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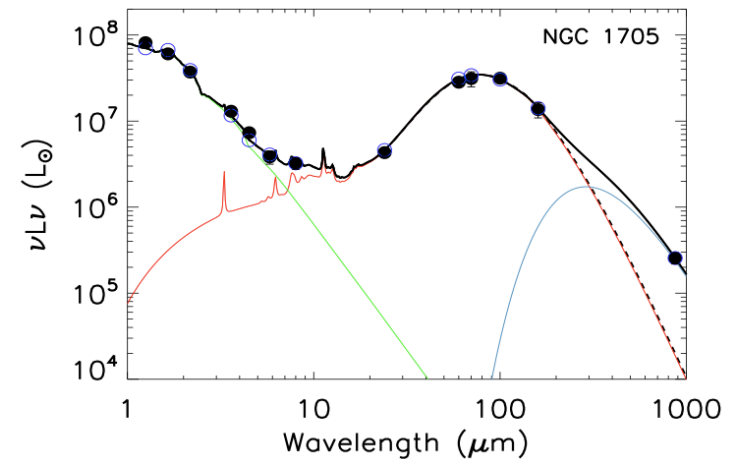
Deep sub-mm imaging of the nearby galaxy NGC 7331 with SCUBA-2

Nearby Galaxies Legacy Survey

- NGLS, PI Christine Wilson
- 155 galaxies, HI selected
 - 47 SINGS galaxies
 - 108 galaxies < 4 arcmin, $1/3$ Virgo, $2/3$ “field”
- CO J=3-2 observations complete
 - Data paper submitted, Wilson et al.
- H α maps for entire sample
 - Paper submitted, Sanchez-Gallego et al.
- SCUBA-2 observations since Dec. 2011

Submillimetre excess

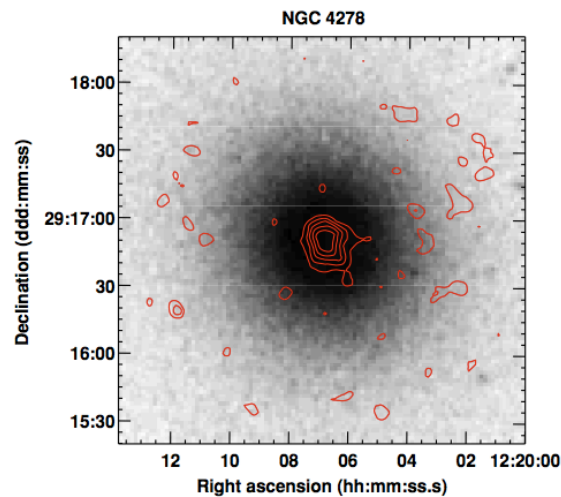
- Physical properties of dust
 - Cold dust $\sim 10\text{K}$
 - Small grains
 - Large grains
 - Spinning dust
- Found mostly in dwarfs
 - Low metallicity?
- Transition occurs at wavelengths $> 500\ \mu\text{m}$
 - Need SCUBA-2!



Galametz et al. (2011)

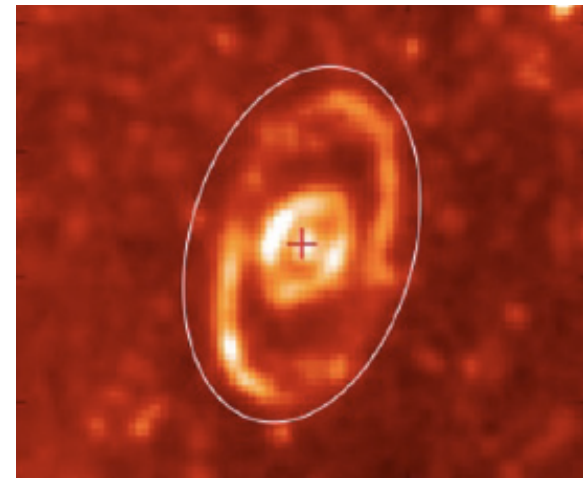
Cold ISM in early-type galaxies

- 27 elliptical galaxies in NGLS
 - 4 detected in CO J=3-2
- Sensitivity of dust detection at D=25 Mpc
 - $4 \times 10^5 M_{\text{solar}}$ ($>2 \times$ CO J=3-2 sensitivity)



