SCUBA-2 OBSERVATIONS OF NEARBY SPIRAL GALAXIES

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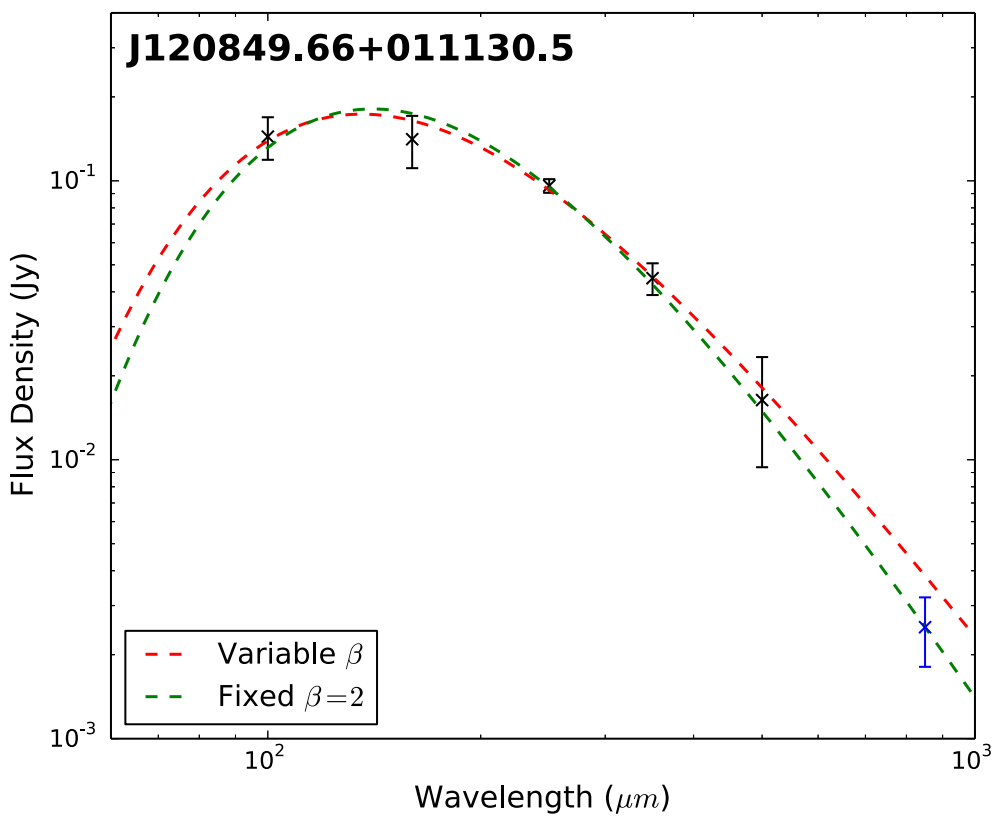
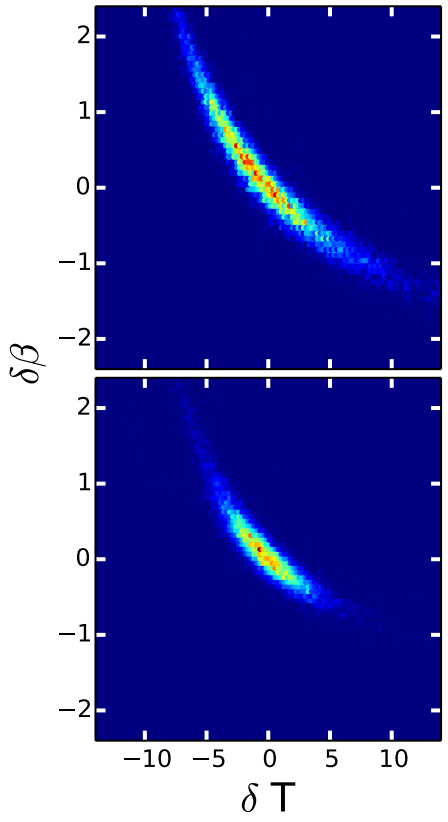
Why do we need 850 μm data?





