

ALMA Multiple Array Configuration Combination

Group 2
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2023.08.04

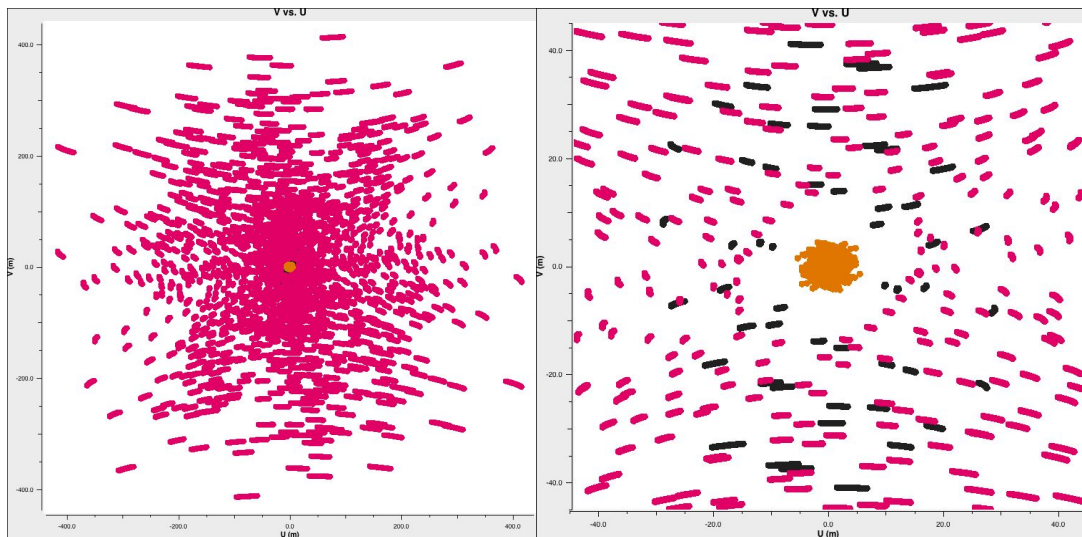
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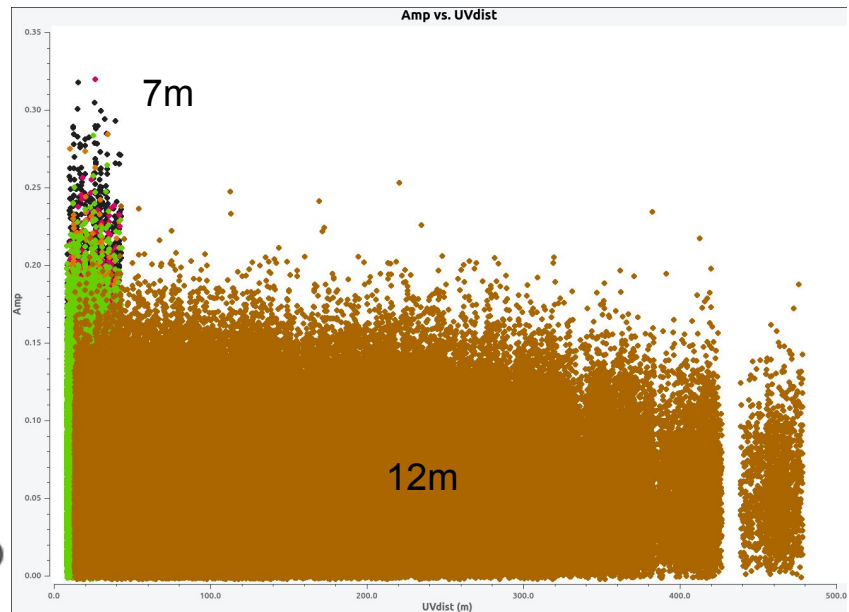
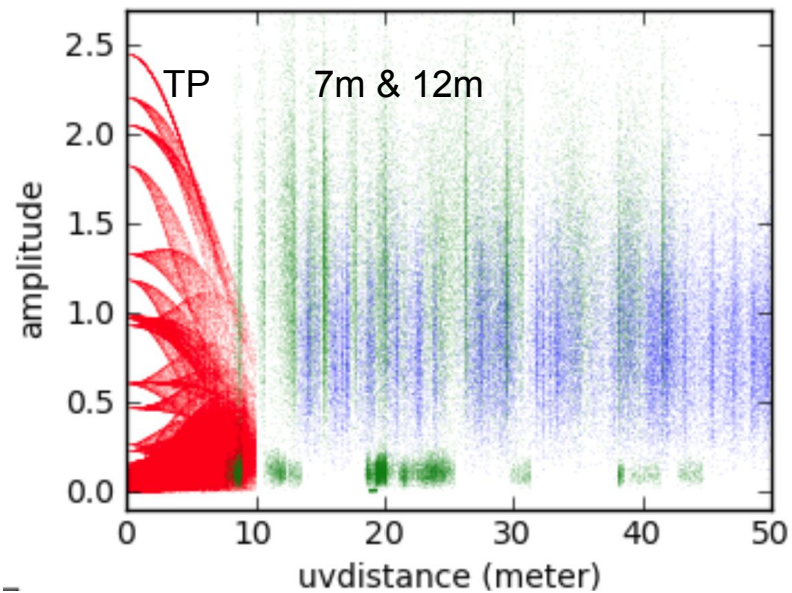
ALMA Atacama Large Millimeter/submillimeter Array

Our group will reduce the ALMA data for a star-forming galaxy, NGC 2775 obtained as a part of the PHANGS-ALMA large program. To capture line emission from all scales, It is essential to combine 12m, 7m, and total power observation. We will use two different methods to combine the interferometric (12m and 7m) and total power data.

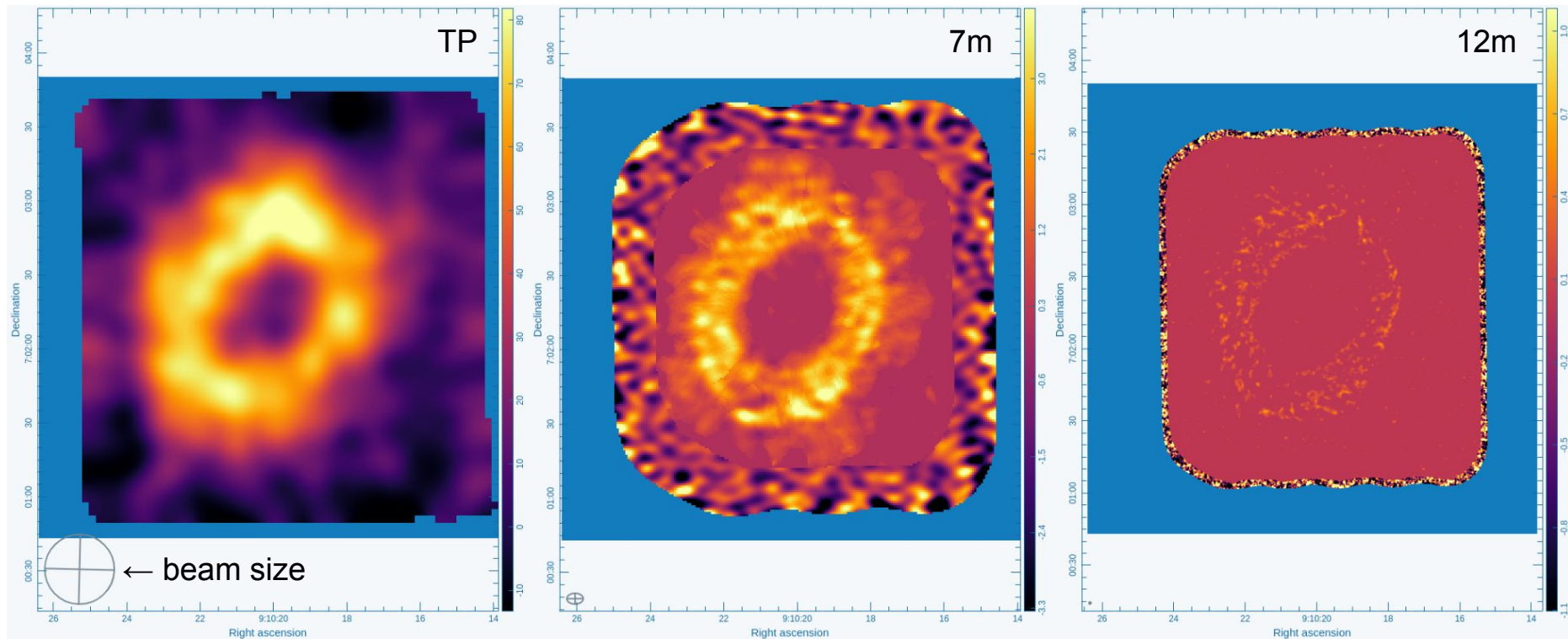
- 12-m array, 7-m array, Total Power



UV distance coverage



Comparison of Moment0 map



How to combine 7 m, 12 m, & TP data in CASA?

