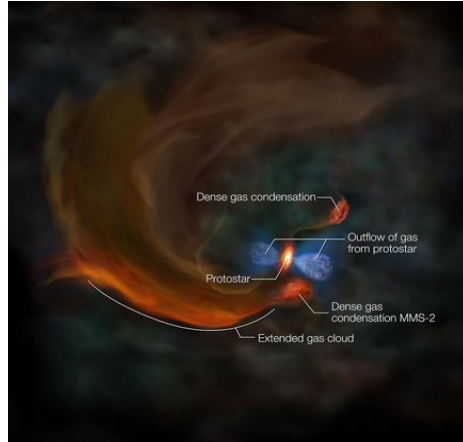
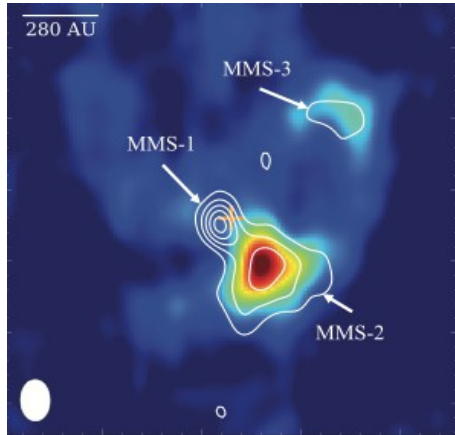
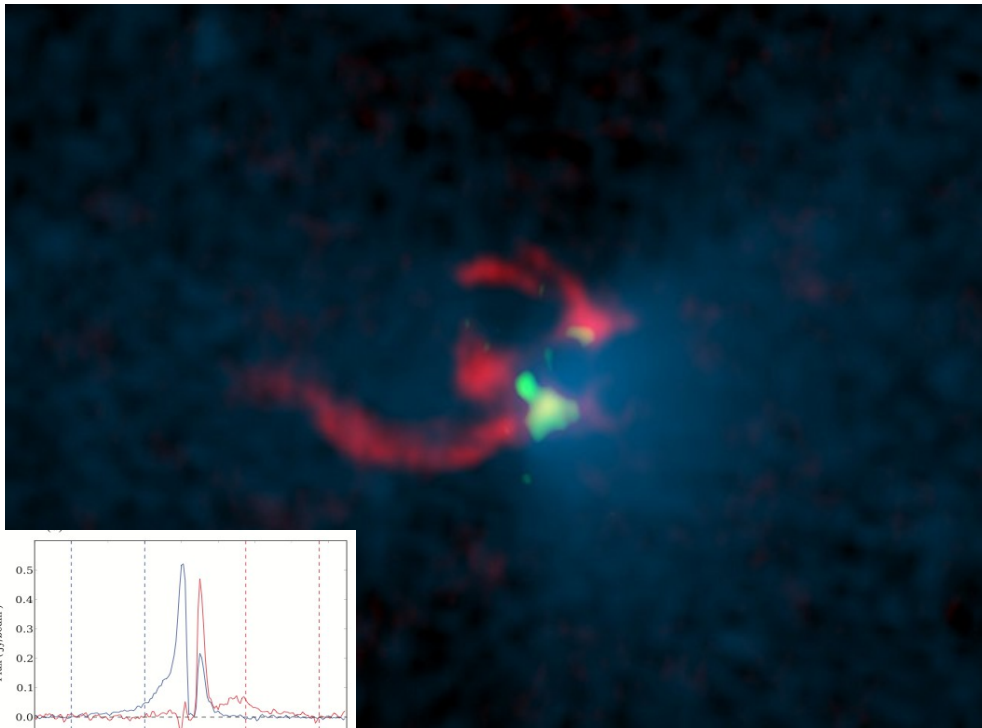




