Dust in the Wind

circumnuclear dust in nearby AGN imaged with JWST

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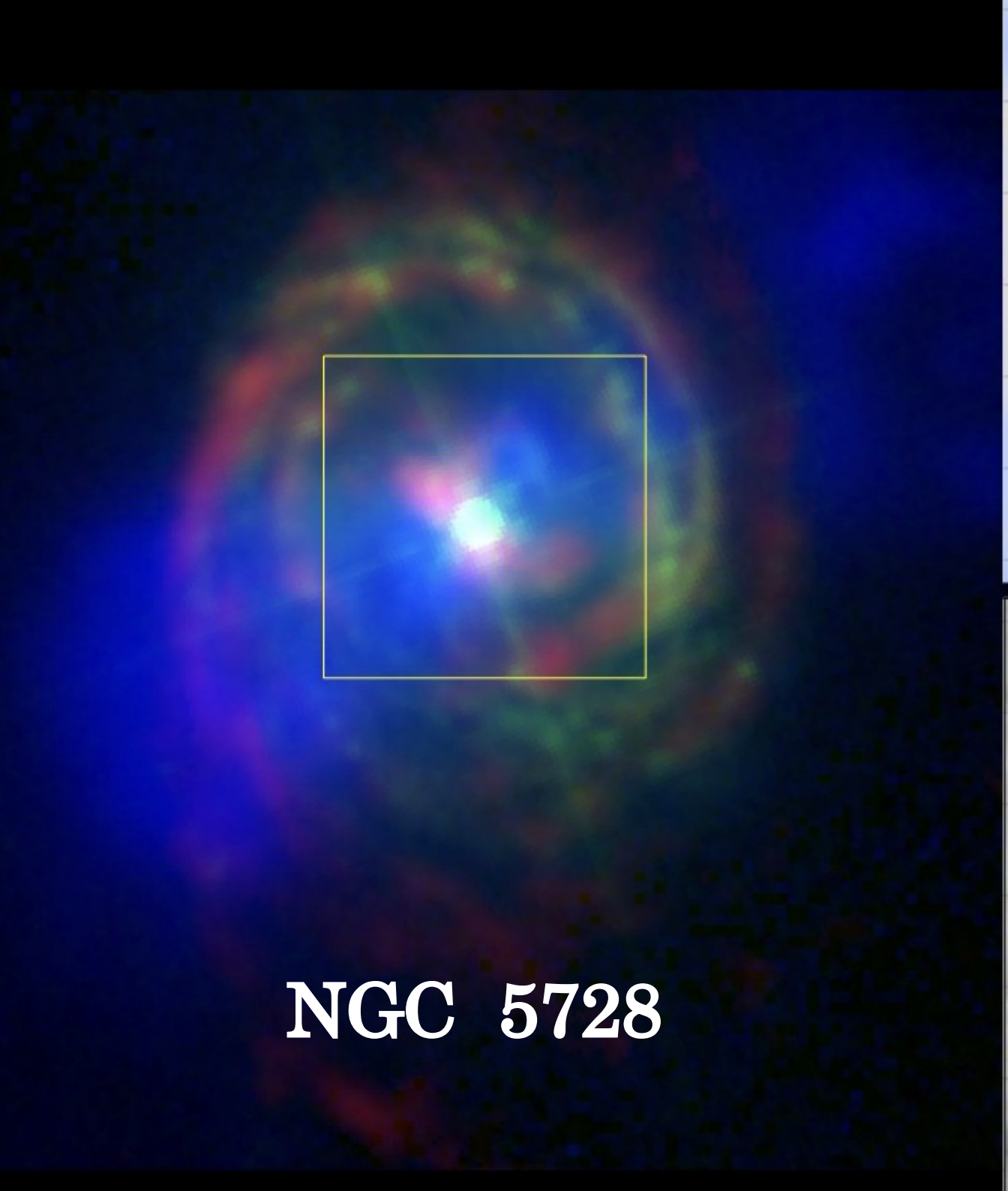
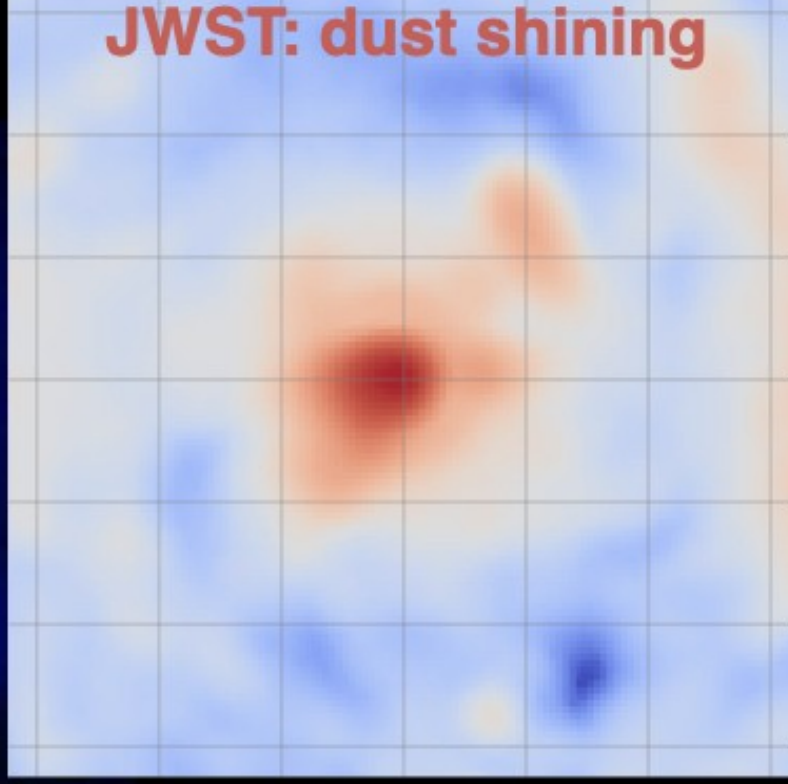
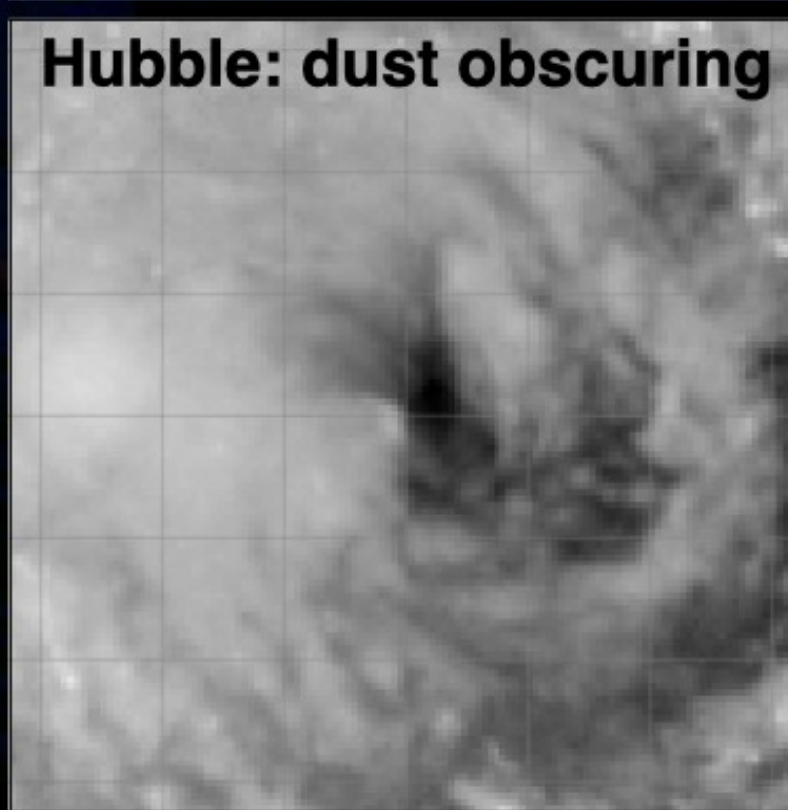
We are an international team of observers, modellers and instrument specialists with the express aim of understanding the small-scale structure and dynamics of AGN, from the circumnuclear region (inner 100s of pc) to the accretion disk.