- **tp2vis** command
 - **convert TP data to visibility data**
 - **combine 7 m, 12 m, & visibility-like TP data** using concat command

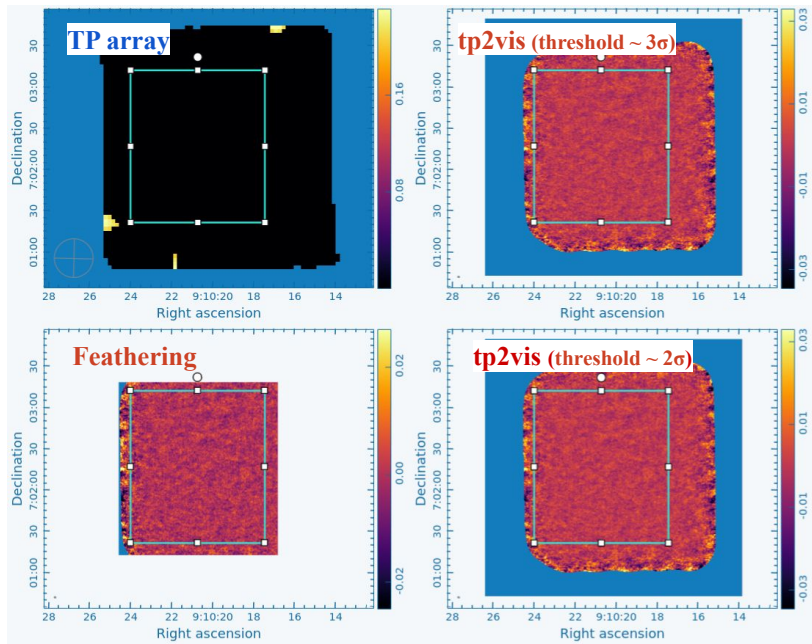
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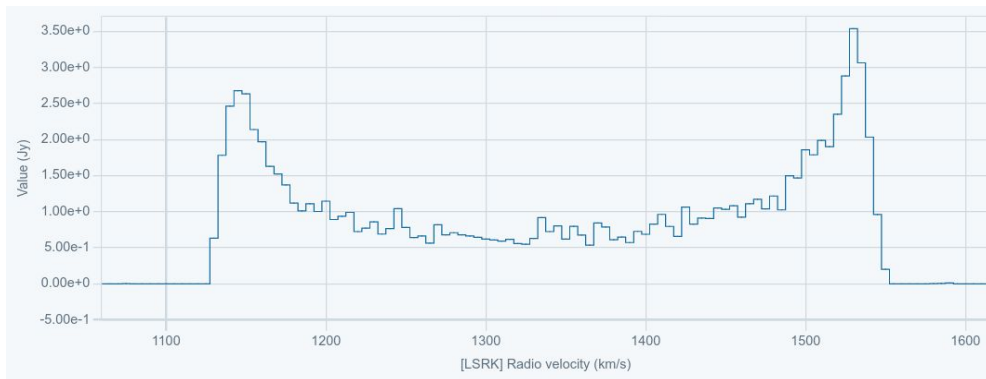
- **feather** command
 - **combine 7 m and 12 m visibilities** using concat command
 - **TP data overlay on integrated (7 m + 12 m) data**



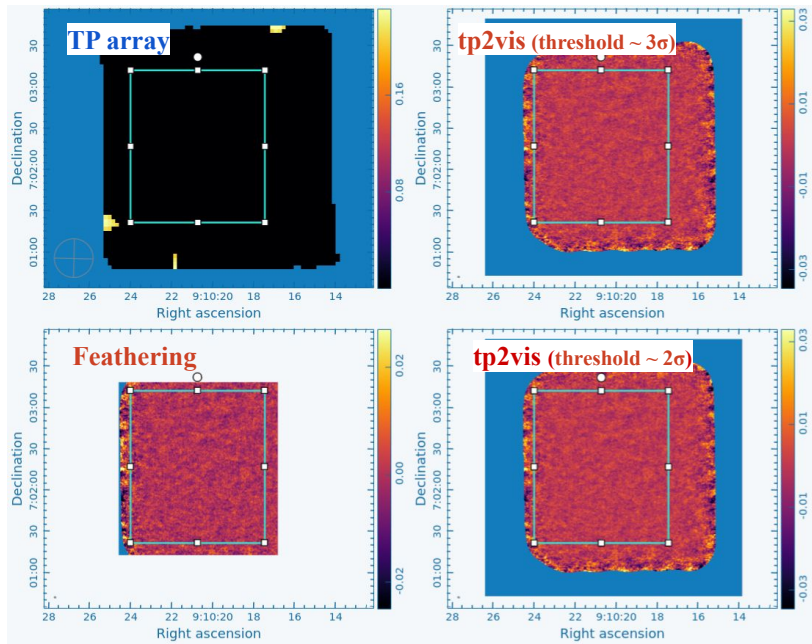
Comparison of merged spectra



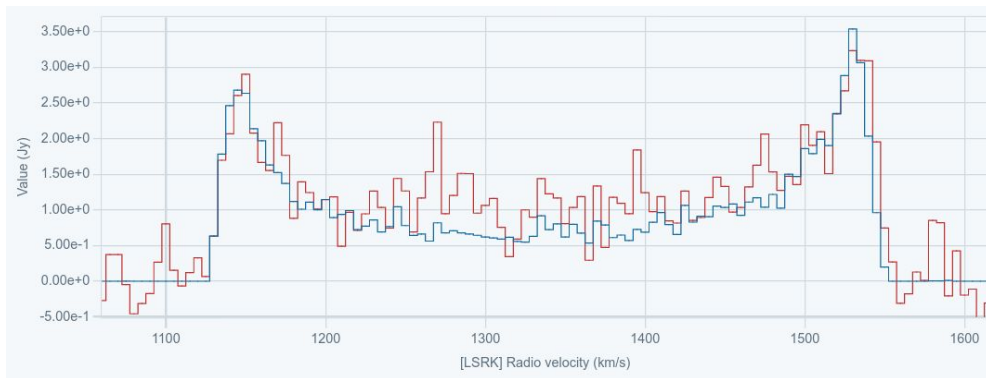
TP array



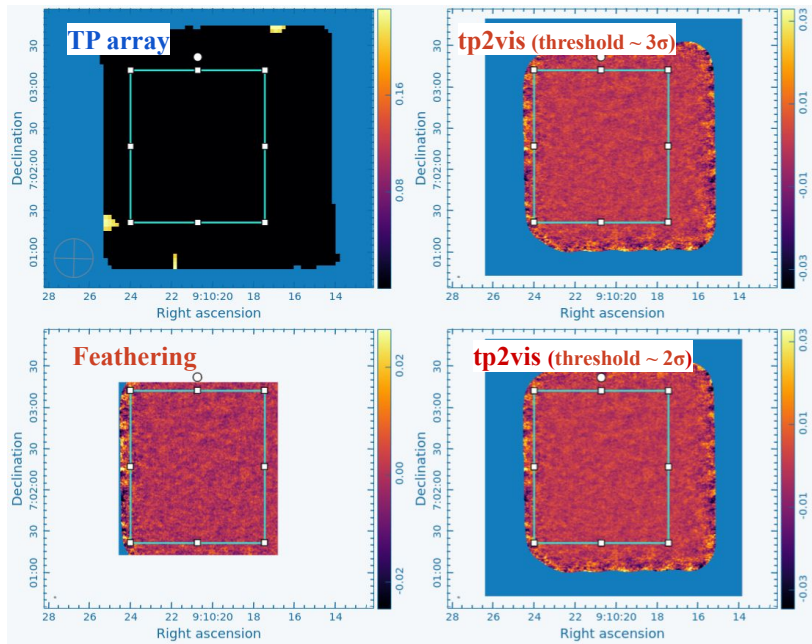
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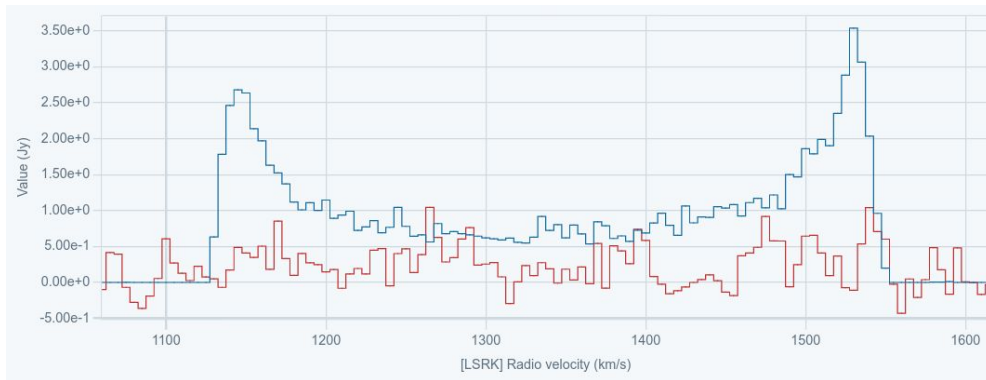
TP array vs. Feathering
→ **good correspondence**



