First Science Results from the Submillimeter Array

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Harvard-Smithsonian CfA

Presenting for:

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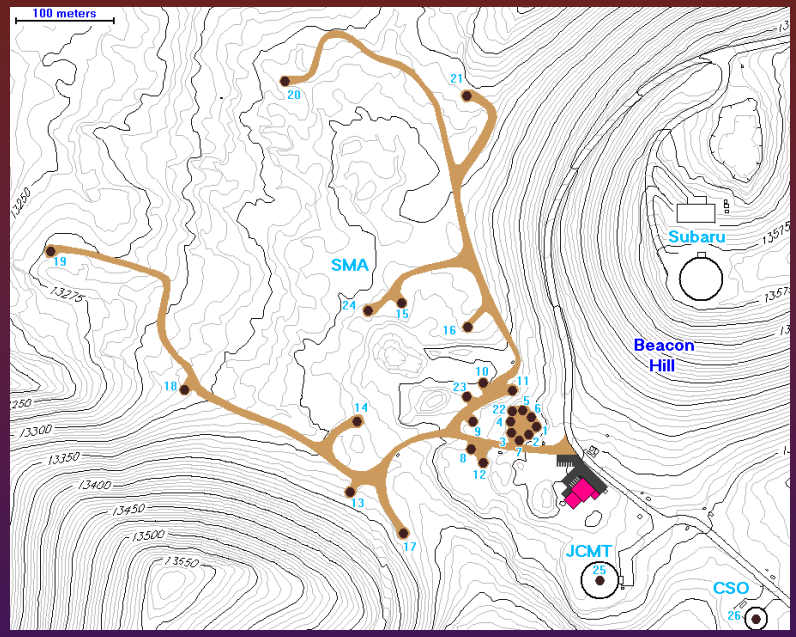
Eight Antennas

