ALMA, JCMT
New Opportunities to the KAS

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The Atacama Large Millimeter/submillimeter Array (ALMA), an international astronomy facility, is a partnership of the European Organisation for Astronomical Research in the Southern Hemisphere (ESO), the U.S. National Science Foundation (NSF) and the National Institutes of Natural Sciences (NINS) of Japan in cooperation with the Republic of Chile. ALMA is funded by ESO on behalf of its Member States, by NSF in cooperation with the National Research Council of Canada (NRC) and the National Science Council of Taiwan (NSC) and by NINS in cooperation with the Academia Sinica (AS) in Taiwan and the Korea Astronomy and Space Science Institute (KASI).

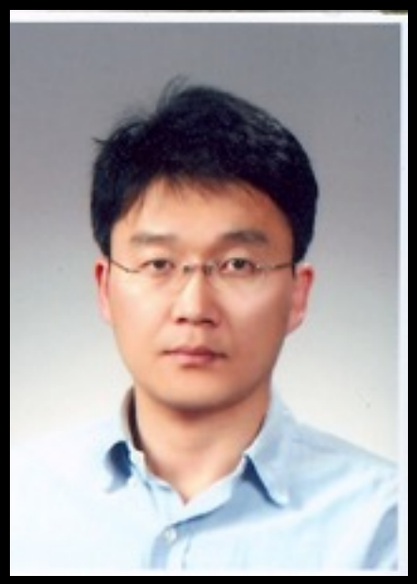
Korean Flag at OSF at 2900m

ALMA Korean Project

ARC: A-Ran Lyo, Ji-Hyun Kang, Kyung-Hee Kim, Chandreyee Sengupta