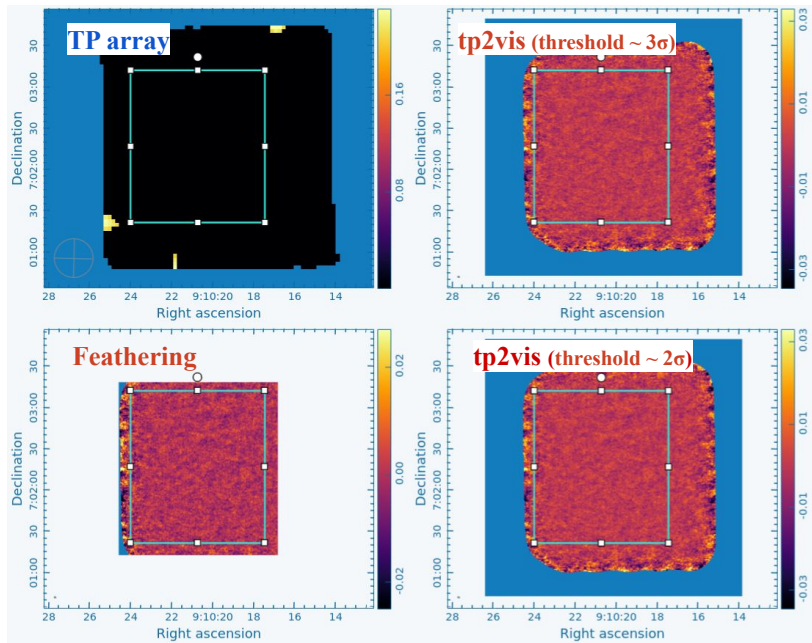
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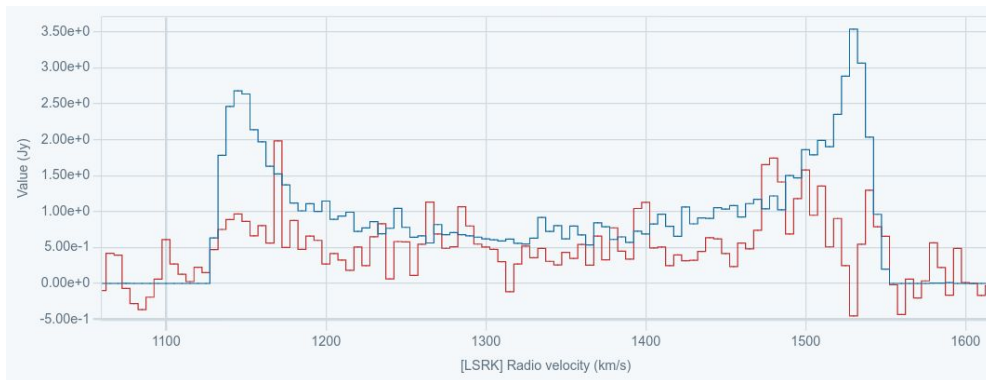
TP array vs. tp2vis (threshold $\sim 3\sigma$)
→ **poor correspondence**