6m dishes composed of 72 aluminum panels

Carbon fiber backup structure

Assembled in summit hangar

For more info, see Peck and Schinckel poster #11



Four configurations

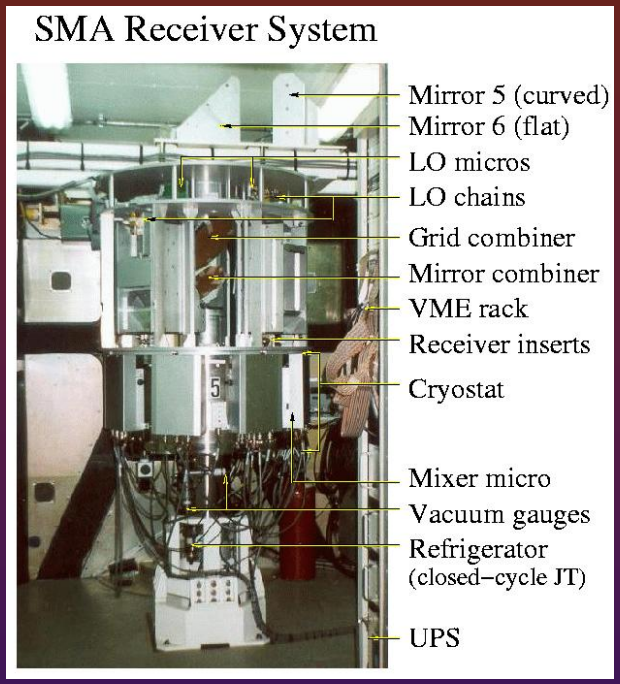
based on Reuleaux triangles

Baselines ranging from 7 to 500 m

Can move 3 antennas per day

Pointing checked optically, then using single-dish radio measurements

Baseline parameters determined to fraction of a wavelength by tracking quasars

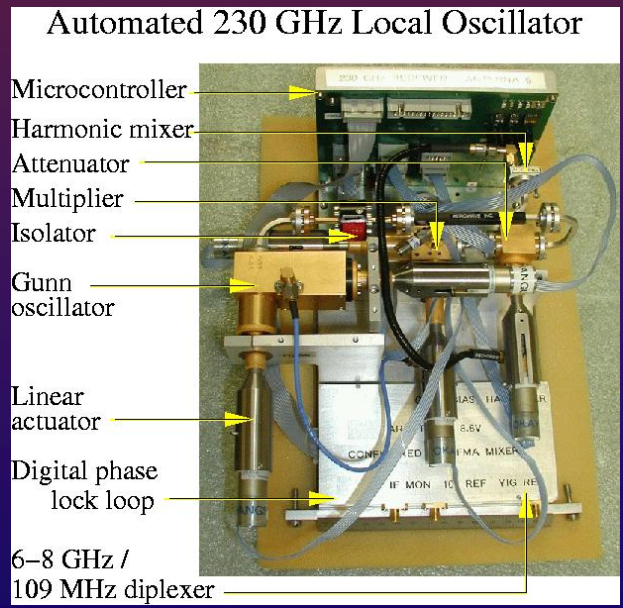


Six receiver inserts

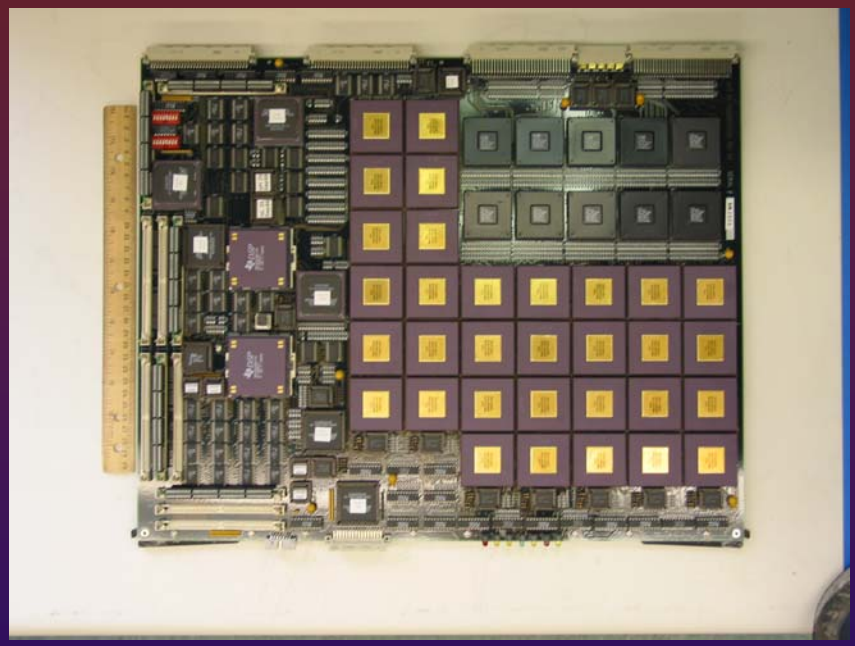
170-240 GHz
2x 260-350 GHz
300-420 GHz
650-710 GHz
820-910 GHz

Automated Tuning

For the 230 and 345 GHz LOs



Correlator



2 GHz bandwidth in 24 IFs
in each of 2 sidebands.

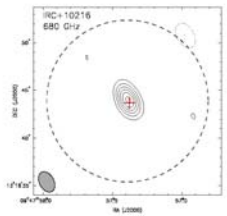
Allows mixed resolution setups, with between 8 and 512 channels in any IF, for high continuum sensitivity as well as sub-km s^{-1} velocity resolution on lines.

Soon 2 receivers simultaneously for dual-band observations, or dual polarization

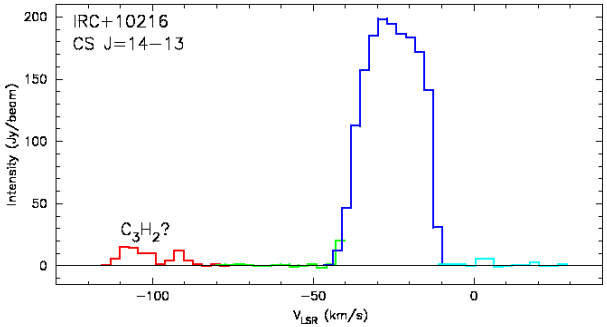
Interferometric Imaging at 685 GHz

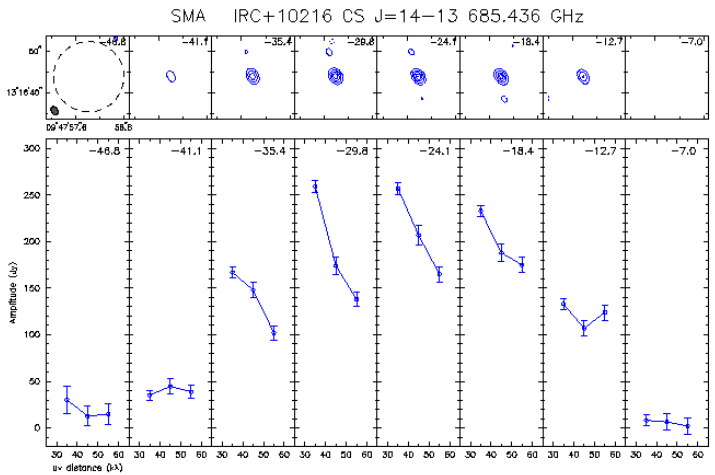
Observations made in late 2002 using 3 antennas during phase closure demonstration

Imaging difficult, but uvplots show CS(14-13) emission is spatially resolved at central frequencies