NGC 3945 (SB0)
HERSCHEL 200 μm
Smith+ 2012

NGC 4278 (E4)
SCUBA 850 μm
Savoy+ 2009



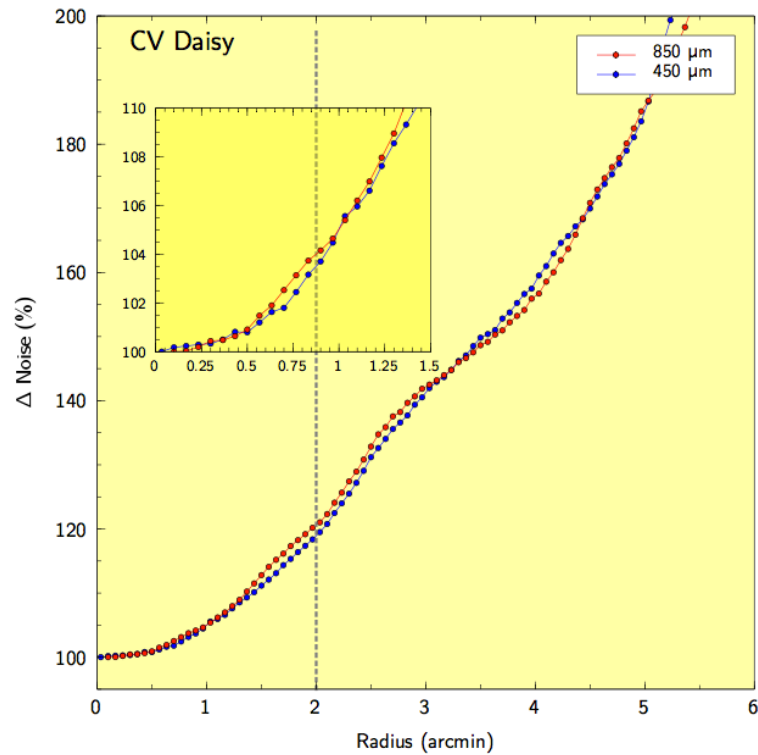
Influence of the environment

- Morphology and Environment
- Gas and dust properties
- CO J=3-2 detection (Golding+, in prep.)
 - 7% detection rate in field galaxies
 - 30% in Virgo cluster galaxies
 - Molecular concentrated in galaxy centres
 - Influence of group interaction?

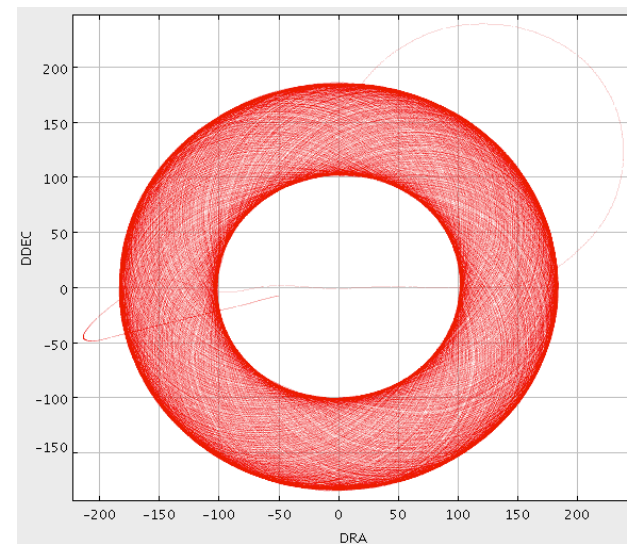
Molecular gas and star formation

- Schmidt-Kennicutt relation
 - SFR correlates with HI mass
- THINGS HI galaxy survey
 - (Walter+ 2008, Leroy+ 2008, Bigiel+ 2008)
 - Molecular gas regulates SF locally (~1 kpc)
- SCUBA-2 high resolution
 - @13 Mpc 0.4/0.9kpc resolution (450/850 μm)
- Determine the gas to dust ratio
- CO-to-H₂ conversion factor

