

# Looking for More Evidence of Transient Clumps in HH 43

O. Morata

LAEFF

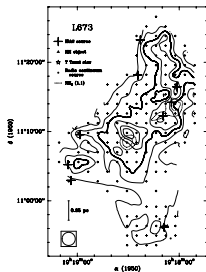
in collaboration with:

at Barcelona: J. M. Girart, R. Estalella

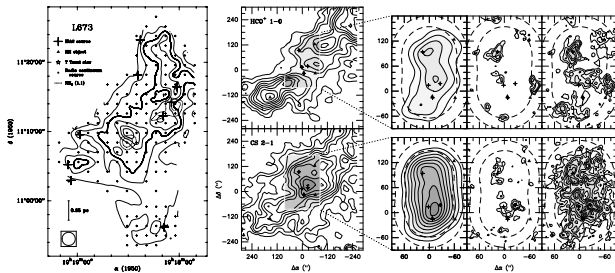
at UCL (UK): D. A. Williams, S. D. Taylor, R. Garrod, J. M. C Rawlings, S. Viti

MINI-WORKSHOP ON STAR FORMATION AND ASTROCHEMISTRY

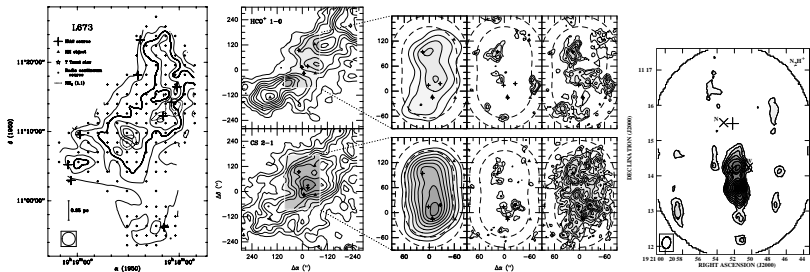
# Maps of L673



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## Results in L673

- ▶ Very complex structure. Clumpier structure is apparent, clumps are 13–25''
- ▶ Some might coincide with  $\text{HCO}^+$  clumps. Still some difference with  $\text{N}_2\text{H}^+$  emission

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- ▶ 15 clumps, all resolved
  - ▶ Sizes 0.03–0.09 pc
  - ▶  $M \sim 0.02\text{--}0.36 M_{\odot}$
  - ▶  $n \sim 0.6\text{--}4.6 \times 10^4 \text{ cm}^{-3}$  (subthermalized)
  - ▶  $\Delta V \sim 0.31\text{--}0.65 \text{ km s}^{-1}$

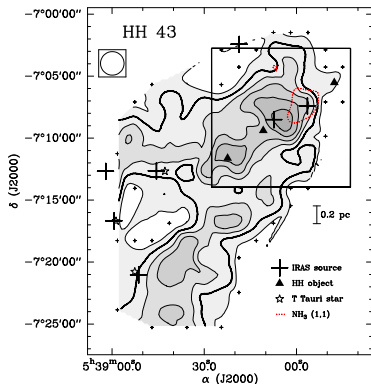
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- ▶ Spatial segregation N-S
  - ▶ North - more clumps, smaller and less massive
  - ▶ South - fewer clumps, but the largest and more massive one
  - ▶  $\text{N}_2\text{H}^+$  and  $\text{NH}_3$  (low-res) in the southern region

# L673 and transient clumps model

- ▶ Low-angular resolution core breaks down into several clumps
- ▶ Massive clumps few, coincident with emission of late-time molecules
- ▶ Less massive clumps found everywhere. Early-time molecules.