Herschel Only

Herschel & SCUBA2

Figure from JINGLE proposal 2015; by Ilse de Looze

850 μm flux as proxy for gas mass

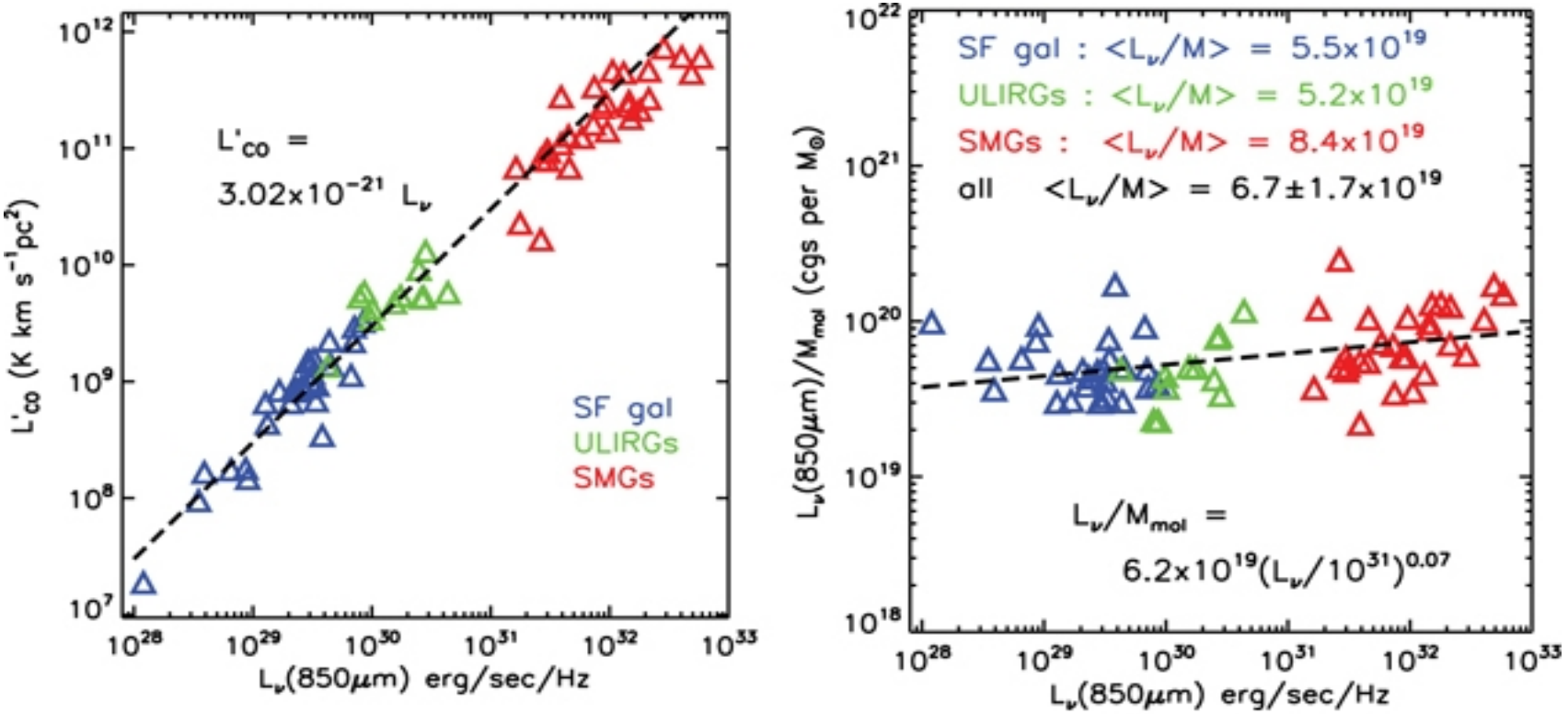
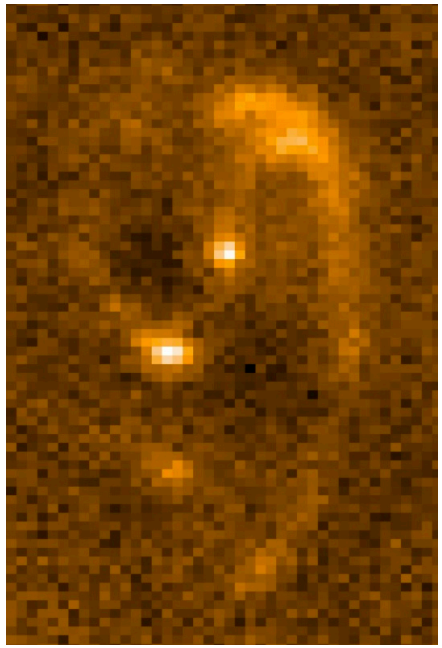
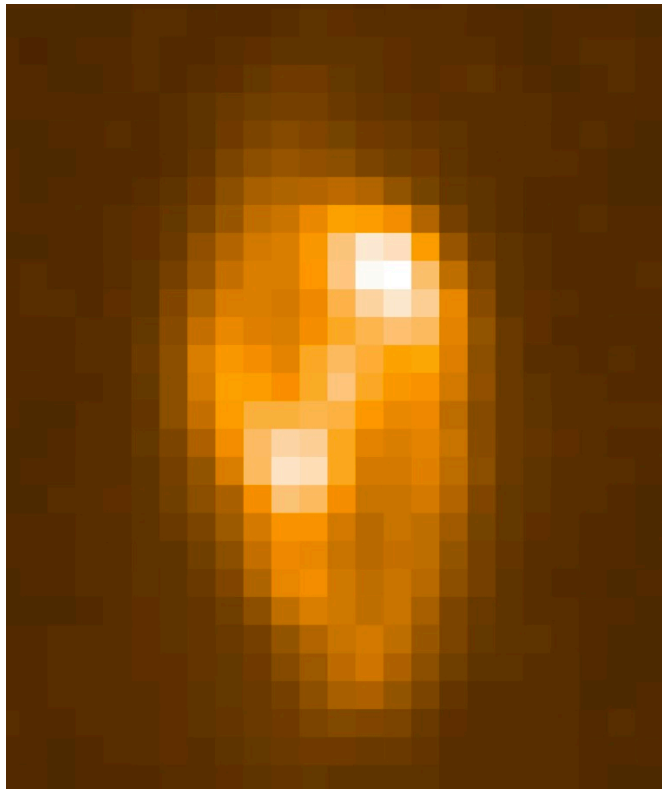


Figure 1 from ISM Masses and the Star formation Law at Z = 1 to 6: ALMA Observations of Dust Continuum in 145 Galaxies in the COSMOS Survey Field
N. Scoville et al. 2016 ApJ 820 83 doi:10.3847/0004-637X/820/2/83

Higher resolution: SCUBA-2 vs Herschel (NGC 3627)



450 micron (cropped)
JCMT+SCUBA2
NGLS



500 micron
Herschel+SPIRE
KINGFISH (Kennicutt et al. 2011, PASP)

The JCMT Nearby Galaxies Legacy Survey: an HI-flux selected sample

- 155 galaxies between 2 and 25 Mpc
- HI flux > 6 Jy km/s
- Sample described in Wilson et al. 2012, MNRAS
  - 47 **SINGS galaxies** (Kennicutt et al. 2003)
  - 18 HI brightest Irr and E galaxies (HI flux > 3 Jy km/s) + 18 randomly selected spirals in **Virgo Cluster**
  - random selection of 72 **field galaxies**
    - $D_{25} < 5'$
    - Randomly select 18 galaxies in each of 4 morphology bins (E, early S, late S, Irr)