Observations



- NGC 7331
- Science verification
- 30 min “daisy” pattern
- 4-5 arcmin FOV
- 17 hrs in total

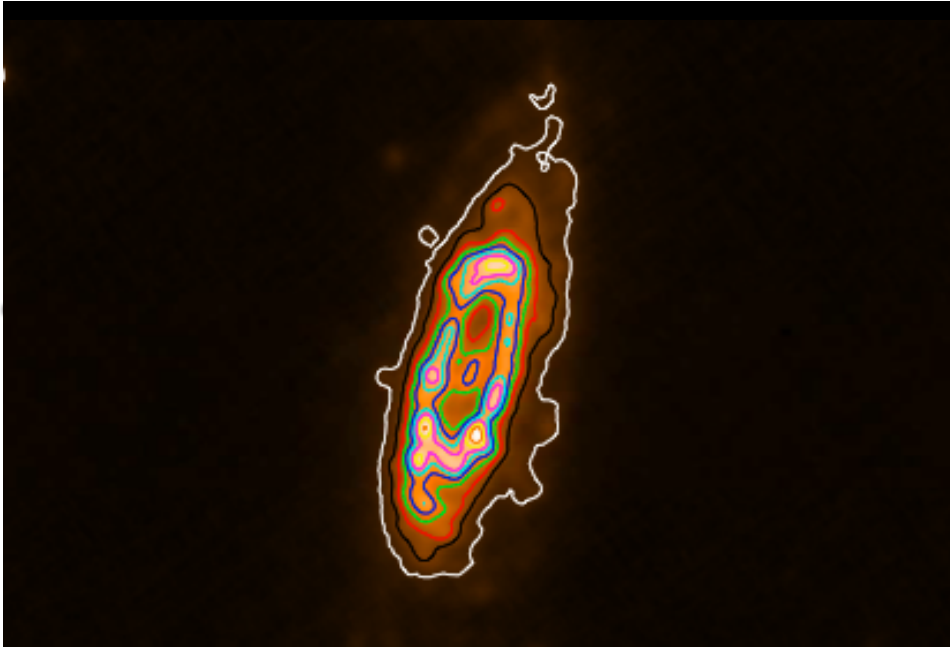


Data reduction

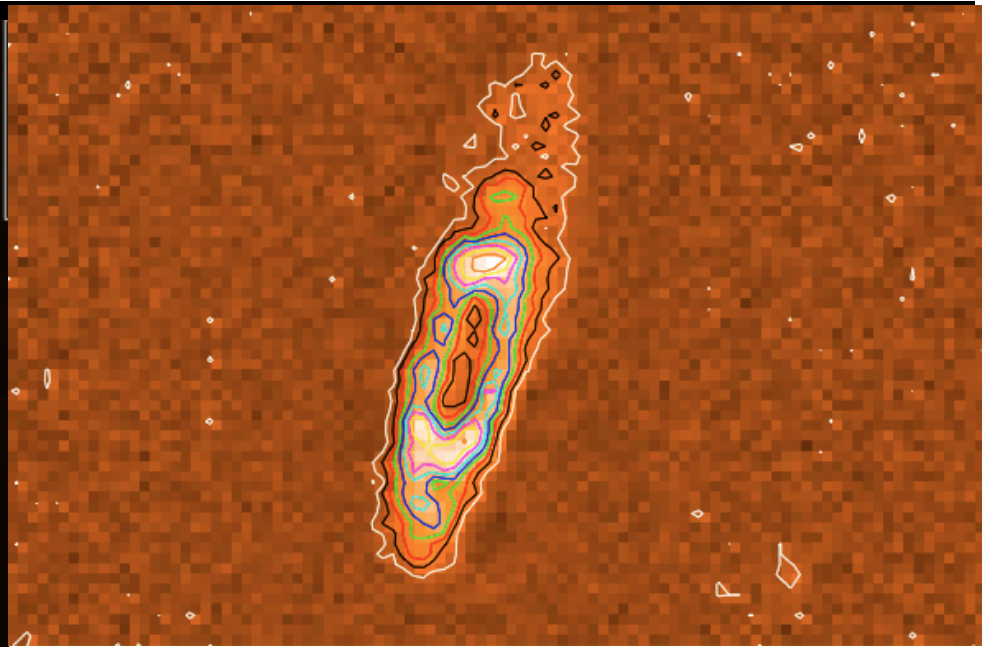
- Kappa / SMURF
- Spatial filtering
- 200" high-pass filter
- 30" low-pass filter
- S/N 3 sigma cut-off
- 5–10 iterations
- To Do
 - Calibration
 - Recover halo emission