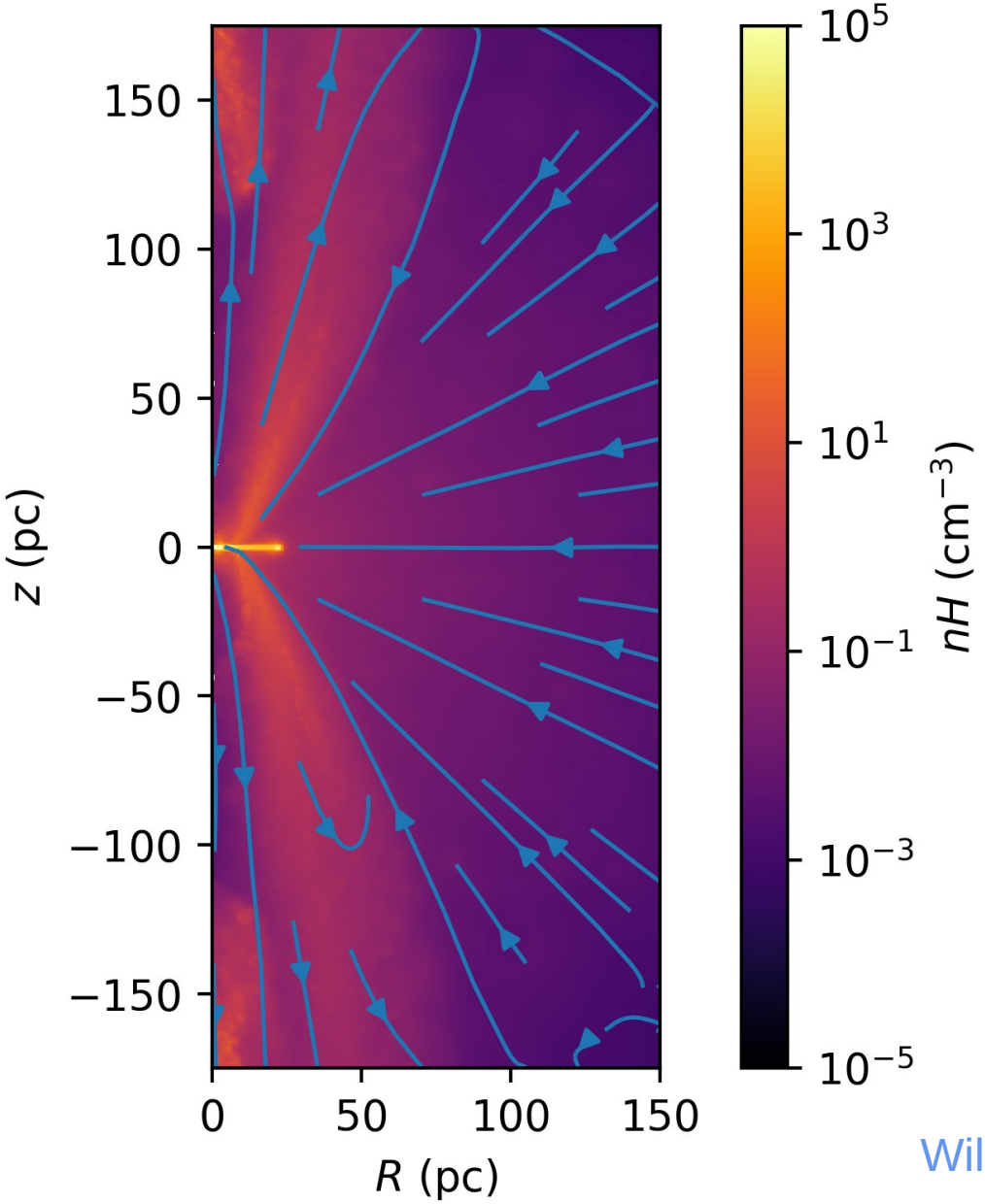
We use ALMA, JWST, 8-10 mt class telescopes (VLT, GTC, Keck), SOFIA and other facilities.