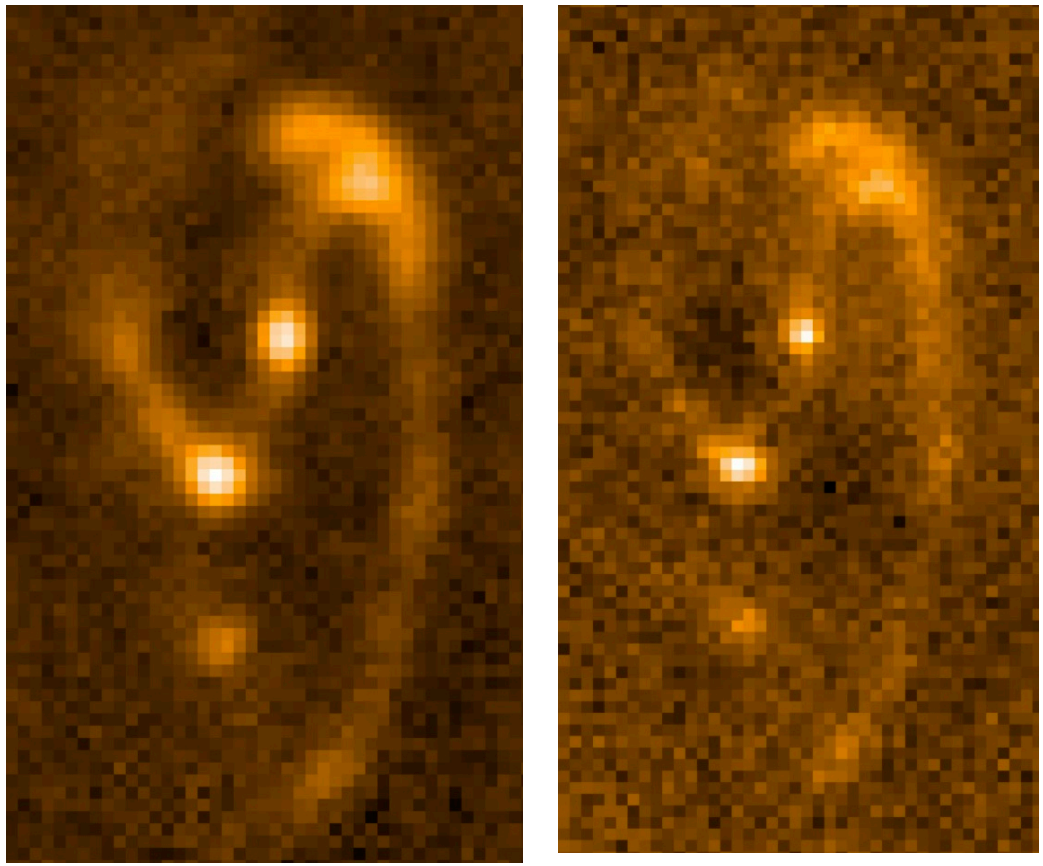
JCMT data

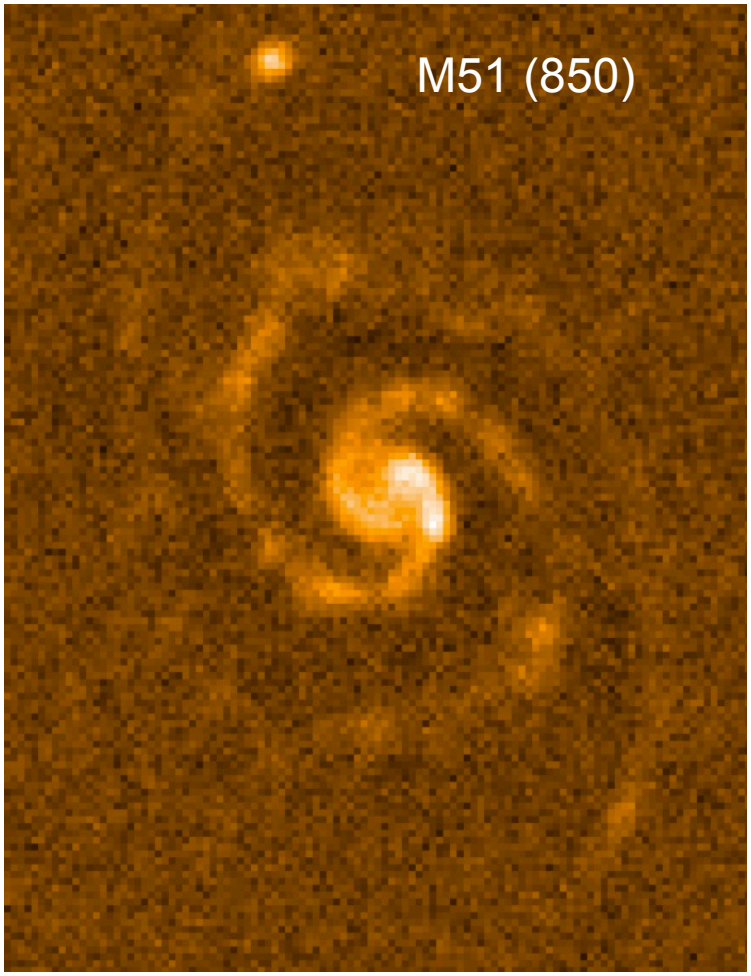
- **SCUBA-2 850 and 450 micron imaging (100 hours)**
  - Area covered is roughly $D_{25}/2$
  - Sensitivity goal 1.8 mJy/beam at 850 μm in center of map
  - **48 spiral galaxies observed** (25 from SINGS sample)
  - Only ~40% of SINGS galaxies observed in sufficiently good weather that 450 μm data usable

- **CO J=3-2 data cubes (256 hours)**
  - Area covered is $D_{25}/2$ for **all 155 galaxies**
    - Plus follow-up PI program on additional Virgo spirals
  - Sensitivity 19 mK at 20 km/s resolution rms
  - Equivalent to Av = 1 mag or 2×10^{21} H/cm^2 rms
  - Detect ~45% of spirals, 20% of ellipticals, almost no irregulars

