 | 21247.255 | 222915 |

## Special Requirements

Phase 0.98551592 to 0.98943054 with period 10.64387 Days and zero-phase 2458903.5435 HJD
Aperture PA Range 128 to 143 Degrees (V3 127.43873283 to 142.43873283)
Aperture PA Range 273 to 286 Degrees (V3 272.43873283 to 285.43873283)
Time Series Observation
No Parallel Attachments

## Observation

**Proposal 6932, Observation 4: NIRSpec_toi1801** Wed Jan 07 21:00:18 GMT 2026

**Diagnostic Status: Warning**

Observing Template: NIRSpec Bright Object Time Series

## Diagnostics

(NIRSpec_toi1801 (Obs 4)) 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 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Miscellaneous |
|---|---|---|---|---|
| (1) | TOI-1801 | RA: 11 42 18.1365 (175.5755687d)<br>Dec: +23 01 37.34 (23.02704d)<br>Equinox: J2000 | Proper Motion RA: -204.8915 mas/yr<br>Proper Motion Dec: 41.8389 mas/yr<br>Parallax: 0.0323697"<br>Epoch of Position: 2016.0 | |

*Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.*
*Category=Star*
*Description=[Exoplanet Systems, Exoplanets, M dwarfs, M stars, Young stellar objects]*
*Extended=NO*

## Acquisition

| # | Target | TA Method | Subarray | Filter | Readout Pattern | Groups/Int | Integrations/Exp | Total Integrations | Total Exposure Time | Optional ETC ID |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 Gaia_DR3_3980043972982309504 | WATA | SUB2048 | CLEAR | NRSRAPID | 3 | 1 | 1 | 3.628 | 222915 |

## Template

| Subarray |
|---|
| SUB2048 |

## Spectral Elements

| # | Grating/Filter | Readout Pattern | Groups/Int | Integrations/Exp | Exposures/Dith | Total Dithers | Total Integrations | Total Exposure Time | Optional ETC ID |
|---|---|---|---|---|---|---|---|---|---|
| 1 | G395H/F290LP | NRSRAPID | 8 | 2608 | 1 | 1 | 2608 | 21225.156 | 222915 |

## Special Requirements

Phase 0.98551592 to 0.98943054 with period 10.6440099046 Days and zero-phase 2461032.3428879734 HJD
Time Series Observation
No Parallel Attachments

## Observation

**Proposal 6932, Observation 5: NIRISS_toi1801**

Wed Jan 07 21:00:18 GMT 2026

**Diagnostic Status: Warning**

Observing Template: NIRISS Single-Object Slitless Spectroscopy

## Diagnostics

(NIRISS_toi1801 (Obs 5)) 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 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Miscellaneous |
|---|---|---|---|---|
| (1) | TOI-1801 | RA: 11 42 18.1365 (175.5755687d)<br>Dec: +23 01 37.34 (23.02704d)<br>Equinox: J2000 | Proper Motion RA: -204.8915 mas/yr<br>Proper Motion Dec: 41.8389 mas/yr<br>Parallax: 0.0323697"<br>Epoch of Position: 2016.0 | |

*Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.*
*Category=Star*
*Description=[Exoplanet Systems, Exoplanets, M dwarfs, M stars, Young stellar objects]*
*Extended=NO*

## Acquisition

| # | Target | Acquisition Mode | Filter | Readout Pattern | Groups/Int | Integrations/Exp | Total Integrations | Total Exposure Time | Optional ETC ID |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 TOI-1801 | SOSSFAINT | F480M | NISRAPID | 9 | 1 | 1 | 0.475 | 222915 |

## Template

| Subarray | Include Short First Exposure and F277W Exposure? |
|---|---|
| SUBSTRIP96 | false |

## Spectral Elements

| # | Readout Pattern | Groups/Int | Integrations/Exp | Exposures/Dith | Total Dithers | Total Integrations | Total Exposure Time | Optional ETC ID |
|---|---|---|---|---|---|---|---|---|
| 1 | NISRAPID | 5 | 1597 | 1 | 1 | 1597 | 21247.255 | 222915 |

## Special Requirements

Phase 0.98551592 to 0.98943054 with period 10.6440099046 Days and zero-phase 2461032.3428879734 HJD
Aperture PA Range 128 to 143 Degrees (V3 127.43873283 to 142.43873283)
Aperture PA Range 273 to 286 Degrees (V3 272.43873283 to 285.43873283)
Time Series Observation
No Parallel Attachments

## Observation

**Proposal 6932, Observation 6: NIRSpec_toi1801** Wed Jan 07 21:00:18 GMT 2026

**Diagnostic Status: Warning**

Observing Template: NIRSpec Bright Object Time Series

## Diagnostics

(NIRSpec_toi1801 (Obs 6)) 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 6:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Miscellaneous |
|---|---|---|---|---|
| (1) | TOI-1801 | RA: 11 42 18.1365 (175.5755687d)<br>Dec: +23 01 37.34 (23.02704d)<br>Equinox: J2000 | Proper Motion RA: -204.8915 mas/yr<br>Proper Motion Dec: 41.8389 mas/yr<br>Parallax: 0.0323697"<br>Epoch of Position: 2016.0 | |

*Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.*
*Category=Star*
*Description=[Exoplanet Systems, Exoplanets, M dwarfs, M stars, Young stellar objects]*
*Extended=NO*

## Acquisition

| # | Target | TA Method | Subarray | Filter | Readout Pattern | Groups/Int | Integrations/Exp | Total Integrations | Total Exposure Time | Optional ETC ID |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 Gaia_DR3_3980043972982309504 | WATA | SUB2048 | CLEAR | NRSRAPID | 3 | 1 | 1 | 3.628 | 222915 |

## Template

| Subarray |
|---|
| SUB2048 |

## Spectral Elements

| # | Grating/Filter | Readout Pattern | Groups/Int | Integrations/Exp | Exposures/Dith | Total Dithers | Total Integrations | Total Exposure Time | Optional ETC ID |
|---|---|---|---|---|---|---|---|---|---|
| 1 | G395H/F290LP | NRSRAPID | 8 | 2608 | 1 | 1 | 2608 | 21225.156 | 222915 |

## Special Requirements

Phase 0.98551592 to 0.98943054 with period 10.6440099046 Days and zero-phase 2461032.3428879734 HJD
Time Series Observation
No Parallel Attachments