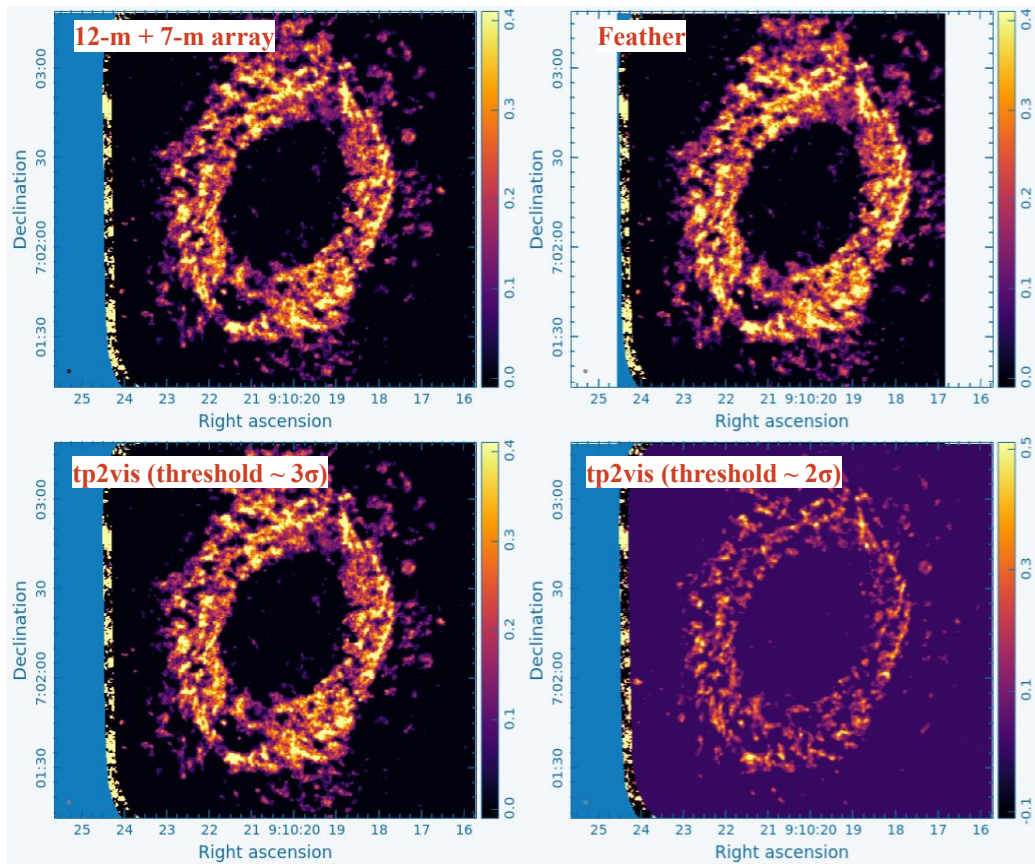
Comparison of merged spectra



TP array vs. tp2vis (threshold $\sim 2\sigma$)
→ still, poor correspondence



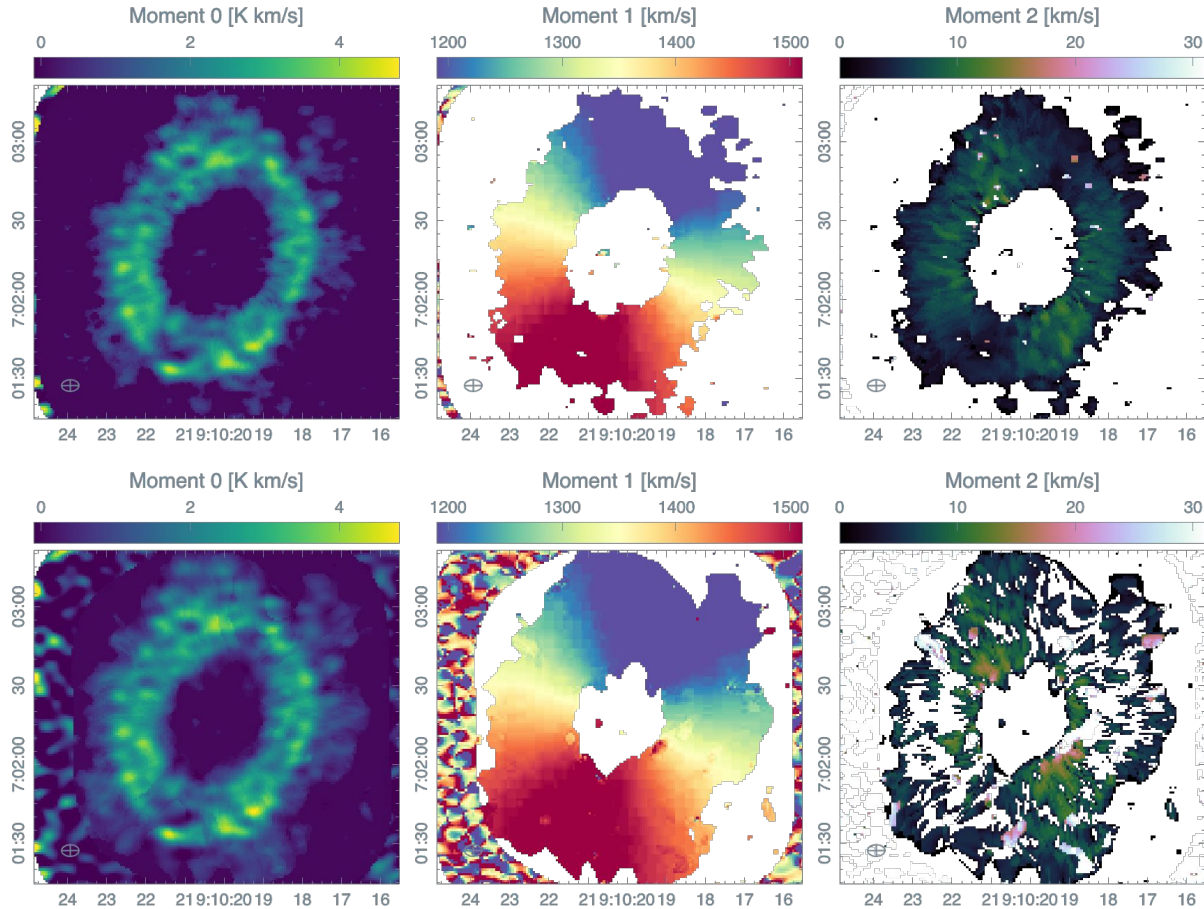
Comparison of Moment0 map



(12 m + 7 m) vs. Feathering

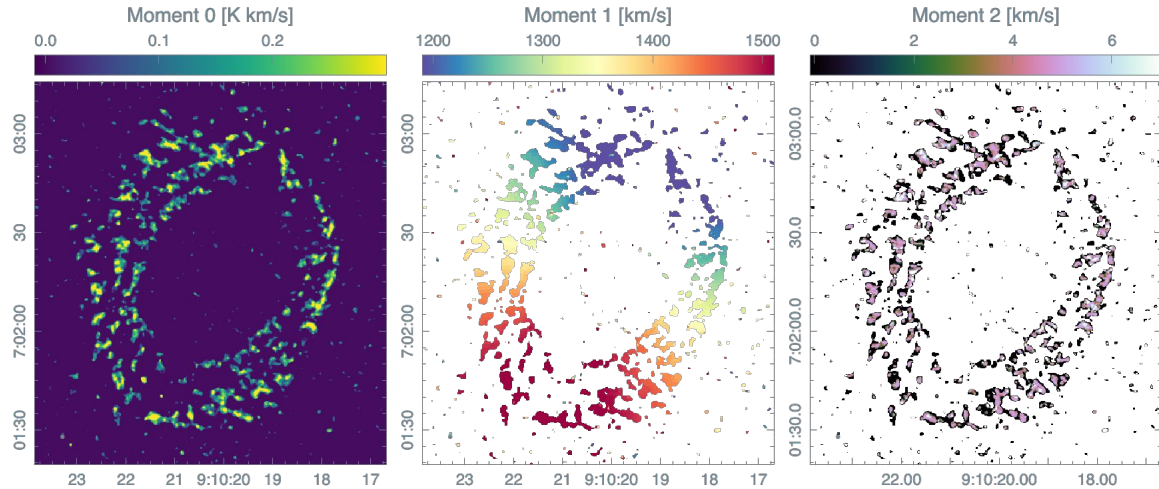
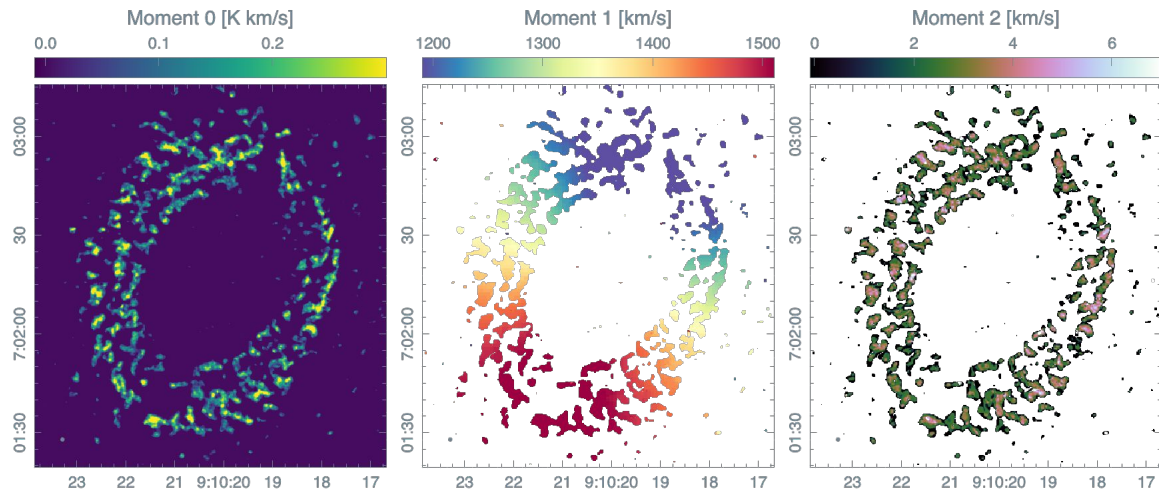
→ Feathering-applied data should contain large structures, fill holes, but almost the same compare to (12 m + 7 m) image.

