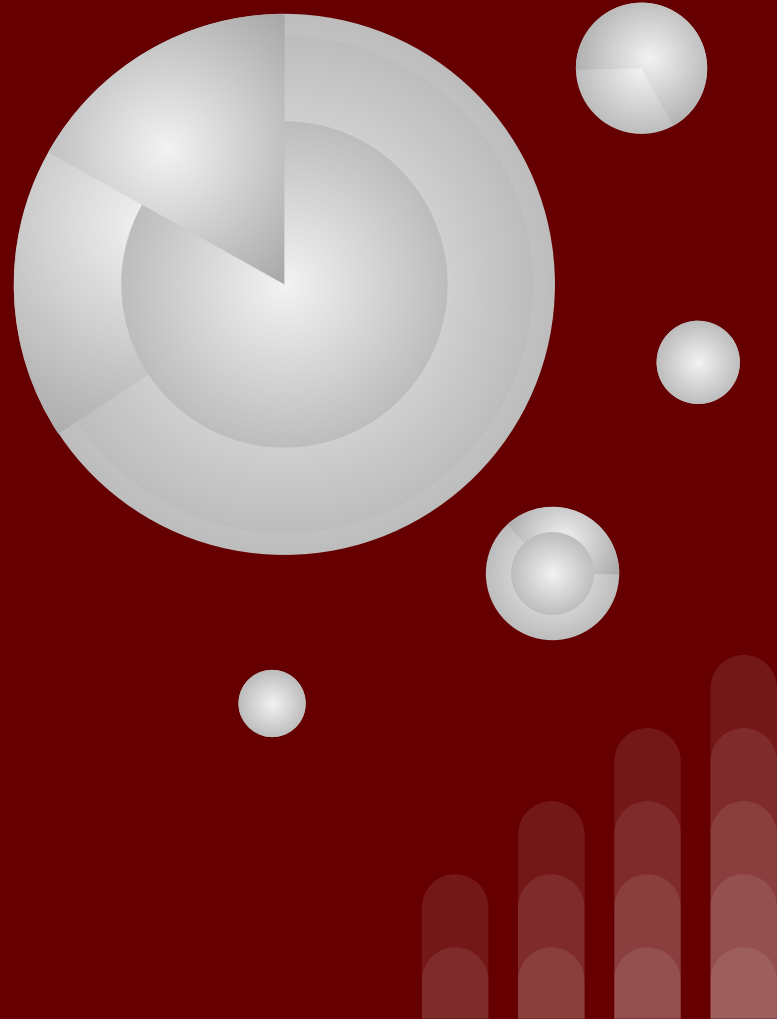


Identifying molecular gas clumps in a star-forming galaxy at cosmic noon.

Toby Devereaux - GALCROSS - Brno 2024



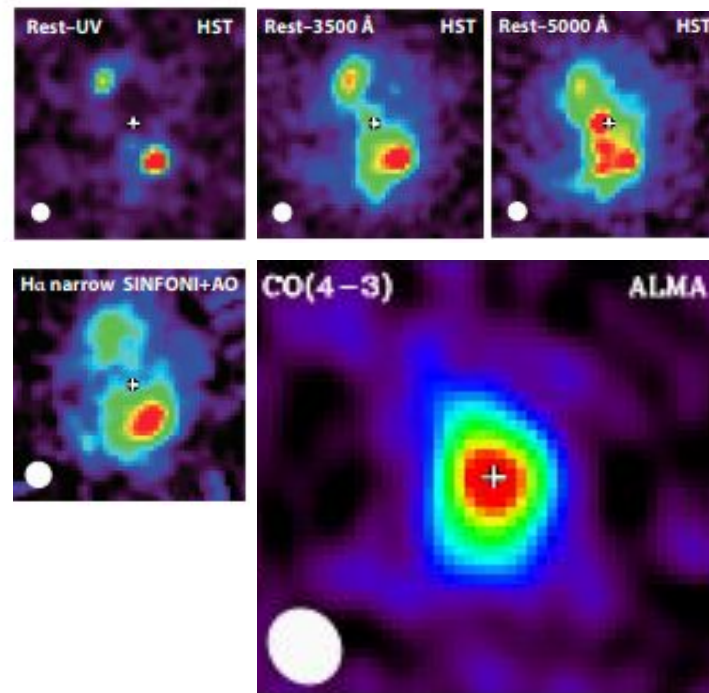


BX610

- › BX610 has excellent observations (HST, SINFONI)
- › Thought to be a typical clumpy galaxy at redshift 2.21
- › SFR estimates of 60-300 M_{\odot} /yr
- › Dominated by 2 clumps in UV (typical of cosmic noon)
- › Uncertainty if purely rotating disk (Rizzo + 23)

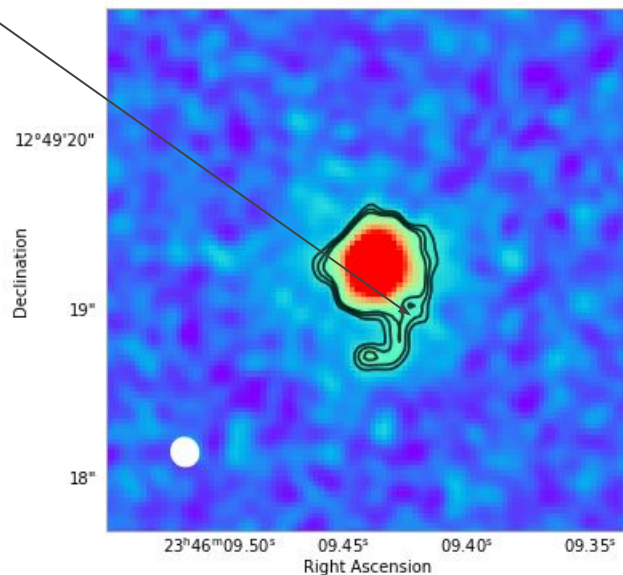
CAN WE OBSERVE CLUMPS IN MOLECULAR GAS?