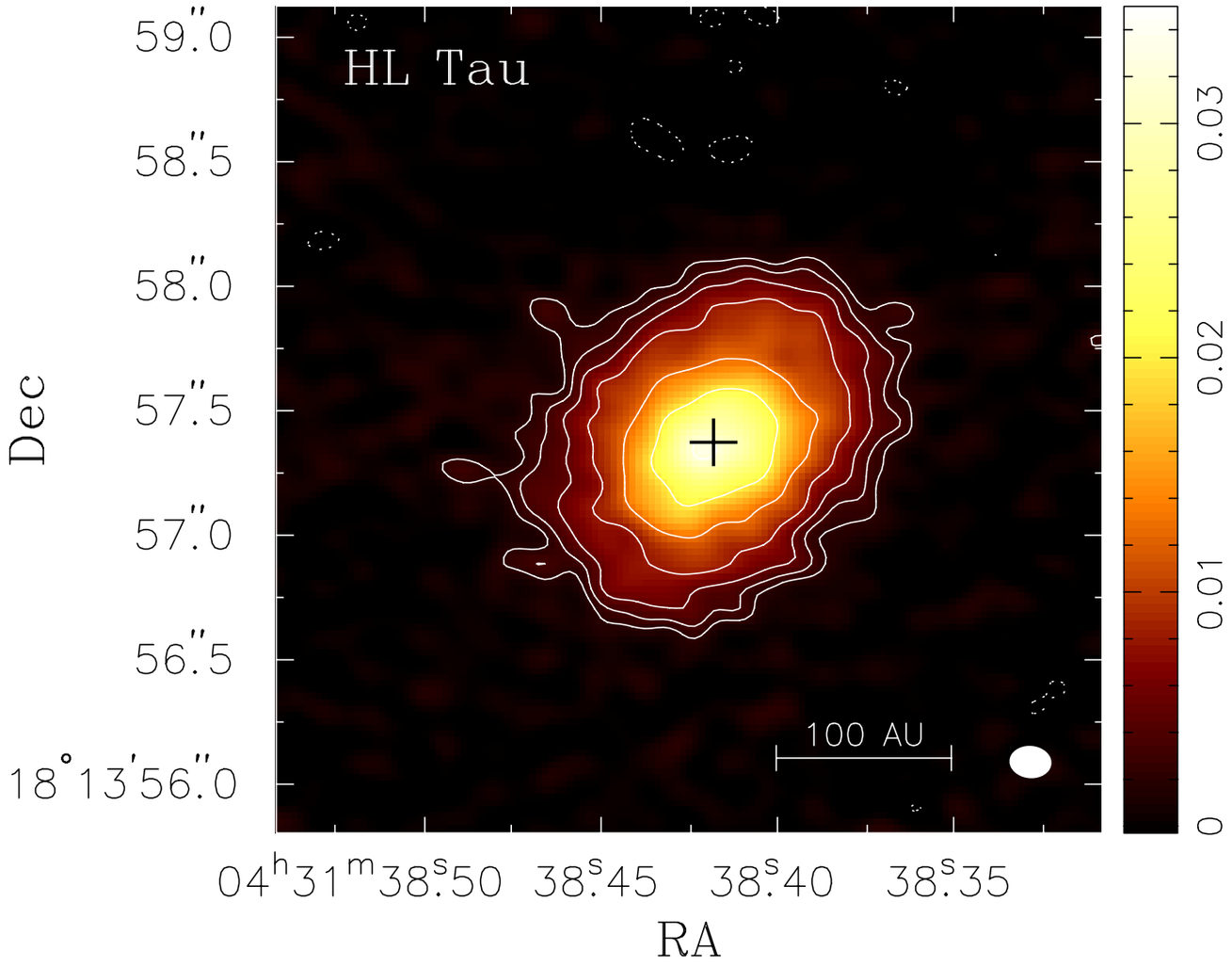



Development: Jungwon Lee, Do-Hung Je, Seung-Lae Kim

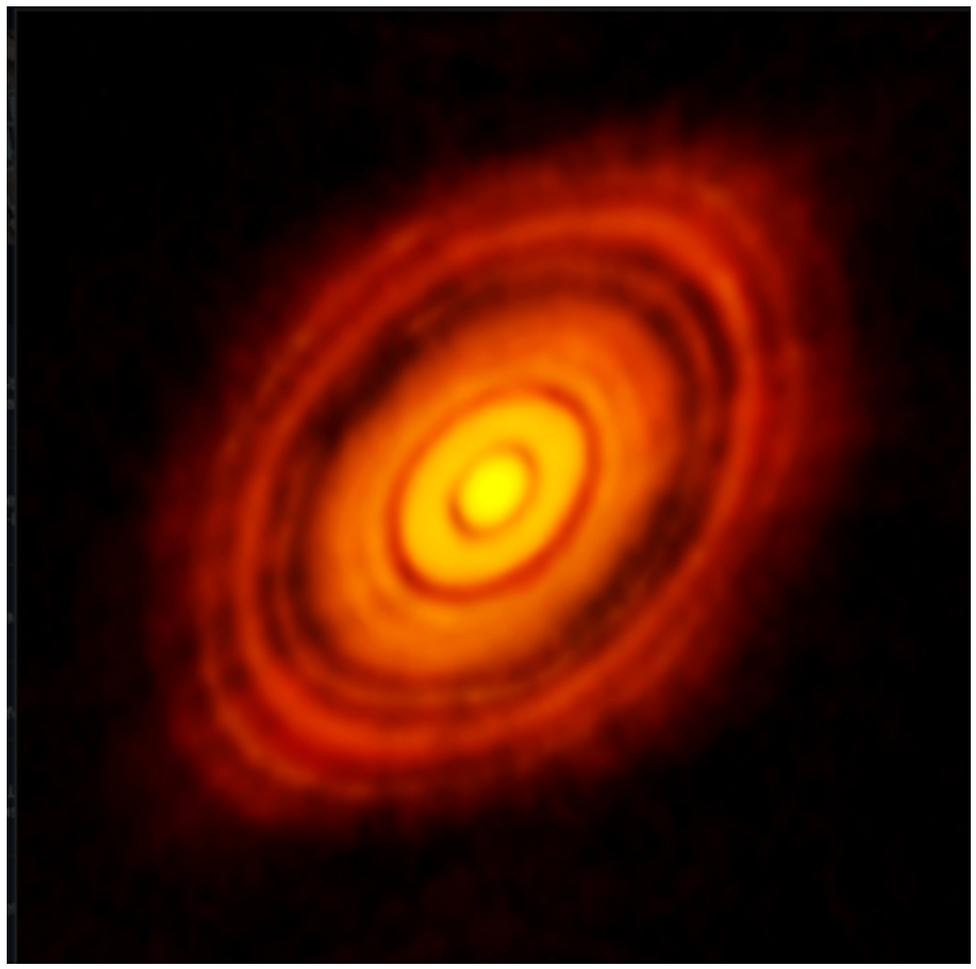


ALMA 2014 conference in Tokyo

CARMA vs. ALMA

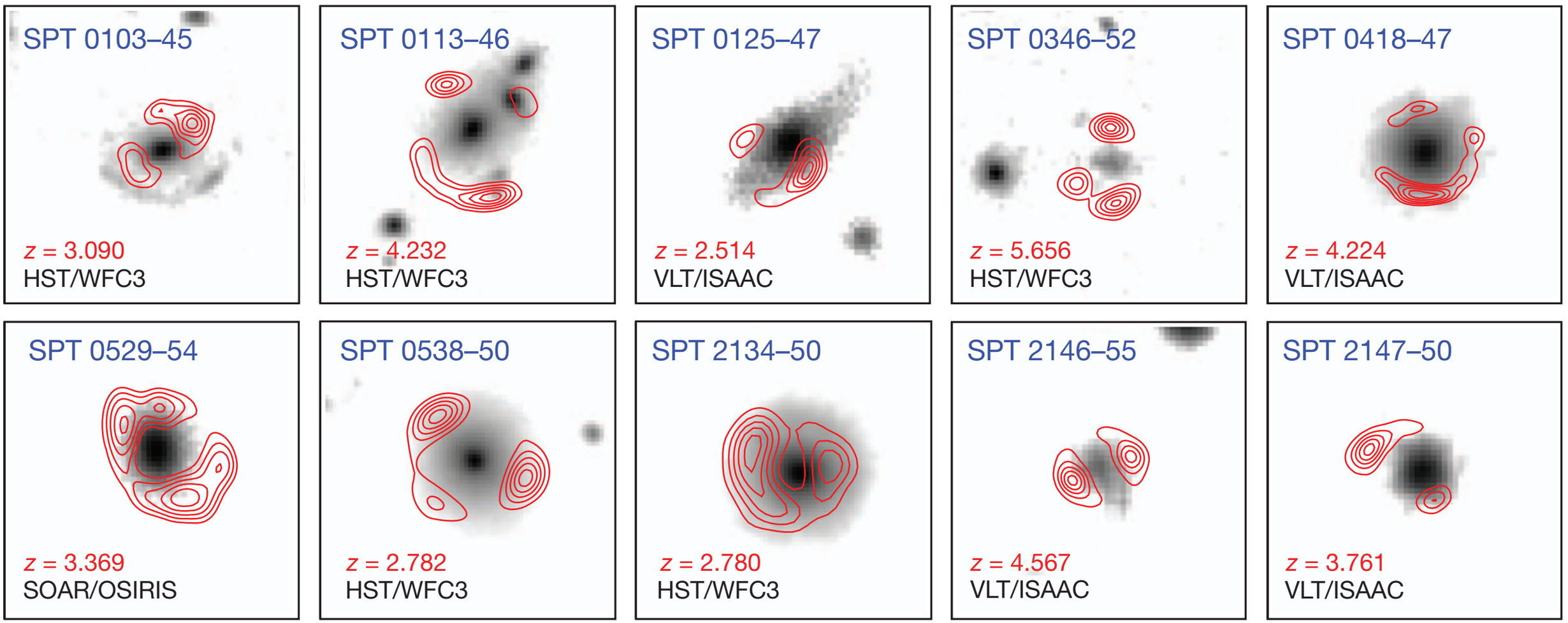


0.13 arcsec@1.3mm
Kwon+ 2011



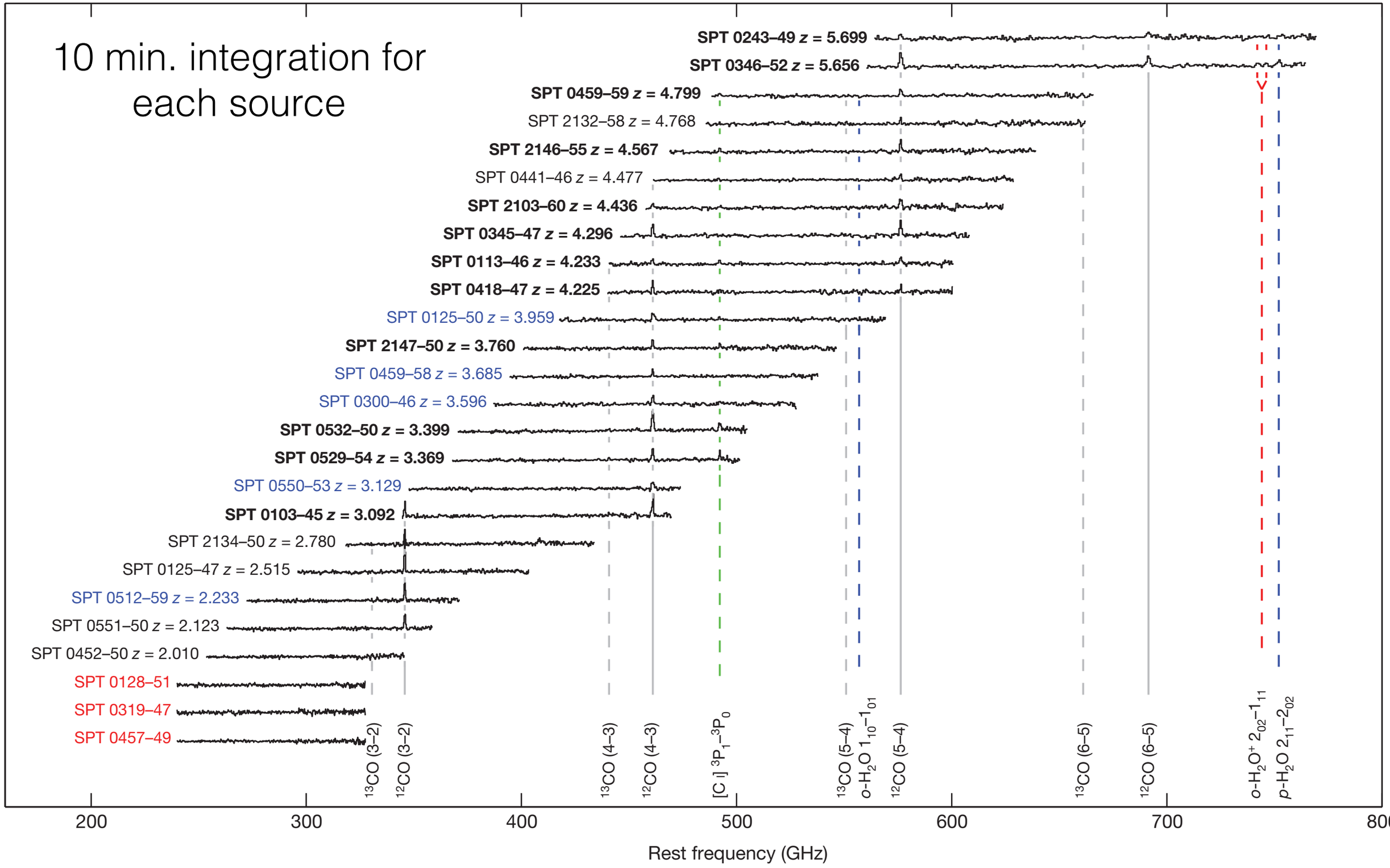
0.035 arcsec@1.3mm
4.5 hour on-source time
SV for long-baselines

Dusty Starburst Gals in high-z (Vieira+, Nature, 2013)



8x8 arcsec^2; Gray: NIR, Red:
ALMA Cycle 0 870um, 2min integration, 0.5 arcsec resol.

ALMA 3mm [84.2-114.9GHz] Spectra



ALMA survey of SMGs in ECDFS (Extended Chandra Deep Field South)

Hodge+ 2013, ApJ, Cycle 0

ALMA band 7 (344GHz, 870μm)

Primary beam: 17.3 arcsec

Angular resolution: 1.5 arcsec (125m)

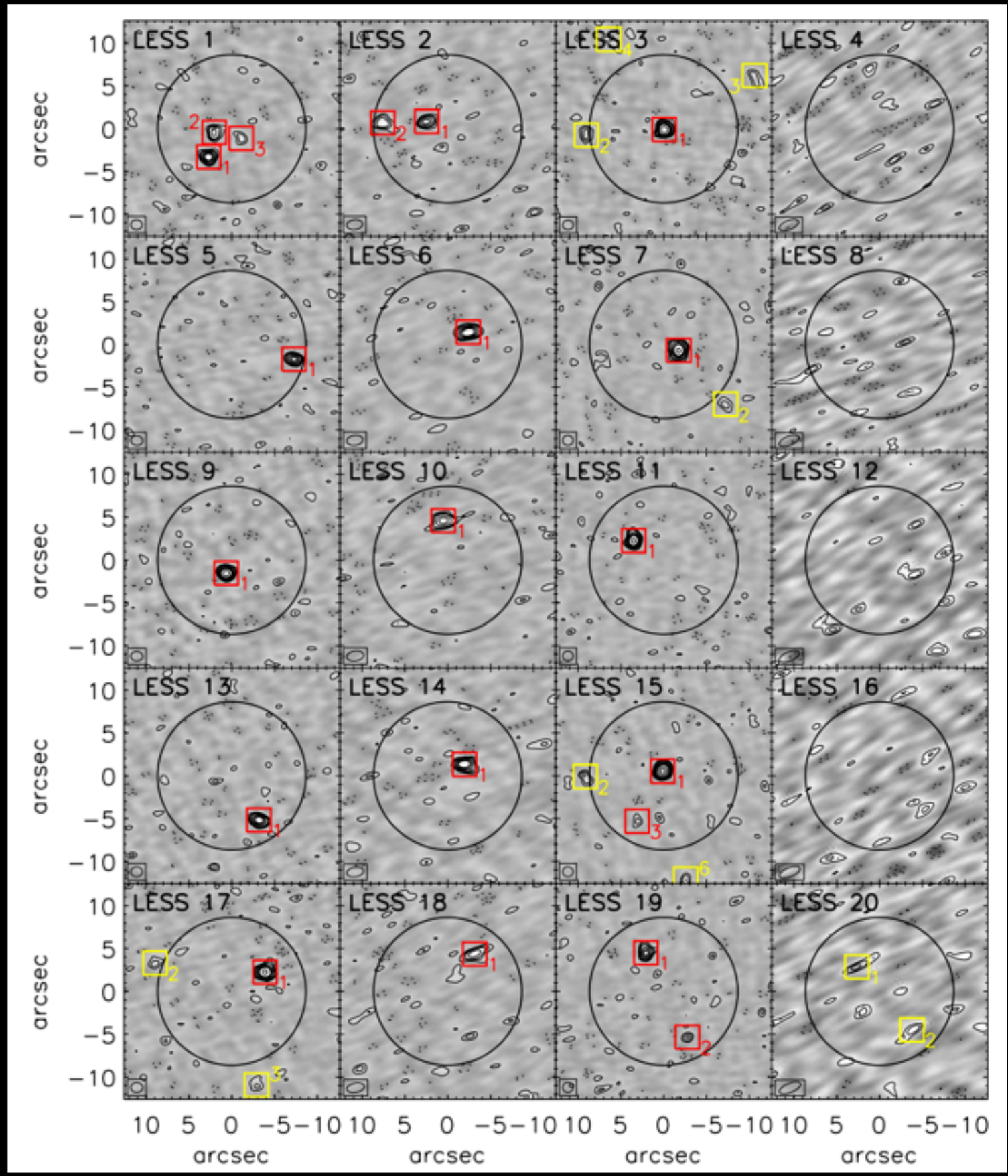
Observed 126 subm sources detected in LESS (LABOCA ECDFS Submillimeter Survey) by 12m APEX