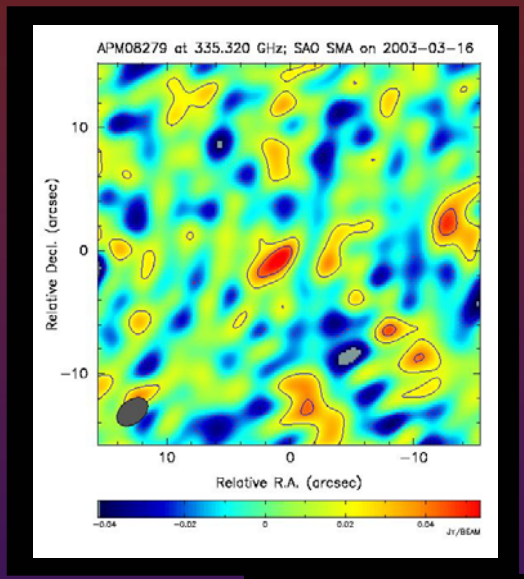
Observations of CO(6-5) (691 GHz) and water masers at 658 GHz made this winter with 5 antennas available soon





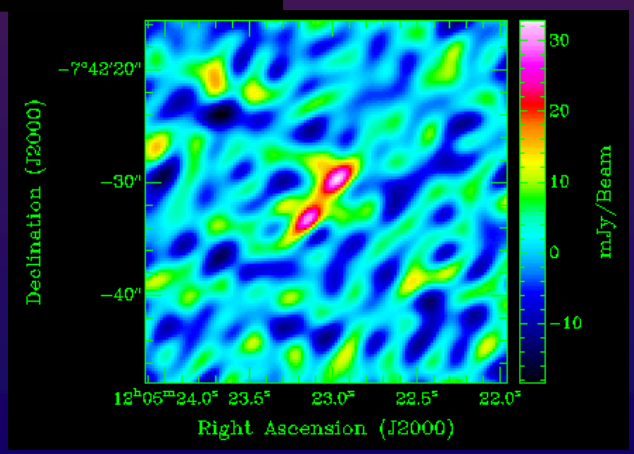
Young et al 2004

High Redshift Galaxies



APM08279+5255: Continuum at 335 GHz
Well-known lensed galaxy at z=3.9
Feasibility study for astrometry on high-z galaxies discovered w/ single-dish:
4 hours on source