Schreiber & Wuyts (2020) & references within



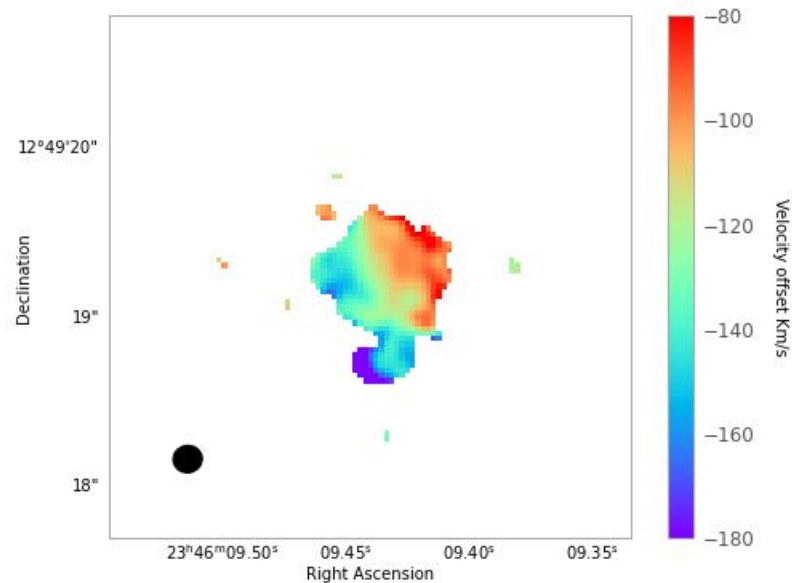
ALMA Observations

Inflow - Genzel +23

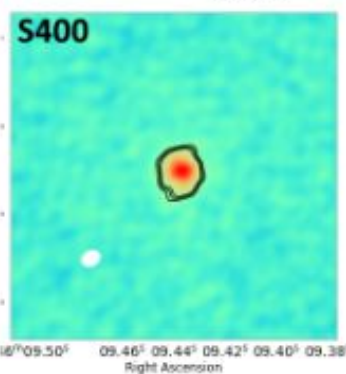
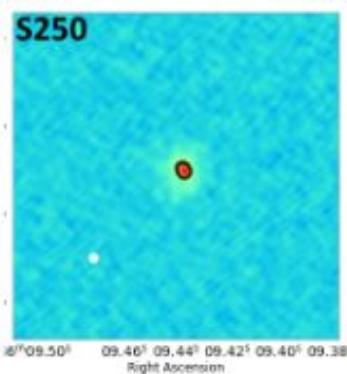
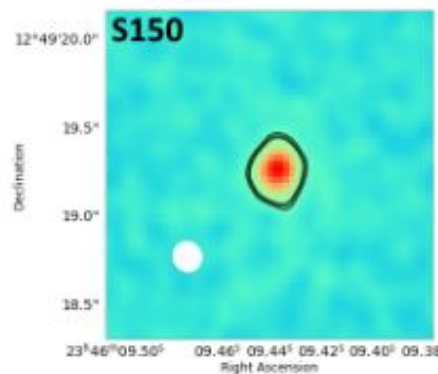
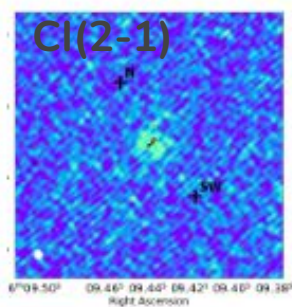
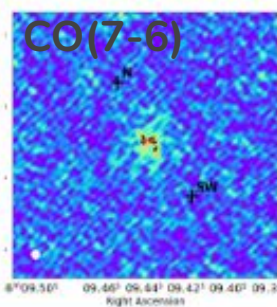
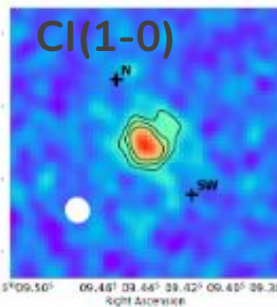
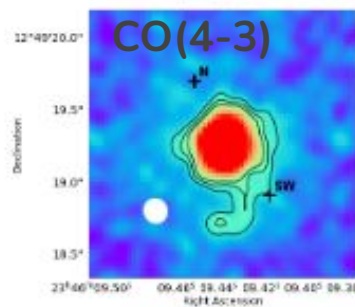
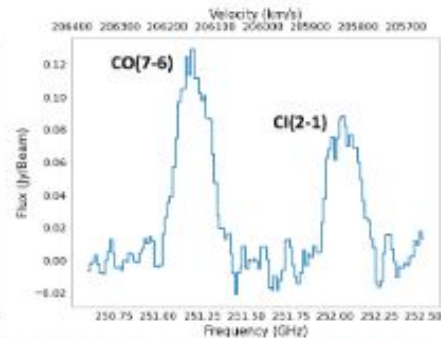
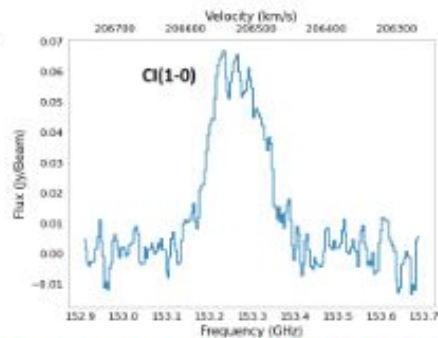
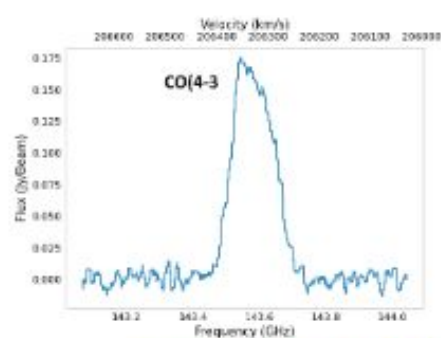