SCUBA-2 images of nearby galaxies

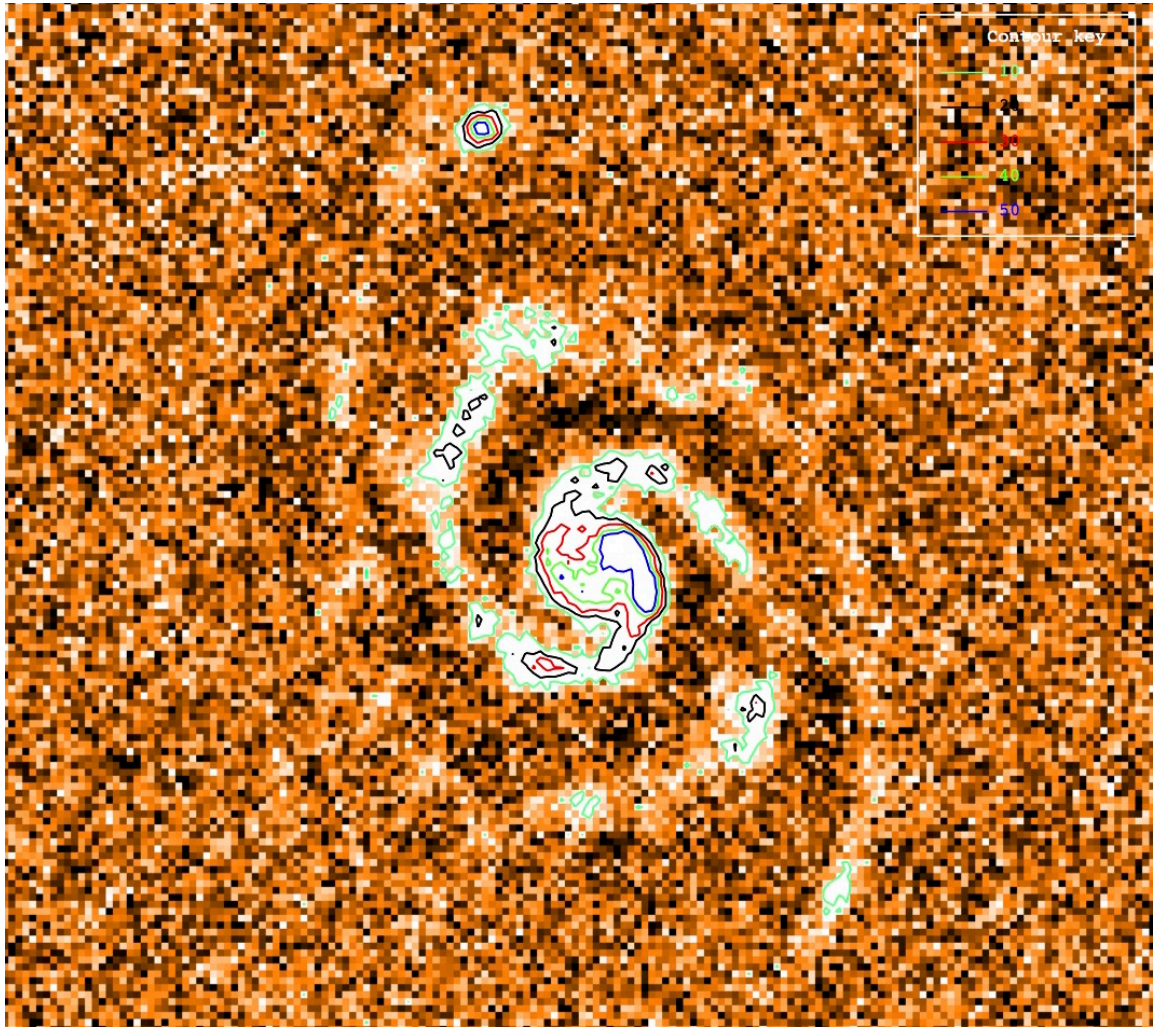
(850) NGC 3627 (450)