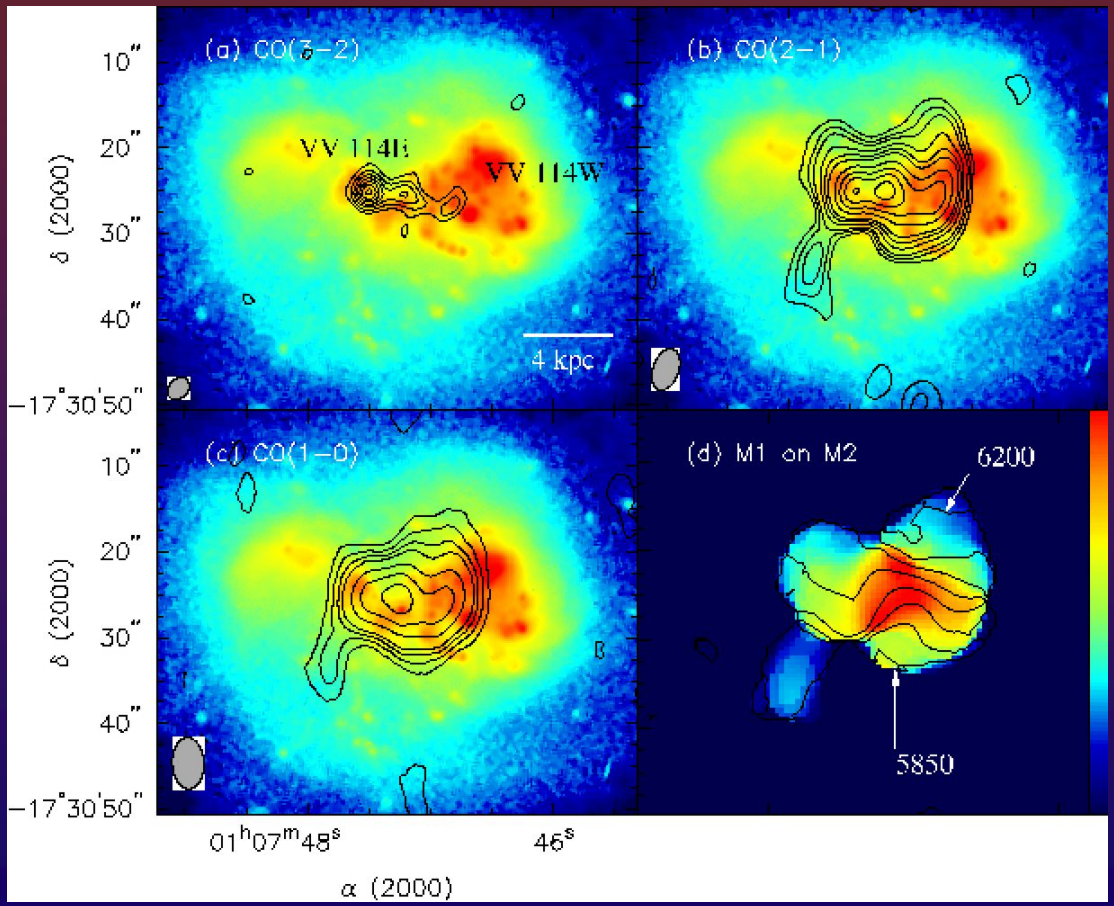
Peck et al 2004



BR1202-0725: Continuum at 332 GHz plus redshifted CII?
(rest freq=158 μm)
z=4.7

Iono et al 2004

Interacting Galaxies: VV114



CO(2-1) and (1-0) detected toward both galaxies and overlap region.

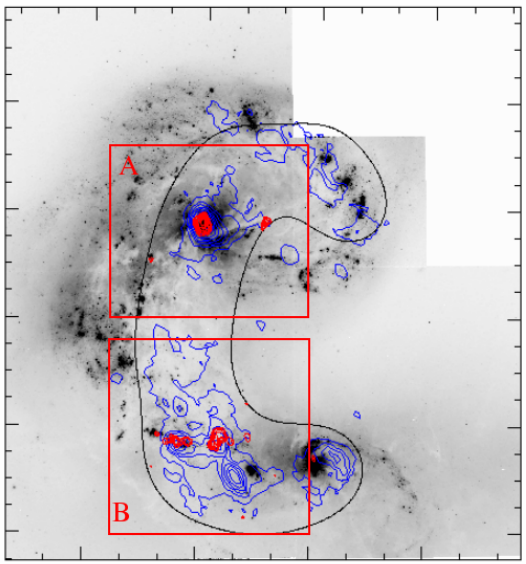
Velocity dispersion greatest toward overlap region

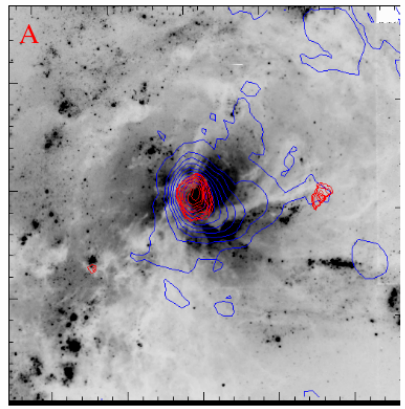
Significantly more dense gas toward VV114E, optically obscured galaxy.

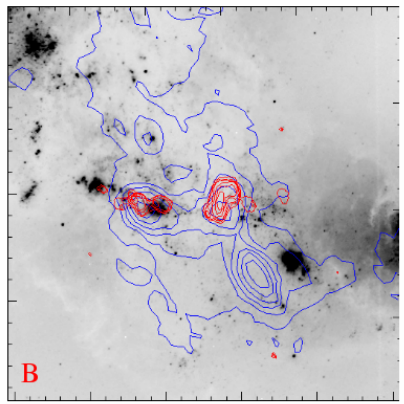
Iono et al 2004

R-band background image courtesy J. Hibbard: CO(1-0) image courtesy M. Yun

Antennae (NGC 4038/9)







Very preliminary
(April 20, 2004)