# HH 43: a not so quiescent core

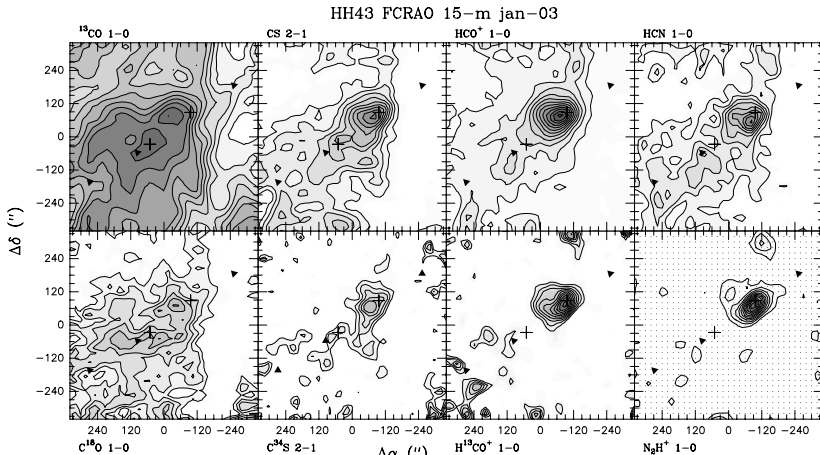


- ▶ Several tracers of star formation: IRAS sources, HH objects, ...
- ▶ Is the gas affected by a jet/outflow?
- ▶ How does the star formation process affect the structure of the cloud?

## Observations in HH 43

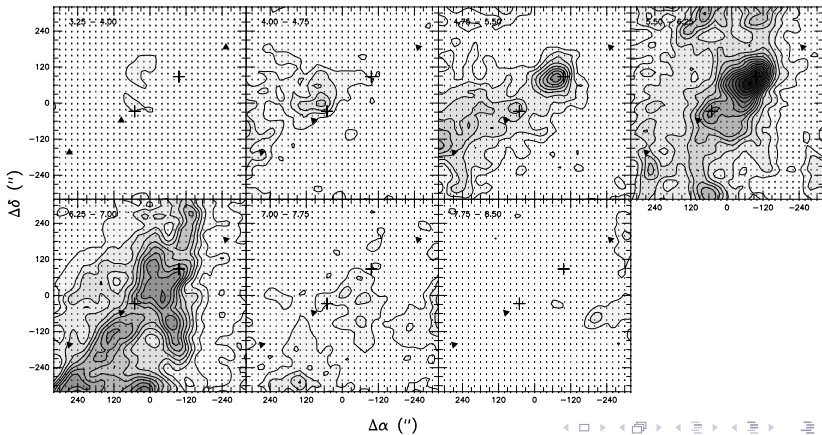
- ▶ Similar approach as in L673: observations with the BIMA telescope, complemented with FCRAO maps.
- ▶ FCRAO observations include all three HH objects.
- ▶ BIMA observations: 7 field mosaic (2 field for  $\text{N}_2\text{H}^+$ ) centered in the more intense emission of FCRAO
- ▶ Multimolecular observations:
  - ▶ **FCRAO**:  $^{13}\text{CO}$ ,  $\text{C}^{18}\text{O}$ , CS,  $\text{C}^{34}\text{S}$ ,  $\text{HCO}^+$ ,  $\text{H}^{13}\text{CO}^+$ ,  $\text{N}_2\text{H}^+$ , HCN
  - ▶ **BIMA**:  $^{13}\text{CO}$ ,  $\text{C}^{18}\text{O}$ , CS,  $\text{C}^{34}\text{S}$ ,  $\text{HCO}^+$ ,  $\text{N}_2\text{H}^+$ , HCN,  $\text{H}^{15}\text{NC}$ , CN,  $\text{C}_3\text{H}_2$ ,  $\text{CH}_3\text{OH}$