CO(4-3) moment 0

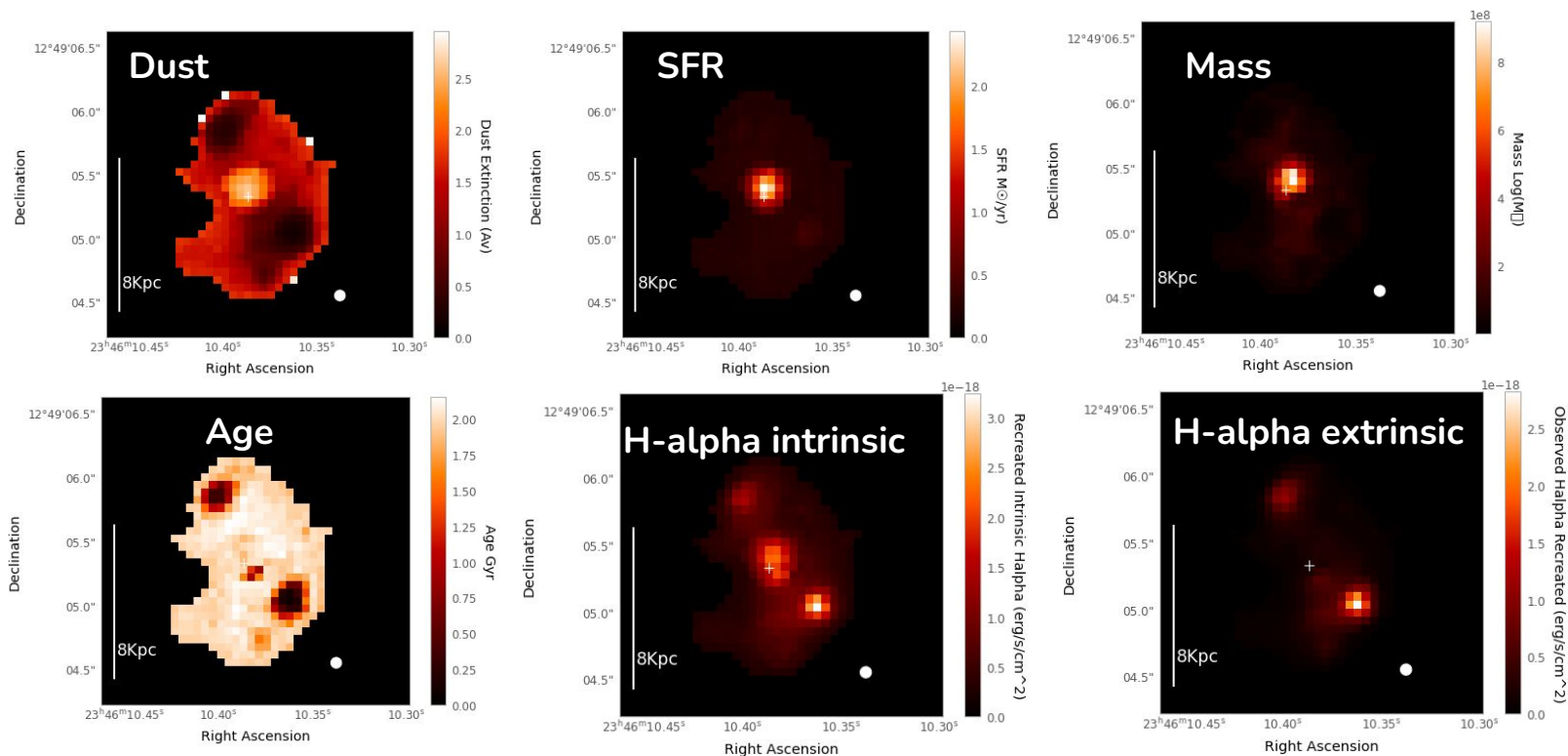
Rotating disk - Rizzo+23



CO(4-3) moment 1



SED fitting - Using continuum



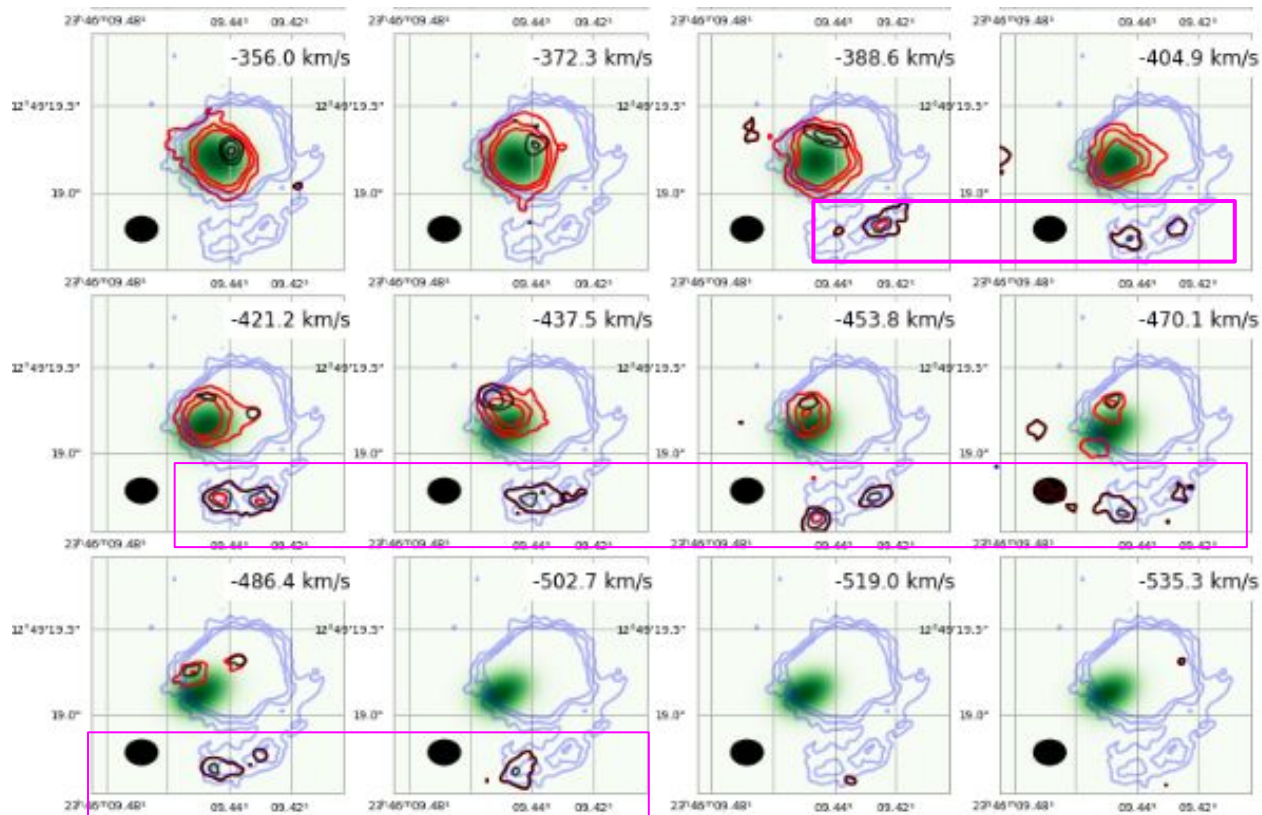


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Channel Maps (Clump S)