# Dynamical Gas Interaction in High-Density Core



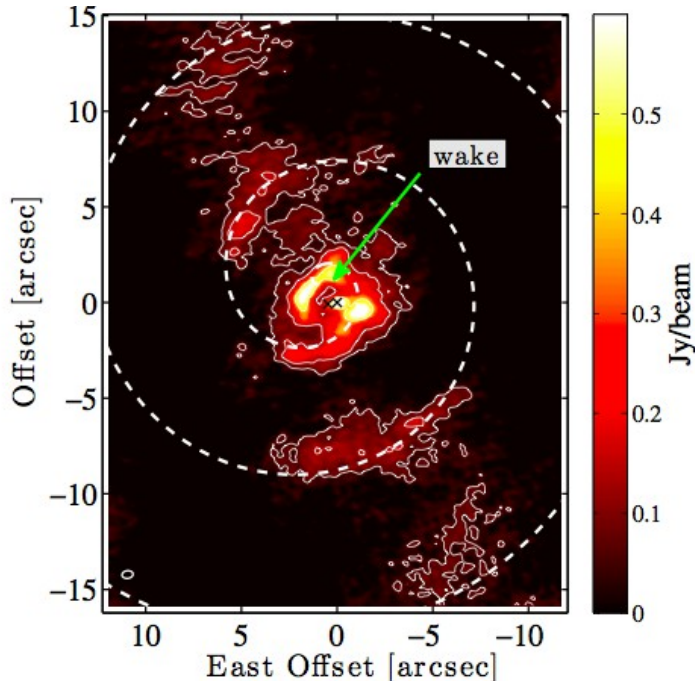
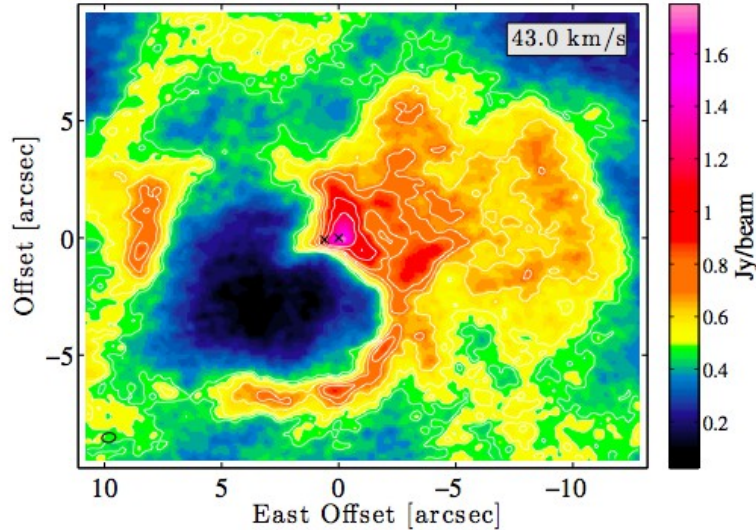
- Starless dense core MC27/L1521F at first protostellar core phase
- Compact bipolar outflow, several cores, arc-like structure due to gas interaction
- Possible site of multiple star formation



Obs. mode	Band6(FDM, 1.1mm, 234MHz, 61kHzx3840ch), HCO+, HCN, H13CO+3-2, CS5-4, SiO6-5
	Mosaic + single pointing, 24 ant with compact+extended configuration
Beamsize	1"
Depth	8mJy at 0.14 km/s, 0.12mJy in continuum

Tokuda et al. (2014)

# Complexity of Mira AB

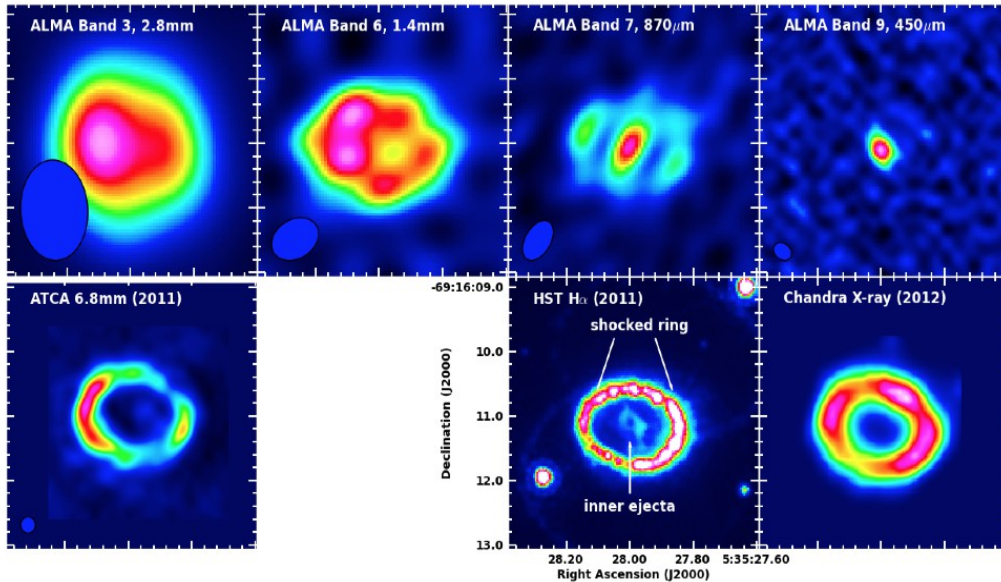


- Mira AB, well-studied and nearby at 92 pc, AGB+White Dwarf, CO 3-2 observation
- Large bubble at 42km/s, the spiral arcs at 47km/s
- Bipolar winds from Mira B due to dense filled Roche-Robe disk of Mira A
- Spirals – agree with orbit and winds of Mira A