# Integrated intensity maps with the FCRAO telescope



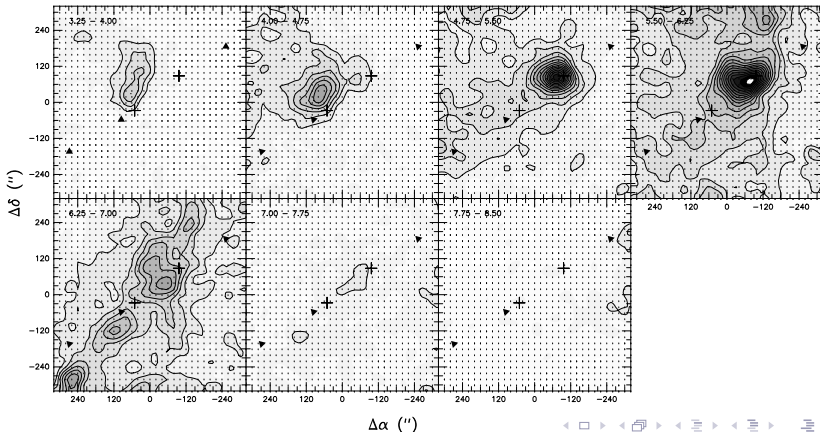
# Moment 0 maps: CS

HH43 FCRAO 15-m jan-03 CS(2-1) ( $0.75 \text{ km s}^{-1}$ ) mom0 maps



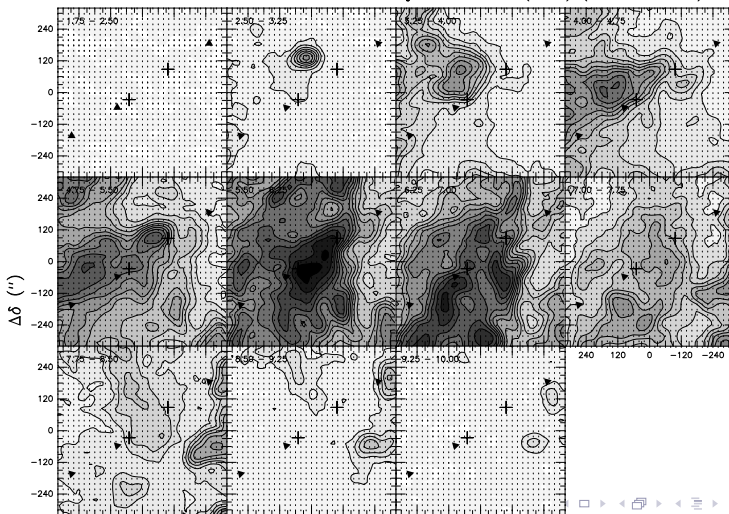
# Moment 0 maps: $\text{HCO}^+$

HH43 FCRAO 15-m jan-03  $\text{HCO}^+$  (1-0) ( $0.75 \text{ km s}^{-1}$ ) mom0 maps



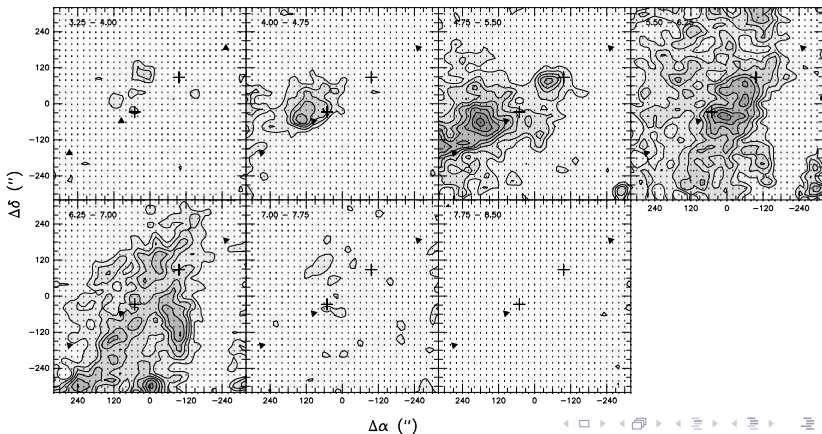
# Moment 0 maps: $^{13}\text{CO}$

HH43 FCRAO 15-m jan-03  $^{13}\text{CO}$  (1-0) ( $0.75 \text{ km s}^{-1}$ ) mom0 maps

