The escape of LyC radiation through galactic labyrinths in Haro 11

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Arjan Bik

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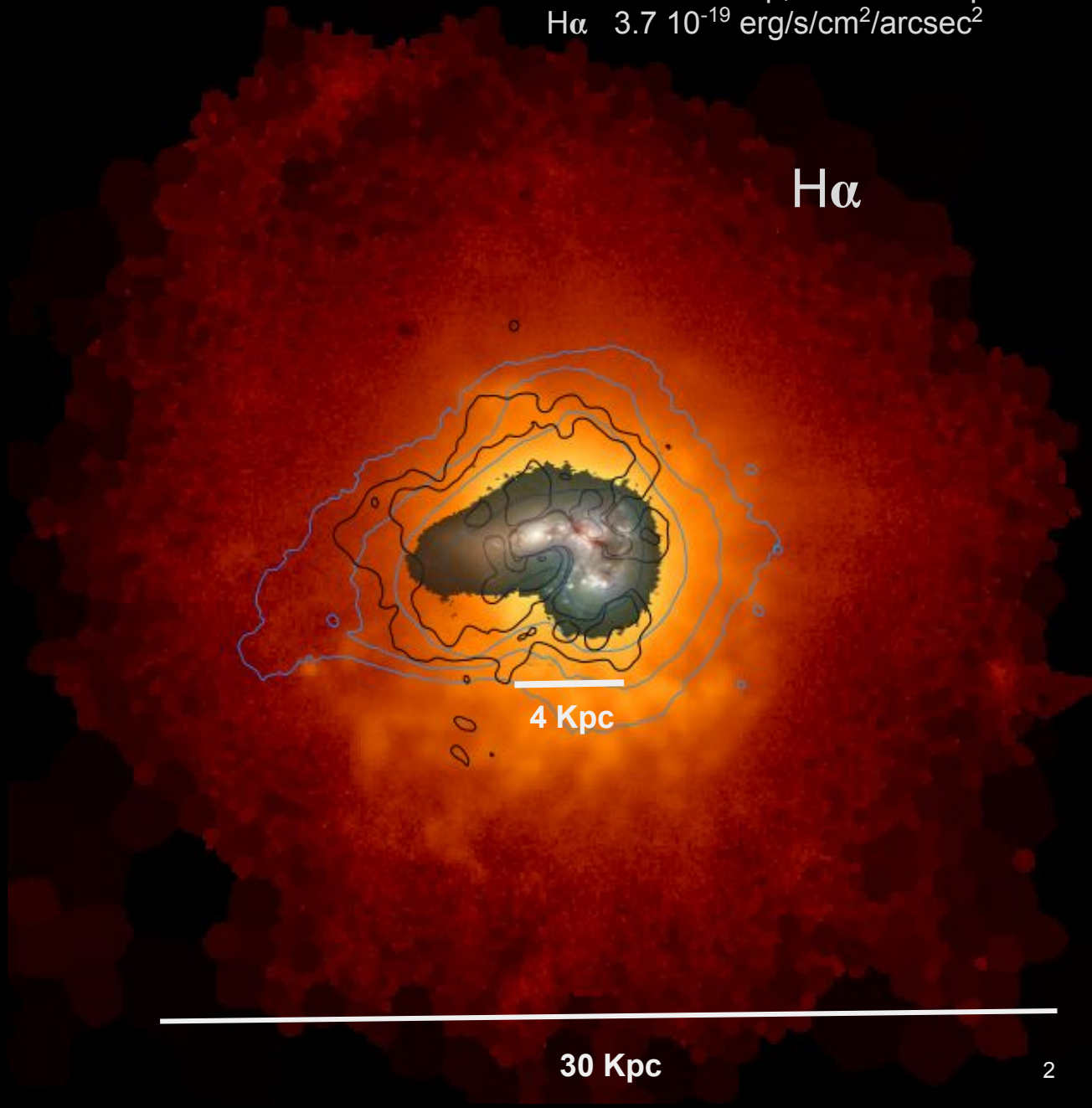
Haro 11

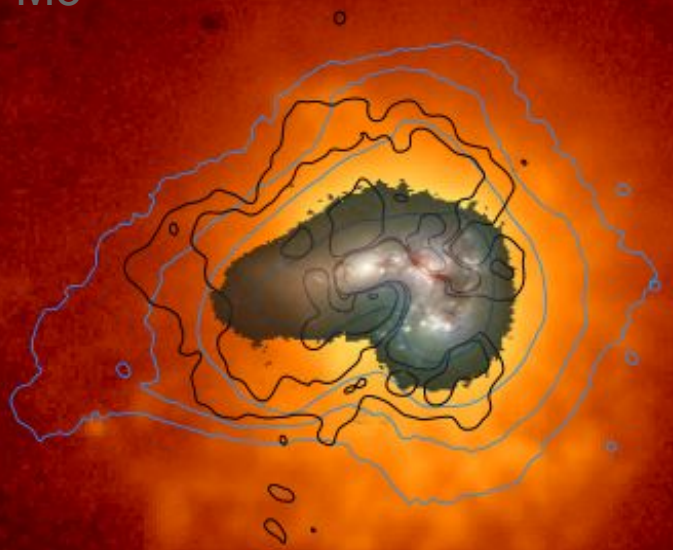
Menacho in Prep, Östlin in Prep.
Hα 3.7 10^{-19} erg/s/cm^2/arcsec^2



Pardy 2017, Östlin in prep.
Östlin 2001,2015

Haro 11

- BCG
- M* ~1.6 10^{10}, $M_{HI} \simeq M_{HII} \sim 5\ 10^{9}$ Mo
- Low HI gas mass



- LyC leaker (fesc~3.3)
- Lyα emitter.