CO(3-2) – red
SMA 10 ptg mosaic,

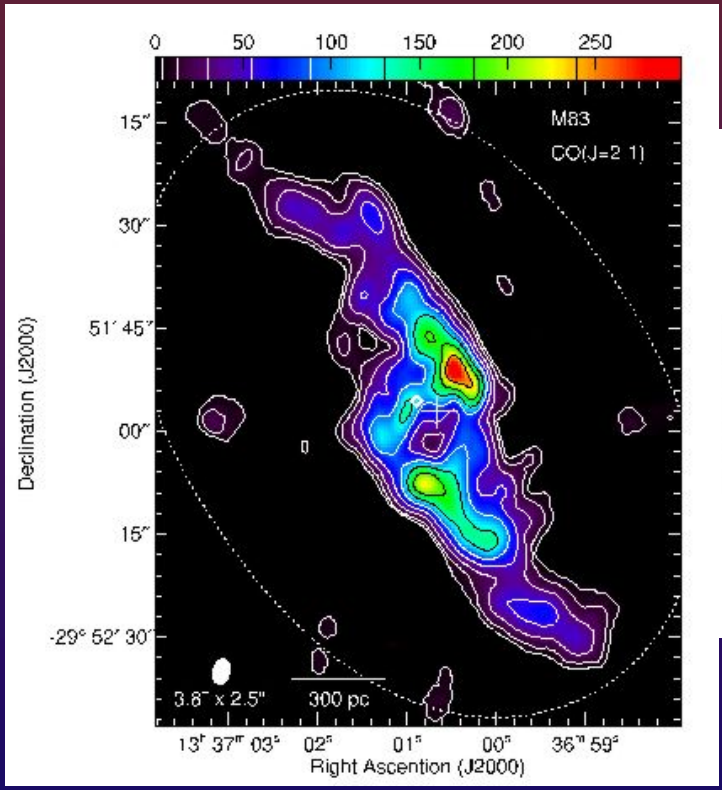
CO(1-0) – blue
courtesy C. Wilson

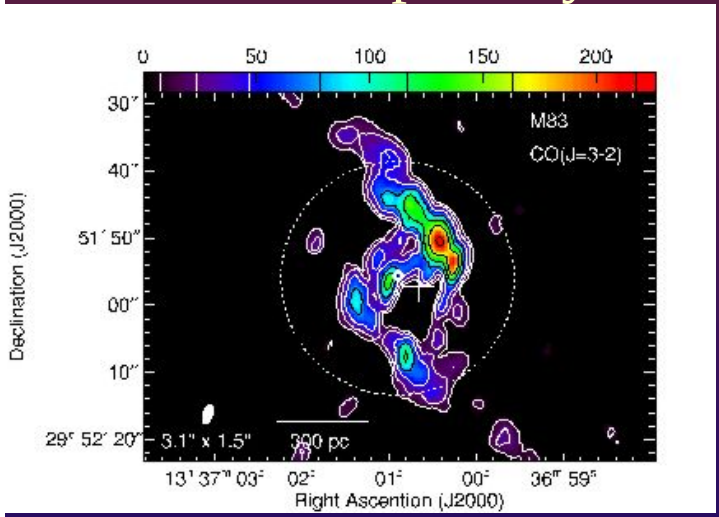
Optical V-band – grey
courtesy B. Whitmore