2 minutes integration time for each source

3x sensitivity 200x resolution

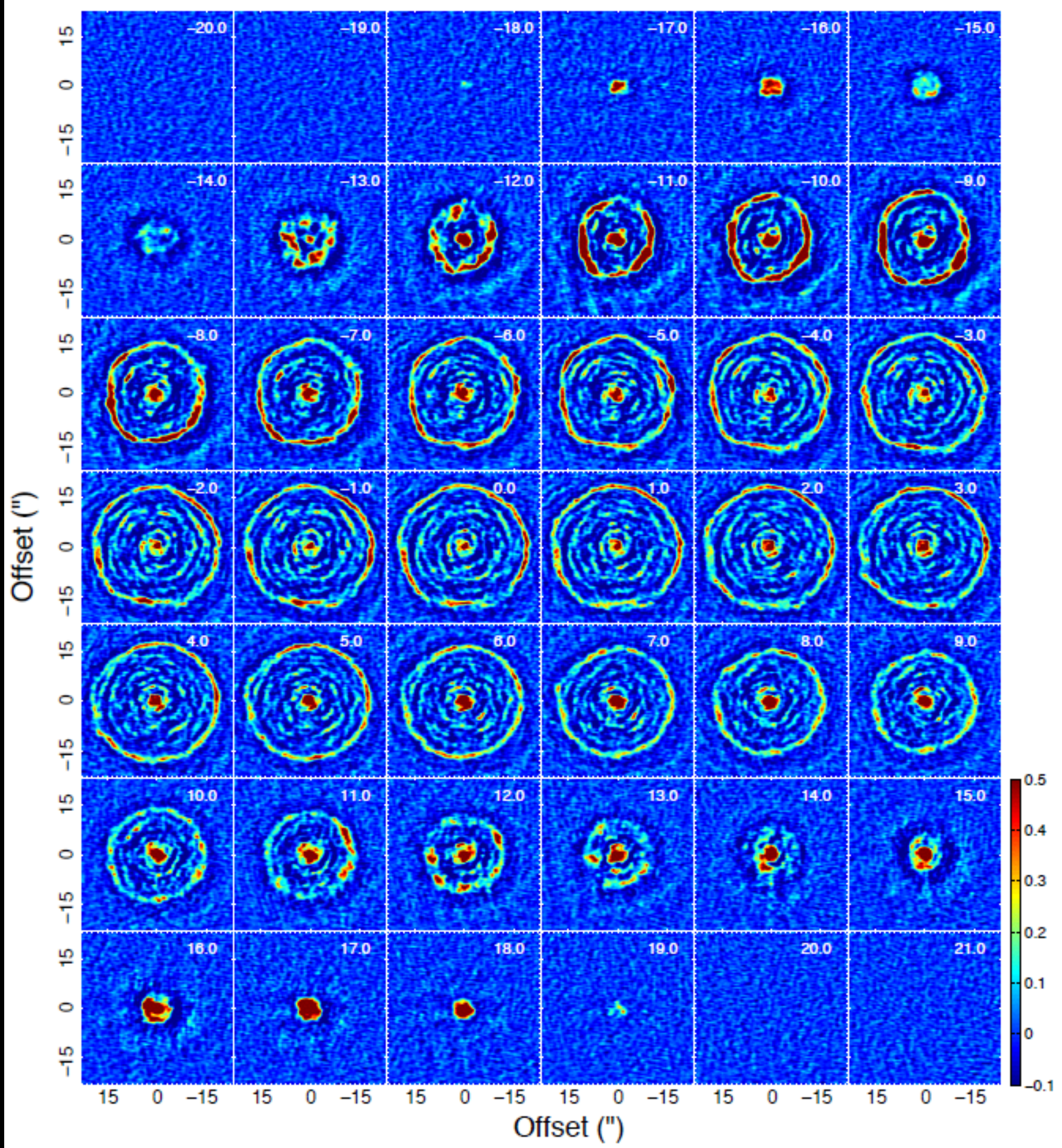
à Resolve previously blended sources

à Main 99 SMGs+ supplementary 32 SMGs

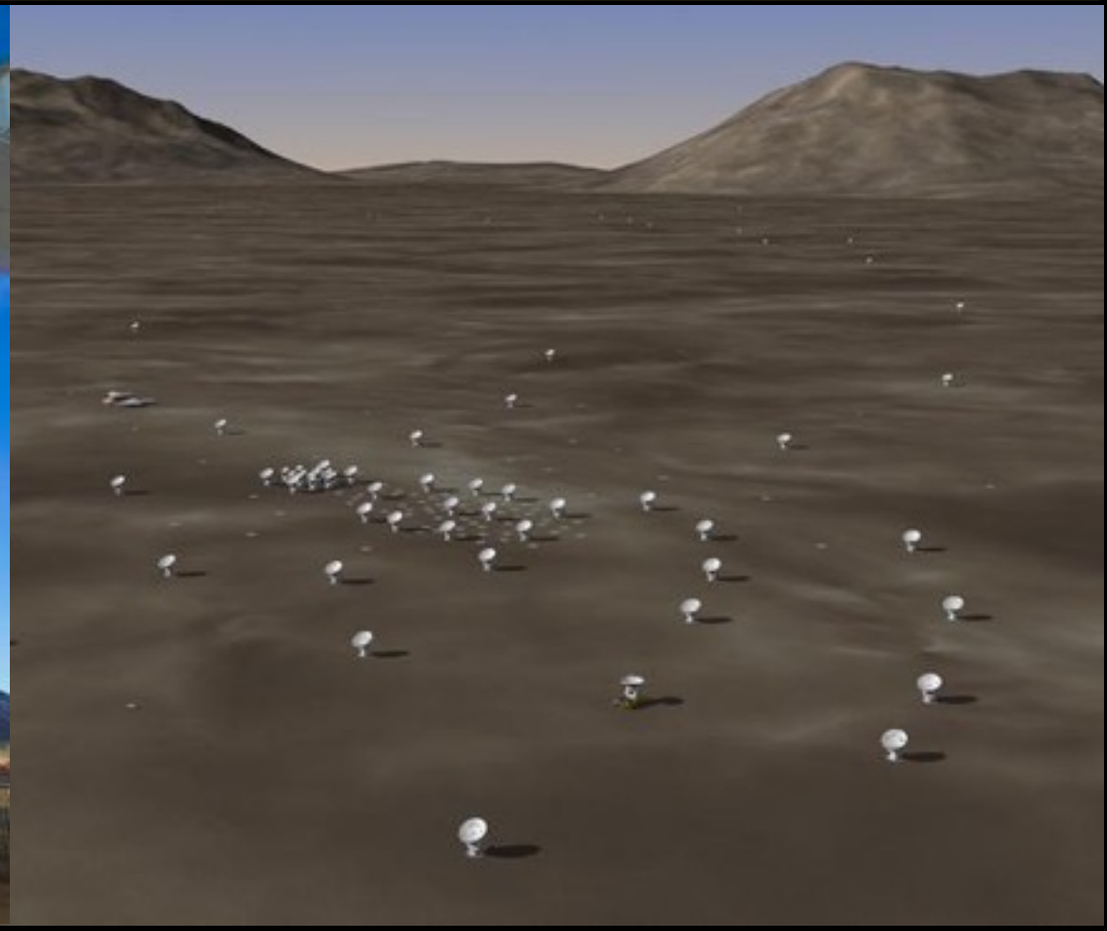


Large Mass Loss from R Sculptoris, an AGB Star

Maercker+ 2012 (Oct-11), Nature
Cyclo 0
December 2011, data delivered
CO(J=3- 2) 345GHz
1.3”x10” beam
50”x50” map, 45-point mosaic
CASA



50x12m-Array
12x7m-Array
4 12m-TP Array
Longest baseline: 16 km
Completed in 2013



Cycle 3 pre-announcement

- March 24,2015: official announcement of call-for-proposal
- April 23, 2015: call-for-proposal deadline
- October 2015: start observations
- September 2016: end observations
- 2100 hours for both 12-m and 7-m arrays

