

FORCAST

FORCAST: Faint Object InfraRed Camera for the SOFIA Telescope

Facility Class, Mid/Far-Infrared Camera and Spectrograph

Principal Investigator: Terry Herter, Cornell University

Star Formation Signatures in the Galactic Center

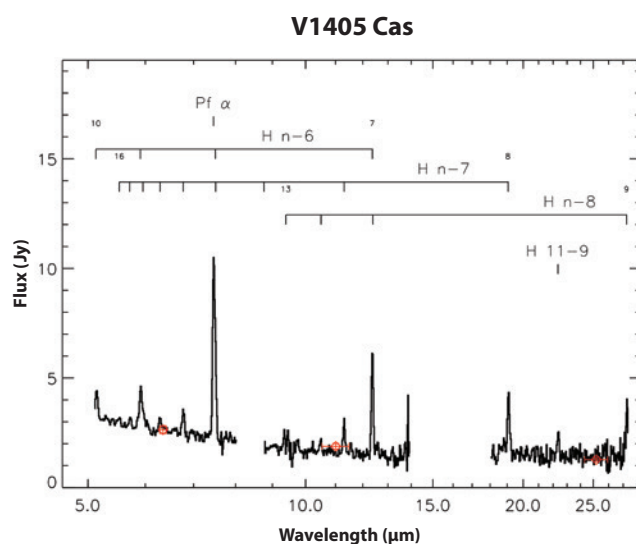
A composite image of the Galactic Center from the Cycle 7 FORCAST Galactic Center Legacy Survey (*Hankins et al. 2020, ApJ, 894, 55*) at 25 μm in blue and 37 μm in green, combined with Herschel data at 70 μm in red and Spitzer data at 8 μm in white. The survey covered 403 arcmin² including Sgr A, B, and C complexes. The high spatial resolution afforded by FORCAST and the ability to resolve regions that were saturated with Spitzer allow the study of mid-IR sources and sites of ongoing star formation within the Galactic Center region. The publicly available dataset contains images of



regions with the most extreme conditions of star formation in our galaxy and reveal extended features, structures in the Arched Filaments and Sickie H II regions, hints of ongoing star formation in Sgr B2 and C, and isolated star formation activity. The angular resolution and details visible in these FORCAST images of the Galactic Center provided by the Legacy program are unrivaled and unprecedented at these wavelengths.

Grism Coverage 5–27 μm

Spectra, obtained with three of the four grisms (G063, G111, and G227) in FORCAST and spanning 5–27 μm at low spectral resolution ($R \sim 120\text{--}140$), of the very slow, bright nova V1405 Cas. These data reveal the full suite of hydrogen recombination lines labelled to the right. The absence of forbidden metallic emission lines ~ 105 days after the outburst began (March 18, 2021) suggests the density in the ejecta is sufficiently high to quench the lines. The relative line strengths and shape of these spectra are notably similar to those of nova V339 Del (*Gehrz, R. D., et al. 2018, ApJ, 812, 132*). The red points are the photometric results from FORCAST filter images, demonstrating the accuracy of the spectroscopic flux calibration. (*Gehrz et al. 2021, ATel, 14794*)



Specifications

The short wavelength channel (SWC) and long wavelength channel (LWC) can be used individually or together for simultaneous imaging of the same field of view. For grism observations, either channel may be used independently.

Imaging

The point spread function (PSF) in FORCAST images is consistent with the telescope's diffraction limit convolved with the 1.3" rms jitter. In dual channel mode, a dichroic is used to split the beam into the SWC and LWC, decreasing the throughput of the system by 40–85% relative to the single channel mode.

Camera Details

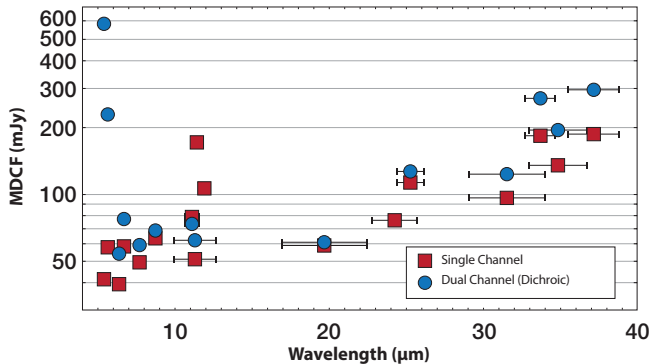
Camera	Wavelength Range	Detector
SWC	5–25 μm	Si:As (BIB)
LWC	25–40 μm	Si:Sb (BIB)

Each channel consists of a 256x256 pixel array that yields a 3.4"x3.2' instantaneous field-of-view with 0.768" pixels

Filter Parameters

SWC Filters		LWC Filters	
λ_{eff} (μm)	$\Delta\lambda$ (μm)	λ_{eff} (μm)	$\Delta\lambda$ (μm)
5.4	0.16	11.3	0.24
5.6	0.08	11.8	0.74
6.4	0.14	24.2	2.9
6.6	0.24	31.5	5.7
7.7	0.47	33.6	1.9
8.8	0.41	34.8	3.8
11.1	0.95	37.1	3.3
11.2	2.7	A subset of these will be chosen each cycle as the nominal set.	
19.7	5.5		
25.3	1.86		

FORCAST Sensitivity



Continuum point source sensitivities for single and dual channel modes. Values are for S/N = 4 in 900 s under nominal conditions. Investigators are encouraged to use the SOFIA Integration Time Calculator (SITE) for their calculations.

Spectroscopy

FORCAST grisms provide coverage from 5–40 μm . Blazed diffraction gratings are used in transmission and stacked with blocking filters to prevent order contamination. Two long slits (2.4"x191", 4.7"x191") are available.

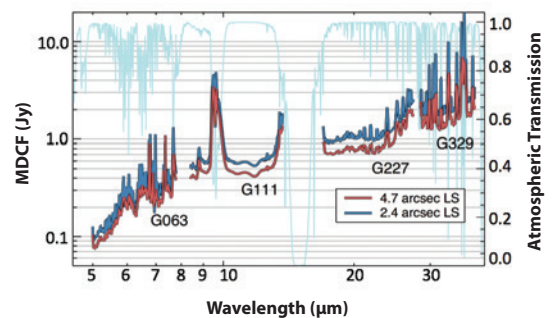
Grism Details

Grism	Coverage (μm)	R ($\lambda/\Delta\lambda$) ^a
G063	4.9–8.0	120 ^b /180
G111	8.4–13.7	130 ^b /260
G227	17.6–27.7	110/120
G329	28.7–37.1	160

^a For the 4.7"x191" and the 2.4"x191" slits, respectively.

^b The resolution of the long, narrow-slit modes is dependent on (and varies slightly with) the in-flight IQ.

FORCAST Grism Sensitivities



Grism continuum point source sensitivities for both wide and narrow long slits overlaid on an atmospheric transmission model (light blue). Values are for S/N = 4 in 900 s under nominal conditions.