Velocity Resolution (channel width) Comparison



7m array observation

Velocity Resolution	Weighting
5 km/s	Natural
10 km/s	Natural

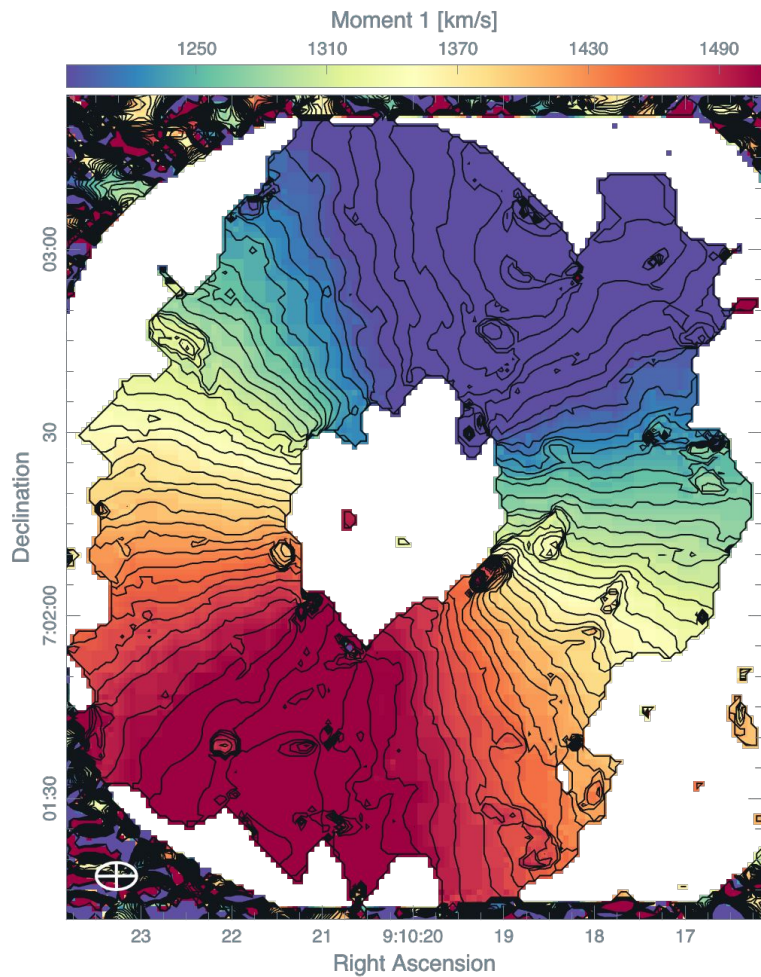
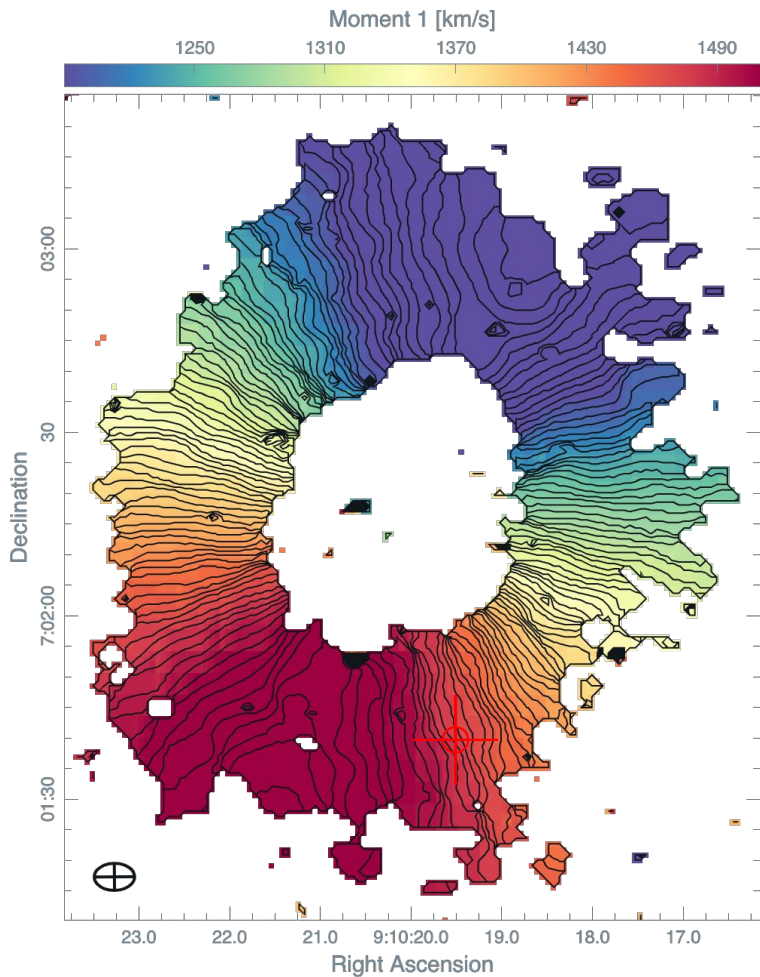


12m array observation

Velocity Resolution	Weighting
5 km/s	Natural
10 km/s	Natural

The iso-velocity contour

7m array observation



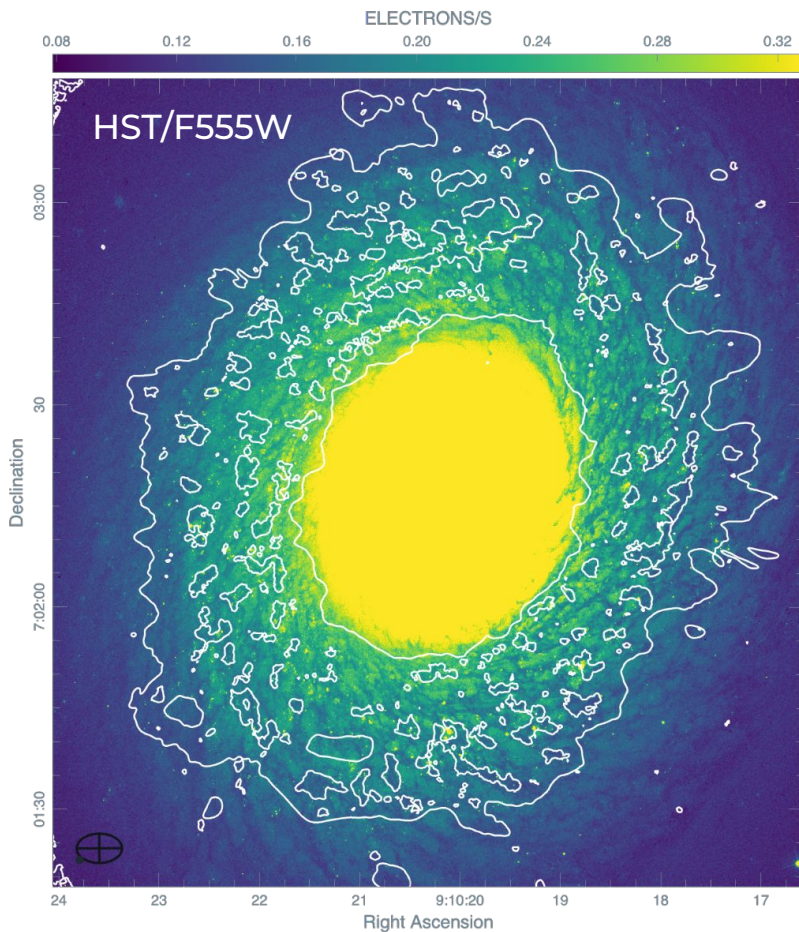
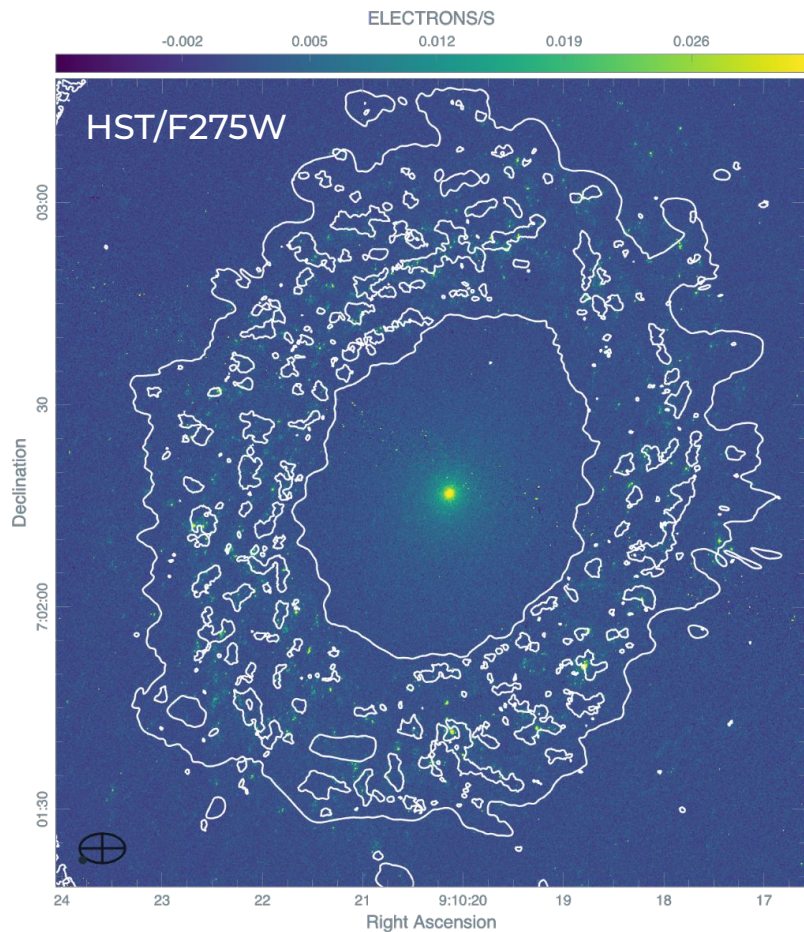
Restoring beam = $6.6241''$
 $\times 4.42774''$, -89.5347 deg

impact of
SN 1993Z?