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Red = CO data for
that channel

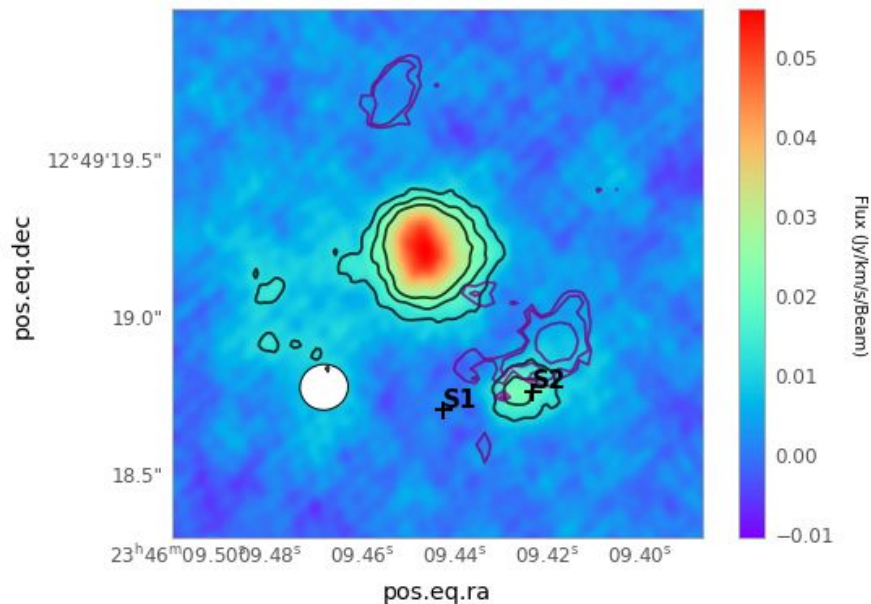
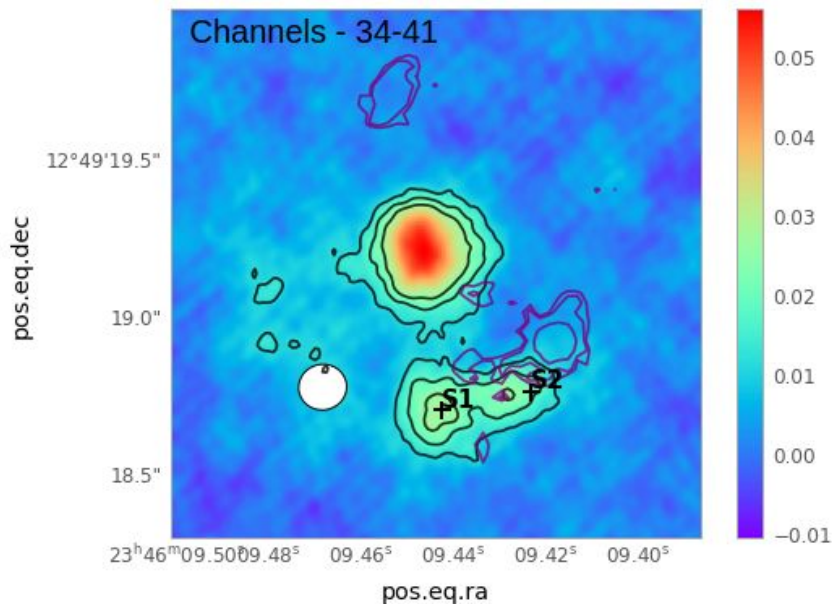
Green = Model from
Rizzo +23