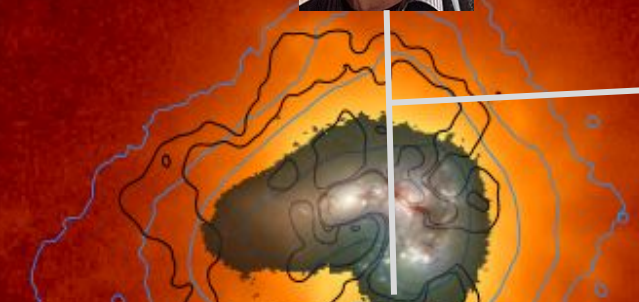
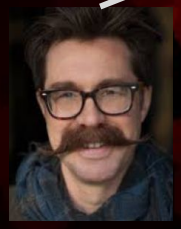
Bergvall 2016. Leitet 2011 , Hayes 2007, Adamo 2010,

Haro 11

Swedish Tradition

- Bergvall,N
  - Öslin, G
    - Hayes, M
    - Adamo,A
    - Micheva,G
    - Rivera-Thorsen,T
    - Sandberg, A
    - Menacho, V
      - Bik,A





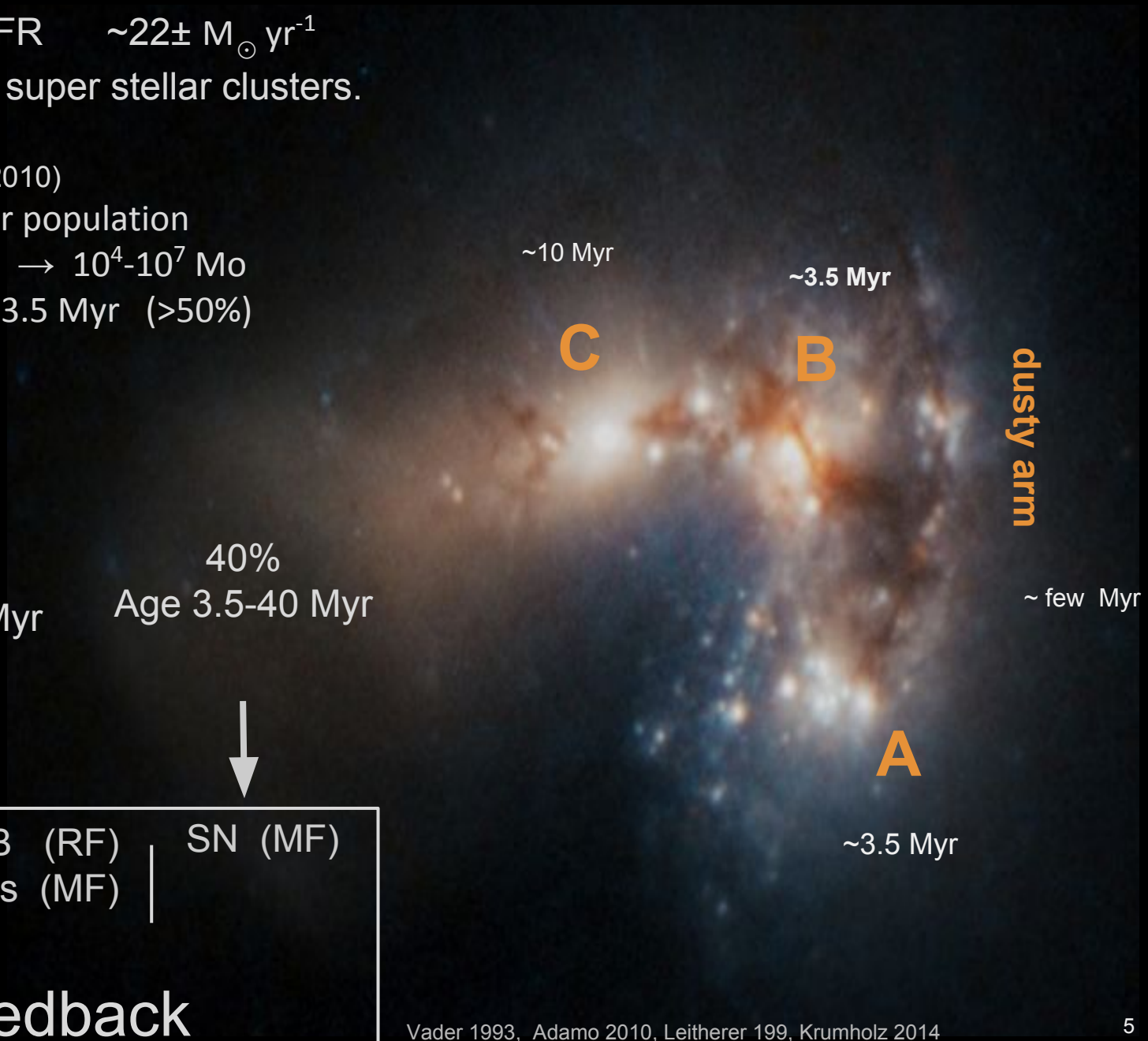

PHD Students

- High SFR ~22± $M_\odot$ yr^{-1}
- Rich in super stellar clusters.

Adamo et al (2010)

Stellar cluster population

- 200 SC → 10^4-10^7 Mo
- Peak at 3.5 Myr (>50%)



> 50%
Age < 3.5 Myr

40%
Age 3.5-40 Myr

Radiative FB (RF)
Stellar Winds (MF)

SN (MF)

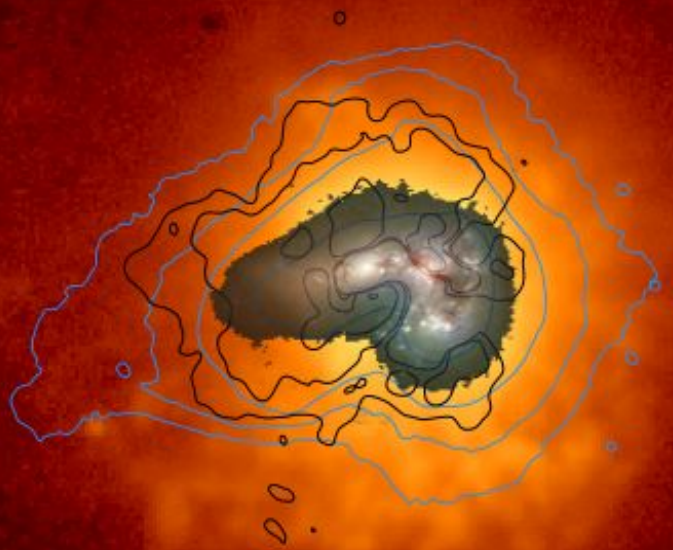
Feedback

Vader 1993, Adamo 2010, Leitherer 199, Krumholz 2014

Motivation: Haro 11

- ISM properties
- Impact of Stellar Feedback

- LyC leakage:
  - Where ?
  - How ?