The **bulge** seems remarkably **void of gas**, and a natural explanation is that a **galactic wind** is present, carrying the gas away...

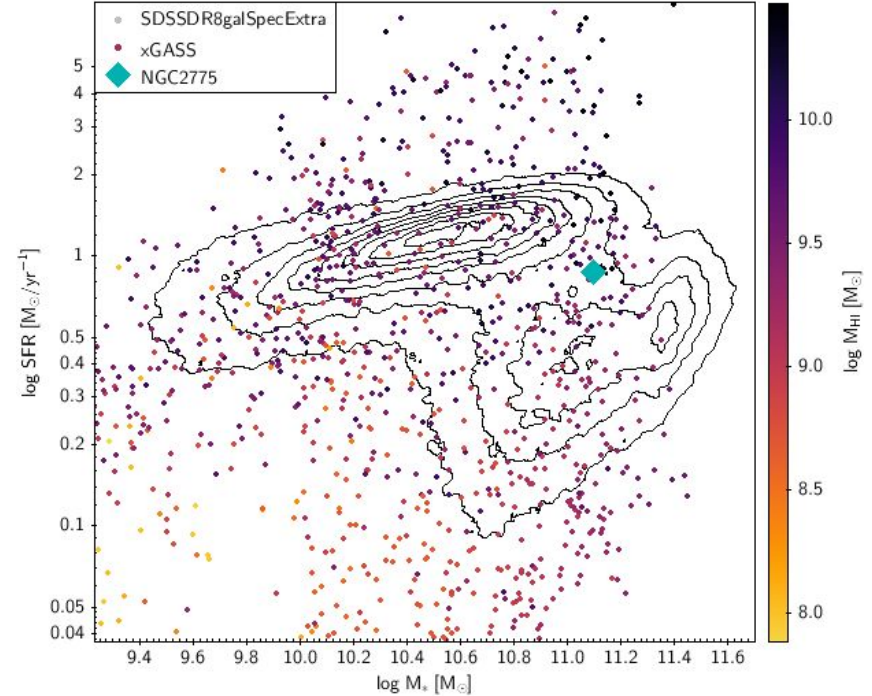
The agent driving a galactic wind is most naturally **supernovae**... (Hogg & Roberts et al. 2001 AJ)

Two CO contours overlaid on the HST images (F275W/555W)



Star forming nature of the NGC 2775

“Birds of a Feather”

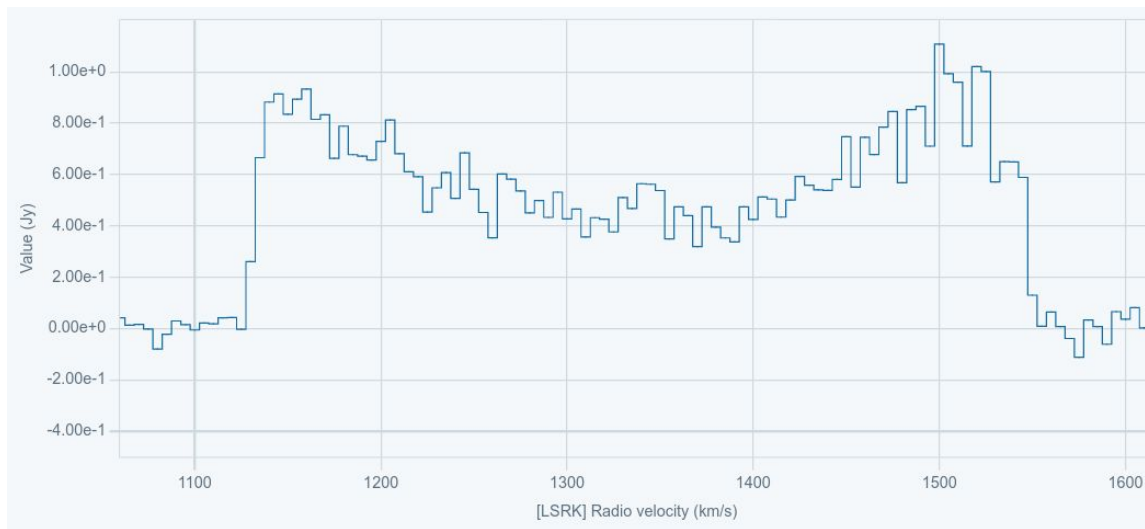
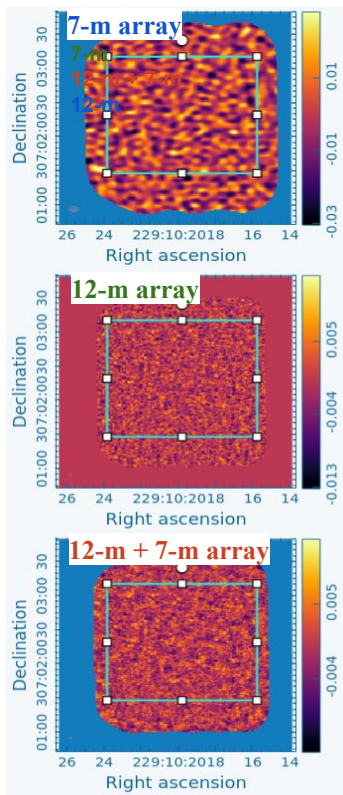


- There is **no detectable cold gas** in the central region, either in the form of H I, CO, or from dust emission (Hogg & Roberts et al. 2001 AJ).

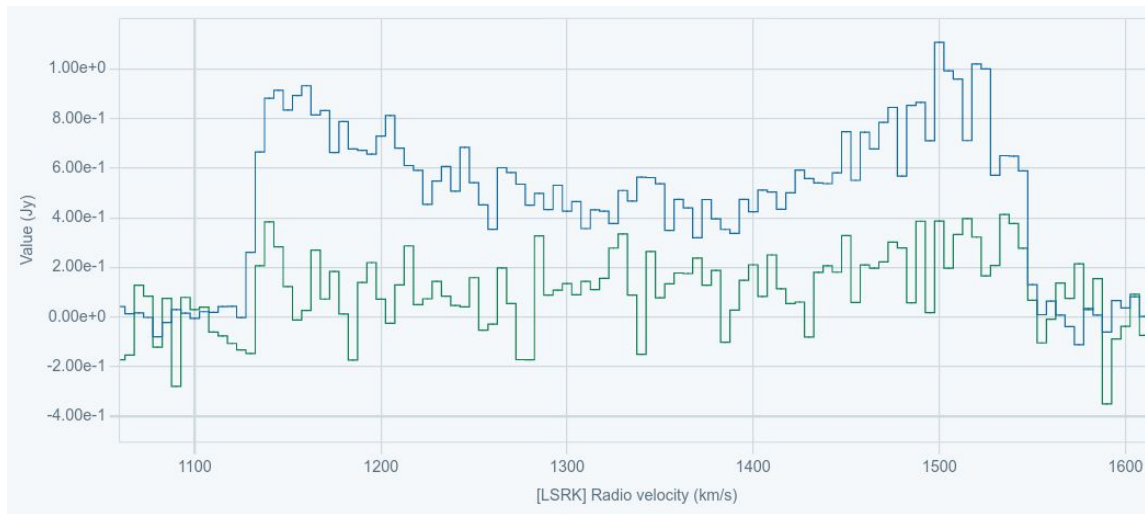
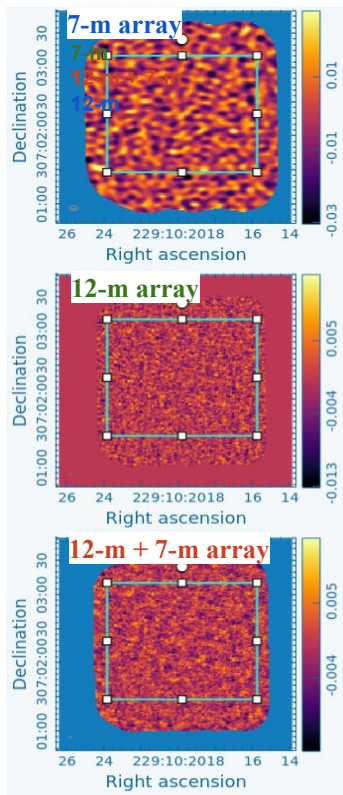
- There is virtually **no star formation in the central part of the galaxy**, which is dominated by an unusually large and relatively **empty galactic bulge**, where **all the gas was converted into stars** long ago (PHANGS-HST team).