Black = Residuals
when model is
subtracted from the
CO Data



Clump S1/S2

Purple contours = HST rest frame UV



Create moment 0 map of just selected channels & fit clumps

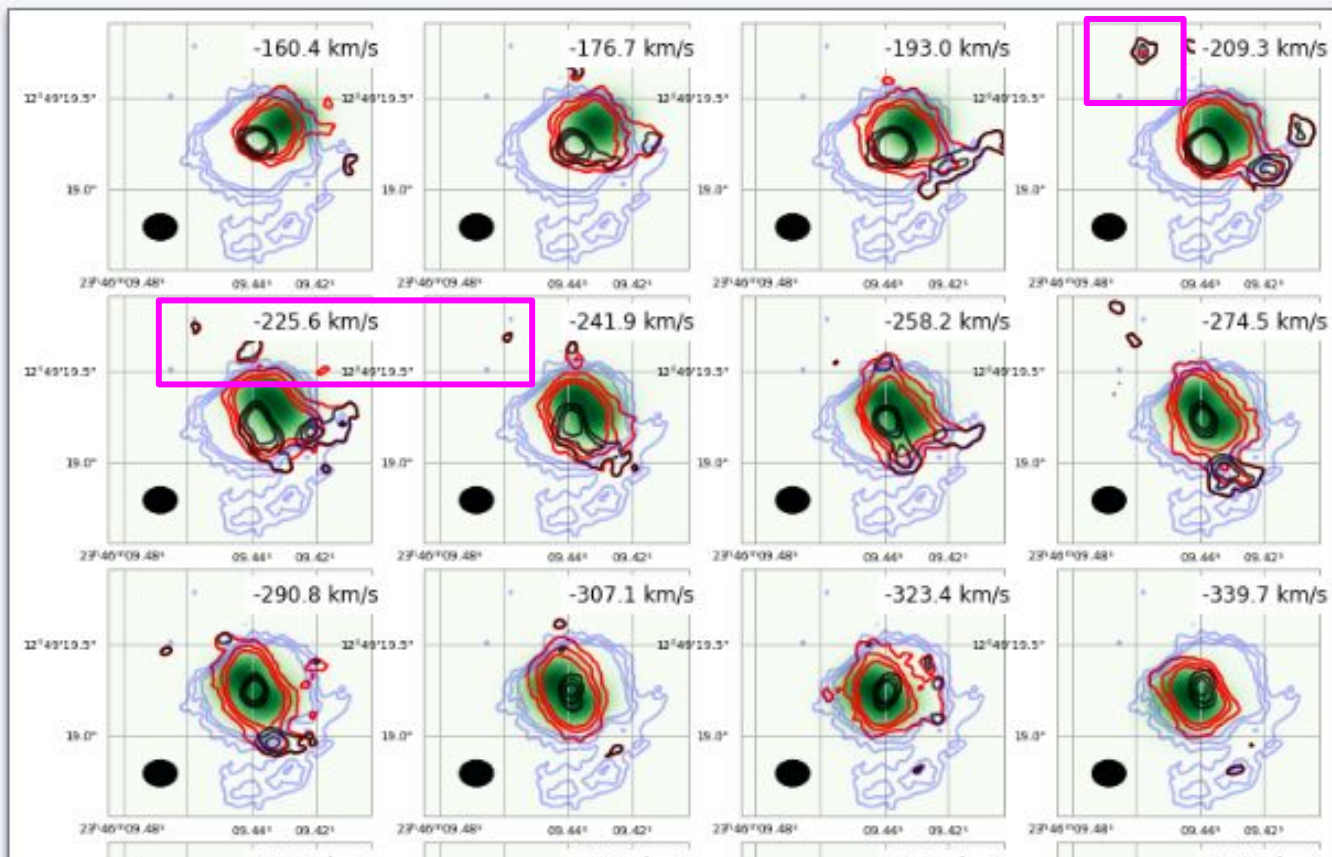


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Channel Maps (Clump N)