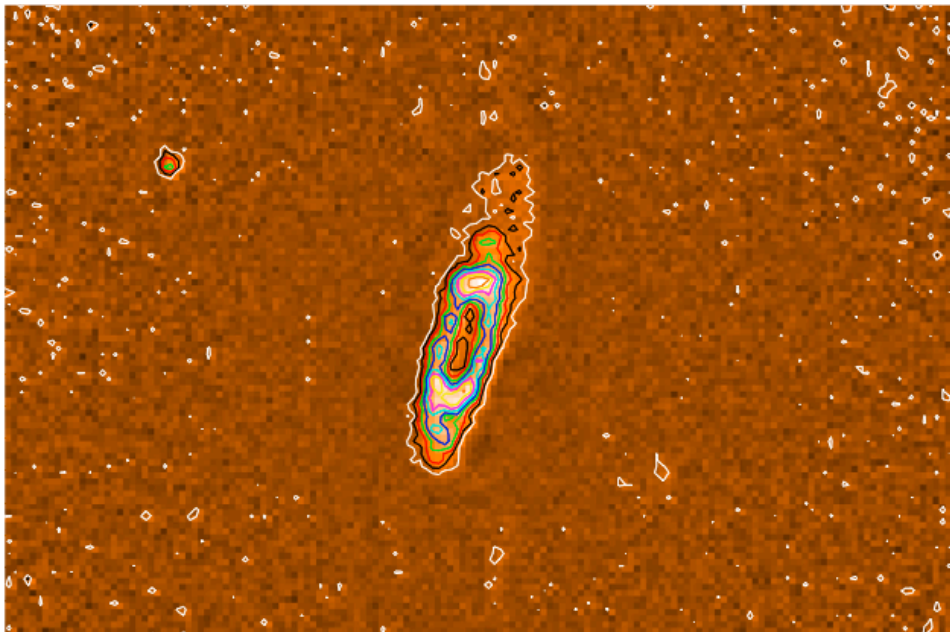
NGC 7331, 850 mu



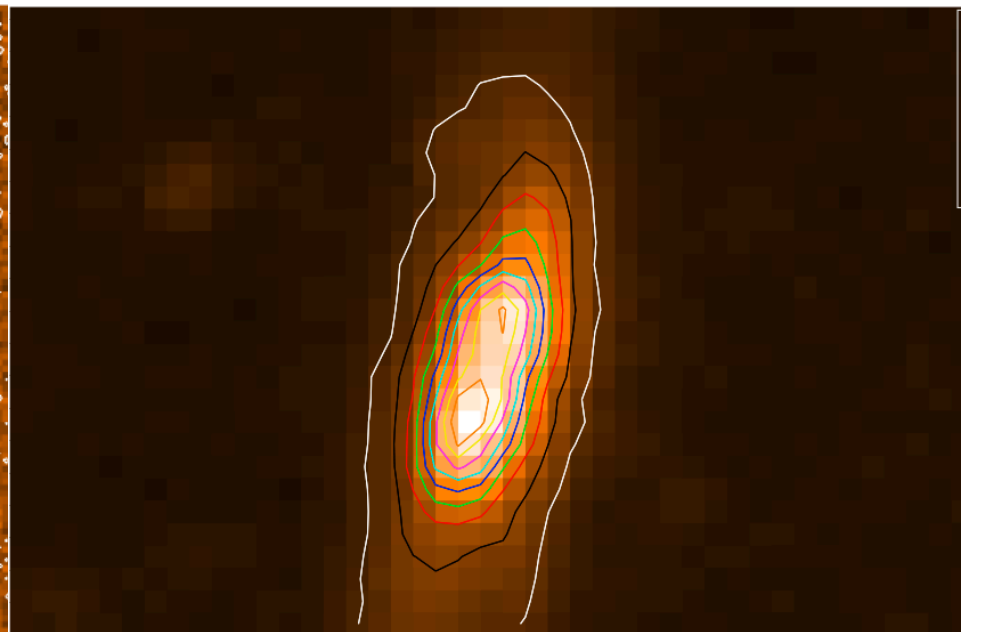
HERSCHEL 100 μ



SCUBA-2 450 μ



SCUBA-2 450 μ