Wilson, Parkin, Newton, Meng, He et al., in prep

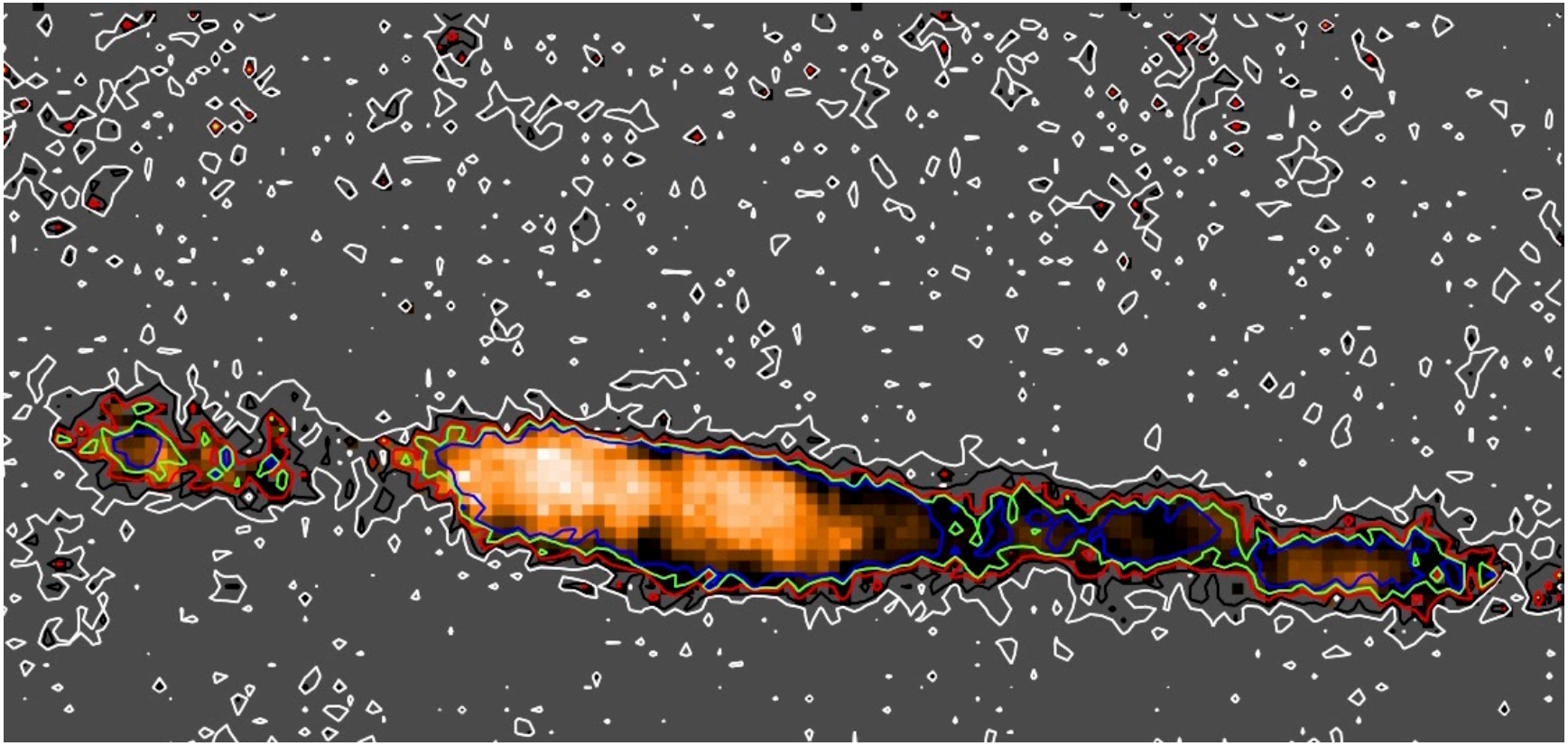
Recent work on SCUBA-2 data



M51 at 850 microns

Contours 10,20,30, 40,50 mJy/beam

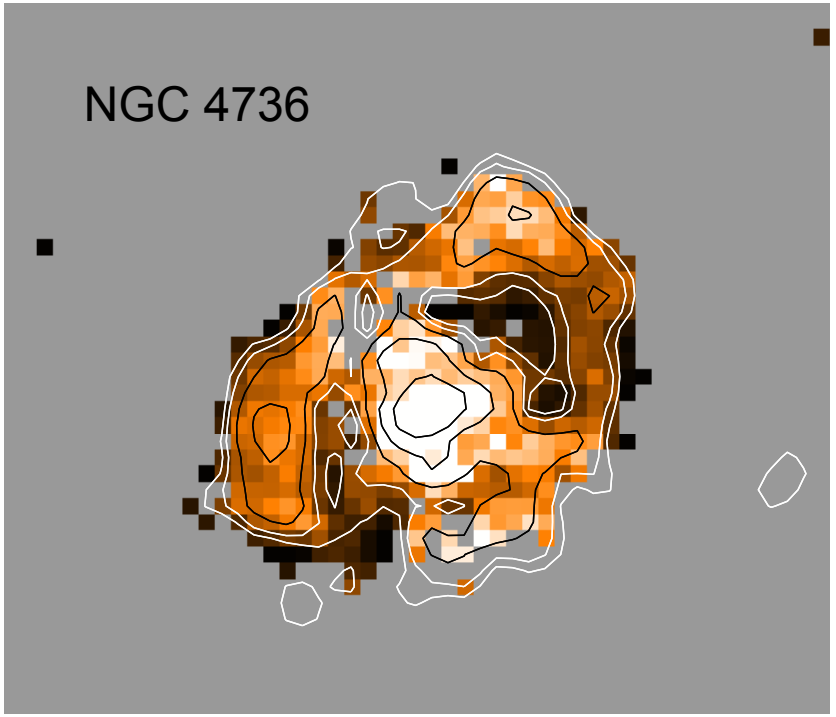
CO contamination of 850 micron flux: NGC 4631



Colour: CO / 850; contours: 850 micron flux (4,8,12,16,20 mJy/beam)

Significant CO contamination of bright central regions of galaxies

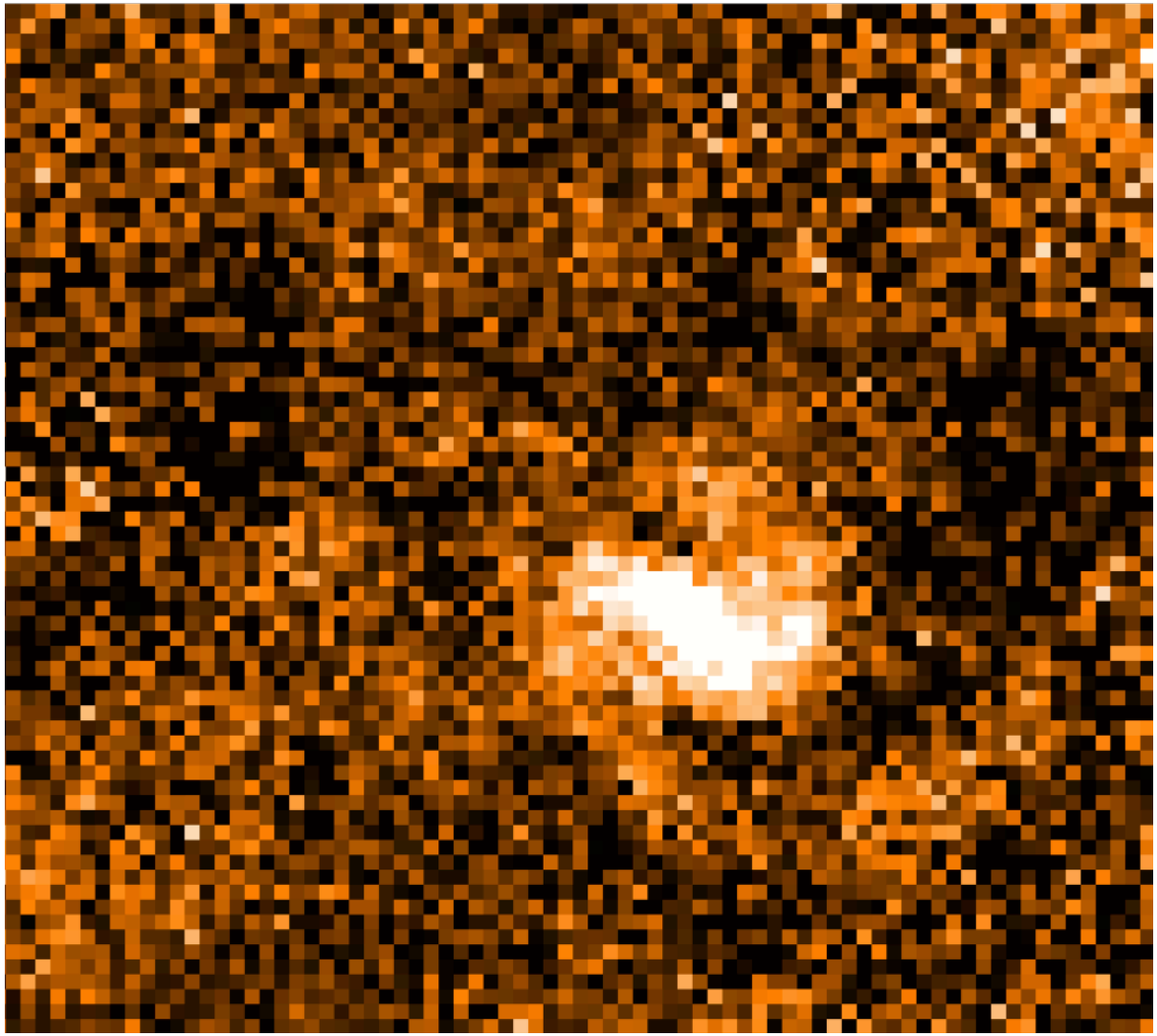
- Average contamination 0.25 for 20 galaxies
  - But significant range:
    - 0.12 in NGC4631
    - 0.35 in M82
- Some indication of higher contamination in starburst or Seyfert nucleus
- Lower contamination in NGC4631might suggest lower contamination in outer portions of disk?