Cycle 3 Capability

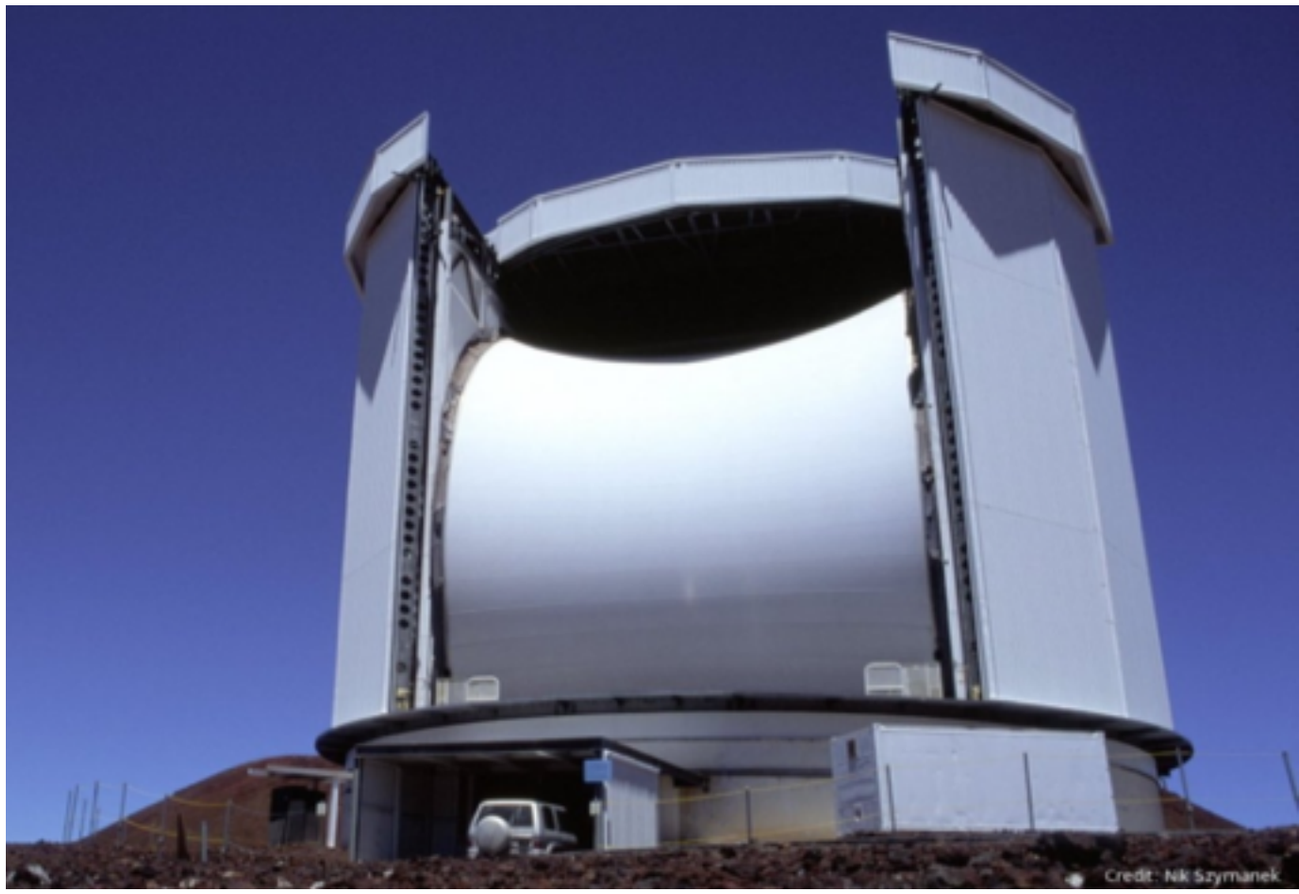
- at least 36 12-m, 10 7-m ACA, 2 12-m TP antennas
- receiver bands: 3,4,6,7,8,9,10 (3.1,2.1,1.3,0.87,0.74,0.44, and 0.35mm)
- baselines: 2 km for B8,9,10, 5km for B5, 10km for B3,4,6
- both single-field and mosaics
- spectral-line obs. for all arrays, continuum obs. for 12-m and 7-m arrays
- on-axis continuum polarization obs. in B3,6,7 (no ACA, no mosaics, no circular pol.)
- mixed correlation modes (low and high frequency resolution)

Town Meetings

- Lectures and Q&A:
    - ALMA Science Cases
    - Cycle 3 Capability,
        - Observing Tool,
        - ALMA Archive
- March 25: KIAS
- March 26: SNU+Yonsei
- March 27: KyungHee University
- April 3: KASI

JCMT; James Clerk Maxwell Tel.

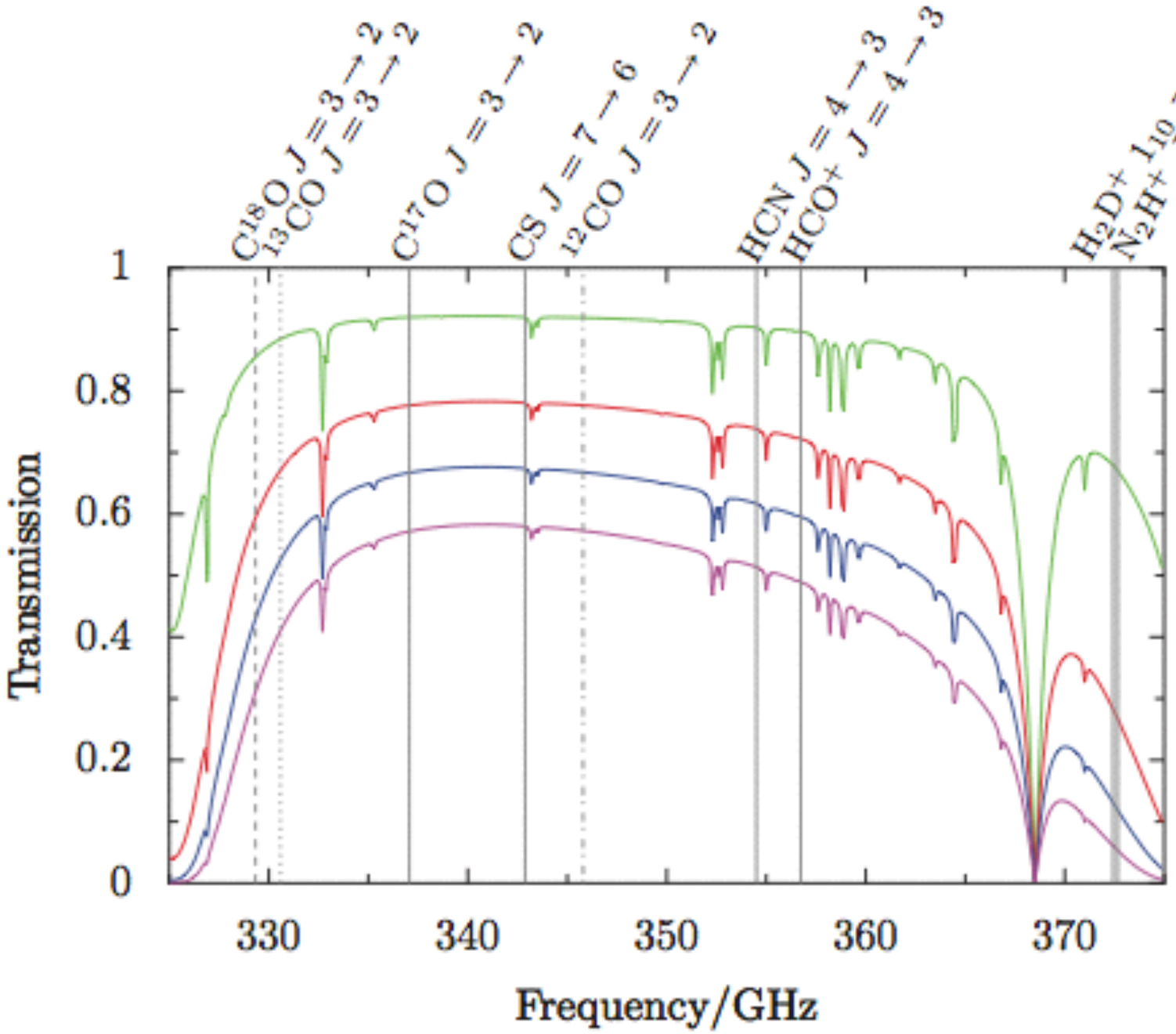
- 15m diameter (14 arcsec@345GHz), a largest submm telescope at Mauna Kea, 4092m
- operated by UK 75% (will withdraw on Feb. 28, 2015) and Canada 25% (withdrew on Sep. 30, 2014)
- Major Instruments
  - HARP, 16beams, 345GHz
  - SCUBA-2, TES, 4x(32x40)@850um,450um
- Publications
  - 103(‘12), 102(‘13)