Iono et al 2004

CO in M83

CO(2-1)- 3 point mosaic
CO(3-2)- single pointing
Dotted line=primary beam

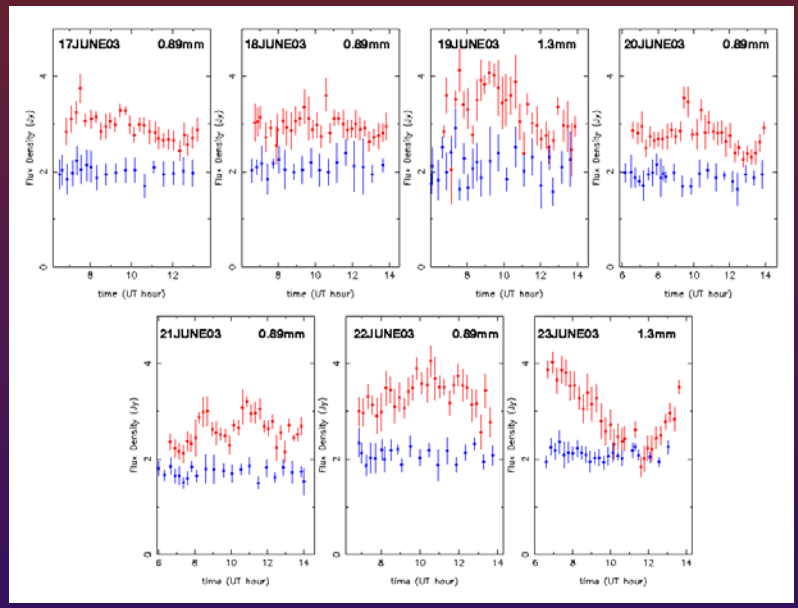




Diamond marks visible nucleus
Cross is isophotal center in K-band

Sakamoto et al 2004

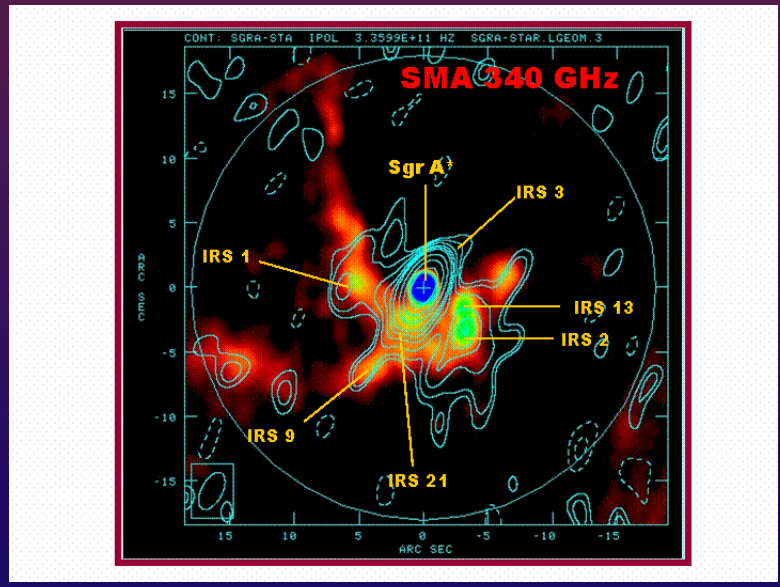
SgrA*: Monitoring and Imaging



Intraday Variability

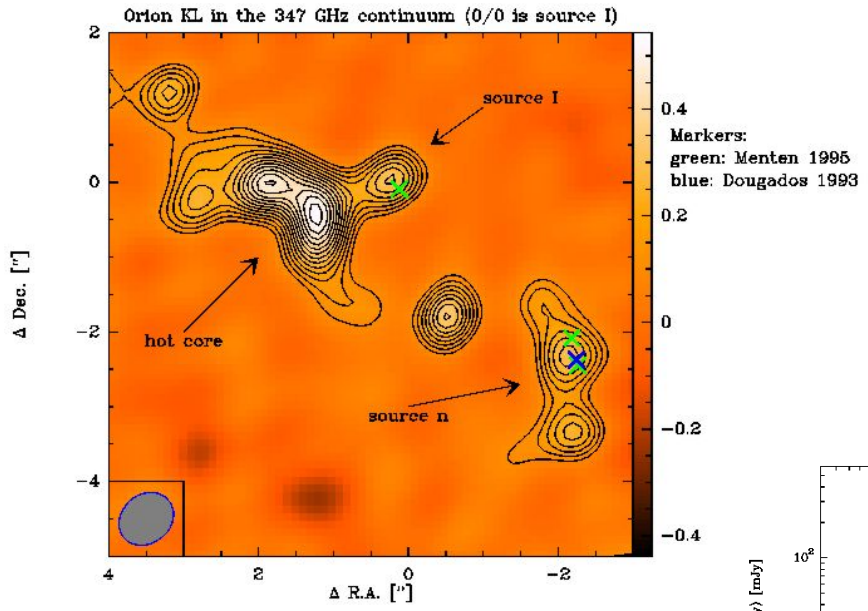
SgrA* flux shown in red, calibrator in blue

340 GHz continuum contours from March 2004 shown with VLA 23 GHz background



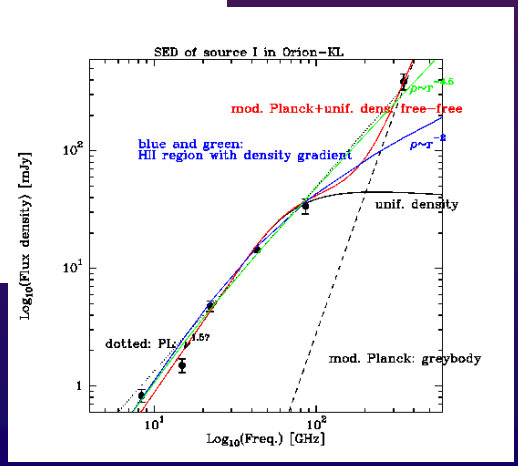
Zhao et al 2004

Orion-KL at 347 GHz



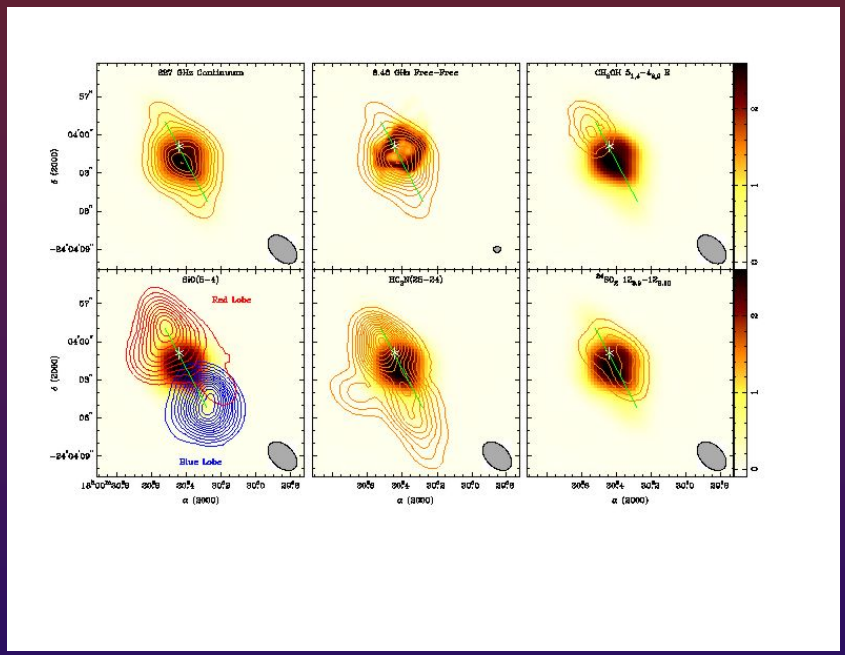
Continuum image with sub-arcsecond resolution, April 2004