Thank you

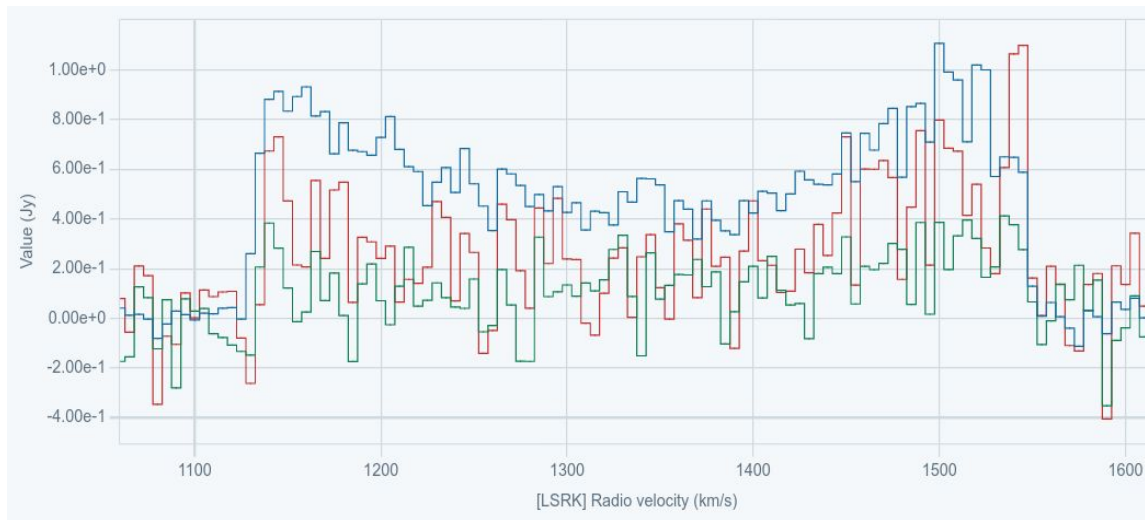
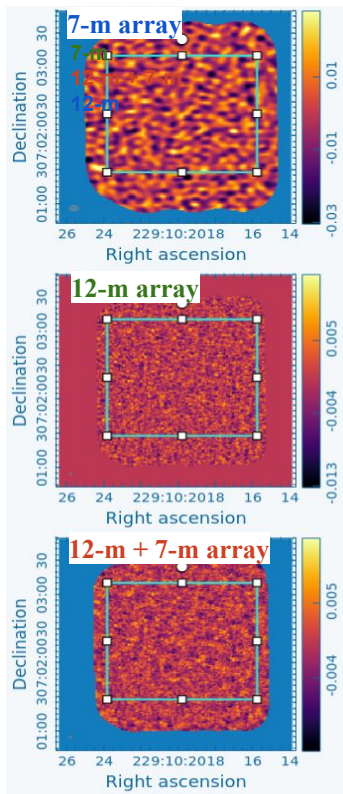
Comparison of 7 m, 12 m, & merged spectra