Toby Devereaux

toby.devereaux@studenti.unipd.it



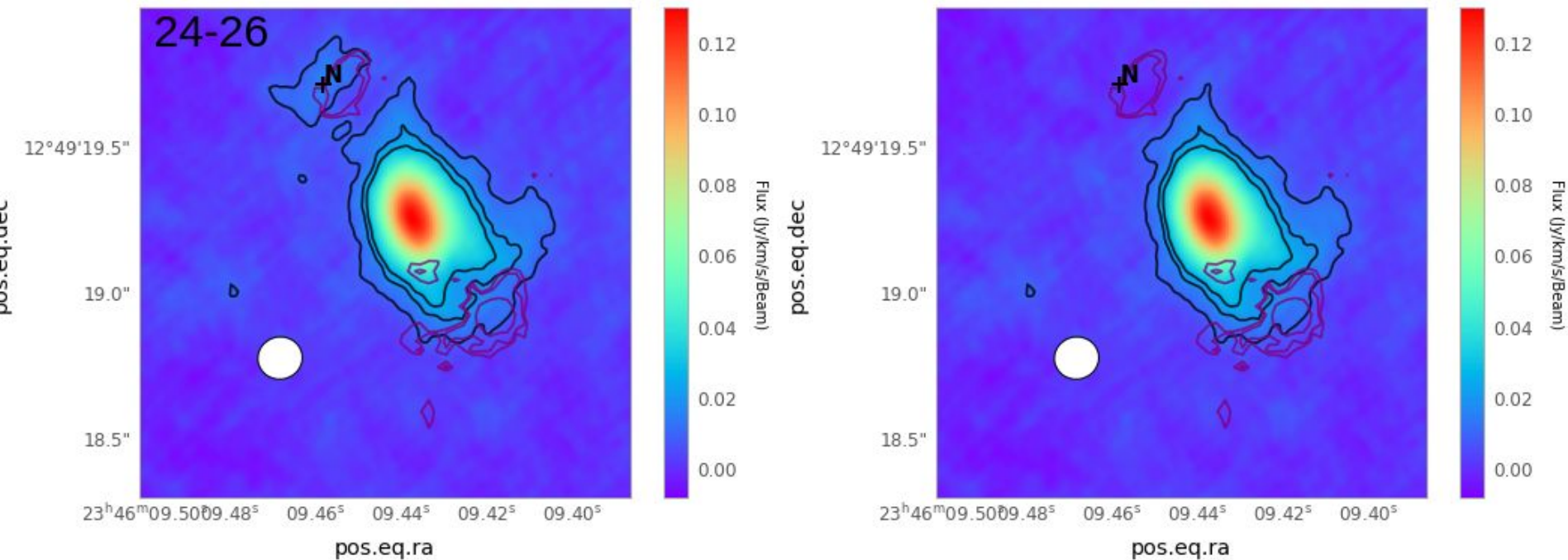
Red = CO data for that channel

Green = Model from Rizzo +23

Black = Residuals when model is subtracted from the CO Data



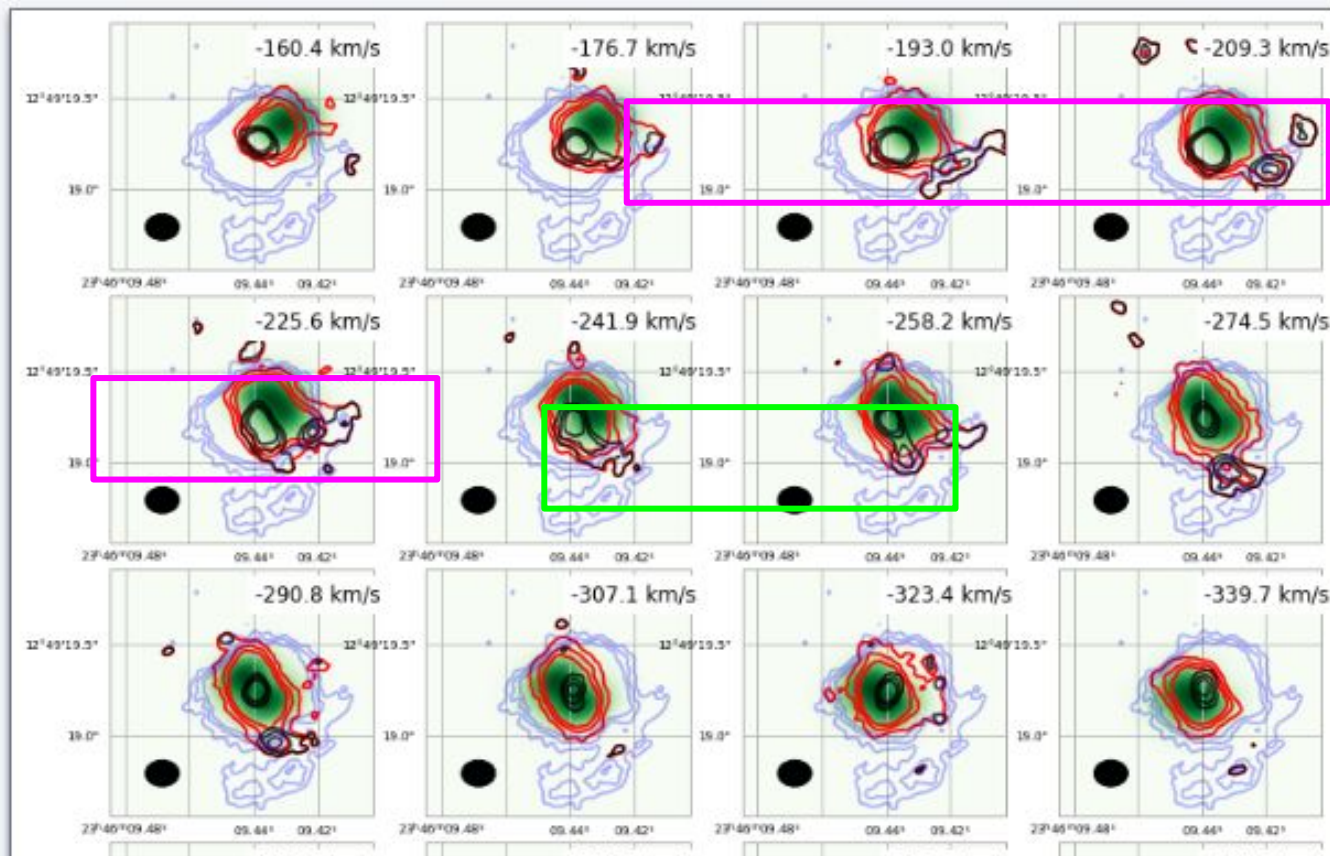
Clump N



Channel Maps (1)

Toby Devereaux