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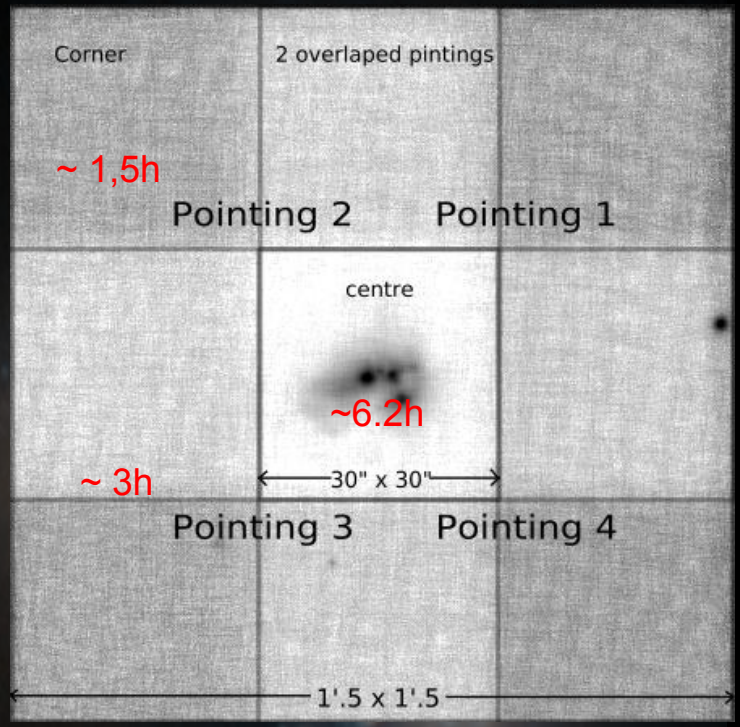
Observations:

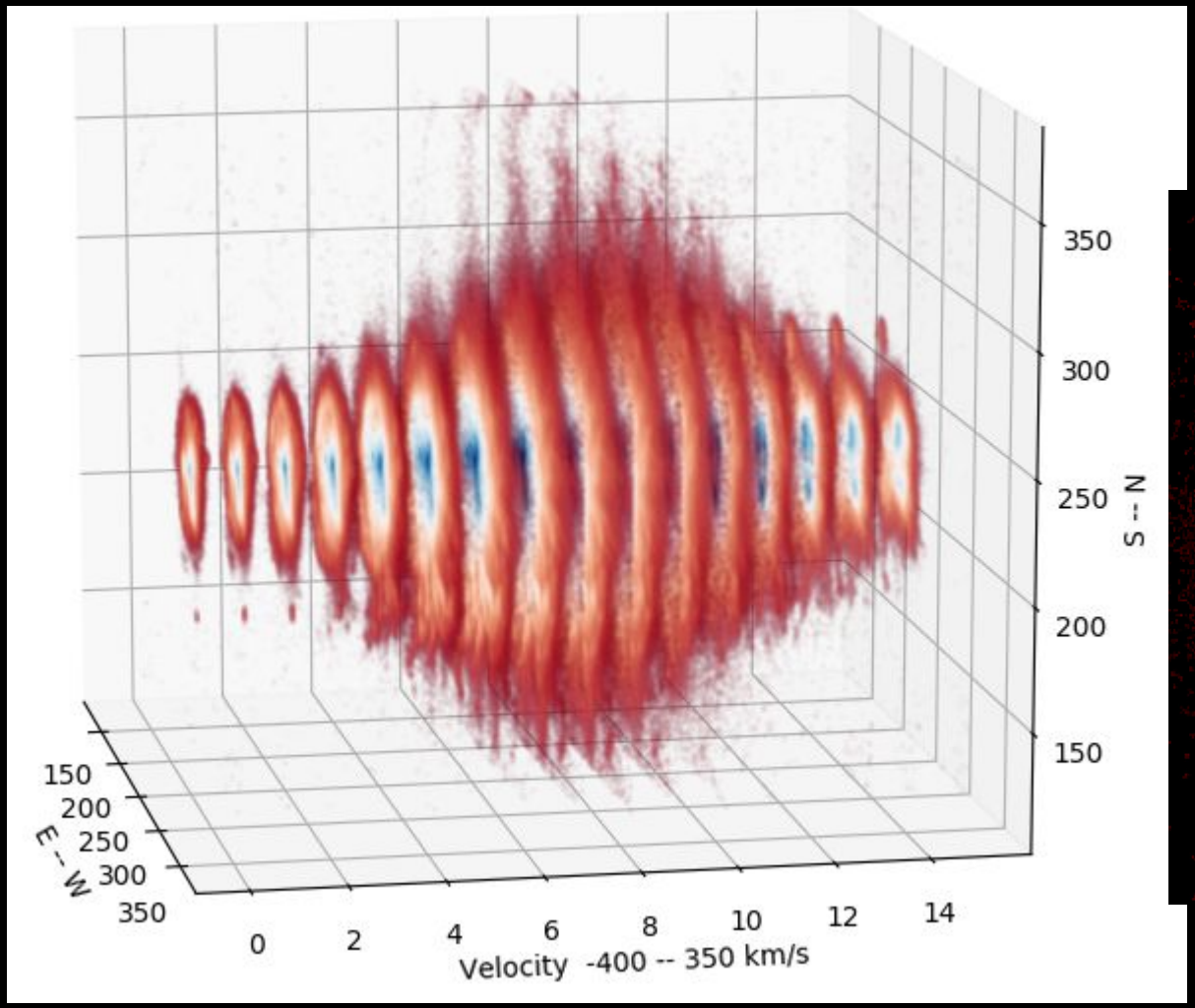
Deep MUSE observations:

- Stellar abs. Corrections
- Resampling to 50 kms^{-1}
- Convolution

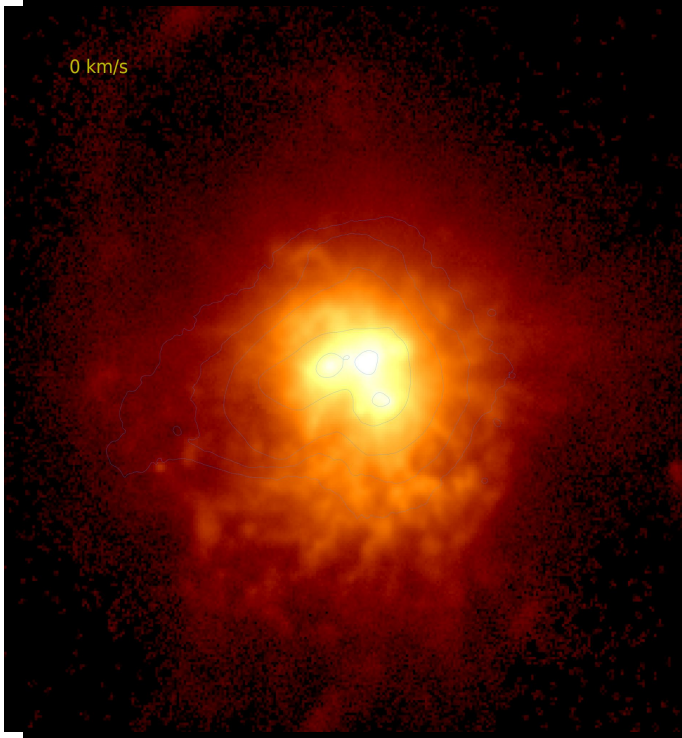
- Hα, [OIII]λ5007
  - Ionized gas Hα
  - Ionization map, [OIII]/Hα



Results:

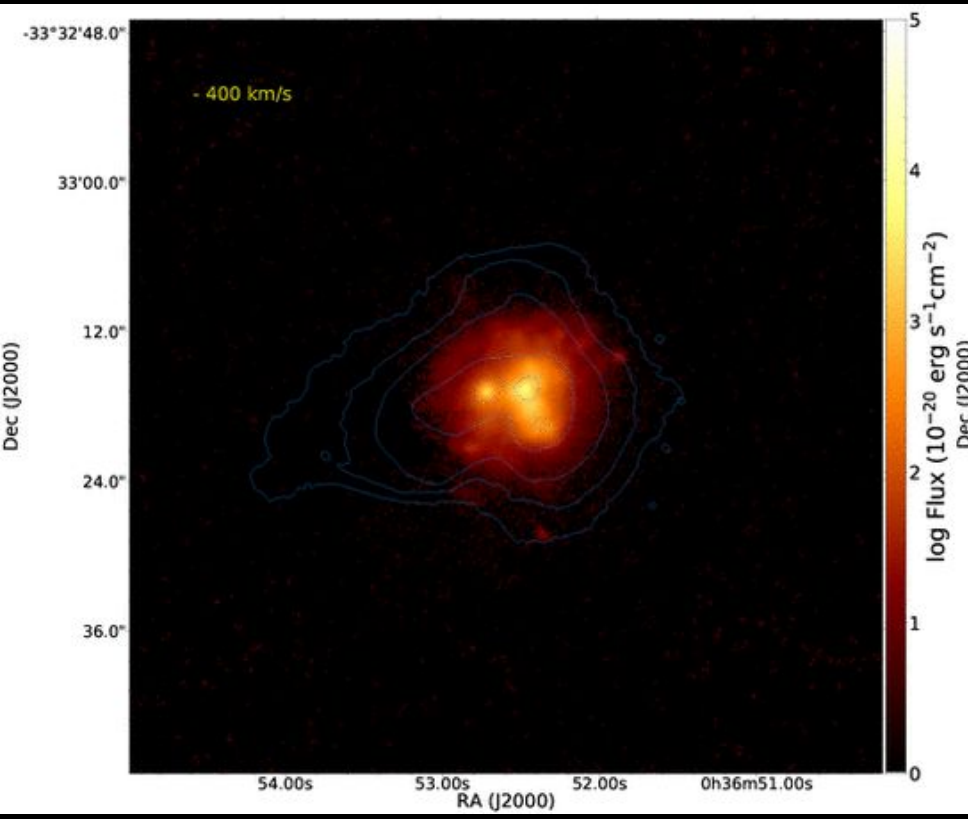


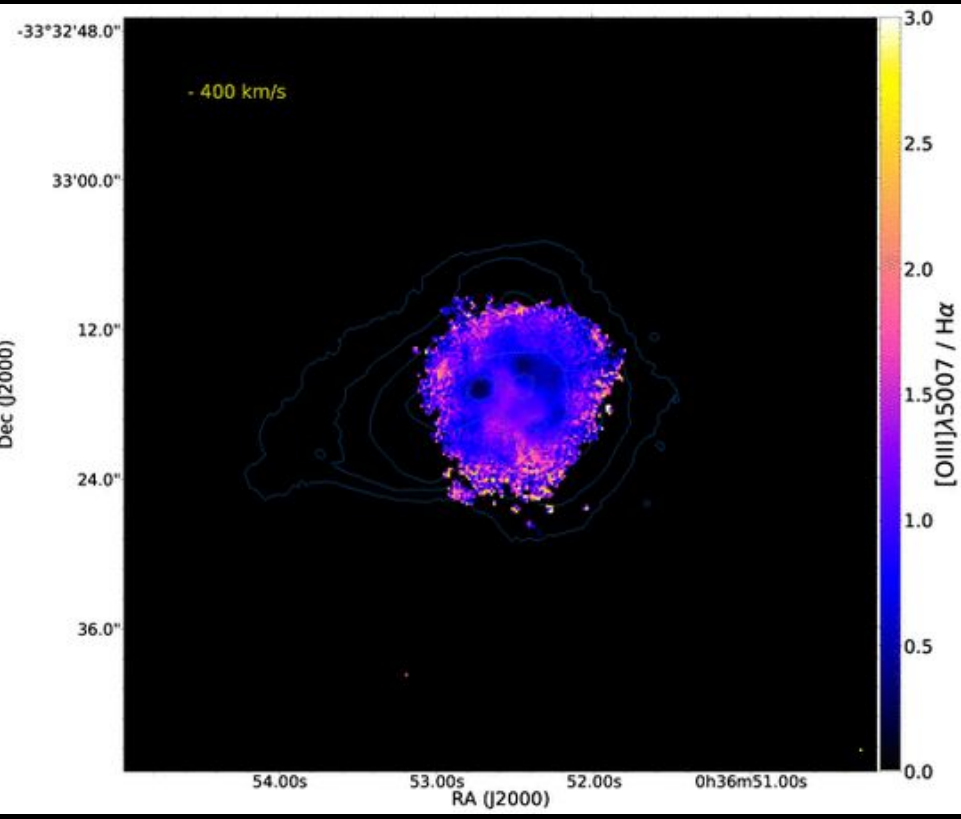
Hα 0 kms^{-1}



Hα

Ionization map



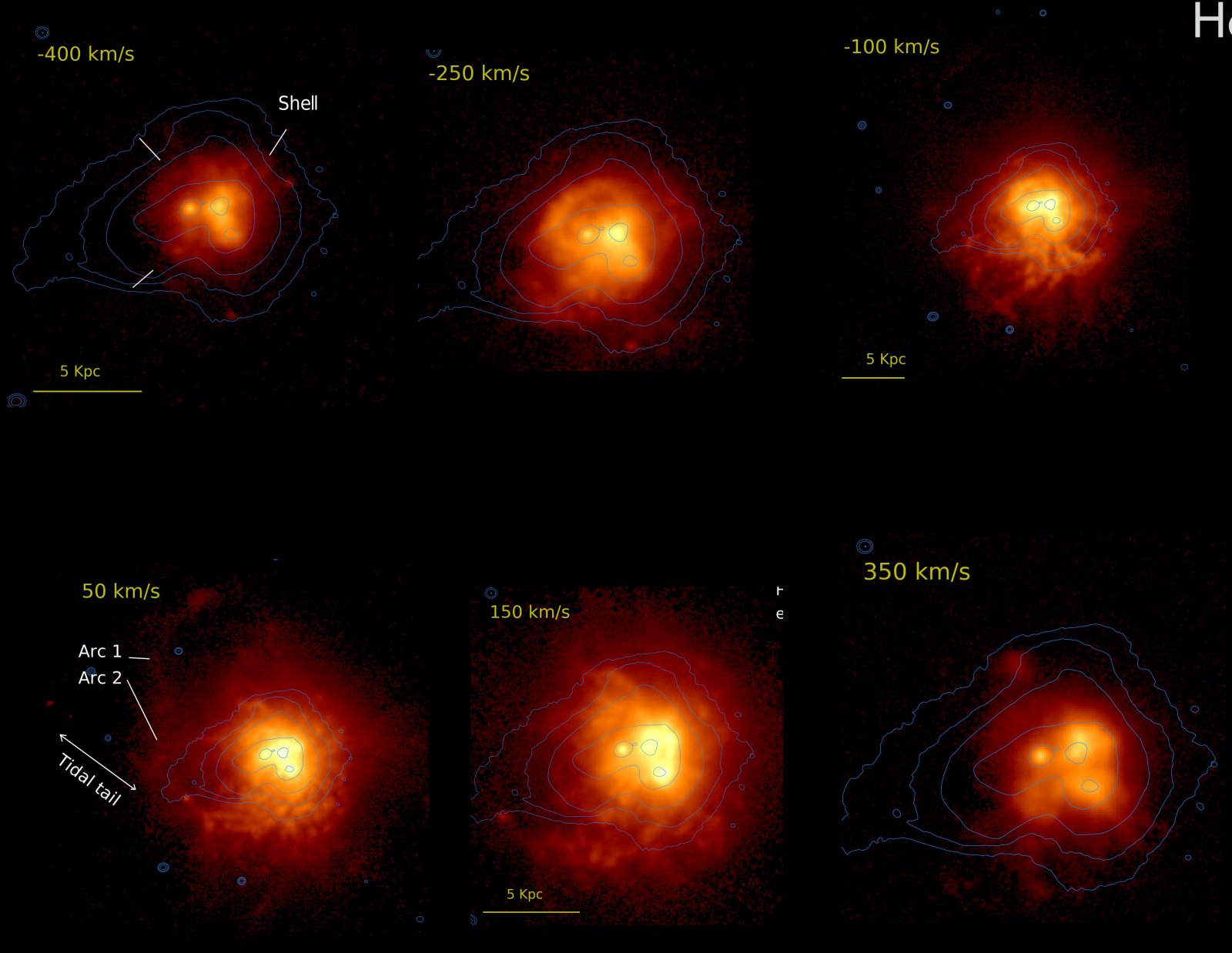


Courtesy: A. Bik

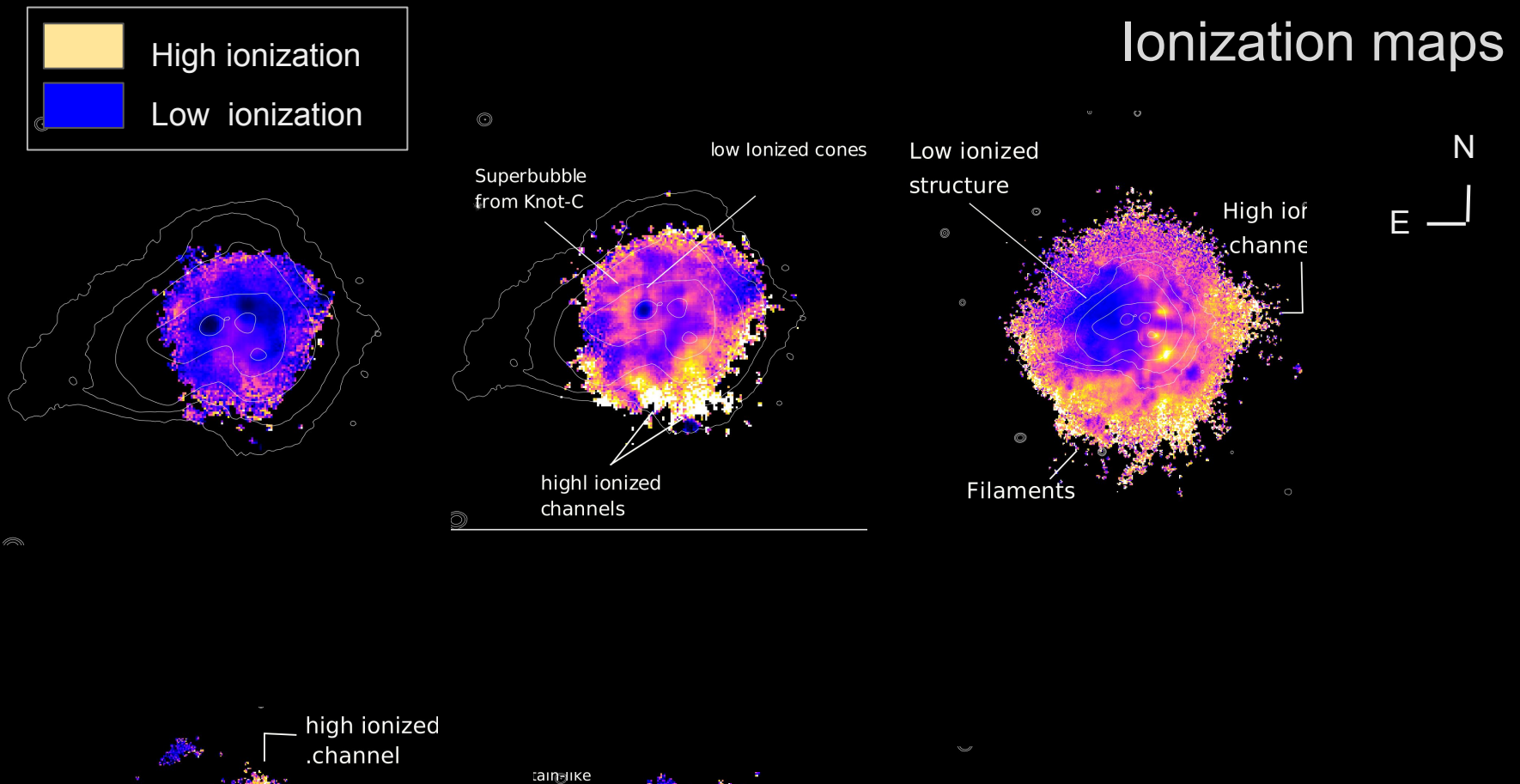
Hα

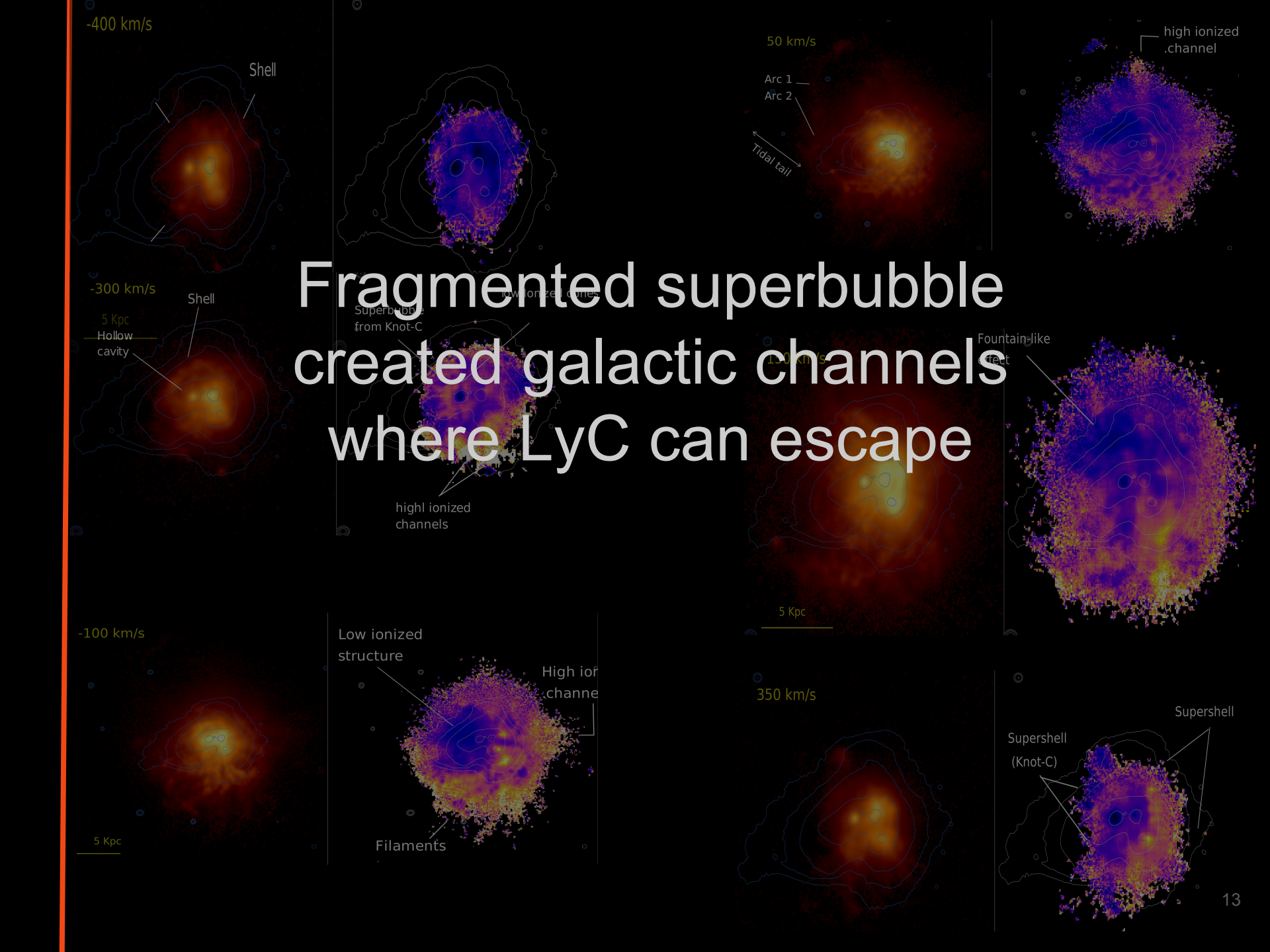
Ionization map

Hα


-400 km/s