Source I clearly resolved from the hot core, and several new components identified



Beuther et al 2004

Massive Outflow in G5.89



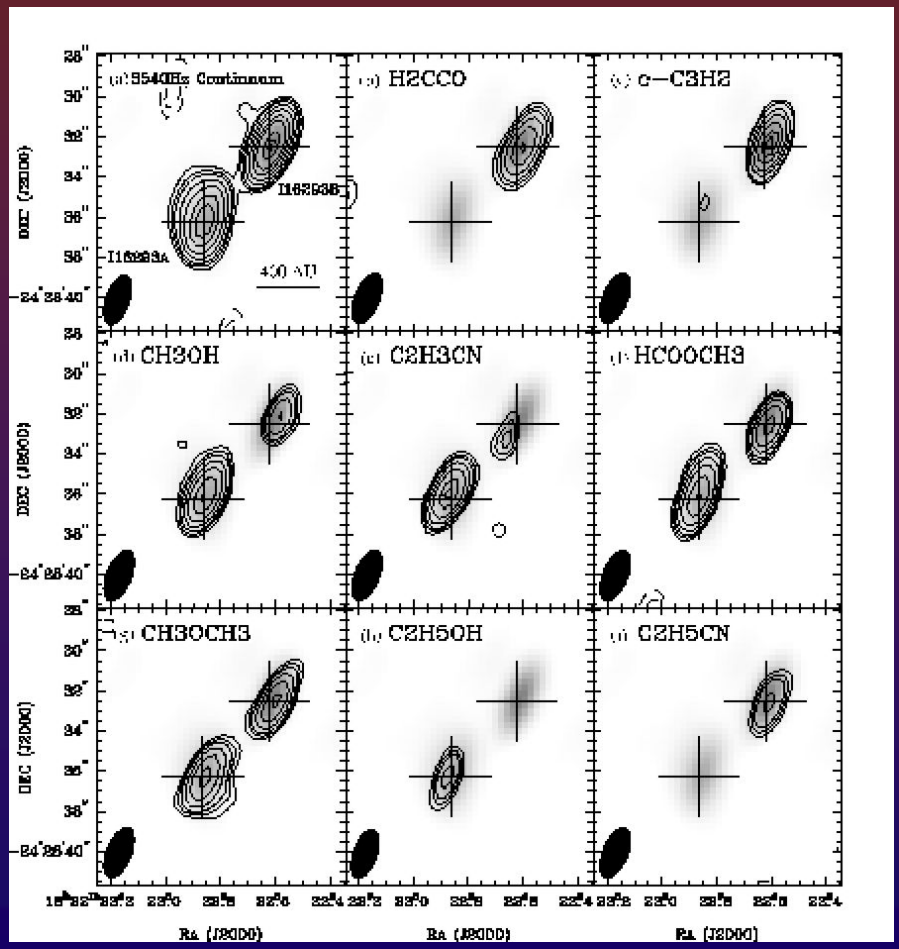
227 GHz continuum and resolved molecular line emission

All lines integrated over full velocity range except SiO(5-4), where blue contours show –25-5 km s^{-1} and red contours show 15-45 km s^{-1}

Sollins et al 2004

8.4 GHz free-free emission image: Wood & Churchwell (1989)

Hot Core in IRAS 16293-2422



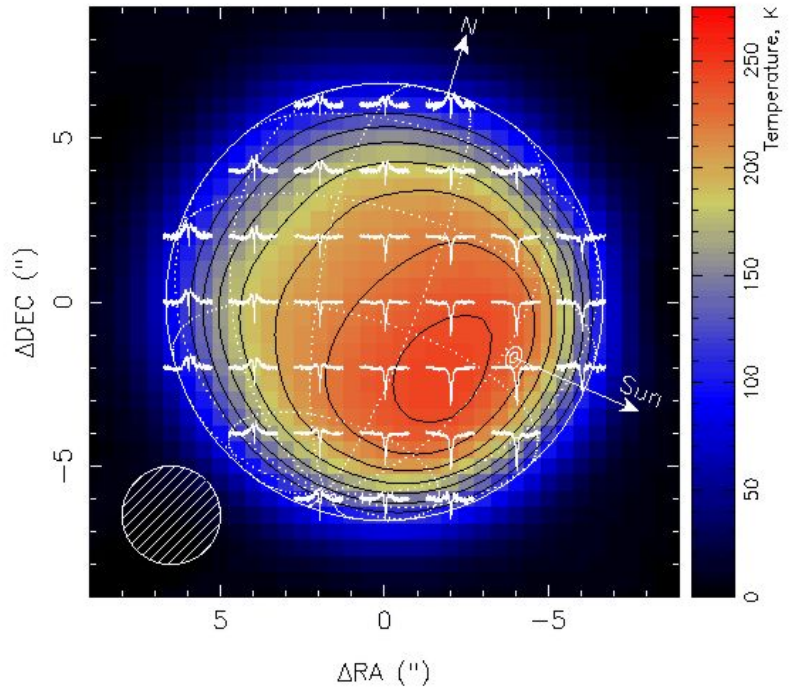
Class 0 young stellar object

Panel 1 shows continuum (also shown in grayscale)

