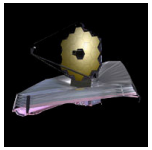

# 12518 - Confirmation of a new outer planet orbiting beta Pictoris A

Cycle: 4, Proposal Category: DD

**INVESTIGATORS**

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**OBSERVATIONS**

| *Folder* | *Observation* | *Label* | *Observing Template* | *Science Target* |
|---|---|---|---|---|
| NIRSpec observations | | | | |
| | 1 | bet Pic NIRSpec roll 1 | NIRSpec IFU Spectroscopy | (1) bet-Pic |
| | 2 | bet Pic NIRSpec roll 2 | NIRSpec IFU Spectroscopy | (1) bet-Pic |
| Observation Folder | | | | |
| | 3 | bet Pic MRS | MIRI Medium Resolution Spectroscopy | (1) bet-Pic |
| | 4 | ref star MRS | MIRI Medium Resolution Spectroscopy | (2) N-CAR |

**ABSTRACT**

We propose NIRSpec IFU and MIRI MRS observations of a newly discovered third planet candidate orbiting beta Pictoris A to confirm its proper motion and determine its fundamental properties. The new outer planet (<600 K; <2 MJup) was serendipitously discovered in the plane of the debris disk from NIRSpec IFU observations (R~2,700; 4-5 um). The existence of a third outer planet in the system was already postulated and has strong and immediate implications for the interpretation of on-going JWST programs due to its impact on the dynamics of both the other planets and the disk. We propose an additional NIRSpec IFU observation in late March 2026 to resolve the projected orbital motion and proper motion of the planet since the discovery epoch in Nov. 2025. We also propose follow-up MIRI MRS observations of bet Pic d in sub-band B to better determine its temperature and mass.

**OBSERVING DESCRIPTION**

We aim to measure the orbital motion of bet Pic d and its effective temperature (to constrain mass) using respectively the NIRSpec IFU (G395H/F290LP; R~2,700; 3--5 um) and MIRI MRS (R~3,700; subband B). respectively.
The JWST observing window for bet Pic closes March 31 2026.

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NIRSpec IFU observations:

The host star is K=3.5 and will saturate in less than two groups.
The V3PA constraints (99 deg < V3PA < 106 deg) is designed to ensure that the planet stays clear of diffraction spikes and the charge transfer on the NIRSpec detector. The saturation does not impact the planet detections as long as the planets are not in the same IFU slice as saturated pixels.
Between 4-5 um, the planet is ~1e-5 fainter than the host star and separated by ~1.1 arcsec.
Two observatory rolls (>4 deg) are implemented to avoid chance alignment between the planet and the speckles, as well as for improving systematics by sampling the NIRSpec point cloud differently.
The two rolls cannot be interrupted to ensure consistency of the NIRSpec wavelength solution and wavefront errors.
A small cycling dither pattern with 16 dithers/roll is used to mitigate NIRSpec spatial undersampling.
The data will be acquired in G395H/F290LP, NRSIRS2RAPID, 4 groups, and 3 integrations.
No target acquisition is required.

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MIRI MRS observations:

The host star bet Pic needs to be offset from the field of view to avoid as much stray light as possible.
The V3PA constraints for MRS (83 deg < V3PA < 88 deg) is to make sure the candidate is away from diffraction spikes and that the star can be shifted out of the field of view for all the dithers. We require a reference star observation with the same offsets to help with fringes calibration during the post-processing.
The two MRS observation cannot be interrupted to maximize consistency between the target and the reference observation.
The data will be acquired in the medium (B)  sub band of MRS, with FAST ramps, 120 groups, and 4 integrations.
Target acquisition is required on both observations to enhance pointing accuracy and reproductibility of the fringes on the reference star.

# Proposal 12518 - Targets - Confirmation of a new outer planet orbiting beta Pictoris A

**Fixed Targets**

| # | Name | Target Coordinates | Targ. Coord. Corrections | Miscellaneous |
|---|---|---|---|---|
| (1) | bet-Pic | RA: 05 47 17.0877 (86.8211988d)<br>Dec: -51 03 59.44 (-51.06651d)<br>Equinox: J2000 | Proper Motion RA: 5.16 mas/yr<br>Proper Motion Dec: 84.041 mas/yr<br>Parallax: 0.0509307"<br>Epoch of Position: 2000 | |
| *Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.*<br>*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.*<br>*Category=Star*<br>*Description=[A stars]*<br>*Extended=NO* | | | | |
| (2) | N-CAR | RA: 06 34 58.5668 (98.7440283d)<br>Dec: -52 58 32.03 (-52.97556d)<br>Equinox: J2000 | Proper Motion RA: -8.469571867308019E-4 sec of time/yr<br>Proper Motion Dec: 0.010539999999999999 arcsec/yr<br>Epoch of Position: 2015.5 | |
| *Comments:*<br>*Category=Star*<br>*Description=[A stars]*<br>*Extended=NO* | | | | |