Color scale % CO contamination,
range from 0-50%
CO contours 1,2,4,8,16 K km/s

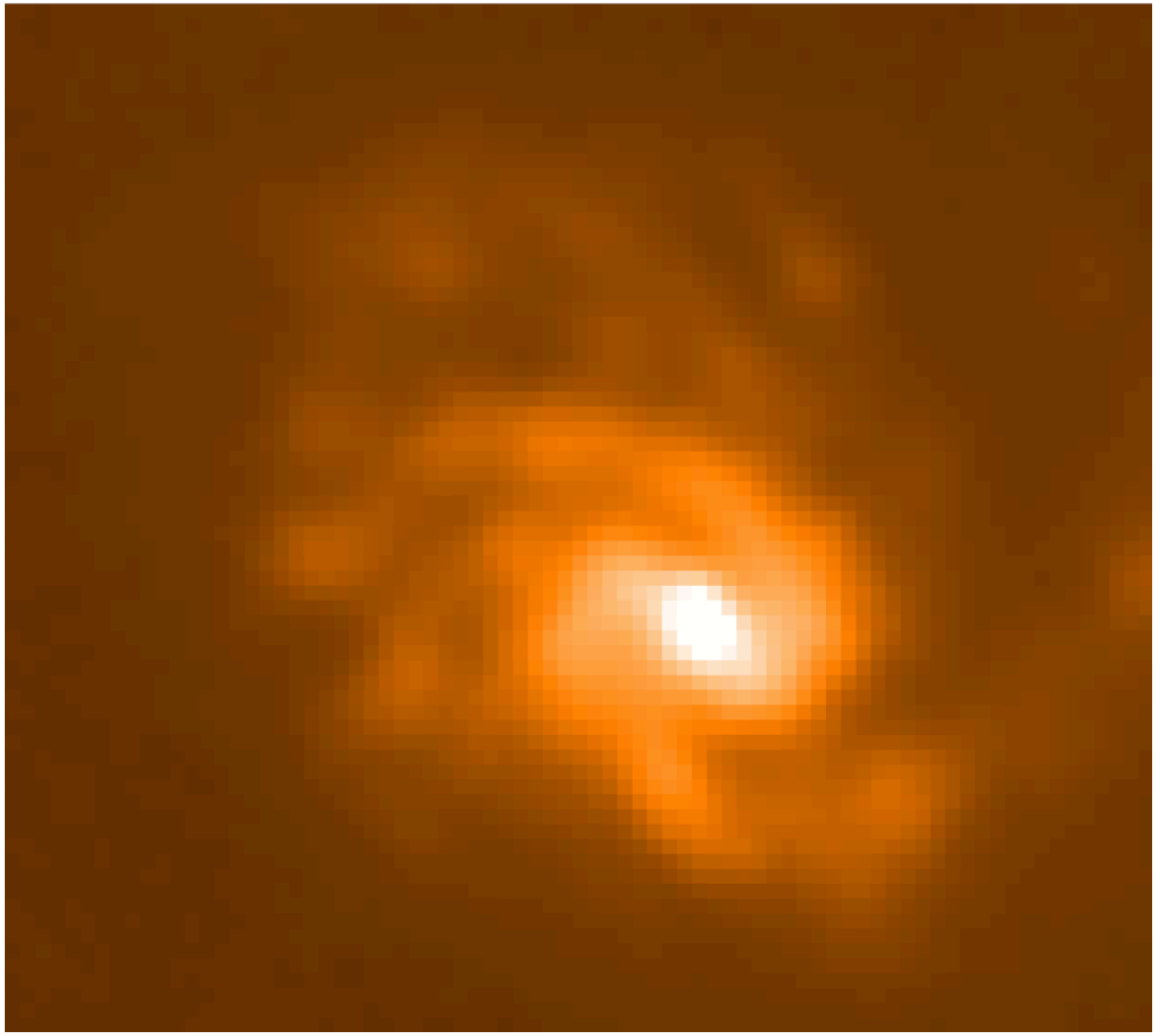
Far-infrared colors: constraining the dust temperature