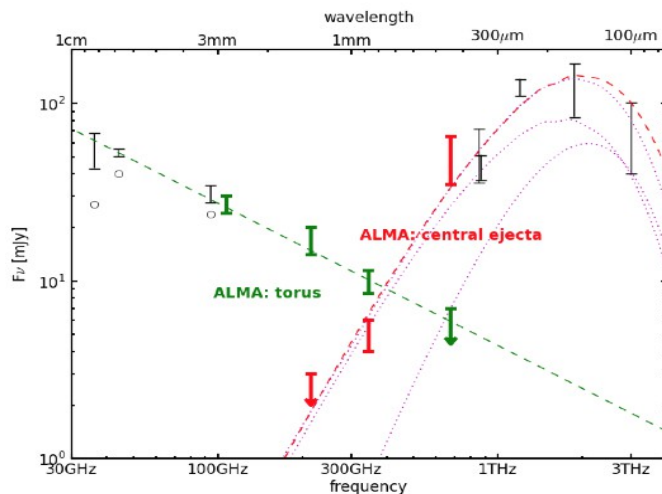
Obs. mode	Band7(FDM), 4 spws (331 - 345GHz), bw =1.875 GHz, Cycle1
	mosaic (25"x25", 10 pnts) +ACA(3 pnts)
Beam	0".5,
Baseline	13-450m (MRS=6") +ACA 9-45m (MRS ~ 9")
On source time	6.23min (main) + 6min (ACA)
Depth	23 mJy at 0.85 km/s



# Dust Production & Particle Acceleration in SN 1987A



- Continuum observation at 2.8mm, 1.4mm, 870μm, 450μm
- Synchrotron (2.8mm) ↔ Dust (450μm)
- For the first time, prove that dust has formed in the inner ejecta
- Dust not yet been affected by shocks → SN : important cosmological dust producers, if lots of them survive.

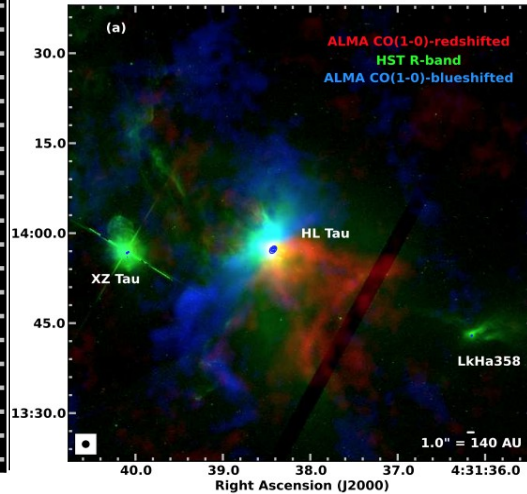
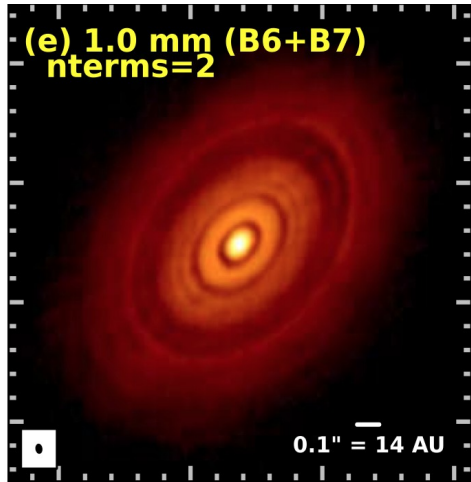


Obs mode	Band 3,6,7,9
Beamsize	0.3-1.6''