## Observation

**Proposal 12518, Observation 1: bet Pic NIRSpec roll 1**

Tue Jun 09 15:00:11 GMT 2026

**Diagnostic Status: Warning**

Observing Template: NIRSpec IFU Spectroscopy

## Diagnostics

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

(bet Pic NIRSpec roll 1 (Obs 1)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Miscellaneous |
|---|---|---|---|---|
| (1) | bet-Pic | RA: 05 47 17.0877 (86.8211988d)<br>Dec: -51 03 59.44 (-51.06651d)<br>Equinox: J2000 | Proper Motion RA: 5.16 mas/yr<br>Proper Motion Dec: 84.041 mas/yr<br>Parallax: 0.0509307"<br>Epoch of Position: 2000 | |

*Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.*

*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.*
*Category=Star*
*Description=[A stars]*
*Extended=NO*

## Template

| TA Method | HFF Readout Mode |
|---|---|
| NONE | false |

## Dithers

| # | Dither Type | Size | Starting Point | Number of Points | Points |
|---|---|---|---|---|---|
| 1 | CYCLING | SMALL | 1 | 16 | |

## Spectral Elements

| # | Grating/Filter | Readout Pattern | Groups/Int | Integrations/Exp | Leakcal | Dither | Autocal | Total Dithers | Total Integrations | Total Exposure Time | Optional ETC ID |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | G395H/F290LP | NRSRAPID | 4 | 3 | false | true | NONE | 16 | 48 | 2576.825 | |

| Special Requirements | |
|---|---|
| | Aperture PA Range 237.97164917 to 244.97164917 Degrees (V3 99.0 to 106.0)<br><br>Group Observations 1, 2, Non-interruptible<br>Aperture PA Offset 1 from 2 by 4 to 20 Degrees (Same offsets in V3) |

## Observation

**Proposal 12518, Observation 2: bet Pic NIRSpec roll 2** Tue Jun 09 15:00:11 GMT 2026

**Diagnostic Status: Warning**

Observing Template: NIRSpec IFU Spectroscopy

## Diagnostics

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

(bet Pic NIRSpec roll 2 (Obs 2)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Miscellaneous |
|---|---|---|---|---|
| (1) | bet-Pic | RA: 05 47 17.0877 (86.8211988d)<br>Dec: -51 03 59.44 (-51.06651d)<br>Equinox: J2000 | Proper Motion RA: 5.16 mas/yr<br>Proper Motion Dec: 84.041 mas/yr<br>Parallax: 0.0509307"<br>Epoch of Position: 2000 | |

*Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.*

*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.*
*Category=Star*
*Description=[A stars]*
*Extended=NO*

## Template

| TA Method | HFF Readout Mode |
|---|---|
| NONE | false |

## Dithers

| # | Dither Type | Size | Starting Point | Number of Points | Points |
|---|---|---|---|---|---|
| 1 | CYCLING | SMALL | 1 | 16 | |

## Spectral Elements

| # | Grating/Filter | Readout Pattern | Groups/Int | Integrations/Exp | Leakcal | Dither | Autocal | Total Dithers | Total Integrations | Total Exposure Time | Optional ETC ID |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | G395H/F290LP | NRSRAPID | 4 | 3 | false | true | NONE | 16 | 48 | 2576.825 | |

| Special Requirements | |
|---|---|
| | Aperture PA Range 237.97164917 to 244.97164917 Degrees (V3 99.0 to 106.0)<br><br>Group Observations 1, 2, Non-interruptible<br>Aperture PA Offset 1 from 2 by 4 to 20 Degrees (Same offsets in V3) |

## Observation

**Proposal 12518, Observation 3: bet Pic MRS** Tue Jun 09 15:00:11 GMT 2026

**Diagnostic Status: Warning**

Observing Template: MIRI Medium Resolution Spectroscopy

## Diagnostics

(Visit 3:1) Warning (Form): Data Excess over lower threshold

(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) | bet-Pic | RA: 05 47 17.0877 (86.8211988d) | Proper Motion RA: 5.16 mas/yr | |
| | | Dec: -51 03 59.44 (-51.06651d) | Proper Motion Dec: 84.041 mas/yr | |
| | | Equinox: J2000 | Parallax: 0.0509307" | |
| | | | Epoch of Position: 2000 | |

*Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.*

*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.*
*Category=Star*
*Description=[A stars]*
*Extended=NO*

## Acquisition

| # | Target | Filter | Readout Pattern | Groups/Int | Integrations/Exp | Total Integrations | Total Exposure Time | Optional ETC ID |
|---|---|---|---|---|---|---|---|---|
| 1 | SAME | FND | FAST | 4 | 1 | 1 | 11.1 | 291450.4 |

## Template

| Primary Channel | Simultaneous Imaging | Imager Subarray | Grating Wheel Direction |
|---|---|---|---|
| All MRS | NO | FULL | Allow Auto Reorder |

## Mosaic

| Rows | Columns | Row Overlap % | Column Overlap % | Row shift (deg) | Column shift (deg) | Tile Order |
|---|---|---|---|---|---|---|
| 2 | 2 | 98.0 | 98.0 | 0.0 | 0.0 | DEFAULT |

## Dithers

| # | Dither Type | Optimized For | Direction |
|---|---|---|---|
| 1 | 2-Point | EXTENDED SOURCE | NEGATIVE |

## Spectral Elements

| # | Wavelength Range | Detector | Filter | Readout Pattern | Groups/Int | Integrations/Exp | Exposures/Dith | Dither | Total Dithers | Total Integrations | Total Exposure Time | Optional ETC ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | MEDIUM(B) | MRSLONG | | FASTR1 | 120 | 4 | 1 | Dither 1 | 2 | 8 | 2680.689 | |
| 1 | MEDIUM(B) | MRSSHORT | | FASTR1 | 120 | 4 | 1 | Dither 1 | 2 | 8 | 2680.689 | |

| Special Requirements | |
|---|---|
| | Aperture PA Range 83.0 to 88.0 Degrees (V3 83.0 to 88.0)<br>Offset 2.0 arcsec, 1.75 arcsec<br><br>Group Observations 3, 4, Non-interruptible |

## Observation

**Proposal 12518, Observation 4: ref star MRS**

Tue Jun 09 15:00:11 GMT 2026

**Diagnostic Status: Warning**

Observing Template: MIRI Medium Resolution Spectroscopy

## Diagnostics

(Visit 4:1) Warning (Form): Data Excess over lower threshold

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

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Miscellaneous |
|---|---|---|---|---|
| (2) | N-CAR | RA: 06 34 58.5668 (98.7440283d)<br>Dec: -52 58 32.03 (-52.97556d)<br>Equinox: J2000 | Proper Motion RA: -8.469571867308019E-4 sec of time/yr<br>Proper Motion Dec: 0.010539999999999999 arcsec/yr<br>Epoch of Position: 2015.5 | |

*Comments:*
*Category=Star*
*Description=[A stars]*
*Extended=NO*

## Acquisition

| # | Target | Filter | Readout Pattern | Groups/Int | Integrations/Exp | Total Integrations | Total Exposure Time | Optional ETC ID |
|---|---|---|---|---|---|---|---|---|
| 1 | SAME | FND | FAST | 4 | 1 | 1 | 11.1 | 291450.5 |

## Template

| Primary Channel | Simultaneous Imaging | Imager Subarray | Grating Wheel Direction |
|---|---|---|---|
| All MRS | NO | FULL | Allow Auto Reorder |

## Mosaic

| Rows | Columns | Row Overlap % | Column Overlap % | Row shift (deg) | Column shift (deg) | Tile Order |
|---|---|---|---|---|---|---|
| 2 | 2 | 98.0 | 98.0 | 0.0 | 0.0 | DEFAULT |

## Dithers

| # | Dither Type | Optimized For | Direction |
|---|---|---|---|
| 1 | 2-Point | EXTENDED SOURCE | NEGATIVE |

## Spectral Elements

| # | Wavelength Range | Detector | Filter | Readout Pattern | Groups/Int | Integrations/Exp | Exposures/Dith | Dither | Total Dithers | Total Integrations | Total Exposure Time | Optional ETC ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | MEDIUM(B) | MRSLONG | | FASTR1 | 120 | 4 | 1 | Dither 1 | 2 | 8 | 2680.689 | |
| 1 | MEDIUM(B) | MRSSHORT | | FASTR1 | 120 | 4 | 1 | Dither 1 | 2 | 8 | 2680.689 | |

| Special Requirements | |
|---|---|
| | Aperture PA Range 83.0 to 88.0 Degrees (V3 83.0 to 88.0)<br>Offset 2.0 arcsec, 1.75 arcsec<br><br>Group Observations 3, 4, Non-interruptible |