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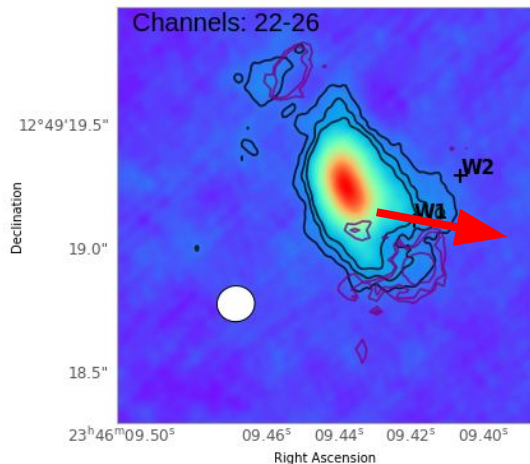


Red = CO data for that channel

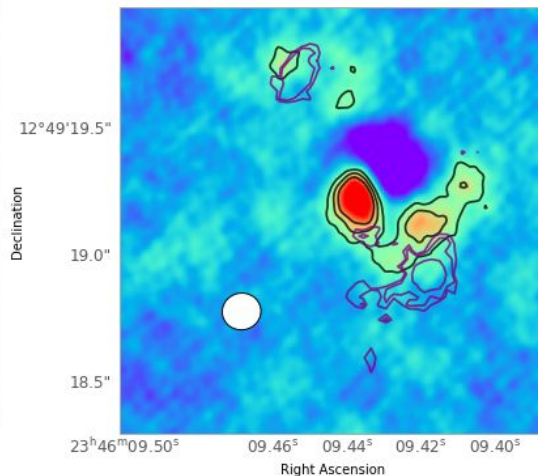
Green = Model from Rizzo +23

Black = Residuals when model is subtracted from the CO Data

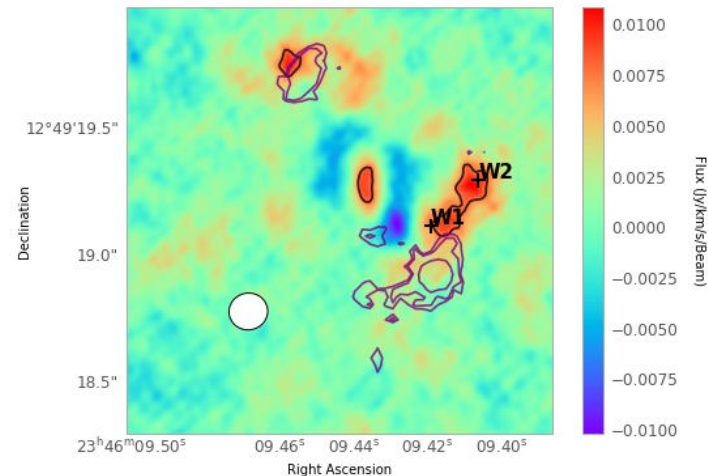
Clump W1/W2 - Outflow, clump or both?