Shell
5 Kpc
-250 km/s
-100 km/s
5 Kpc
50 km/s
Arc 1
Arc 2
Tidal tail
150 km/s
5 Kpc
350 km/s

Ionization maps

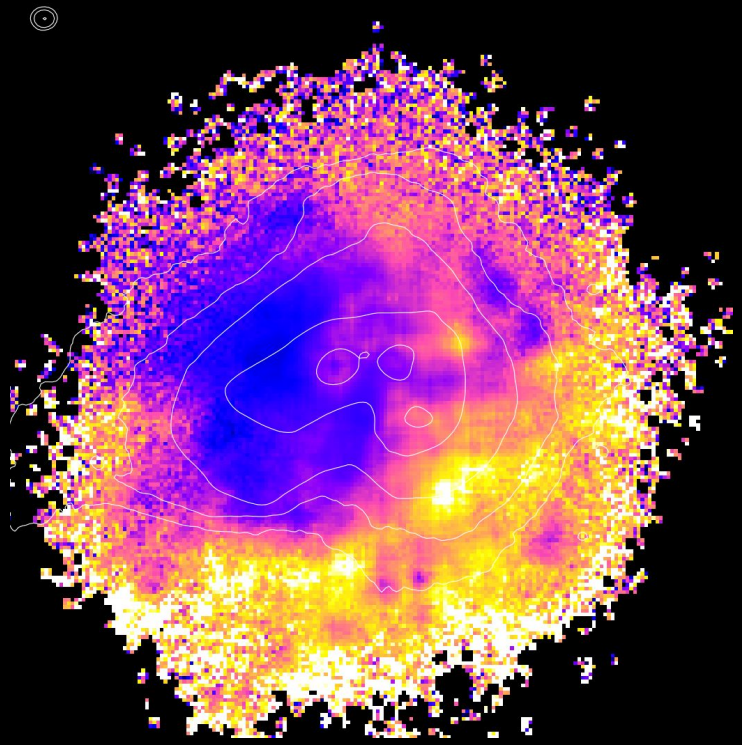




Fragmented superbubble created galactic channels where LyC can escape

Conclusions:

- Impact of Stellar Feedback
  - create superbubbles