NGC 5728


JWST: dust shining

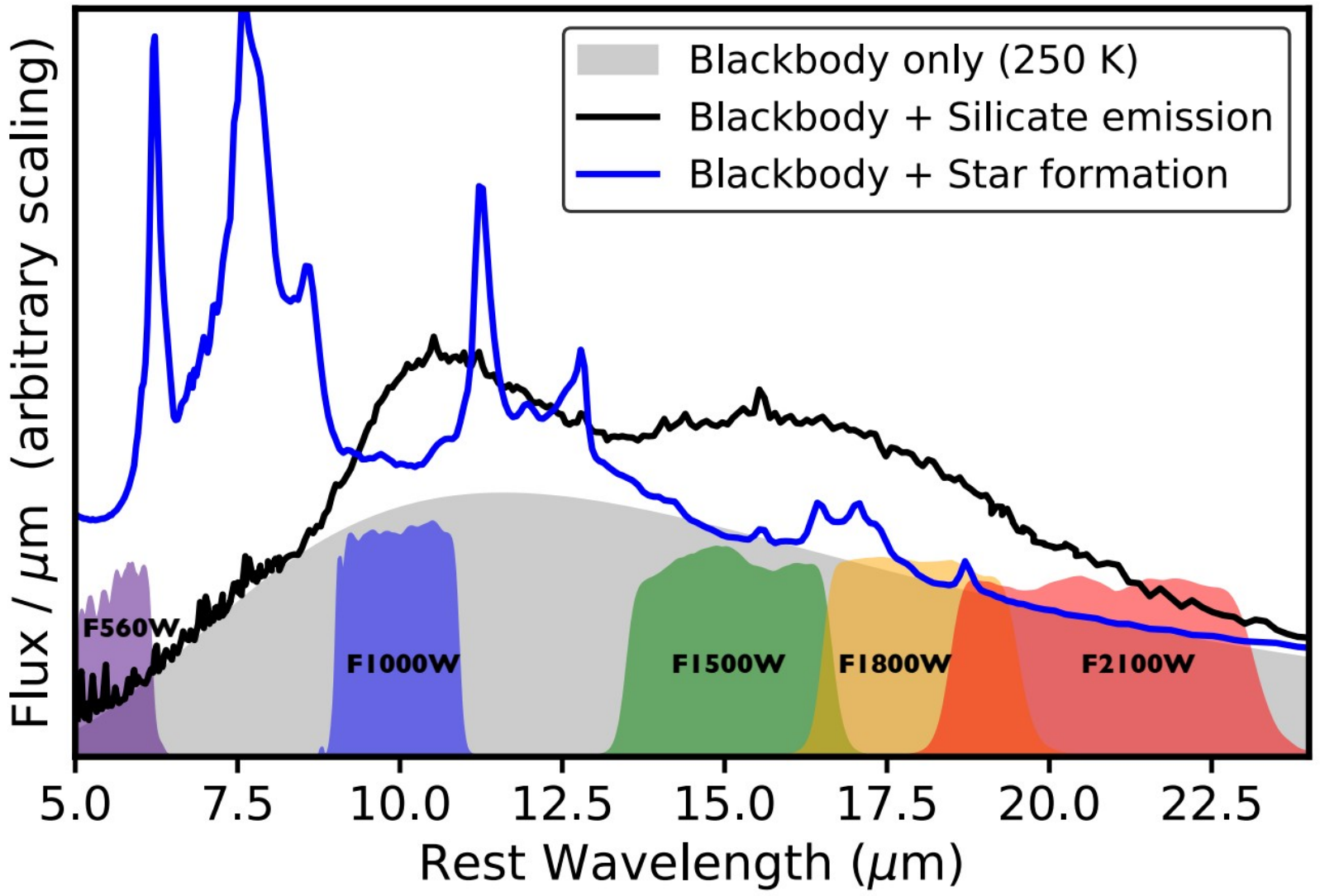

Hubble: dust obscuring

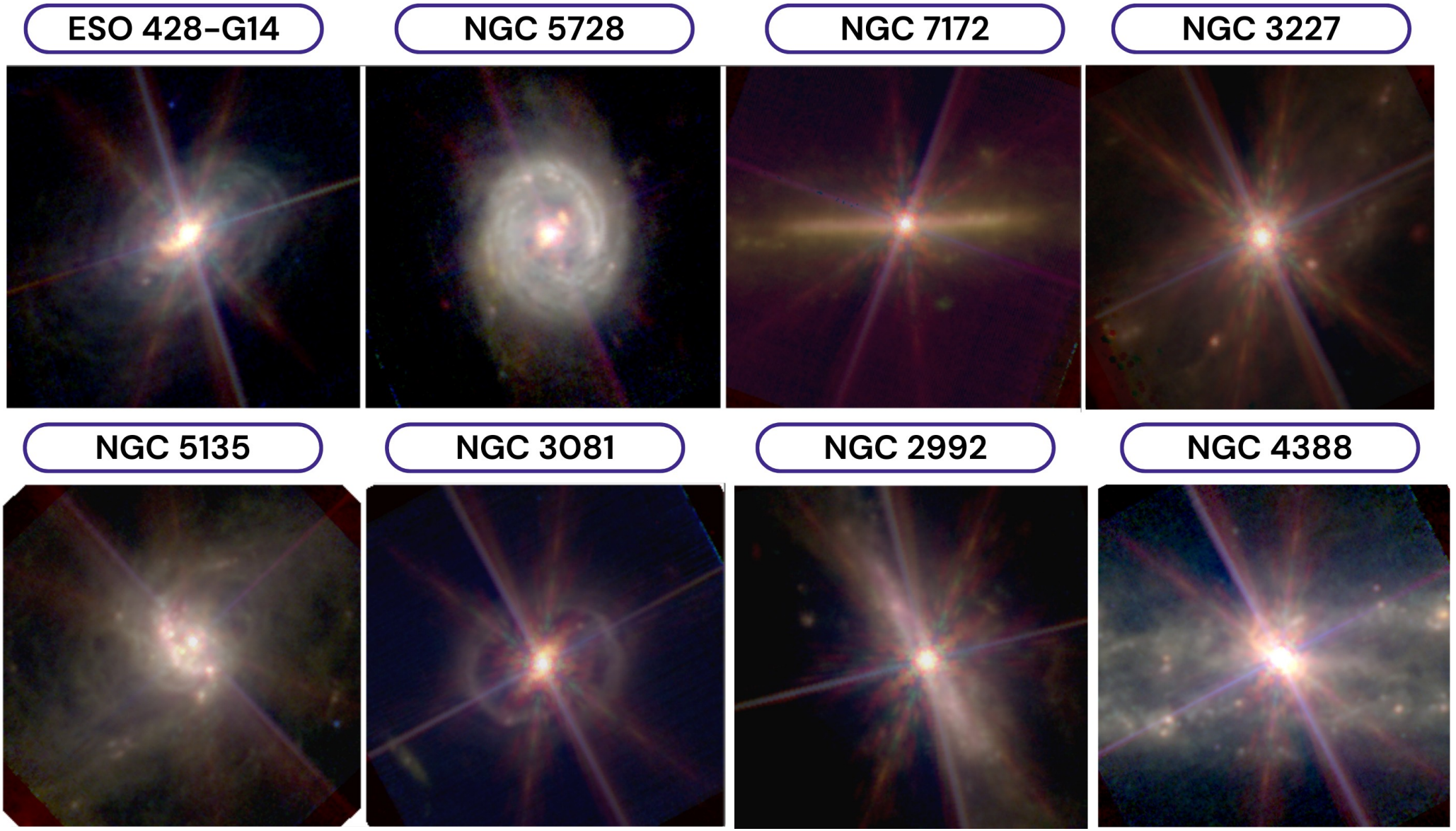
The Windy Torus



Williamson+ (2020)