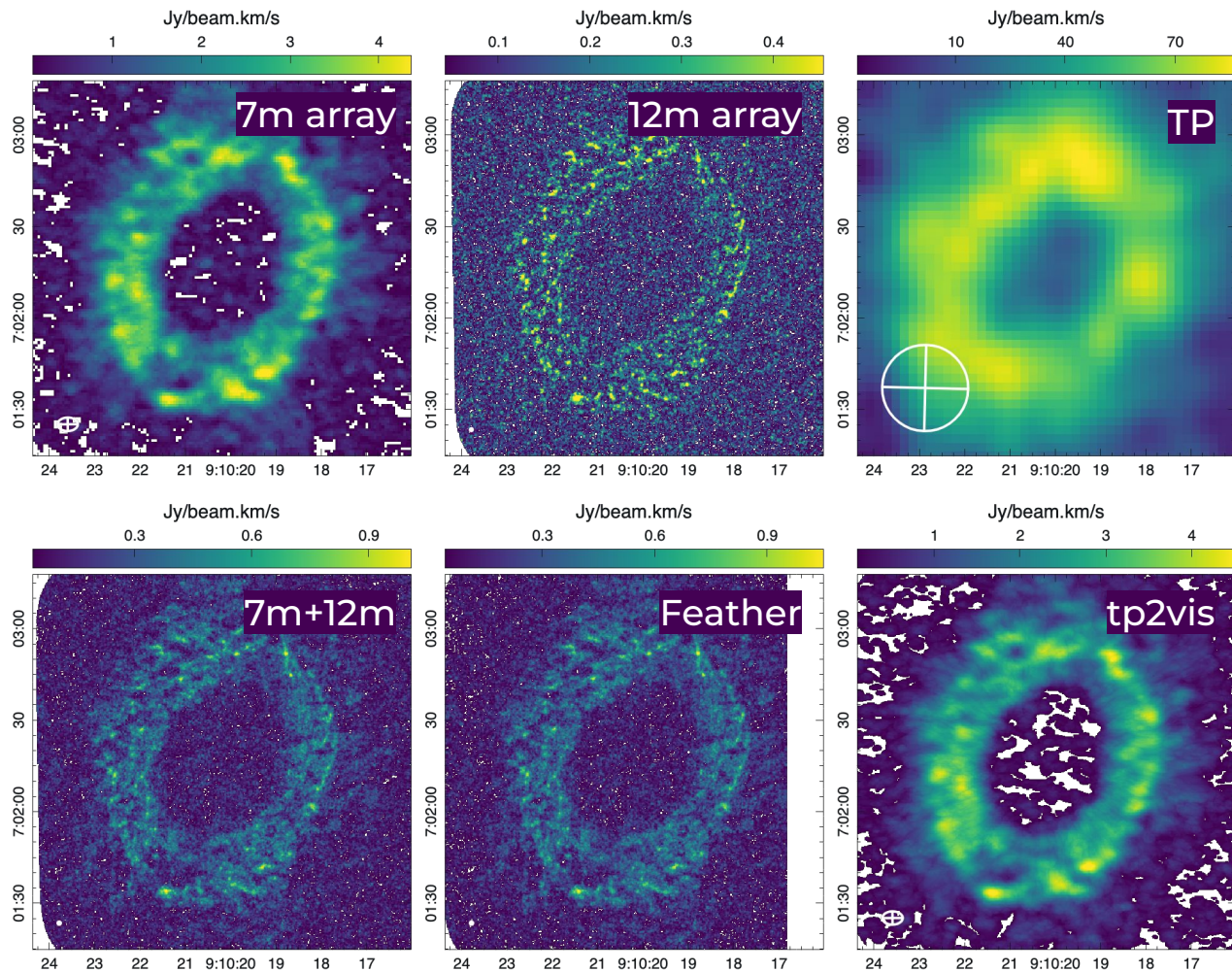


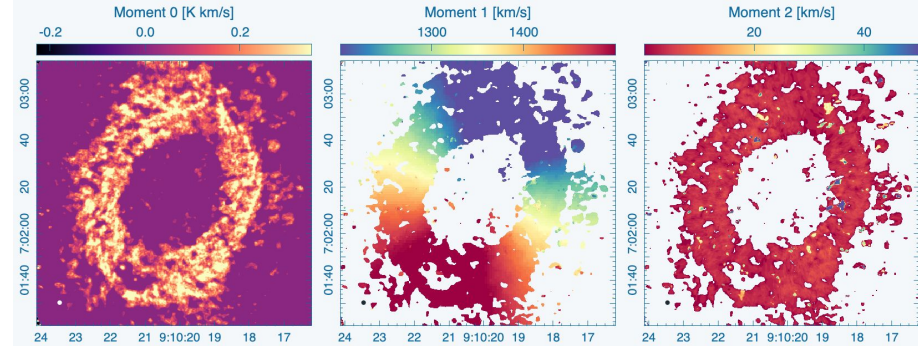
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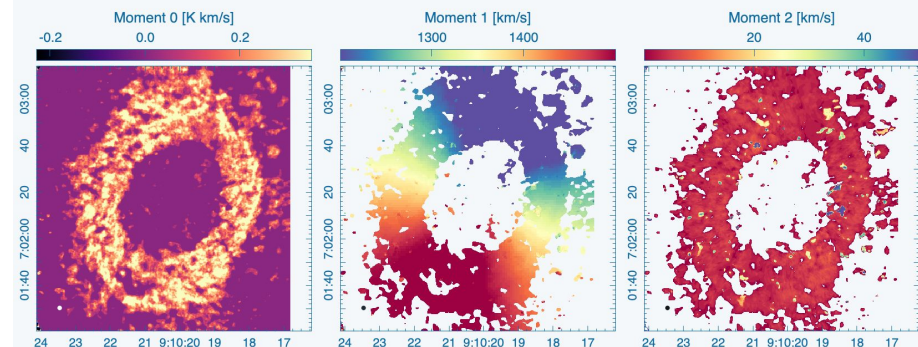
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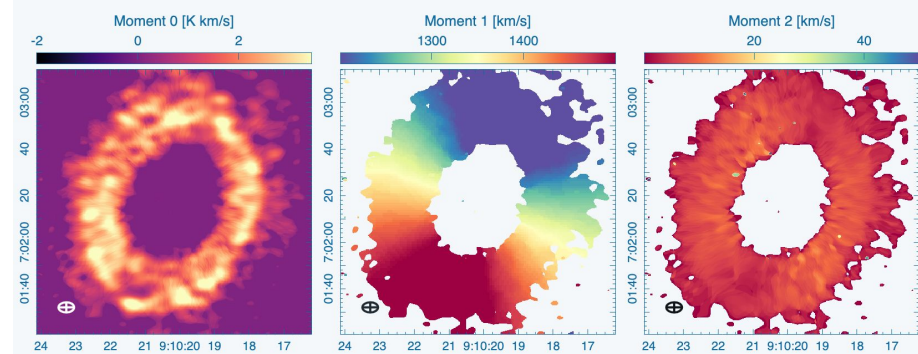




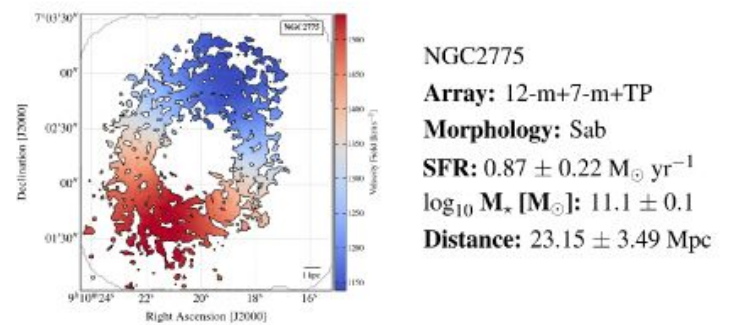
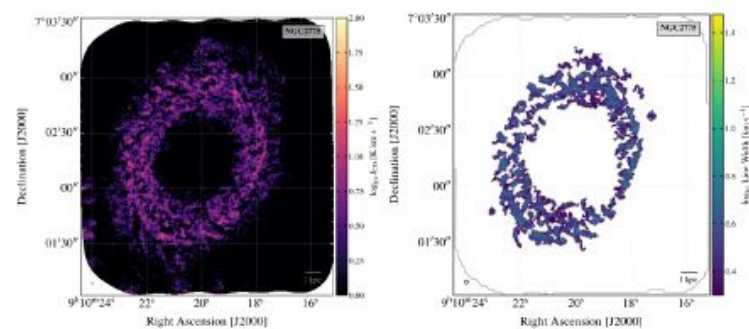
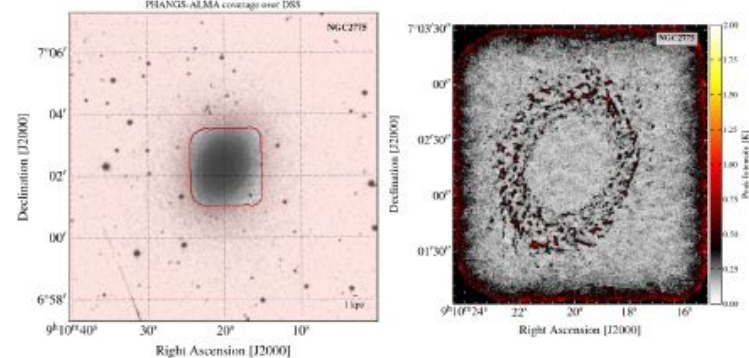
7m+12m



Feather



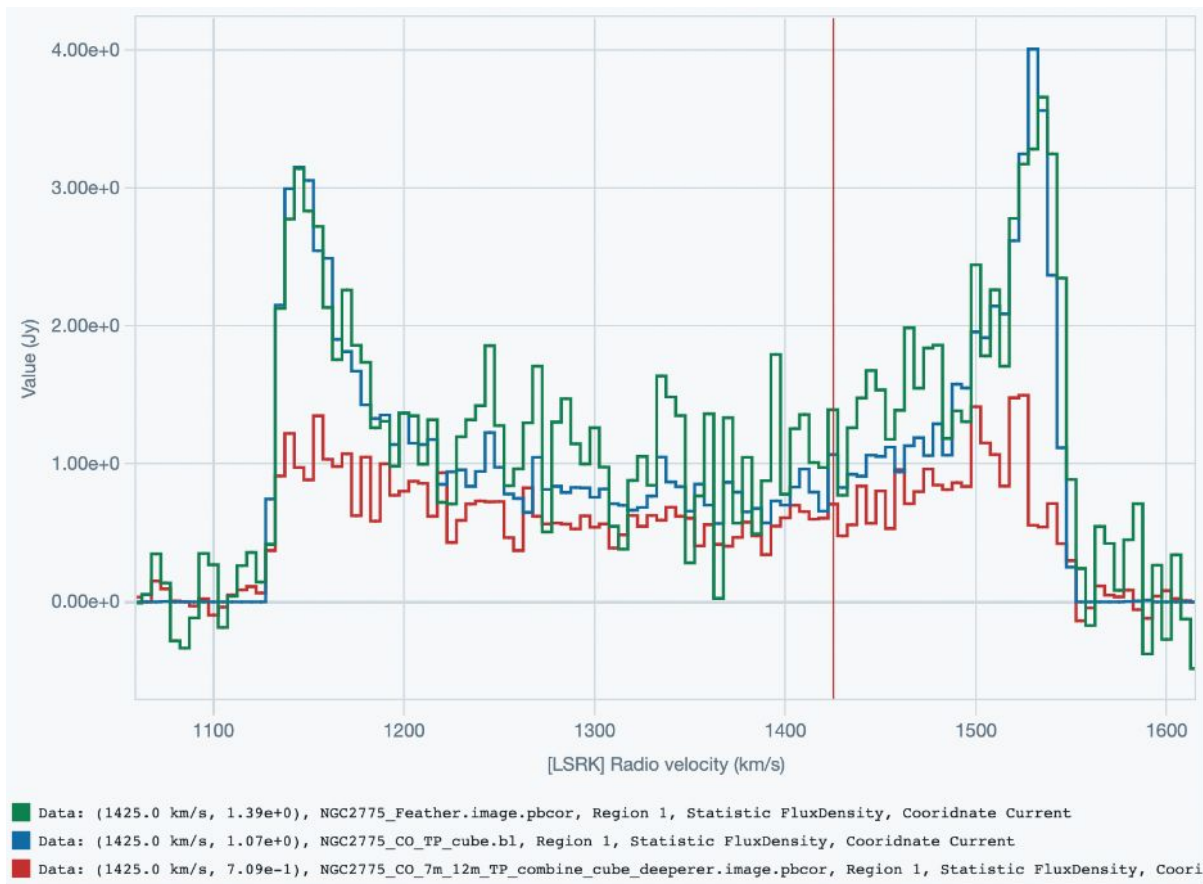
tp2vis



NGC2775
Array: 12-m+7-m+TP
Morphology: Sab
SFR: $0.87 \pm 0.22 M_{\odot} \text{ yr}^{-1}$
log₁₀ M_{*} [M_⊙]: 11.1 ± 0.1
Distance: $23.15 \pm 3.49 \text{ Mpc}$

line profile from Feather(green), tp2vis(red), TP (blue).

backup slides



Optical overlay (DSS)

tp2vis

Feather

7m+12m