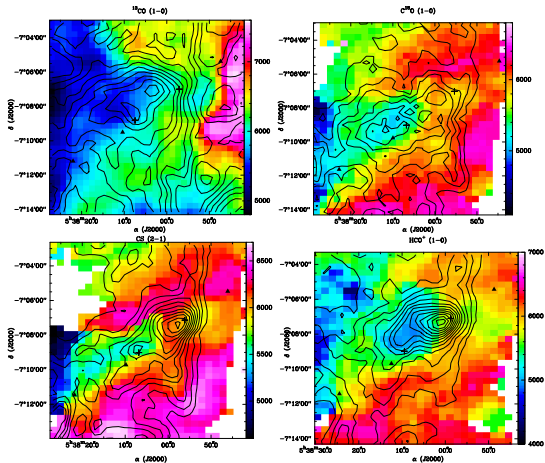


# Moment 0 maps: $C^{18}O$

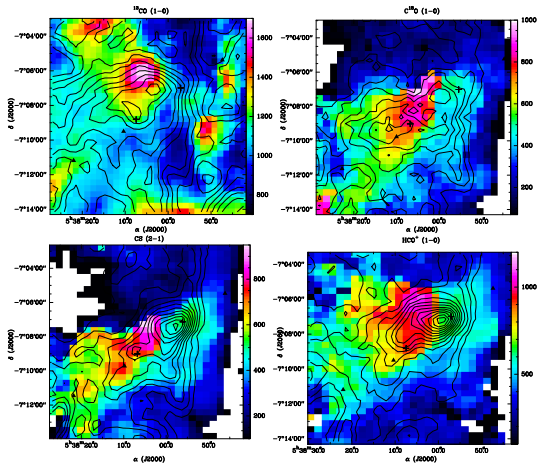
HH43 FCRAO 15-m jan-03  $C^{18}O$  (1-0) ( $0.75 \text{ km s}^{-1}$ ) mom0 maps



# Moment 1 (velocity) maps



# Moment 2 (line-width) maps



# Summary

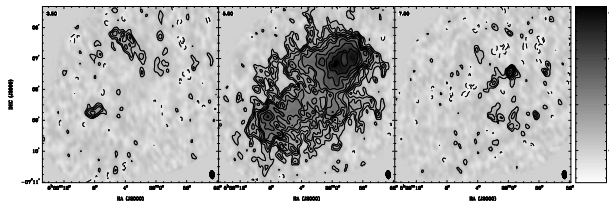
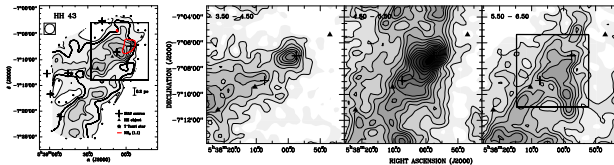
- ▶ Very complex spatial and kinematical structure. Apparently, more than L673.
- ▶ Smooth low-resolution maps turn into more clumpy emission (more so with BIMA maps)
- ▶ Is there a correlation with HH objects?
- ▶ Early- and late-time molecules different emission.

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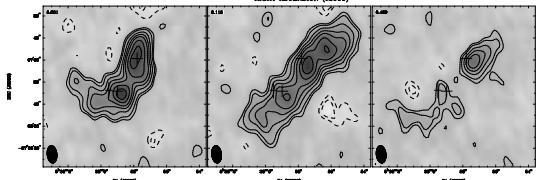
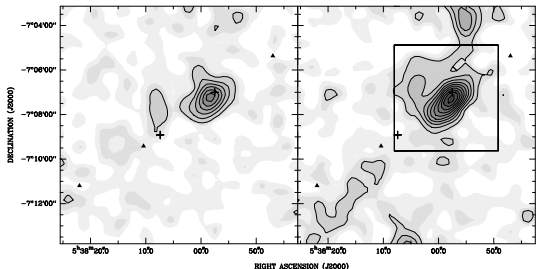
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But, we just started...

# More to come



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RA, DEC, VELO = 6.3804,000, -7.0838,00, -7.712886+08 km/s at pixel (34.00, 41.00, 1.00)  
 Spatial region = 38.97 to 111.09 Spectral line/bin : 1/1 =0.3149/0.3149 (km/s)  
 Pixel map image: hh43.m2h+linecm.sh (11148) Min/max=-0.8297/2.889 Range = -1.998 to 5.997 JY/BEAM (1n)  
 Contour image: hh43.m2h+beam.sh (11148) Min/max=-0.8297/2.889 Contours = 0.39 JY/BEAM  
 Contours : -7, -5, -3, -2, 2, 3, 5, 7, 9, 12, 15, 18, 21, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75