Dust in the Wind
a JWST Cycle 1 program



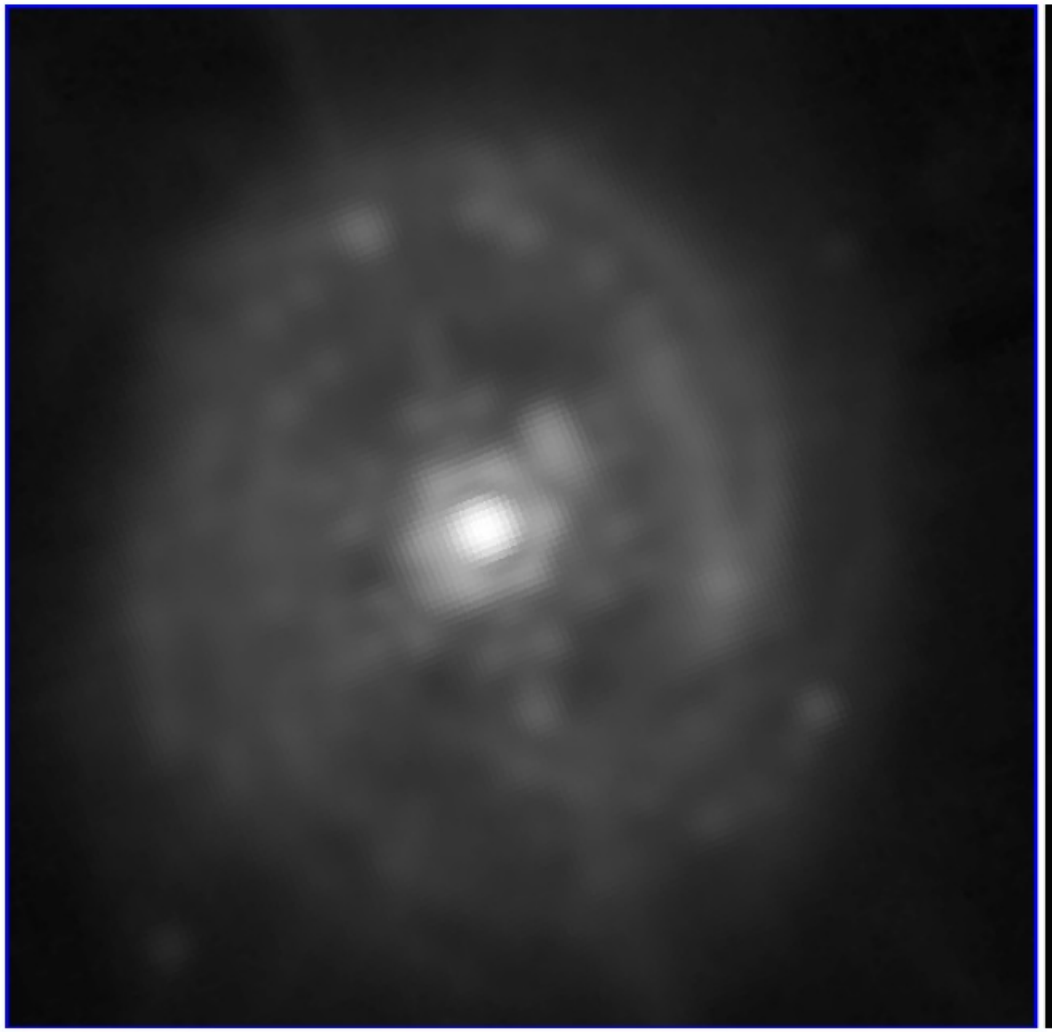


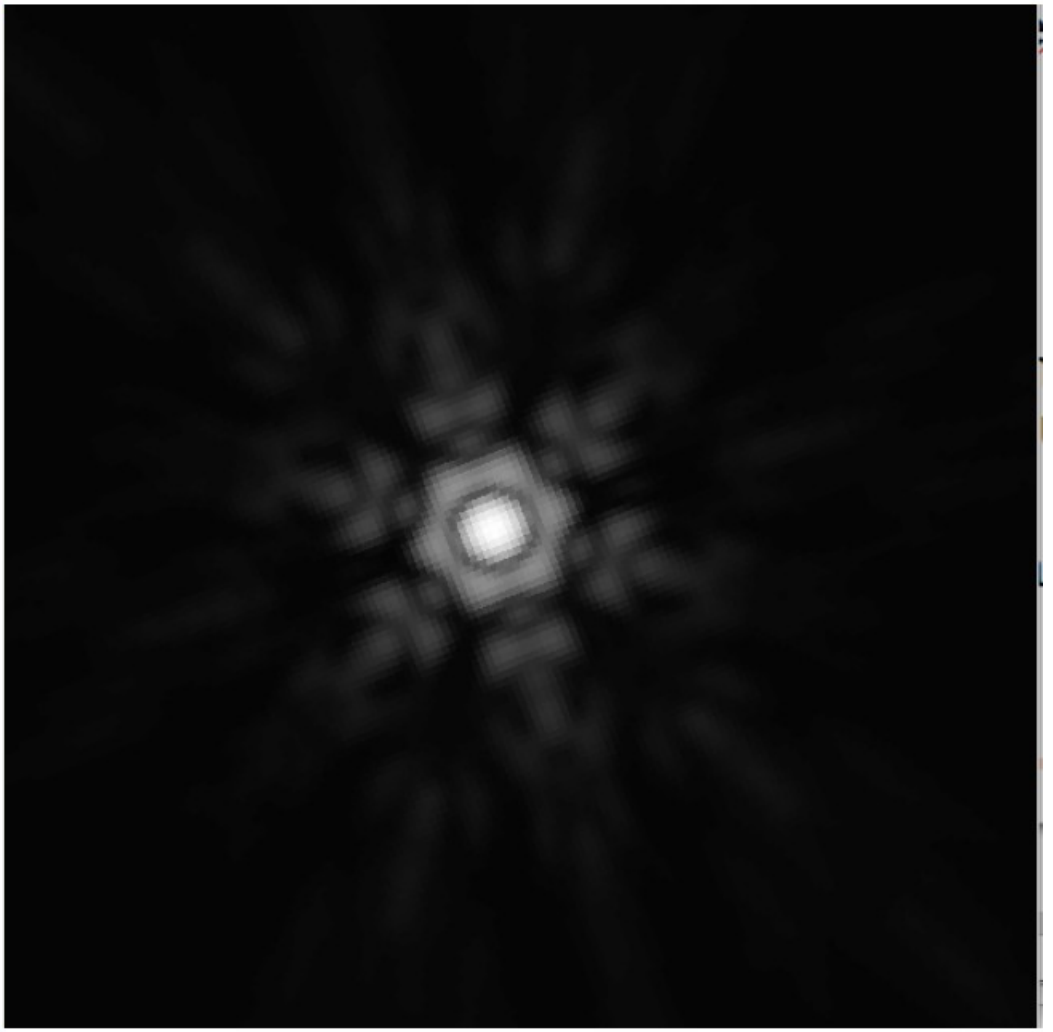
Three-colour full frame images (28” on a side)

