On the thermal structure of the proto-Super Star Cluster 13 in NGC 253

Trages: NOAJ, NASA, ESC Topessing: R. Gendler & R. Colombar

NGC 253 Overview



Leroy et al 2018

- Nearest example of nuclear starburst
 - 3.5 Mpc or 11 Mly
- Central star formation rate 30 times greater than Milky Way
- Forming massive (super) star clusters (SSCs)
 - 10^5 Solar masses, 5pc radius, and less

than 100 Myr in age

Main Starburst Region



Data for Observations from Alma

- Atacama Large Millimeter Array
- Located in Chile
- Up to 62 Antenas
- Uses interferometry to improve
 angular resolution
- Focus on HC_3N emission

cal l

345 GHz



Early 2011	Mid 2011	Mid 2011 Late 2011			2013		
all for ALMA Early cience Proposals	Early Science submission de	Proposal Ea eadline	rly Science beg	ins	2 h J	66 ALMA Ante	ennas
Bands: 3 Frequency (GHz) 84-11	4 125-163	5 163-211	6 211-275	7 275-373	8 385-500	9 602-720	10 787-950
Wavelength (mm) 3.57-2	.59 2.40-1.84	1.84-1.42	1.42-1.09	1.09-0.80	0.78-0.60	0.50-0.42	0.38-0.32
	Ear',	science		A	rray Comple	etion	
ntennas	≥1	6 x 12m		A	t least 54 x 1	2m & 12 x	7m
ands	Band	s 3, 6, 7, 9		Ba	ands 3, 4, 6, 7	7, 8, 9 & 10	
Maximum Bandwidth		16 GHz (2 polarizations x 8 GHz)					
Correlator Configurations		21 (0.02 – 40 km/s)			71 (0.01 – 40 km/s)		
Maximum Angular Recolution		($0.02'' \left(\frac{\gamma}{1 \text{ n}}\right)$	$\left(\frac{1}{100}\right)\left(\frac{1}{100}\right)$	10 km Max Baseline		
Max Baseline		250m (may achieve 500m)			15 km		
Continuum Sensitivity (60 sec, Bands 3–9)		~0.2 – 4.2 mJy			~0.05 – 1 mJy		
Spectral Line Sensitivity (60 sec, 1 km/sec, Bands 3–9)		~30 – 250 mJy			~ 7 – 62 mJy		

Analysis via SLIM

Spectral Line Identification and Modelling

- Top left: column density
- Top right: vibrational temp
- Bottom left: Velocity from

Local Standard of Rest

• Full Width Half Max

velocity



Comparison of Various Star Forming Models







Main Points

- Young Star Cluster in the midst of rapid star formation
- Star formation spread across a 0.9 pc radius
 - Favors a Competitive Accretion Scenario
- Best fit model gives low virial parameter suggesting rapid collapse
- Velocity Structure favors a recent cloud-cloud collision over an outflow