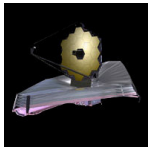

# 9342 - Resolving the nuclear IMBH in the spiral galaxy NGC 3259

Cycle: 4, Proposal Category: GO

**INVESTIGATORS**


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

| *Folder* | *Observation* | *Label* | *Observing Template* | *Science Target* |
|---|---|---|---|---|
| Observation Folder | | | | |
| | 1 | | NIRCam Imaging | (1) NGC3259 |


**ABSTRACT**

The nearby spiral galaxy NGC 3259 contains a low-luminosity broad-line AGN, recently interpreted as a strong IMBH candidate. Located at 27(+5/-10) Mpc, it is the third-closest AGN powered by an IMBH after NGC 4395 and compton-thick IC750. With Chandra, we will spatially disentangle the point-like AGN emission from any extended thermal-plasma or X-ray binaries emission in the nuclear starburst region. Measuring the intrinsic ionizing flux and variability of the AGN will help us interpret its optical line spectrum and calibrate its virial factor. With JWST, we will accurately measure the TRGB distance to the galaxy, further reducing the systematic uncertainty in the IMBH mass estimate.


**OBSERVING DESCRIPTION**

(i) JWST justification

An important uncertainty hampering the BH mass measurements in NGC3259 is the distance to the galaxy, because the virial MBH estimate scales linearly with distance. Grishin et al. (2025) recently adopted a Hubble distance from the CosmicFlows3 online calculator, which can be subject to

systematic uncertainties up to 20% if NGC3259 has a substantial peculiar velocity within its group. Other redshift-independent distance estimates listed in the NASA/IPAC Extragalactic Database are all based on the Tully-Fisher relation and lie in the range 17.0-32.0Mpc. If the true distance is close to the lower boundary, then MBH can be as low as 1e5 MSun.

We propose to measure a 1.5%-accurate distance using the tip-of-the-red-giant branch (TRGB) method with dedicated JWST NIRCam imaging (all existing HST data are too shallow for this purpose). We propose to use the F115W-F150W filter combination, which will also enable another 3%-accurate redshift-independent distance measurement using the J-band asymptotic giant branch technique (JAGB). Both the TRGB and JAGB methods require far fewer resources than the Cepheids Period--Luminosity (CPL) relation, the `gold standard' of extragalactic distance measurements. At the same time, the TRGB method provides a similar accuracy (1-2%) out to 40Mpc, being insensitive to dust unlike the CPL relation.

Thanks to the unique capability of NIRCam of collecting data in short and long channels simultaneously, we will also observe in the F277W and F365W bands. With images in those bands, we will probe the old stellar population without dust obscuration (F277W) and the 3.3um band of polycyclic aromatic hydrocarbons (PAHs) emission. PAH emission in the nuclear star-forming region is an (inverse) proxy for the hard X-ray emission of the AGN, because the tiny grains (size <10A) responsible for the PAH emission are evaporated into the gas phase by the hard X-ray photons. Thus, PAH emission provides an independent constraint on the intrinsic AGN luminosity seen by the surrounding gas. We will compare the PAH constraint from JWST with our direct measurement of X-ray AGN emission obtained from the Chandra spectra.

(ii) Instrument and setup justification
We propose to use NIRCam in the F115W/F277W (60% of exp.time) and F150W/F356W (40%) filters. (1) F115W is needed for a reliable detection of the TRGB and for the application of the JAGB method to detect asymptotic giant branch stars. (2) F150W has a comparable spatial resolution, critical for NGC3259 where crowding is a challenge, and therefore F277W will not provide the desired quality of photometry due to its lower spatial resolution.

(iii) Exposure time justification
We ran the NIRCam ETC to estimate the exposure time required to reach the depth of 28.8 mag in the F115W filter and 28.6 mag in the F150W filter for the M0III spectral template (S/N=5), 1.5 mag deeper than the TRGB at 27 Mpc. We need about 5,400s to reach the desired depth with NIRCam in F115W and 2,480s in F150W. We will use the following setups: for F115W, DEEP8 readout, 4-point dither, 7 groups, 1 integration; for F150W, MEDIUM8 readout, 4-point dither, 6 groups, 1 integration. We will use F277W in the long NIRCam channel in parallel to F115W, and F356W in

parallel to F150W. The total JWST exposure time adds up to 2.4h, which translates to 3.8h including overheads.

# Proposal 9342 - Targets - Resolving the nuclear IMBH in the spiral galaxy NGC 3259

**Fixed Targets**

| # | Name | Target Coordinates | Targ. Coord. Corrections | Miscellaneous |
|---|---|---|---|---|
| (1) | NGC3259 | RA: 10 32 33.4494 (158.1393725d)<br>Dec: +65 02 13.69 (65.03714d)<br>Equinox: J2000 | 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=Galaxy*
*Description=[Active galactic nuclei, Galaxy nuclei, Seyfert galaxies]*
*Extended=YES*

## Observation

**Proposal 9342, Observation 1**

Tue Aug 26 13:01:07 GMT 2025

**Diagnostic Status: Warning**

Observing Template: NIRCam Imaging

## Diagnostics

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

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Miscellaneous |
|---|---|---|---|---|
| (1) | NGC3259 | RA: 10 32 33.4494 (158.1393725d)<br>Dec: +65 02 13.69 (65.03714d)<br>Equinox: J2000 | Epoch of Position: 2000 | |

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*Category=Galaxy*
*Description=[Active galactic nuclei, Galaxy nuclei, Seyfert galaxies]*
*Extended=YES*

## Template

| Module | Subarray | Target Placement |
|---|---|---|
| ALL | FULL | Module A (A3 corner) |

## Dithers

| # | Primary Dither Type | Primary Dithers | Subpixel Dither Type | Dither Size | Subpixel Positions |
|---|---|---|---|---|---|
| 1 | INTRAMODULEBOX | 4 | STANDARD | | 1 |

## Spectral Elements

| # | Short Filter | Long Filter | Readout Pattern | Groups/Int | Integrations/Exp | Total Integrations | Total Dithers | Total Exposure Time | Optional ETC ID |
|---|---|---|---|---|---|---|---|---|---|
| 1 | F115W | F277W | DEEP8 | 7 | 1 | 4 | 4 | 5497.226 | |
| 2 | F150W | F356W | MEDIUM8 | 6 | 1 | 4 | 4 | 2490.931 | |

## Special Requirements

Fiducial Point Override NRCAS_FULL