NGC 4254
850 μm image



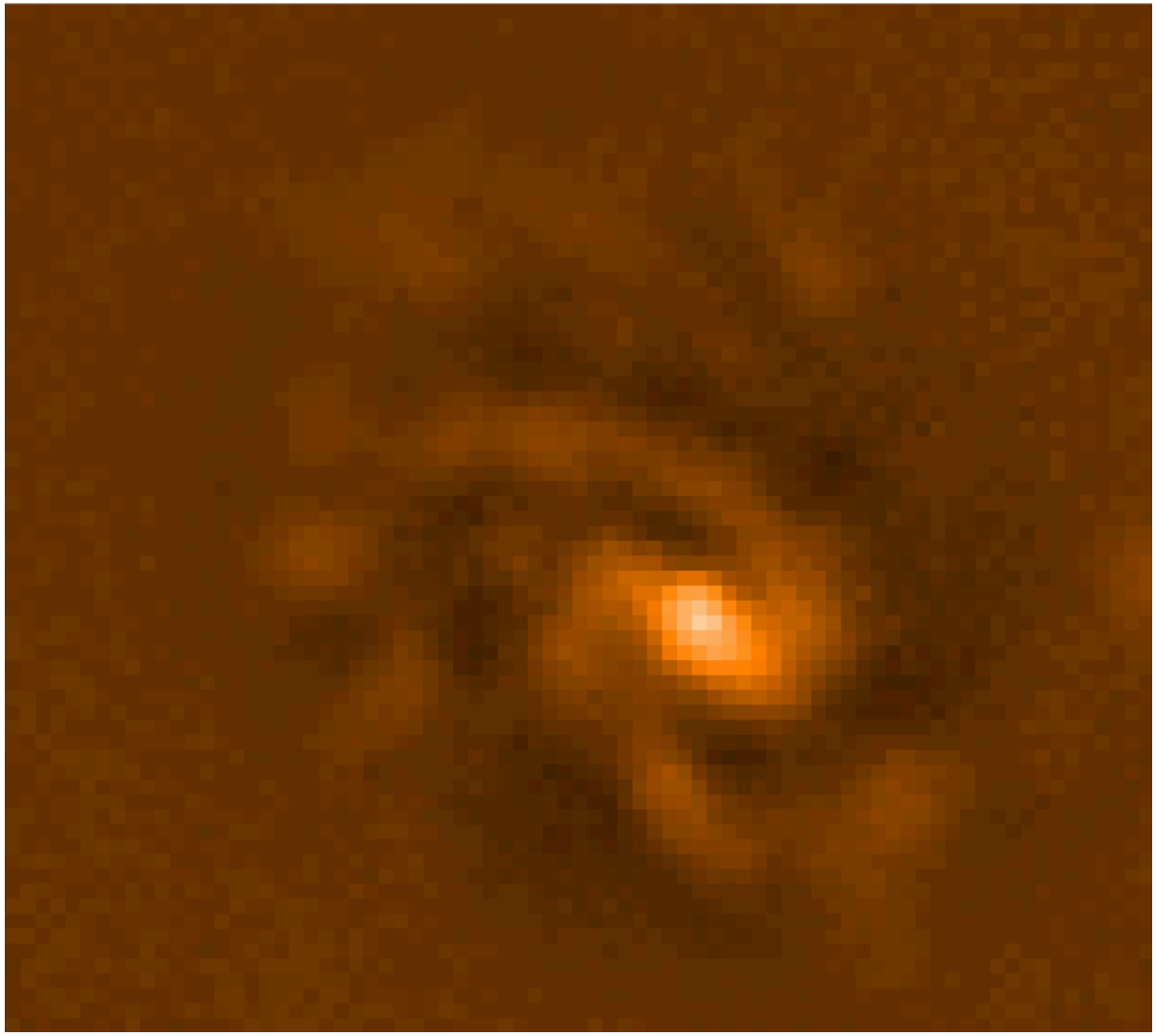
NGC 4254
250 μm image

Original Herschel image from KINGFISH survey, Kennicutt et al. 2010



NGC 4254 250 μm image, skylooped

Herschel image was scaled down so that its brightness was similar to the 850 image; added as a fake source to the SCUBA-2 data time stream; and then re-imaged