15, 10, 5.6 microns

Model PSFs for handling the Point Source

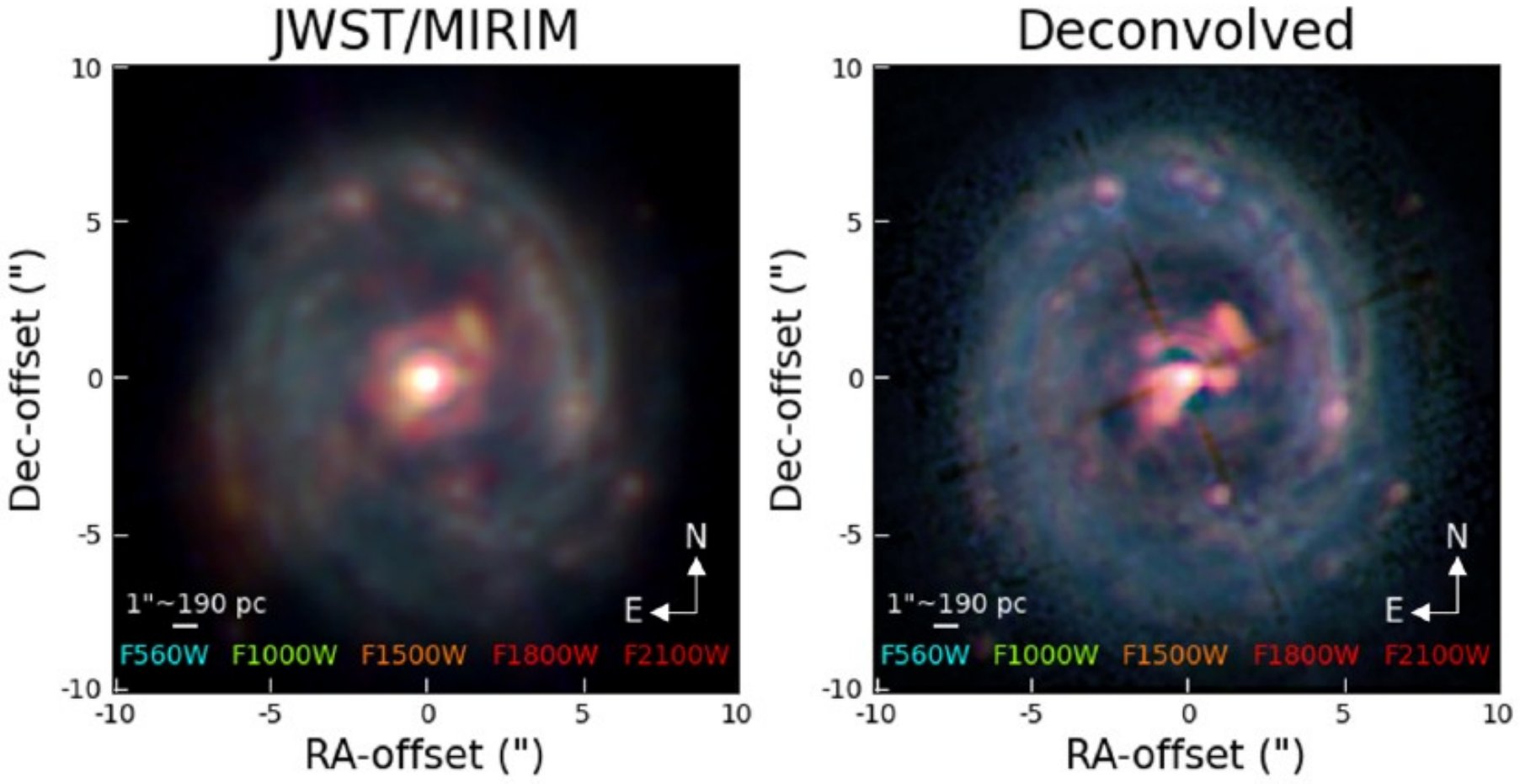
Using the STPSF (formerly WebbPSF) package