HERSCHEL 500 μ

FIR composite

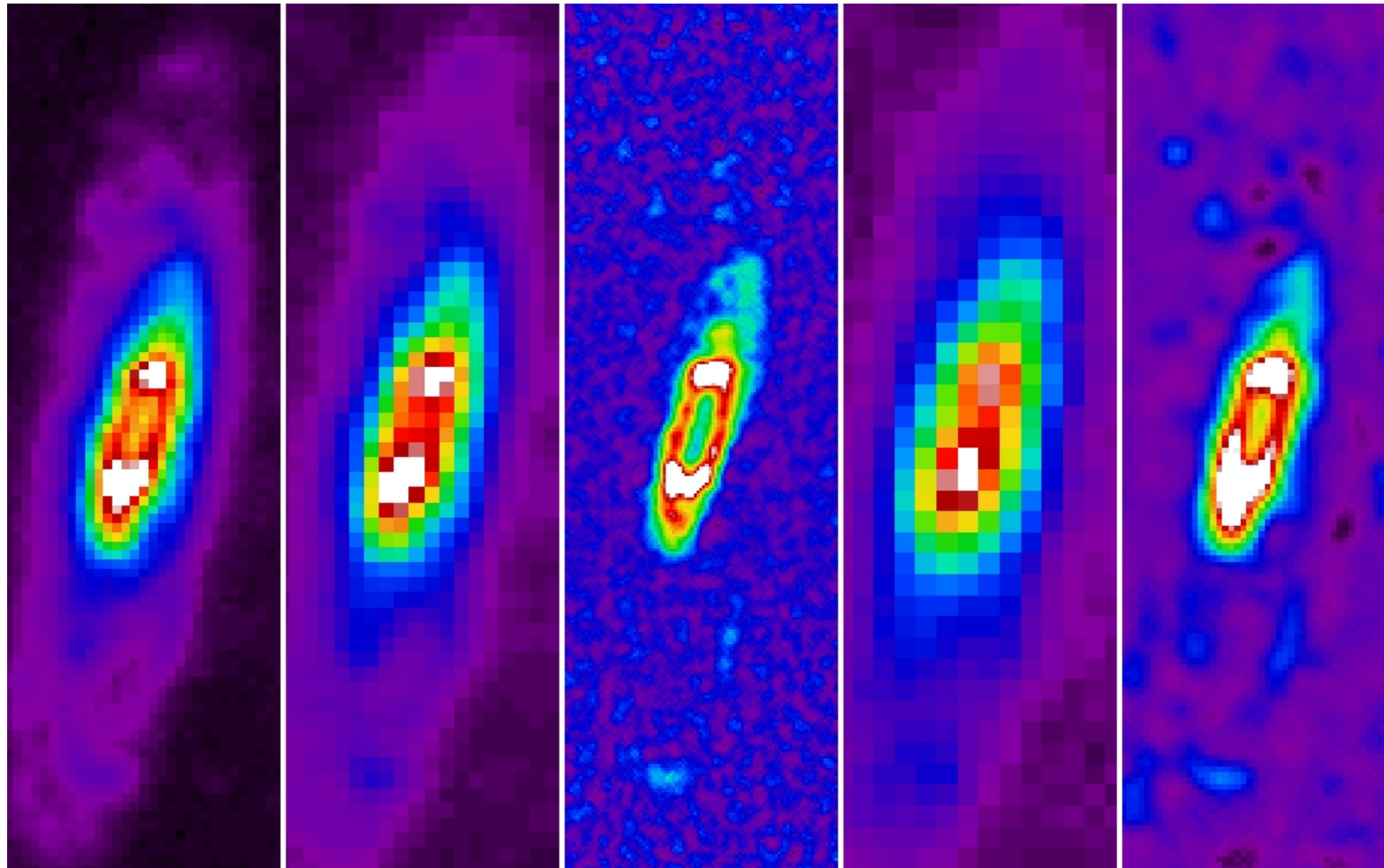
H 250 μ m

H 350 μ m

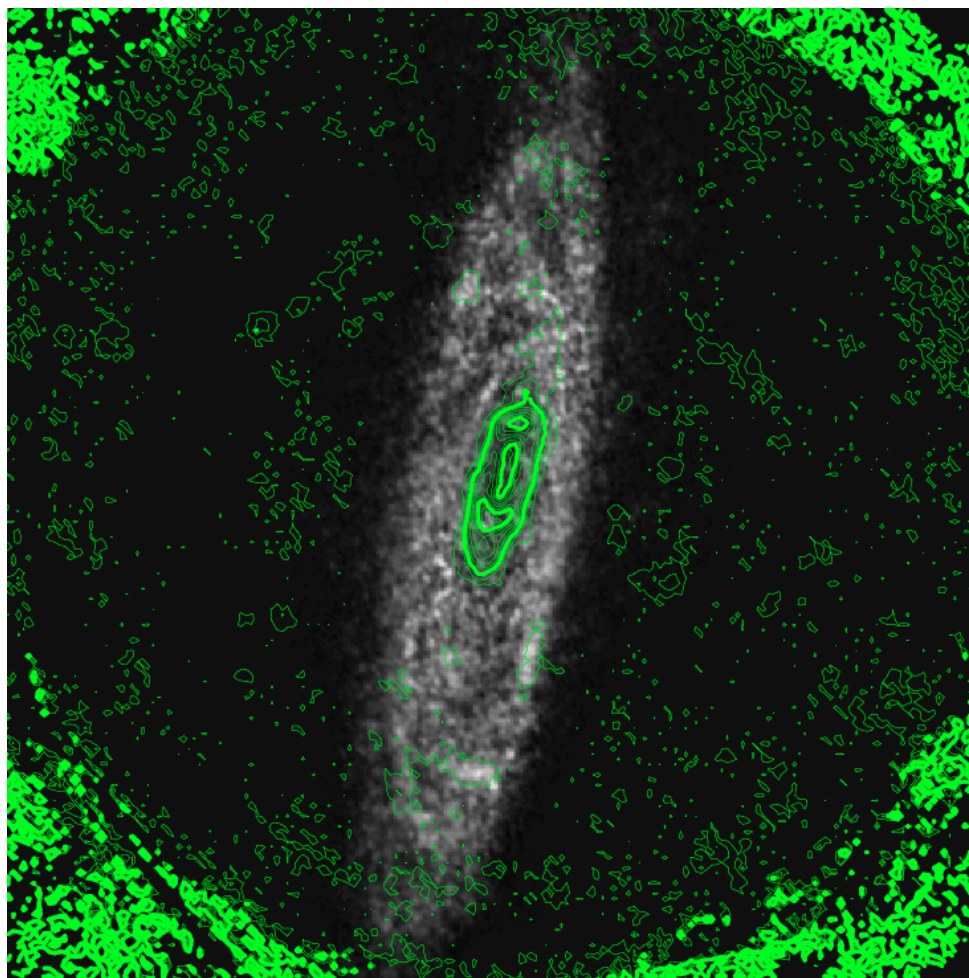