  - create high ioniz. Channels
  - filaments



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- Impact of Stellar Feedback
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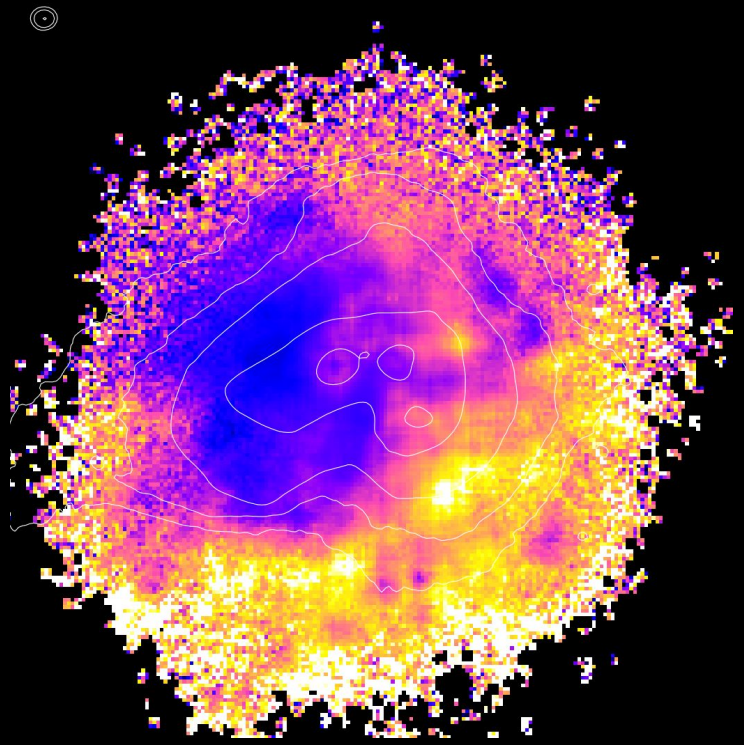
  - How ?
    Fragmented Superbubble
    => Create galactic holes
    => Escape LyC