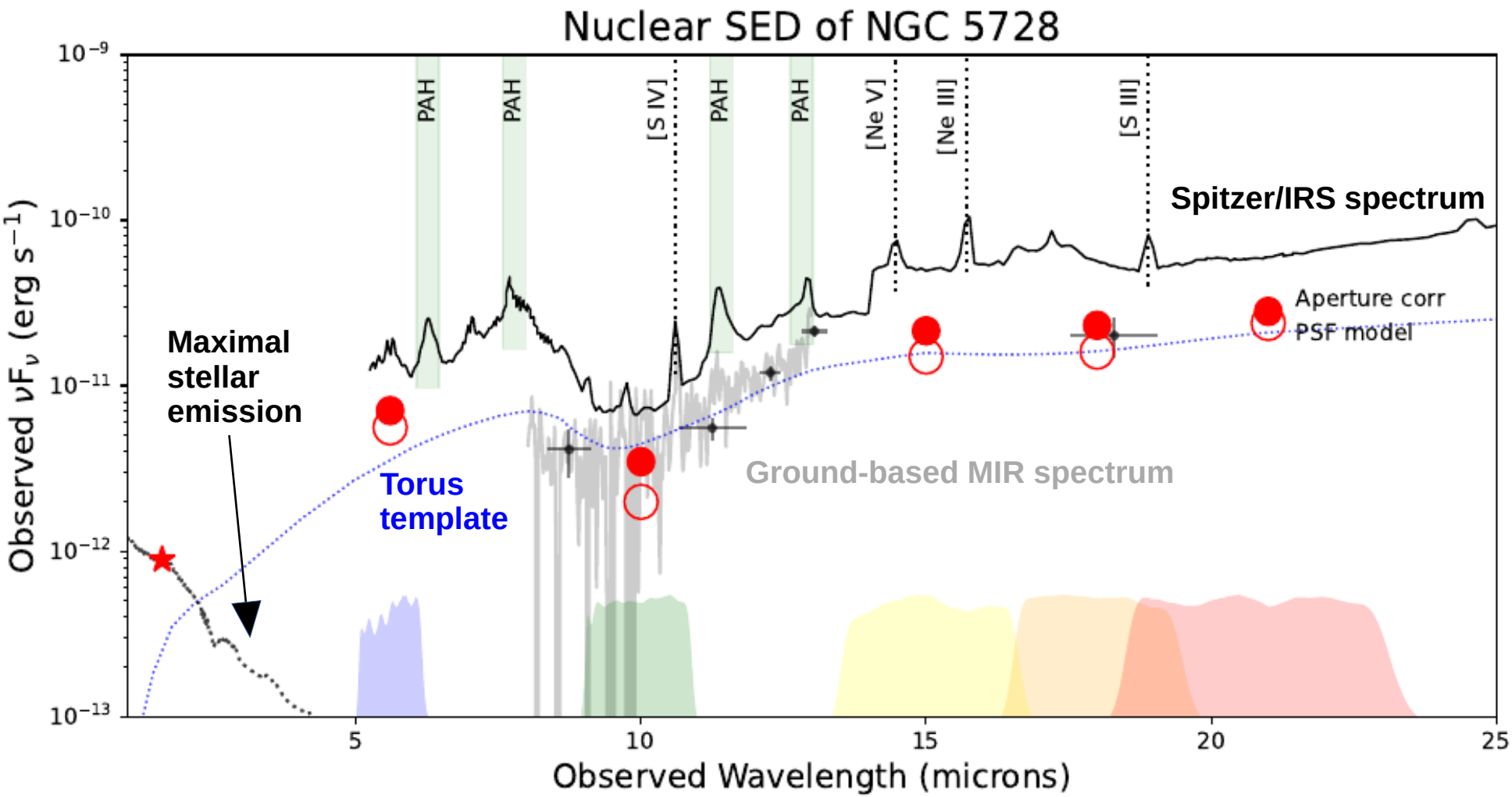
Deconvolution studies

Leist+ (2024)



A test of various modern deconvolution methods on our images. Currently, Kraken (a forward-modelling algorithm) and Richardson-Lucy work best.