Moment 0 from channels
selected in CO

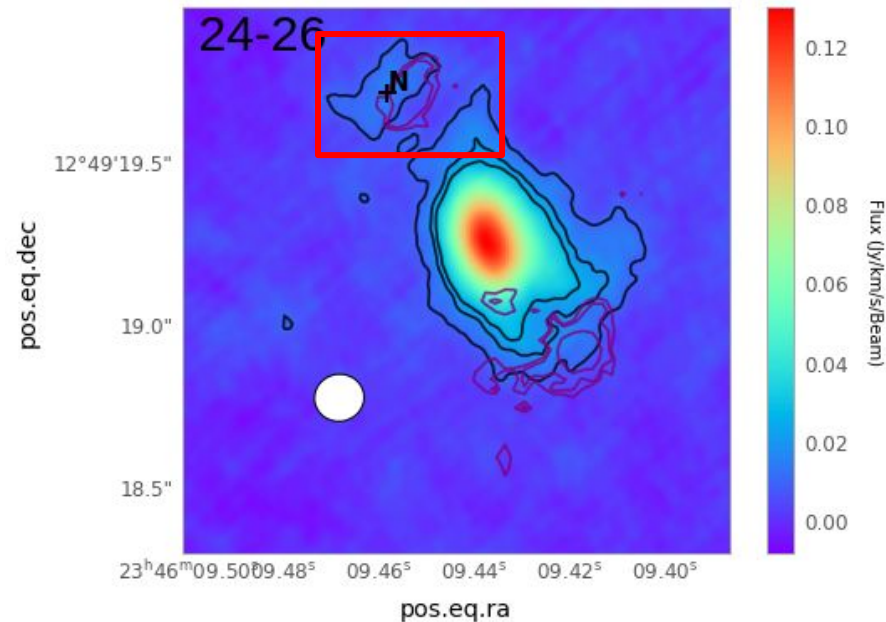
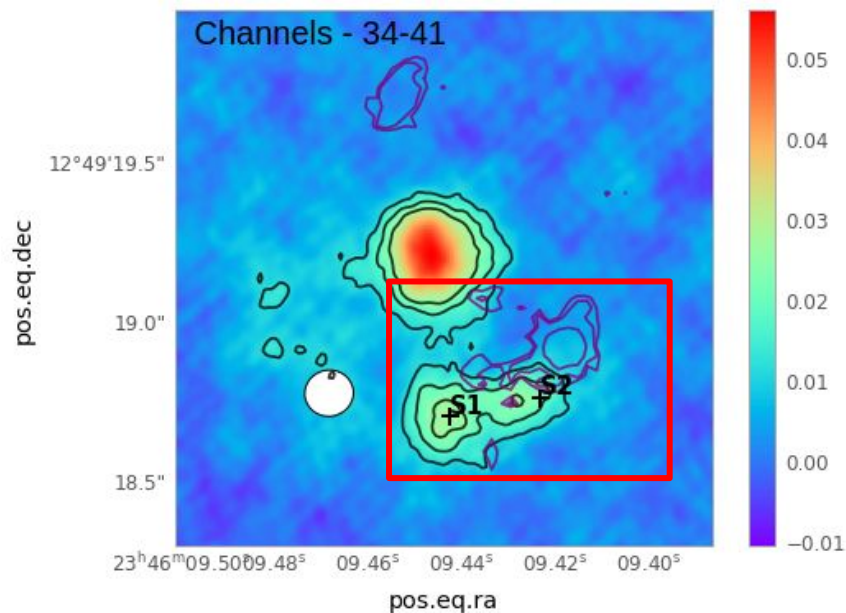


Moment 0 from residuals



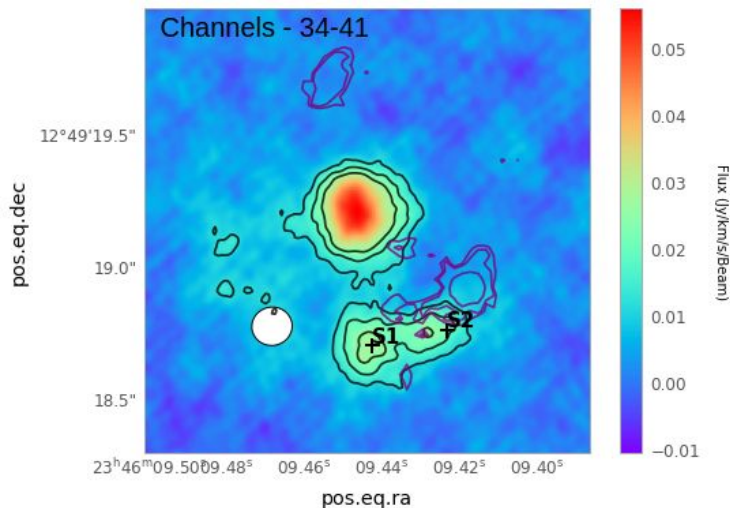
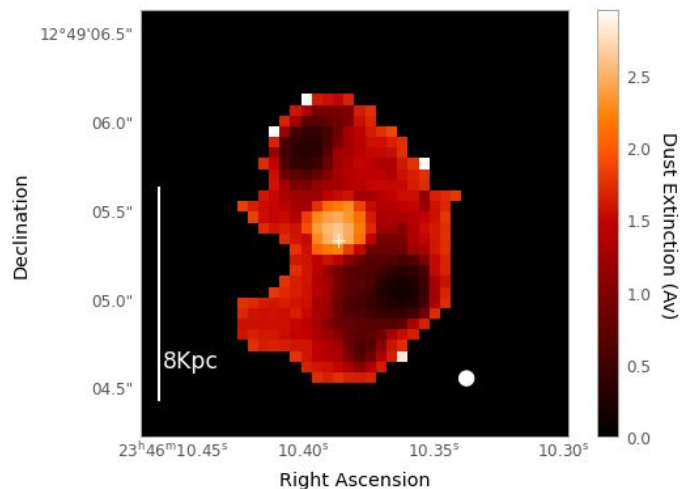
Moment 0 from channels
+ subtracted diffuse
component

Systematic offset in clumps



Clump Outflows inducing molecular gas clumps?

- Low dust content
- Star forming regions offset to molecular gas



*Evidence of Outflows in H-alpha from Förster Schreiber +2009, 2011



Conclusions

- Evidence of **multiple molecular gas clumps** in BX610 both in star forming regions and non star forming regions (all of order $10^9 M_{\odot}$)
- Evidence of a **systematic offset** between the clumps and molecular gas
 - Outflows expelling dust/molecular gas
 - Could be inducing new clump formation
- Evidence of star bursting center - **no evidence of outflowing gas in the central component**