FORCAST

FORCAST: Faint Object InfraRed Camera for the SOFIA Telescope

Facility Class, Mid/Far-Infrared Camera and Spectrograph

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PAH Tracing at 11.2 μm

FORCAST has been used to collect 11.1 μm data of NGC 7023 *(top left)* which was then combined with FLITECAM 3.3 μm data and *Spitzer*/IRAC 8.0 μm data *(top right)* to yield a plot of the 11.2/3.3 μm flux ratio revealing the PAH size distribution *(bottom)*. FORCAST observations provide higher angular resolution than *Spitzer* which thereby enables the PAH size distribution to be traced through the ratio of 11.2 μm emission to the SOFIA/FLITECAM 3.3 μm data.

The famous reflection nebula NGC 7023 was observed with FORCAST in order to better understand the photochemical evolution of polycyclic aromatic hydrocarbons (PAHs) resulting from illumination by the nearby star HD 200775. Similarities to the H_2 flux (contours) indicate that the smallest PAH molecules lie on the surface of the PDR. *(Croiset et al. 2016, A&A, 590, A26.)*


NGC 7023

Grism Coverage from 5–37 μm

The early temporal development of the classical nova V339 Delphini was observed using FORCAST grisms, which provide coverage from 5–40 μm at low spectral resolution (R ~ 140–300). These data revealed a full suite of hydrogen recombination lines, the analysis of which indicated that the ejecta were still at very high density ($n_e > 10^{13}$ cm^{-3}) and that the hydrogen lines were optically thick. *(Gehrz et al. 2015, ApJ, 812, 132.)*
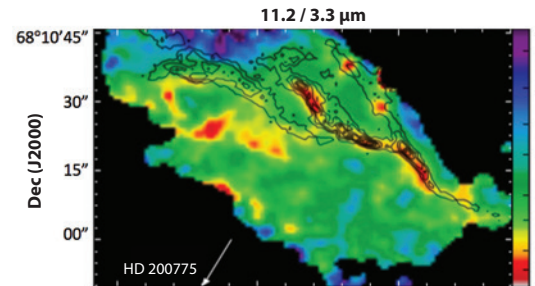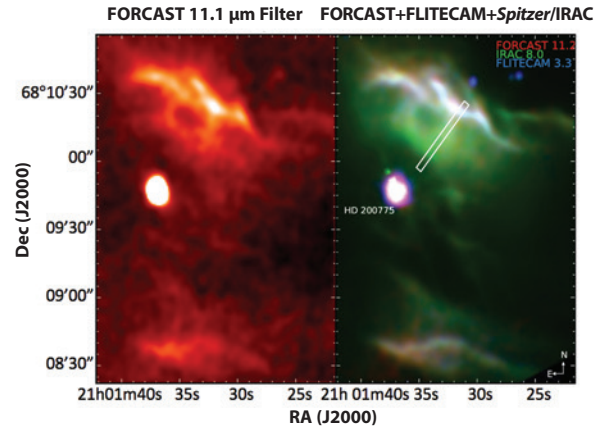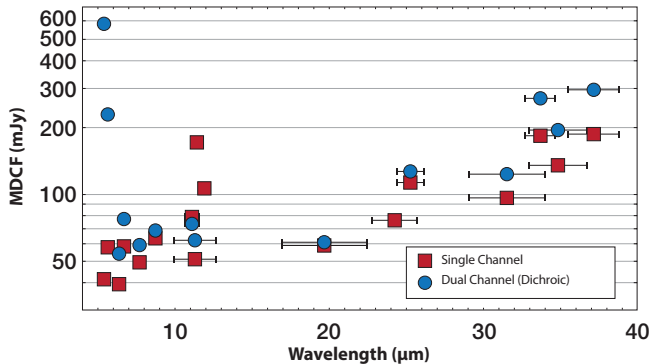

V339 Delphini
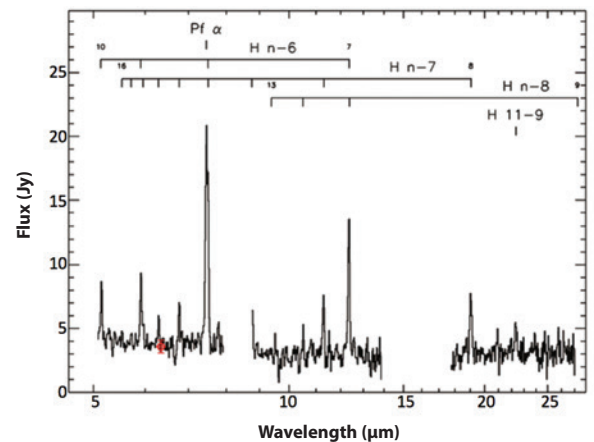
Specifications

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	25–40μm	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	24.2	2.9
5.6	0.08	31.5	5.7
6.4	0.14	33.6	1.9
6.6	0.24	34.8	3.8
7.7	0.47	37.1	3.3
8.8	0.41		
11.1	0.95		
11.2	2.7		
11.3	0.24	A subset of these will be chosen each cycle as the nominal set.	
11.8	0.74		
19.7	5.5		
25.4	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 (λ/Δλ)[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.
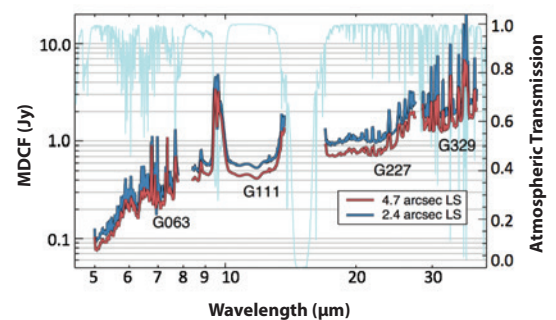[b] The resolution of the long, narrow-slit modes is dependent on (and varies slightly with) the in-flight IQ.

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.