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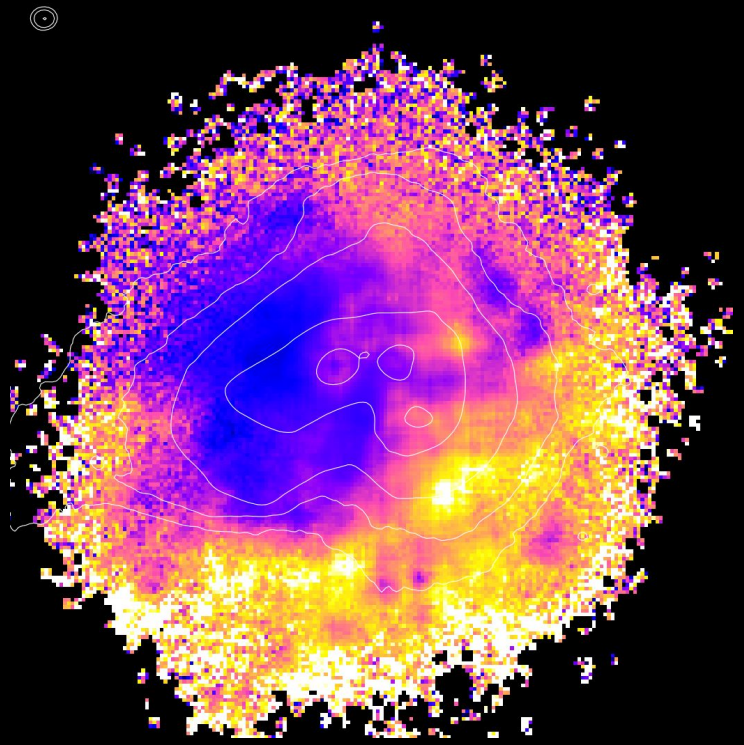
  - How ?
    Fragmented Superbubble
    => Create galactic holes
    => Escape LyC
  - Where ?
    Likely in highly ionized zones



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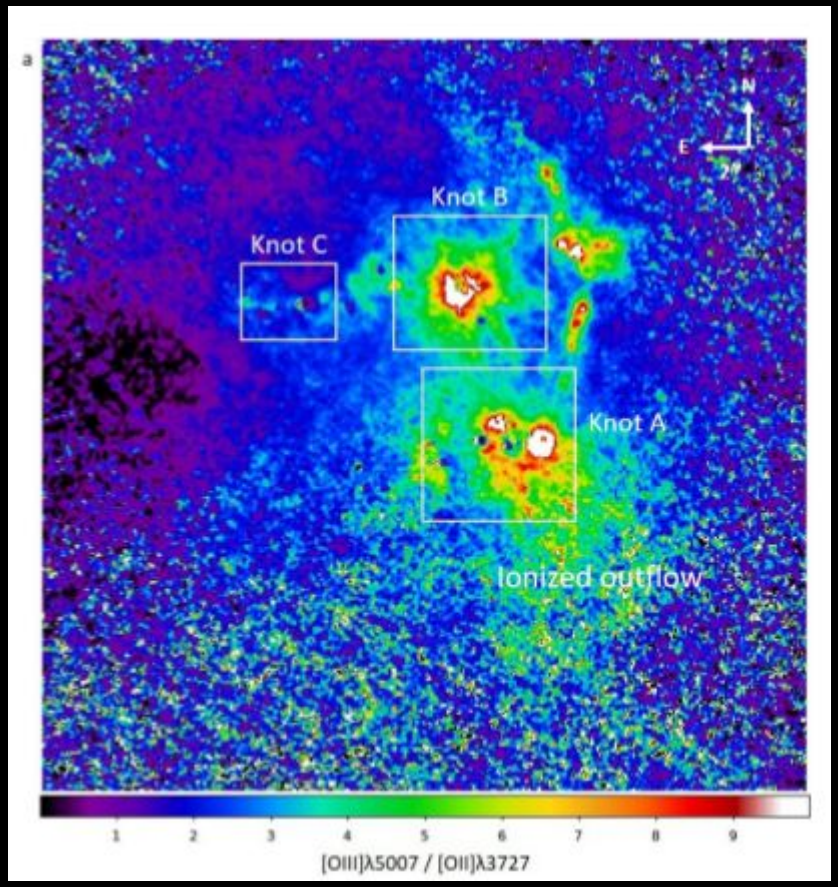
Keenan 2017

Results:

- In agreement with Keenan 2017



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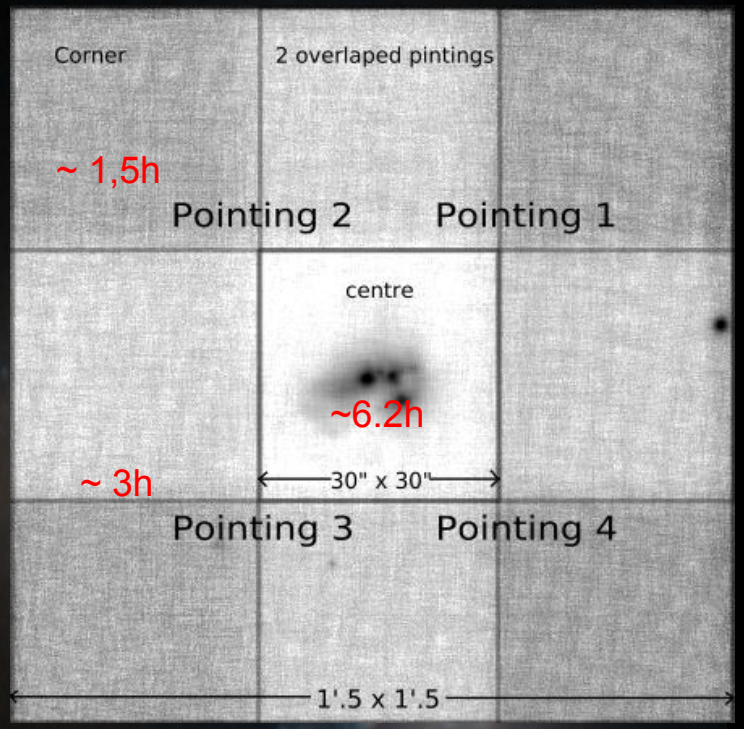

Emission line	λ_{Ham_11} [Å]	$\delta\lambda$ in 50 kms^{-1} bin [Å]	pixels per FWHM	spatial Resolution ["]
Hβ	4961.4	0.83	3.5	0.94
Hα	6697.9	1.12	2.3	0.84
[OIII]λ5007	5109.9	0.85	3.4	0.92
[OI]λ6300	6429.8	1.07	2.1	0.85