HARP

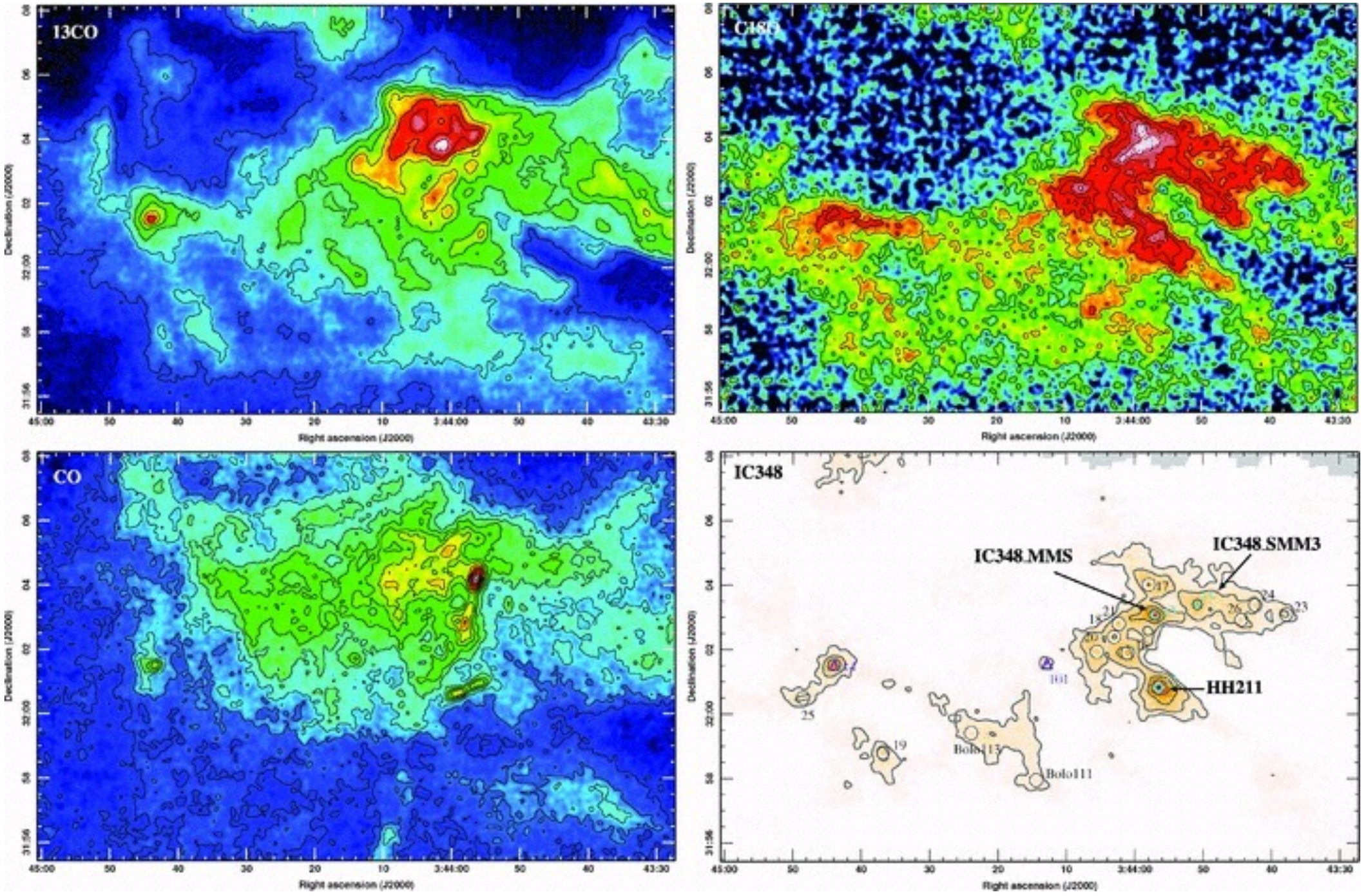
- 16 element focal plane array receiver
- Band: 325 ~ 375 GHz
- Trx ~ 120K, Tsy ~ 300K (SSB)
- Main beam efficiency: 0.61@345GHz
- Speed ~ 1 deg^2 / hour

Transmission, lines



Transition	Frequency (GHz)
$C^{18}O/^{13}CO$ 3 → 2	329.330/330.587
$C^{17}O$ 3 → 2/$C^{34}S$ 7 → 6	337.061/337.396
CH_3OH $7_{14} \rightarrow 6_{14}$	338.345
CS 7 → 6	342.883
$H^{13}CN$ 4 → 3	345.340
CO 3 → 2	345.795
$H^{13}CO^+$ 4 → 3/SiO 8 → 7	346.999/347.330
HCN 4 → 3	354.505
HCO^+ 4 → 3	356.734
DCN/HNC 4 → 3	362.046/362.630
H_2CO $5_{05} \rightarrow 4_{04}$	362.736
H_2D^+ $1_{10} \rightarrow 1_{11}$/$N_2H^+$ 4 →3	372.421/372.672

HARP 13CO (top left panel), C18O (top right panel) and 12CO (bottom left panel) J= 3 → 2 integrated intensity images towards IC348 taken as part of the guaranteed time.



Buckle J V et al. MNRAS 2009;399:1026-1043

12hour obs time

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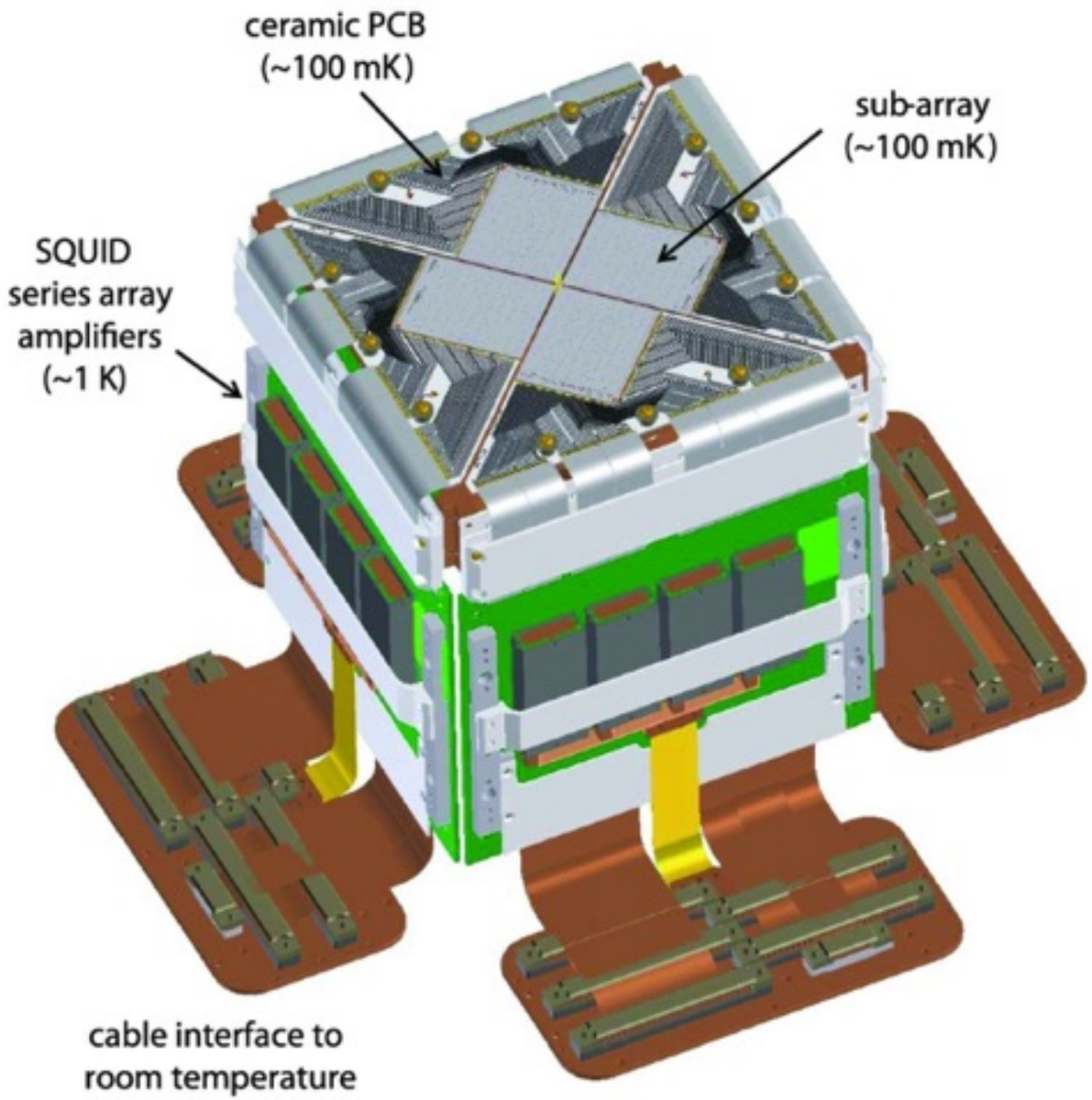
SCUBA-2