SMA images reveal chemical differentiation between the two hot cores

Kuan et al 2004

Solar System: Mars at 230 GHz



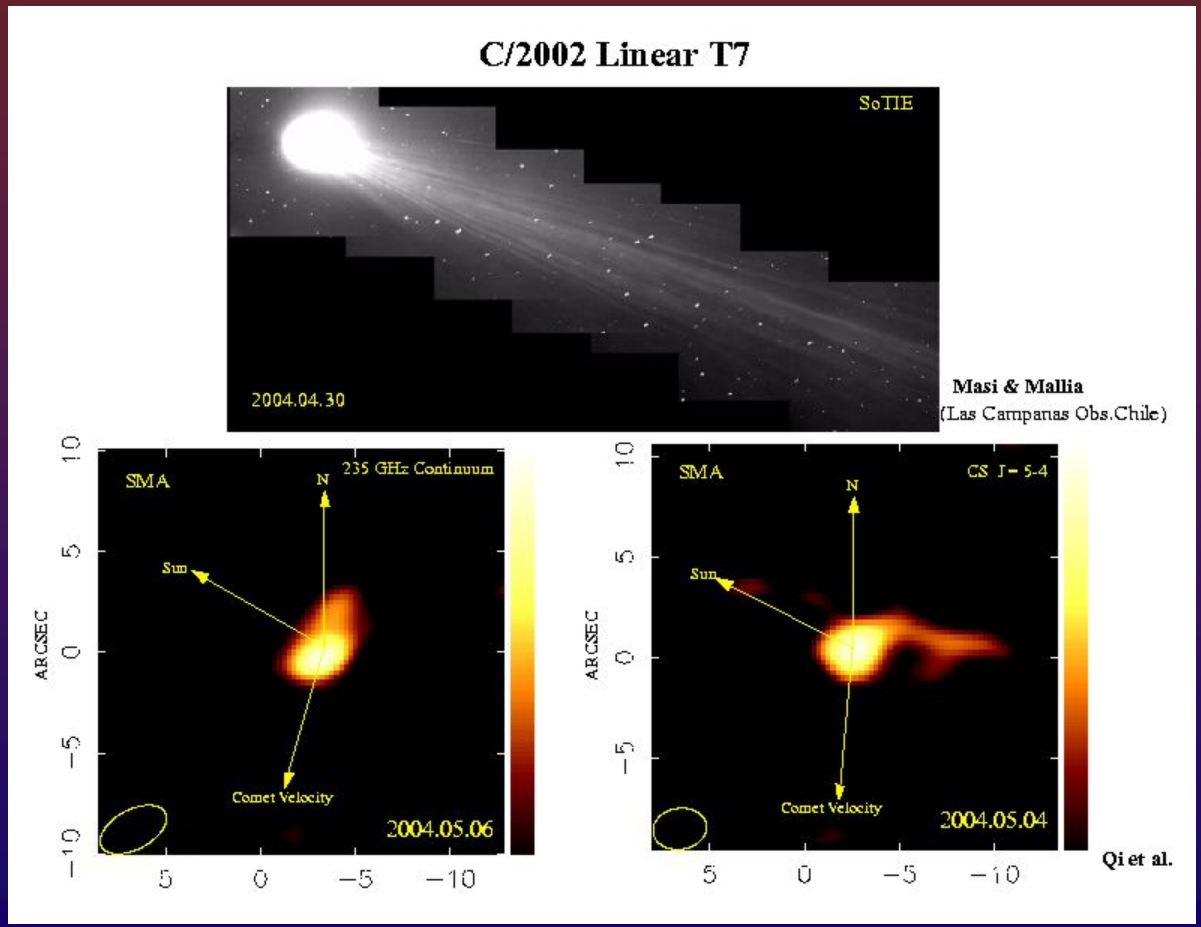
First 8 element image obtained, Nov. 2003

Resolved continuum plus emission and absorption show strong diurnal temperature contrast

8 minutes on source

Gurwell 2004

Comet Observations: May 2004



Daytime observations: weather sufficiently good for 235 GHz until 13:00 HST

Qi et al 2004

That's fine, but when can I use it?

First open call for proposals expected August/September 2004

Observing info:
http://sma1.sma.hawaii.edu

Results shown (and others) can be found at:
http://cfa-www.harvard.edu/~dwilner/smasci/sma_earlypapers.html