S2 450 μ m

H 500 μ m

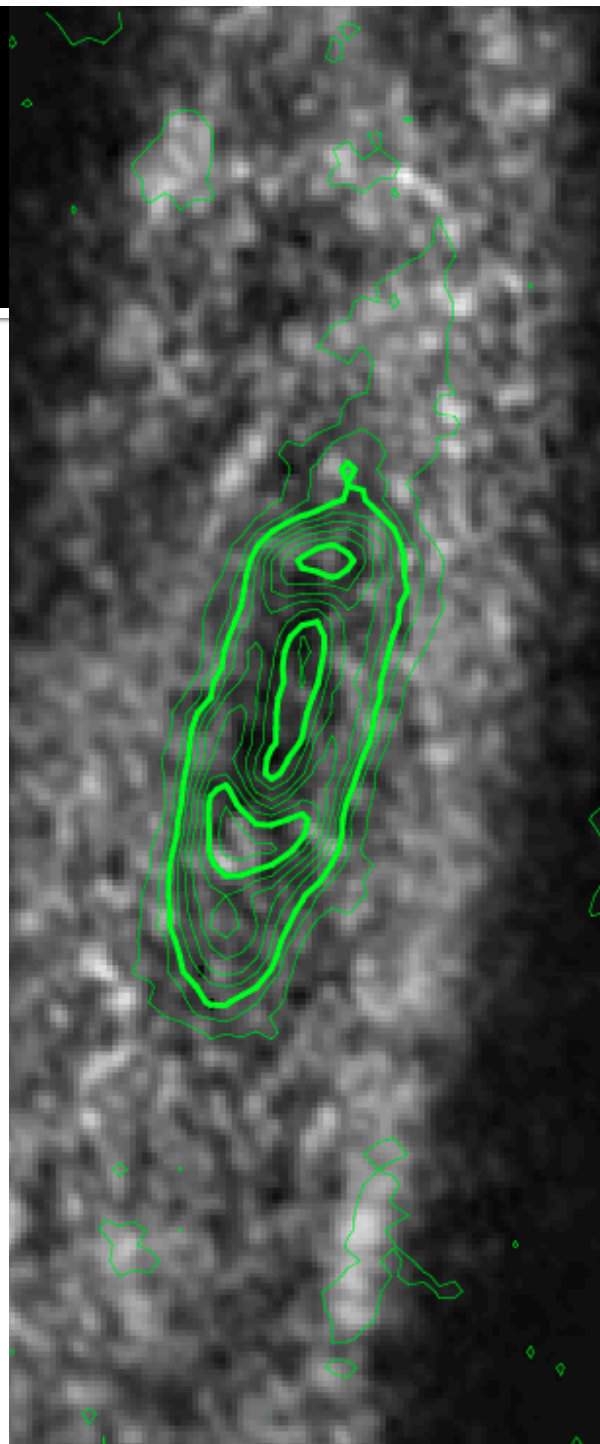
S2 850 μ m



Neutral Hydrogen



HI grey-scale from THINGS



Results

- SCUBA-2 works!
- Detection of a ring of dust in N7331
- Detection of spiral arms
- Superior resolution
- More to be done on calibration
- Need halo emission