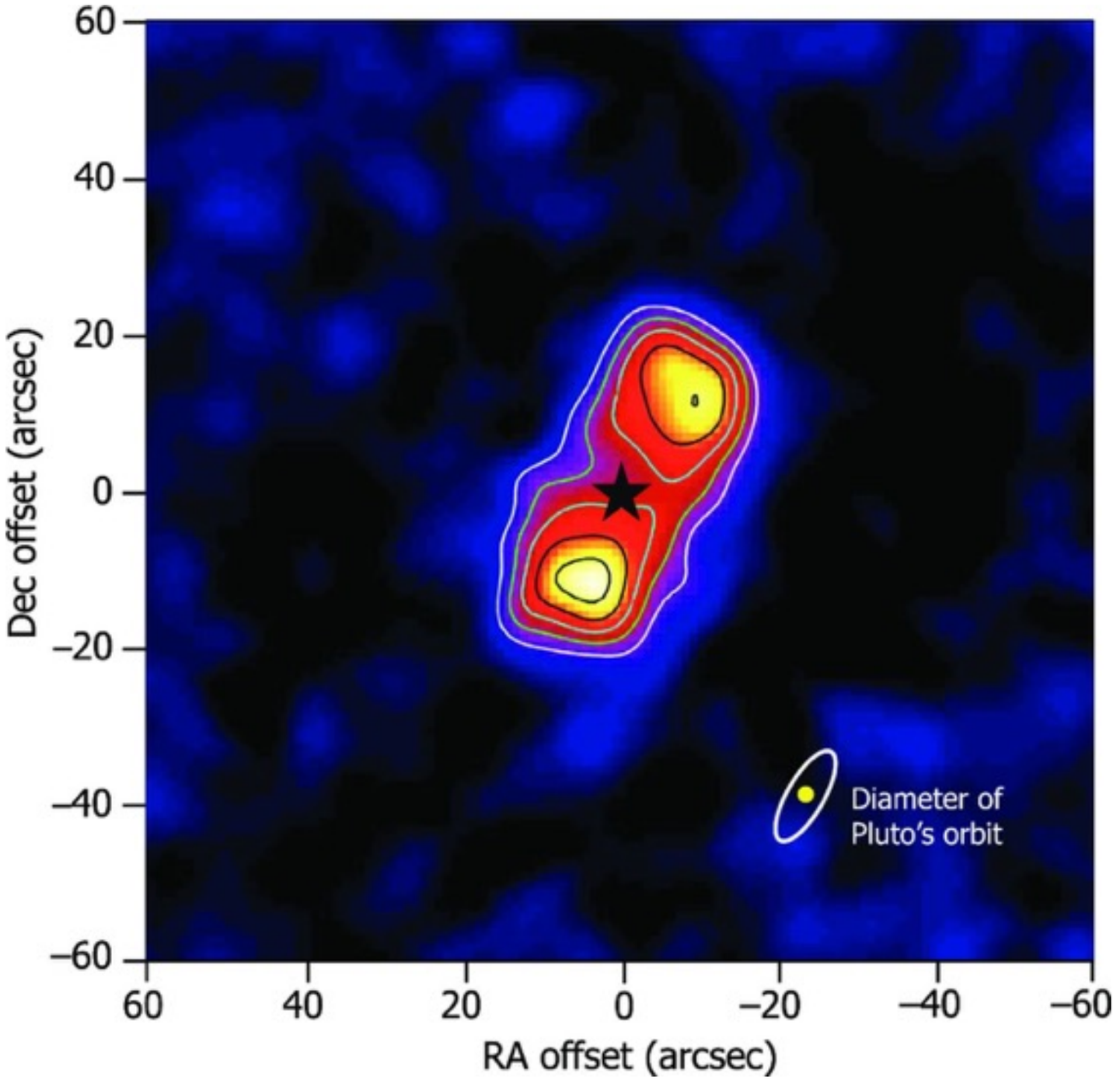
submillimetre Common-User Array 2

- Reference: Holland+ 2013



- Bolometers: SHARC(CSO), SCUBA(91 pixels@450um, 37 pixels@850um, JCMT), BOLOCAM, SHARC II (CSO), LABOCA(APEX), MAMBO(IRAM), SCUBA2(5120pixels@450um,5120pixels@850um)
- $\lambda/\Delta\lambda$=14,10@450um, 850um
- 45 arcmin^2

SCUBA-2 image of the debris disc around Fomalhaut at 850 μm.



Holland W S et al. MNRAS 2013;430:2513-2533

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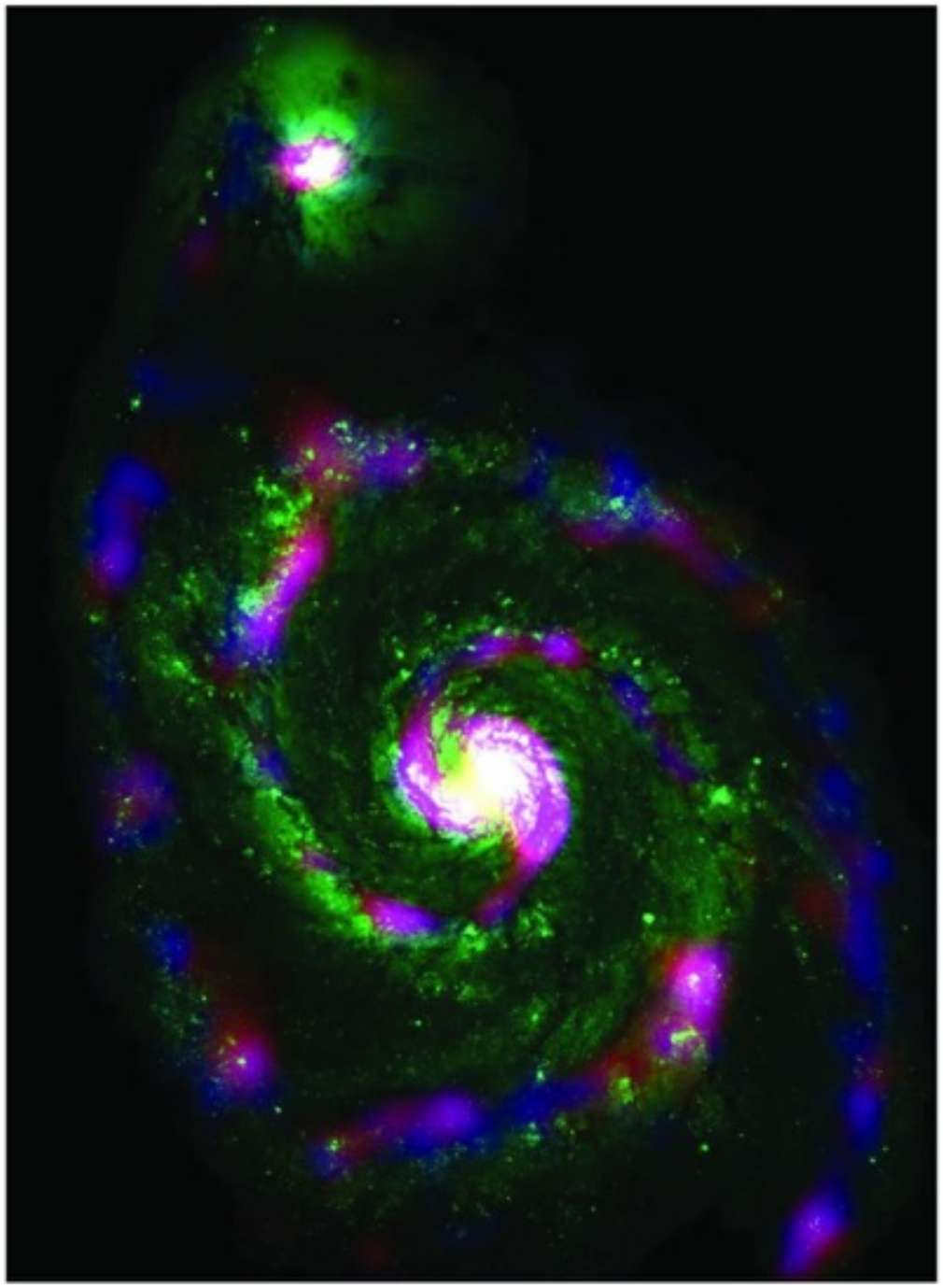
A composite image of the famous Whirlpool Galaxy with SCUBA-2 colours (blue for 450 μm; red for 850) superimposed on a green-scale HST image.