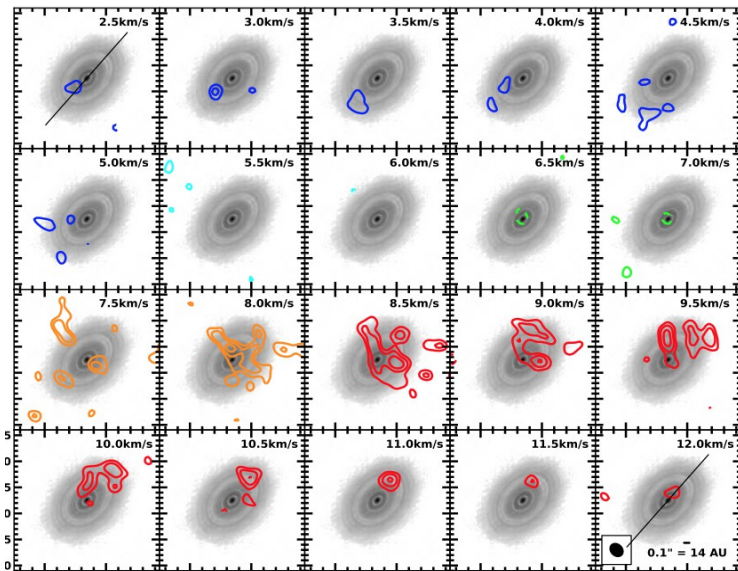




# HL Tau High Resolution Observation



- ALMA SV data with baseline (15m – 15.2 km)
- Beam 0.075 – 0.025'' (10 – 3.5 AU)
- First Image of protoplanetary disk at AU scale
- Planet formation at dark rings ; increasing eccentricity with radius and resonances
- Molecular line obs. Spatially resolving disk kinematics.

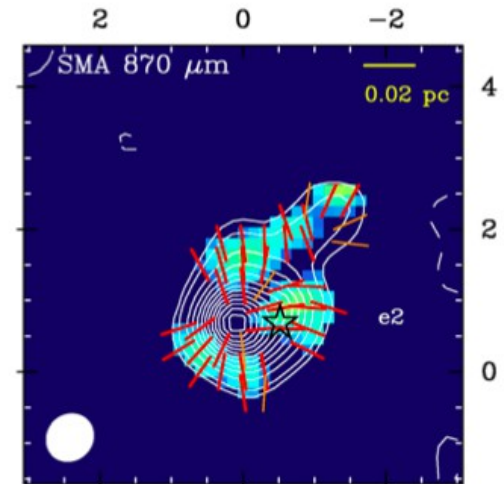


Obs mode	Band 3,6,7
Beamsize	75 – 25 mas
1.3mm,0.87mm	(4x2GHzsp) 128ch/spw
2.9mm	3 cont. spw + two NB spws (HCO+1-0, HCN1-0) – 2 cont. spw + 1 NB spw (12CO1-0) + 1 spw (4 hyperfine trsition of CN1-0)



# Dust Polarization in Star Forming Clouds

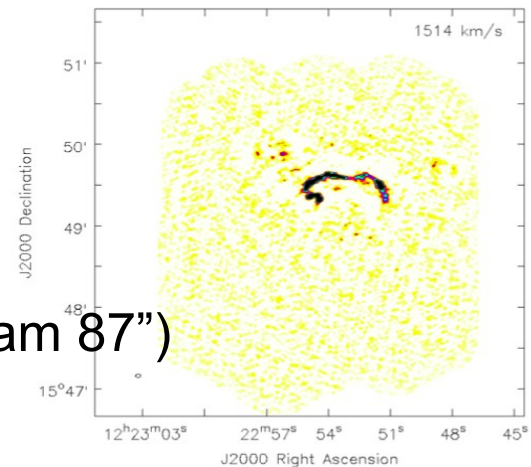
- Science Aim
  - To detect magnetic field through dust polarization in W51 e2
- Receiver : Band 7 (343GHz), highest sensitivity
- Angular Resolution
  - 0.2" (1400AU @7kpc) to resolve thermal Jean's length
- LAS : 0.8" - size of the core
- Continuum Sensitivity : flux density 9.3Jy over 0.8" core
  - ALMA flux density =  $9.3\text{Jy}/16 = 0.6\text{Jy/b}$
  - 6 mJy/b when 1% polarization
  - Request 0.1mJy/b for  $60\sigma$  detection
- Observing Time
  - 4.5 min /7.5GHz bandwidth but minimum 3 hours to get sufficient parallactic angle coverage





# Mosaicing Nearby Spiral Galaxy M100

- Science Aim
  - Face-on spiral in Virgo Cluster at 16 Mpc
  - Map the distribution and kinematics of molecular gas, Wide-field, high resolution image
- Receiver : Band 3 (115GHz) CO(1-0)
- Spectral Sensitivity : to detect large molecular cloud like Orion ( $5 \times 10^5 M_{\odot}$ )
  - $3 \text{ mJy/b}(1\sigma) = 8 \times 10^4 M_{\odot} / 10 \text{ km/s} - 5\sigma$  detection
- Angular Resolution :  $2'' = 150 \text{ pc}$  at M100
- LAS :  $60''$  , examine individual channels in SV
  - $>$  max recoverable scale ( $20''$ )  $<$  7m ACA (primary beam  $87''$ )
- Coverage : rectangular grid, 137 pointings
- Sensitivity and Mosaicing :  $3 \text{ mJy/b}$ ,  $2.7 \text{ min/pointing} \times 137 = 6 \text{ h}$  on source + 52 points of ACA





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More examples in

**Observing with ALMA:  
A Primer for *Early Science*  
(Cycle 3)**