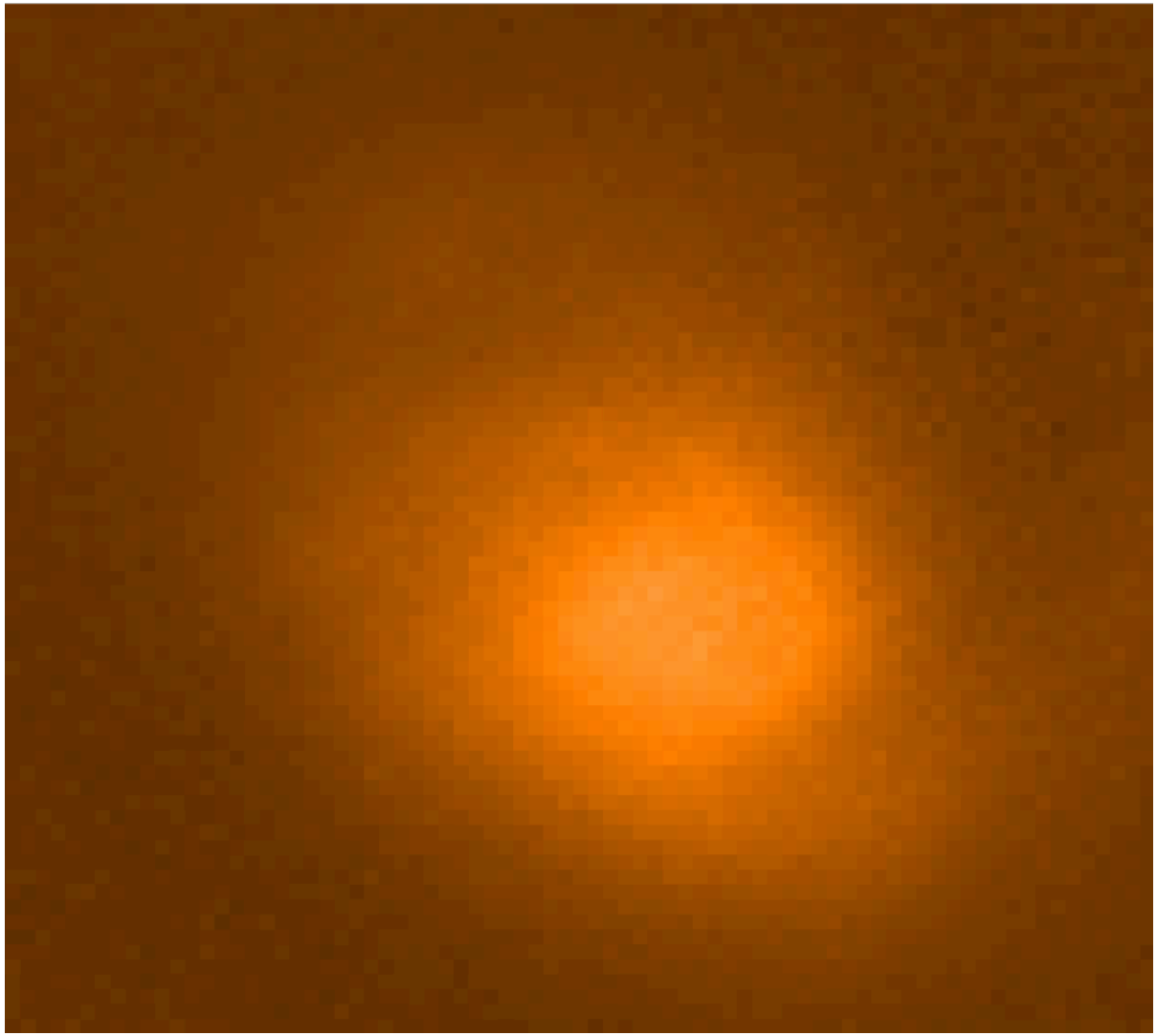


NGC 4254 250 μm flux missed

Flux that is removed in the SCUBA-2 data processing

This image is the difference of the previous two images

At the peak region in the center of the galaxy, at least 1/3 of the flux is gone after skyloop filtering



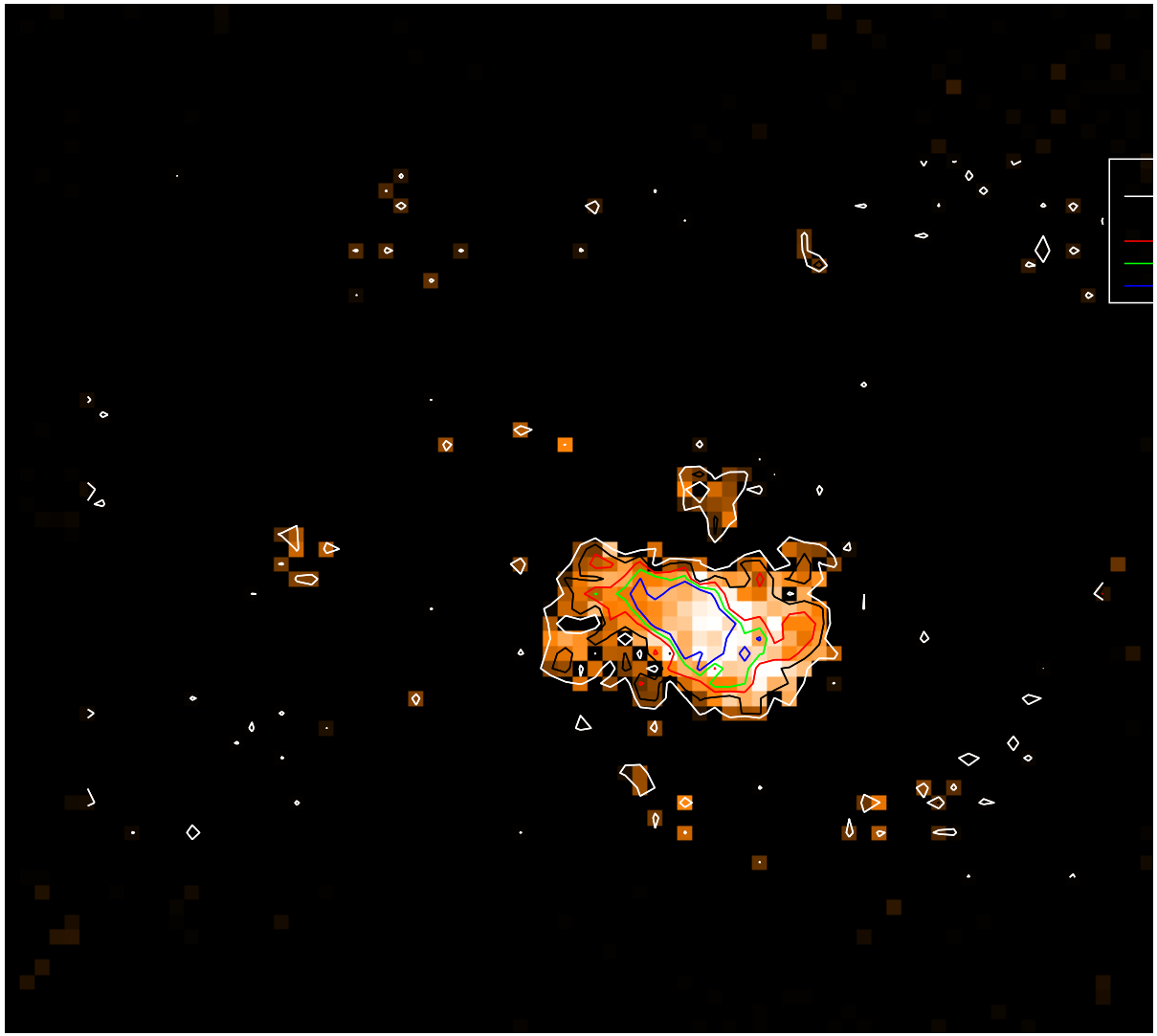
NGC 4254 250/850 ratio

Both images have the same spatial filtering

Color 250/850 flux ratio, scale is 0-40

Ratio map has been clipped at 2sigma in 850 map

Contours are 850 surface brightness, 2,3,4,5,6 sigma contours (1sigma = 0.017 mJy/ square arcsecond)



Conclusions

- Analysis of SCUBA-2 data still at a very early stage
- Significant CO 3-2 contamination in the 850 μm images, especially in galaxy centers
- Comparison with Herschel data should let us constrain dust properties such as temperature

Public link to reduced CO J=3-2 data cubes and maps for complete NGLS:
http://www.physics.mcmaster.ca/~wilson/www_xfer/NGLS/

Are you interested in SCUBA-2 data? Contact me!

NGC628	NGC925	NGC2403	NGC2841	NGC2976	NGC3034
NGC3184	NGC3198	NGC3351	NGC3521	NGC3627	NGC3938
NGC4254	NGC4321	NGC4559	NGC4569	NGC4579	NGC4594
NGC4631	NGC4736	NGC4826	NGC5033	NGC5055	NGC5194
IC0750	NGC404	NGC3077	NGC3162	NGC3277	NGC3353
NGC4013	NGC4041	NGC4567	NGC4568	NGC4647	

Note: not all galaxies are detected
Red indicates weather too poor for 450 μm observations