14501 - Confirming the wide binary companion of IRC+10216

Cycle: 23, Proposal Category: GO/DD

(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
02	(2) IRC+10216-UVIS (3) IRC+10216-IR	WFC3/IR WFC3/UVIS	1	30-Apr-2016 21:00:19.0	yes

1 Total Orbits Used

ABSTRACT

The latest HST optical images of the nearest carbon-rich asymptotic giant branch (AGB) star IRC+10216 revealed two point-like sources at the center of its circumstellar envelope (CSE). A plausible interpretation is that the dense inner envelope is clearing, and hence revealing the central binary stars and the associated structures. Since IRC+10216 has changed so dramatically in 10 years, more frequent monitoring is necessary. A similar dramatic change is also found in the near-infrared (NIR). The clumps detected over two decades have disappeared in a ground-based observation in Feb. 2016, leaving a single peak in H and K and two peaks in J. The second peak in J has a different color from that of the primary peak and its CSE, implying a different origin and thus supporting the identification as a companion star. In particular, its spectral peak is likely at a wavelength slightly shorter than J band, consistent with an M-type main-sequence star. However, its correspondance with the optical source is not conclusive because of the small field of view of the ground-based NIR observations, traded with the high resolution using the adaptive optics. In order to confirm/refute the identication of the AGB star IRC+10216 and its companion and to monitor the evolution of its CSE, we propose for WFC3 snapshots in two UVIS bands and one IR band to simultaneously achieve (1) high resolution and (2) large field of view for astrometry. This would be the first confirmation of a "main-sequence companion" consisting a "wide binary" with an AGB star, which is the major category of missing companions of evolved stars. This observation is optimized near the light curve minimum, which is now.

OBSERVING DESCRIPTION

The proposed observations are to take WFC3 images of IRC+10216 in two UVIS bands (F606W and F814W) and one IR band (F098M). The F606W and F814W observations are the repeats of the previous PID 12205 observations (June 4, 2011) but for shorter integration times. It will also be observed with the F098M filter, which will bridge the F606W and F814W images to our newly observed GEMINI/NIFS data in J band.

The 2011 HST F606W and F814W images consist of one bright point-like source (tentatively identified as a carbon star; IRC+10216 A) connected by bright North-South blobs with a ~0.4 arcsec extension and one weaker point-like source (tentatively identified as a companion, M-type main-sequence star; IRC+10216 B) at ~0.5 arcsec east of the bright source. There were several diffuse clumps surrounding these point-like sources. See Figure 1(c) in the proposal pdf file. As the nature of a carbon star, it has an extended component with FWHM > 1 arcsec over ~100 arcsec (Figure 1(e)). The carbon star (and thus the extended halo component) light is currently in the increasing phase (see Figure 2, dark gray), and the F098M observation would enter nonlinear (or saturation) regime after May 5-10. EARLIER EXECUTION IS DESIRED, and a careful treatment is required after this date. IRC+10216 is not visible in the HST orbit after June 24.

With the on-source time ~700 sec, ~60 sec, and ~15 sec for F606W, F814W, and F098M, the companion (0.3-0.5 arcsec east of the peak) would have

S/N>100. We do not expect any saturation issue for the two UVIS bands. The IR band (F098M) could have saturation issue, therefore we will set the individual exposure time to be the minimum (~2.9 sec). We expect the peak pixel of F098M image to remain in a linear regime before ~May 5 (no later than May 10) and to enter non-linear regime but not to be saturated before ~June 24.

The observations with all 3 filters will be completed in one orbit. To bridge the gap between the UVIS chips for F606W and F814W, we will use a 2-point dither following the WFC3-UVIS-GAP-LINE pattern. For the NIR imaging, we will use a 2-point dither applying the WFC3-IR-DITHER-BLOB pattern to mitigate the effects of blobs and other artifacts.

Visit

Proposal 14501, Visit 02, implementation Sun May 01 01:00:21 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR, WFC3/UVIS

Special Requirements: (none)

Patterns

#	Primary Pattern	Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-GAP-LINE Purpose=MOSAIC Number Of Points=2 Point Spacing=2.414 Line Spacing= Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=true		(2), (3)
(2)	Pattern Type=WFC3-IR-DITHER-BLOB Purpose=DITHER Number Of Points=2 Point Spacing=5.183 Line Spacing= Coordinate Frame=POS-TARG Pattern Orientation=41.859 Angle Between Sides= Center Pattern=true		(1)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	IRC+10216-UVIS	RA: 09 47 59.5193 (146.9979971d) Dec: +13 16 59.12 (13.28309d) Equinox: J2000		V=10.96	Reference Frame: SIMBAD
(3)	IRC+10216-IR	RA: 09 47 59.6487 (146.9985363d) Dec: +13 16 47.42 (13.27984d) Equinox: J2000		V=10.96	Reference Frame: SIMBAD

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) IRC+10216-IR	WFC3/IR, MULTIACCUM, IR	F098M	NSAMP=1; SAMP-SEQ=RAPID		Pattern 2, Exps 1-1 in Visit 02 (2)	2.932291 Secs X 6 (35.187 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 1, Copy 3)]* *[==>(Pattern 1, Copy 4)]* *[==>(Pattern 1, Copy 5)]* *[==>(Pattern 1, Copy 6)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 2, Copy 3)]* *[==>(Pattern 2, Copy 4)]* *[==>(Pattern 2, Copy 5)]* *[==>(Pattern 2, Copy 6)]*	***[1]***
2		(2) IRC+10216-UVIS	WFC3/UVIS, ACCUM, UVIS	F606W			Pattern 1, Exps 2-2 in Visit 02 (1)	350 Secs (700 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
3		(2) IRC+10216-UVIS	WFC3/UVIS, ACCUM, UVIS	F814W	FLASH=4		Pattern 1, Exps 3-3 in Visit 02 (1)	350 Secs (700 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Orbit Structure