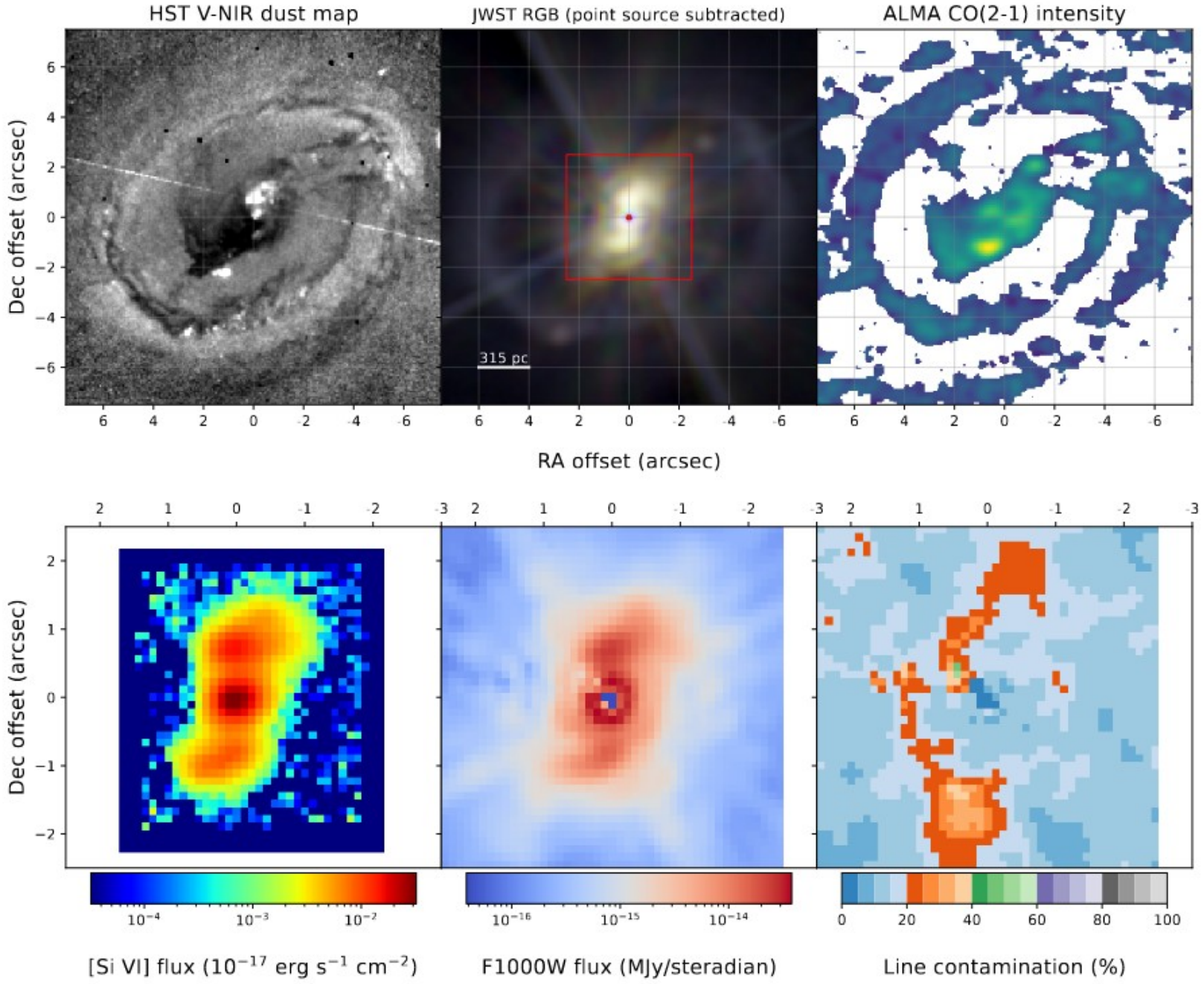
The nuclear point source

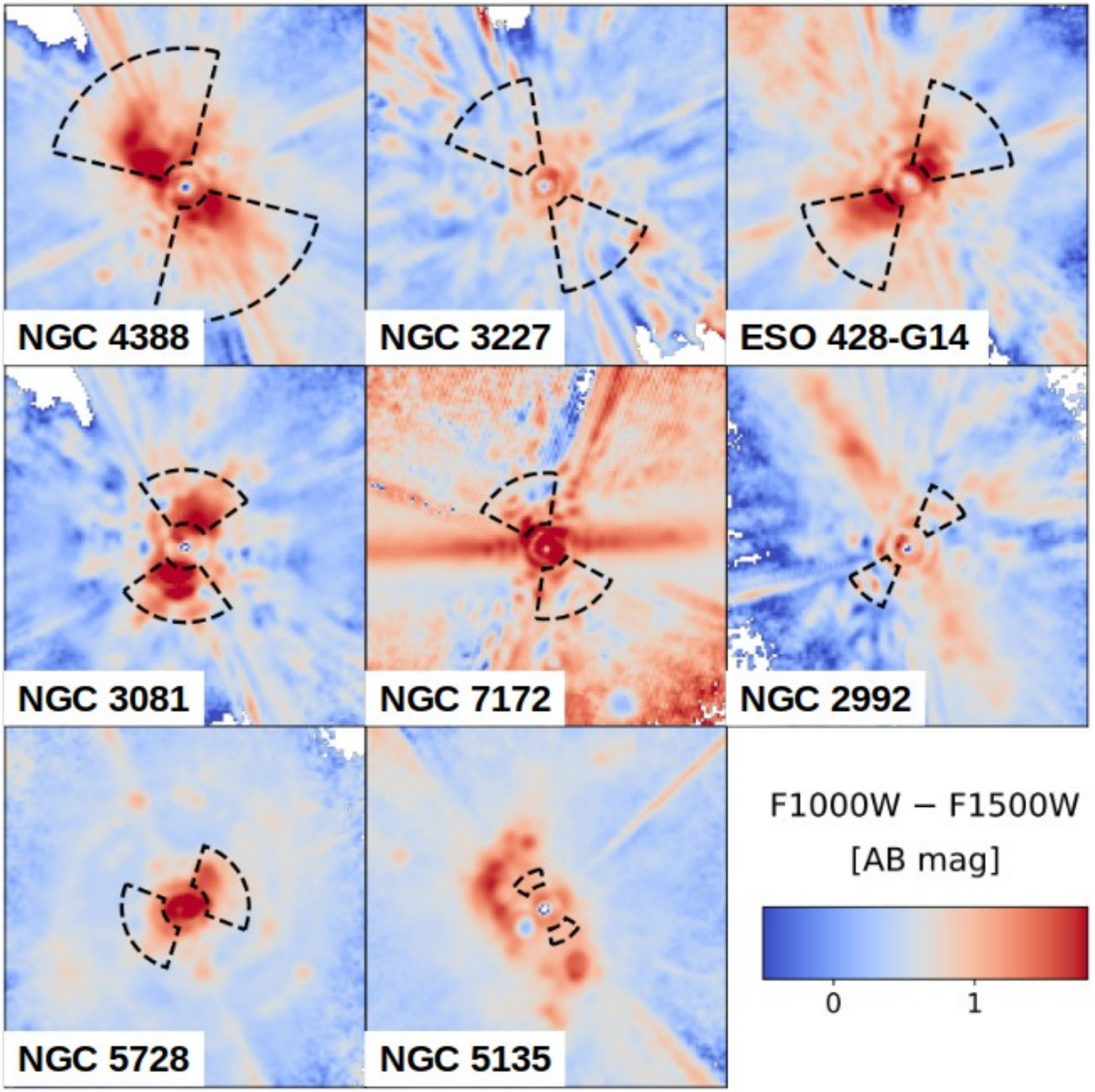


Red points: JWST (and HST) photometry

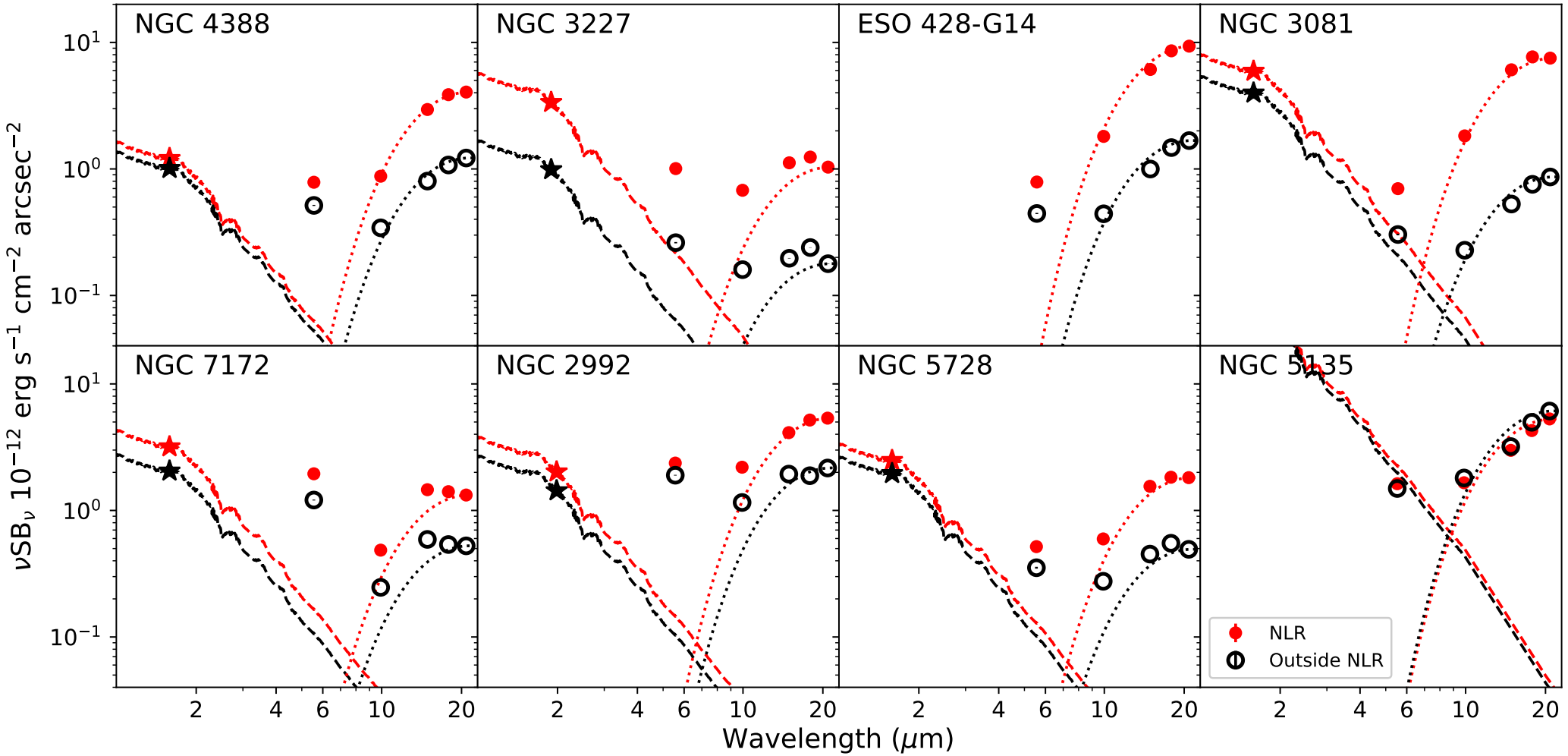
Black points: Ground-based MIR photometry

Multiphase gas and dust structure




NGC 4388
NGC 3227
ESO 428-G14
NGC 3081
NGC 7172
NGC 2992
NGC 5728
NGC 5135
F1000W − F1500W
[AB mag]
0
1

The extended emission



AGN-illuminated regions have high surface brightnesses.

Stellar contamination can be important at wavelengths < 7 microns.

Summary

Our GATOS JWST/MIRI imaging program reveals that AGN-illuminated dust is widespread in nearby Seyferts, with good evidence for compact polar emission in most.

We've developed methods to recover and remove the bright nuclear point sources, which can serve as the basis for accurate nuclear photometry and deconvolution.

Analysis of the extended emission is on-going, but early results suggest normal ISM dust compositions and heating from sources that are not nuclear. Shocks?

Future GATOS data, both imaging and spectroscopy in the MIR, will allow a substantial sample study to place these dust structures in the context of the population of local Seyferts.