Holland W S et al. MNRAS 2013;430:2513-2533

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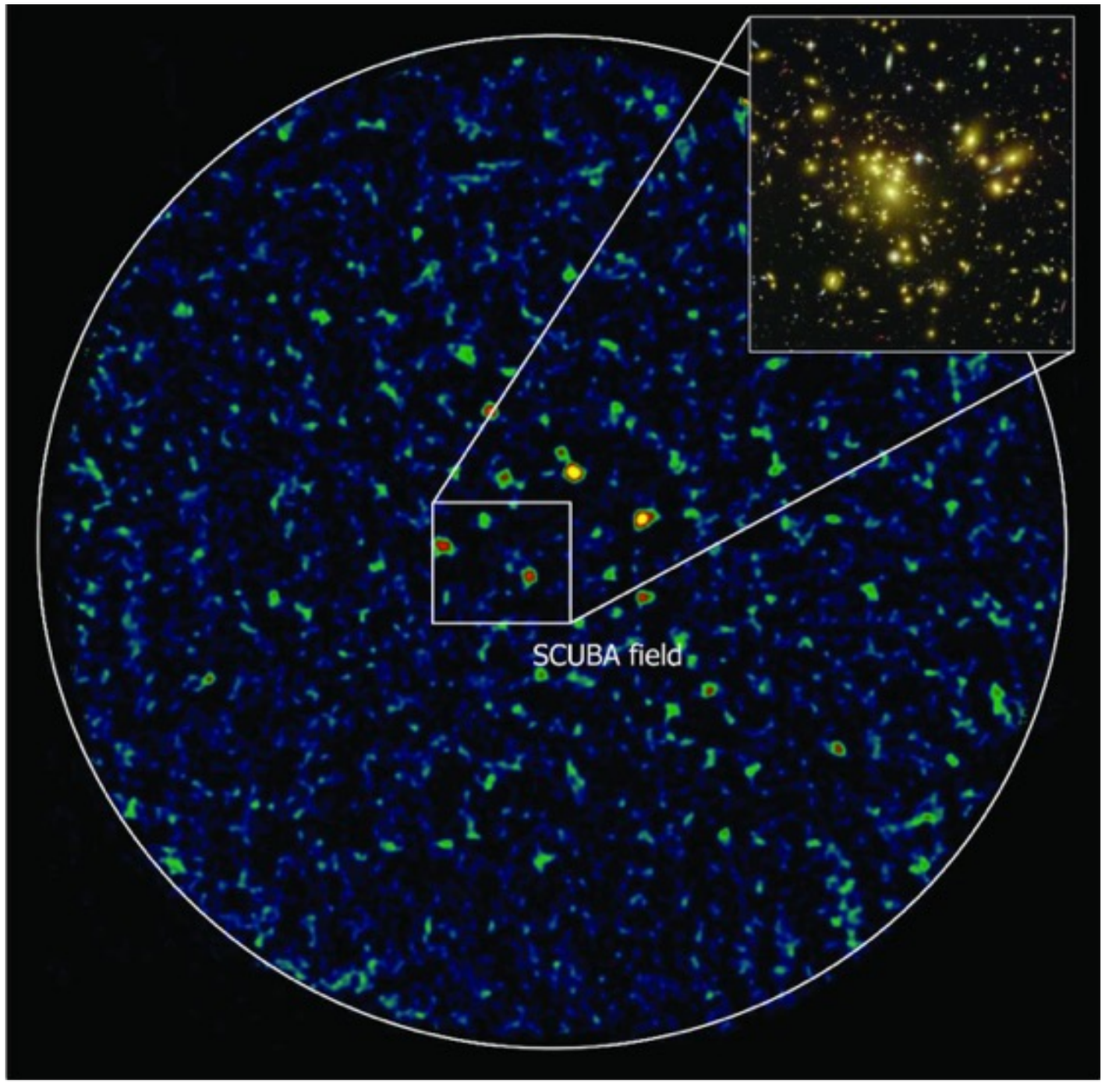
The massive lensing galaxy cluster Abell 1689 observed by SCUBA-2 at 850 μm.



Holland W S et al. MNRAS 2013;430:2513-2533

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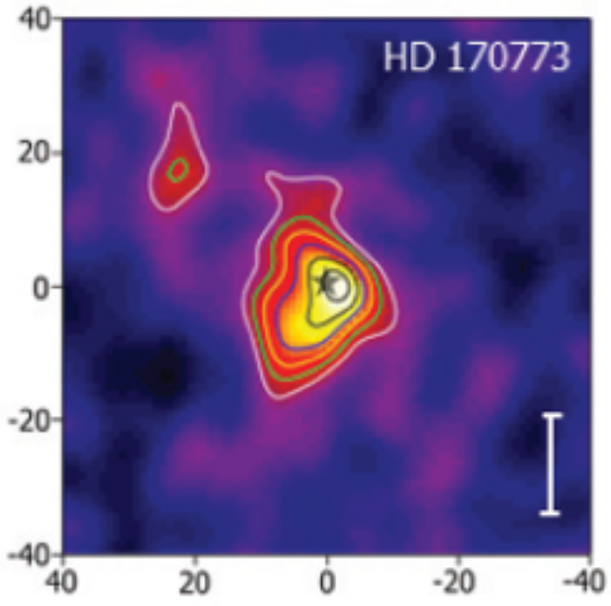
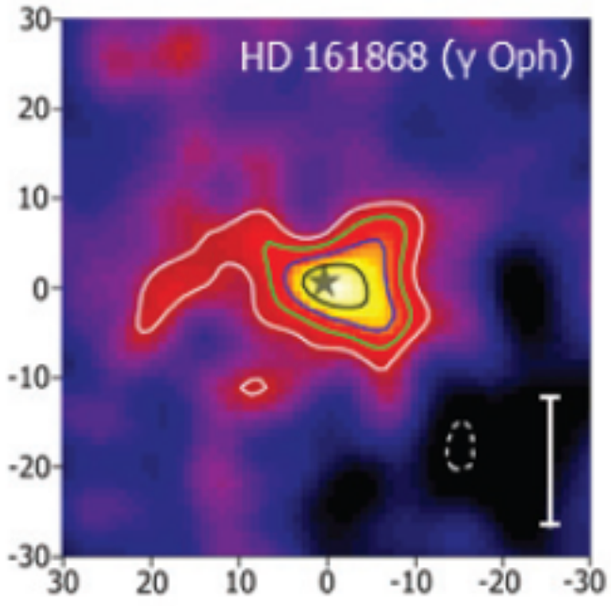
JLS, JCMT Legacy Survey

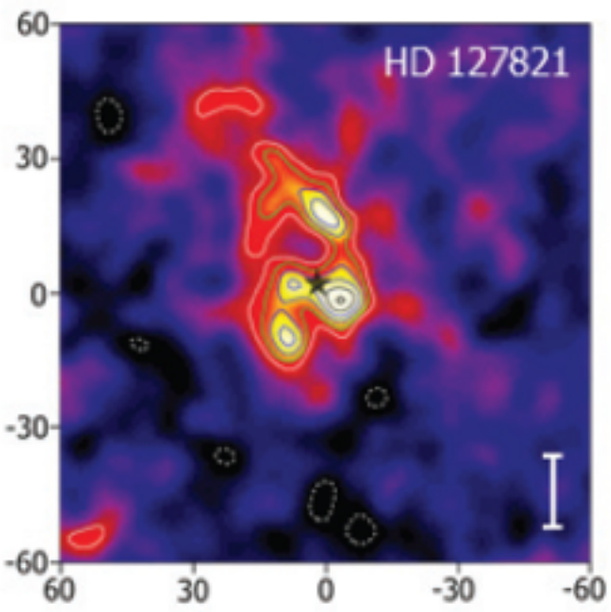
- SASSy, SCUBA-2 Ambitious Sky Survey
- CLS, SCUBA-2 Cosmology Legacy Survey
- NGS, Nearby Galaxies Survey
- JPS, JCMT Galactic Plane Survey
- GBS, Gould Belt Survey
- SLS, Spectral Legacy Survey
- SONS, Survey of Nearby Stars

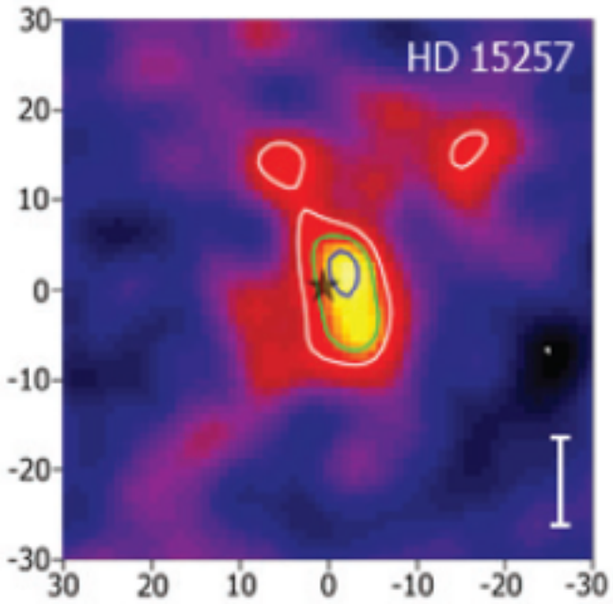
JLS observation parameters

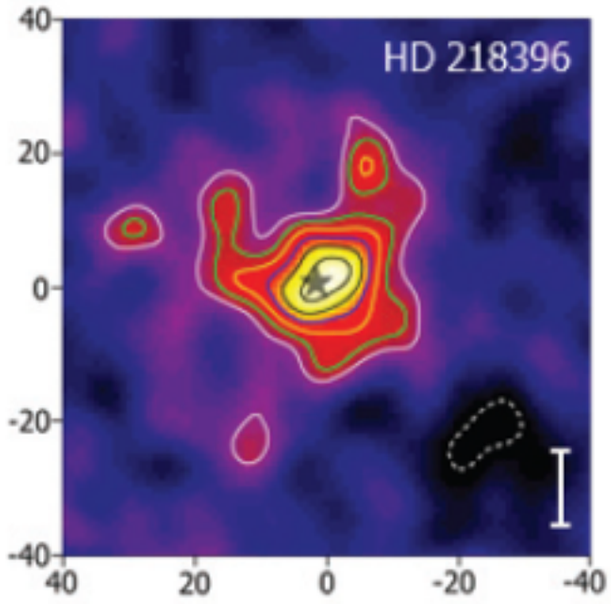
- Galactic Plane Survey: 200 deg^2, 1 sigma depth of 15 mJy at 850um, 450h
- Gould Belt Survey: MCs, ~ 500 deg^2, 3 mJy at 850um, 412h
- Debris Disc Survey: 115 nearby stars, 1.4mJy@850um, 270h
- Local Galaxy Survey: 150 nearby gals, 1.6mJy@850um, 100h
- Cosmology Survey: 10 deg^2 to 1.2mJy@850um, 0.25 deg^2 to 1.2mJy@450um, 1778h
- Ambitious sky Survey: 1100 deg^2, 30mJy@850um, 480h

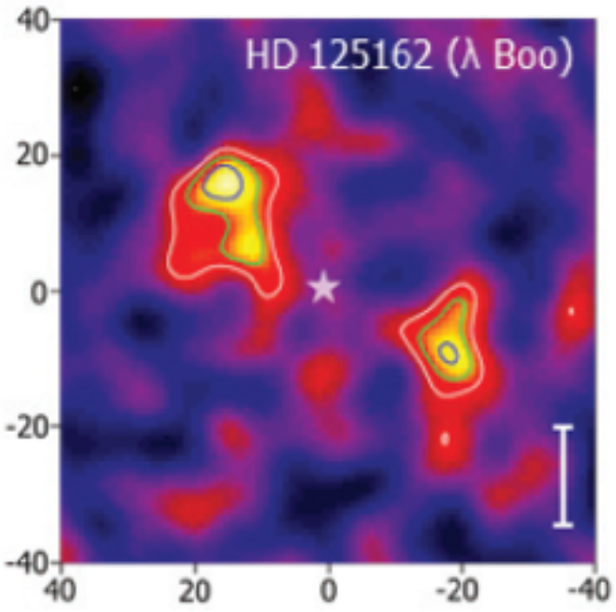


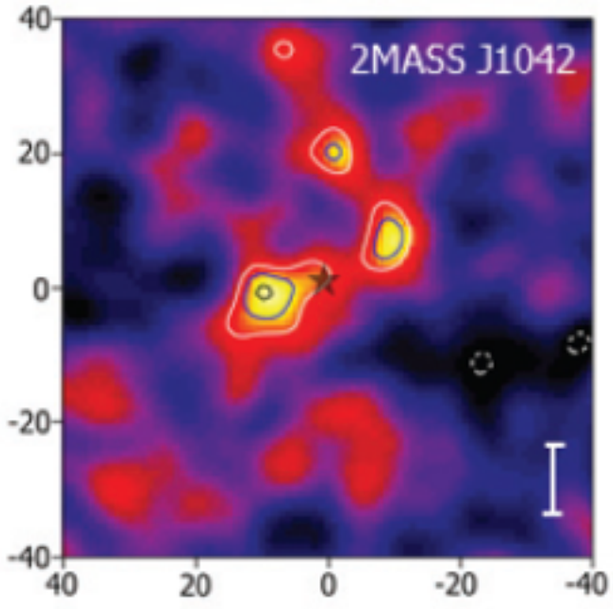


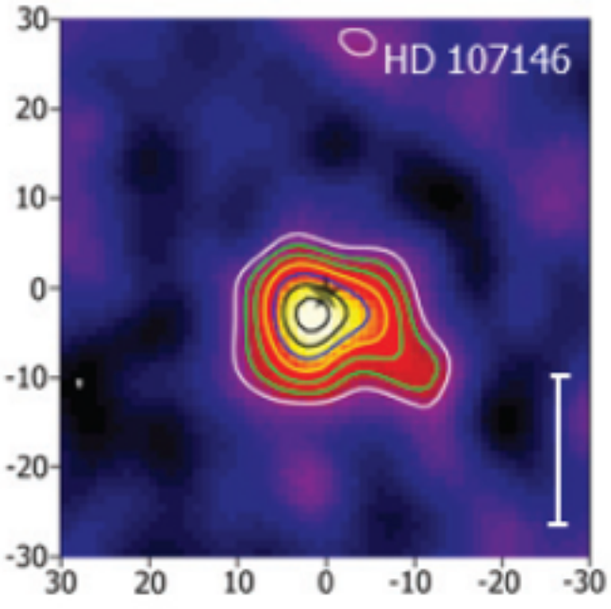


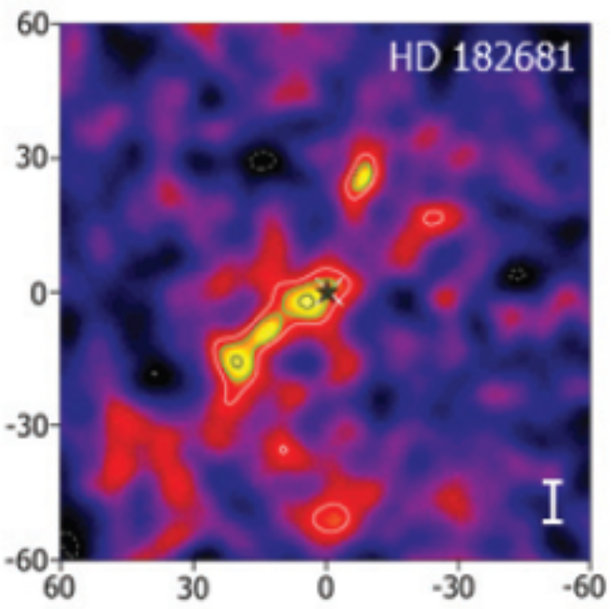












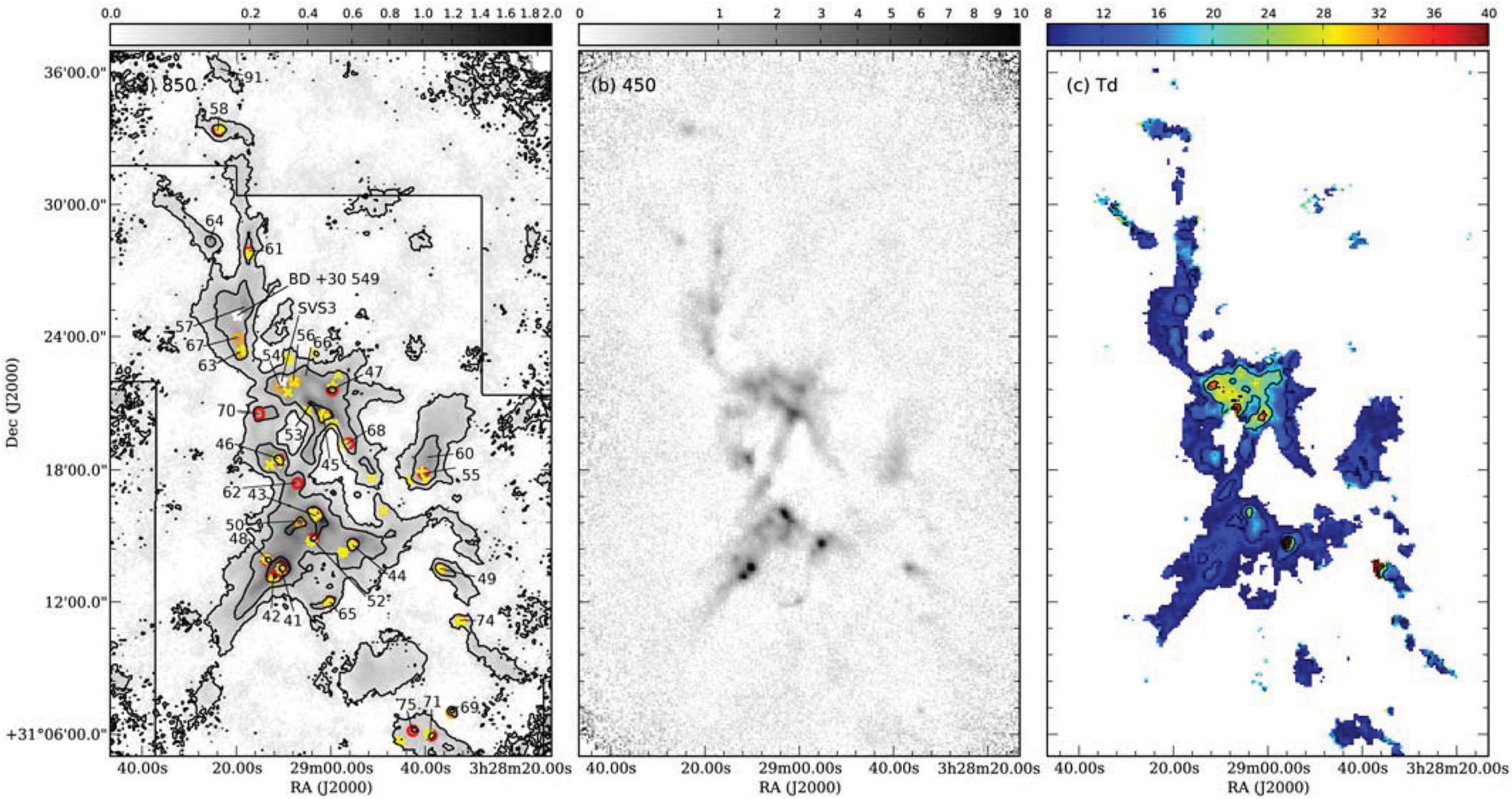
- SONS:

115 nearby stars, 2mJy@850um, 270h

40% detection

Temp of NGC1333; Hatchell+ 2013

$$\frac{S(450)}{S(850)} = \frac{\kappa(450)B(450;T_d)}{\kappa(850)B(850;T_d)}; \kappa = \kappa_0 \nu^\beta$$



Operation of JCMT by EAO

- EAO will operate the JCMT from March 1, 2015 for 5 years
- JCTM budget: 2.6MUSD+alpha
  - EAO 1.6MUSD (China 0.5, Japan 0.5, Korea 0.3, Taiwan 0.3), UK 0.9MUSD, CA 0.1MUSD
  - One or two more partner(s): UA, UT, …
- Observing time:
  - Legacy: 50%, PI: 50%
- Office: current JAO Office (will be purchased by Subaru and then be used by TMT)
- Requested in-kind contribution from EAO: 1(engineer)+1(scientist
- Board: EA 4, UK 2, CA 1, (1 UH)
- one-unified TAC