Potential Escape of Ionizing Photons in IZw18

Antonio Arroyo Polonio

Carolina Kehrig, Jose M. Vílchez, Jorge Iglesias Páramo, Enrique Pérez Montero, Ricardo Amorín, Borja Pérez Díaz…

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Introduction

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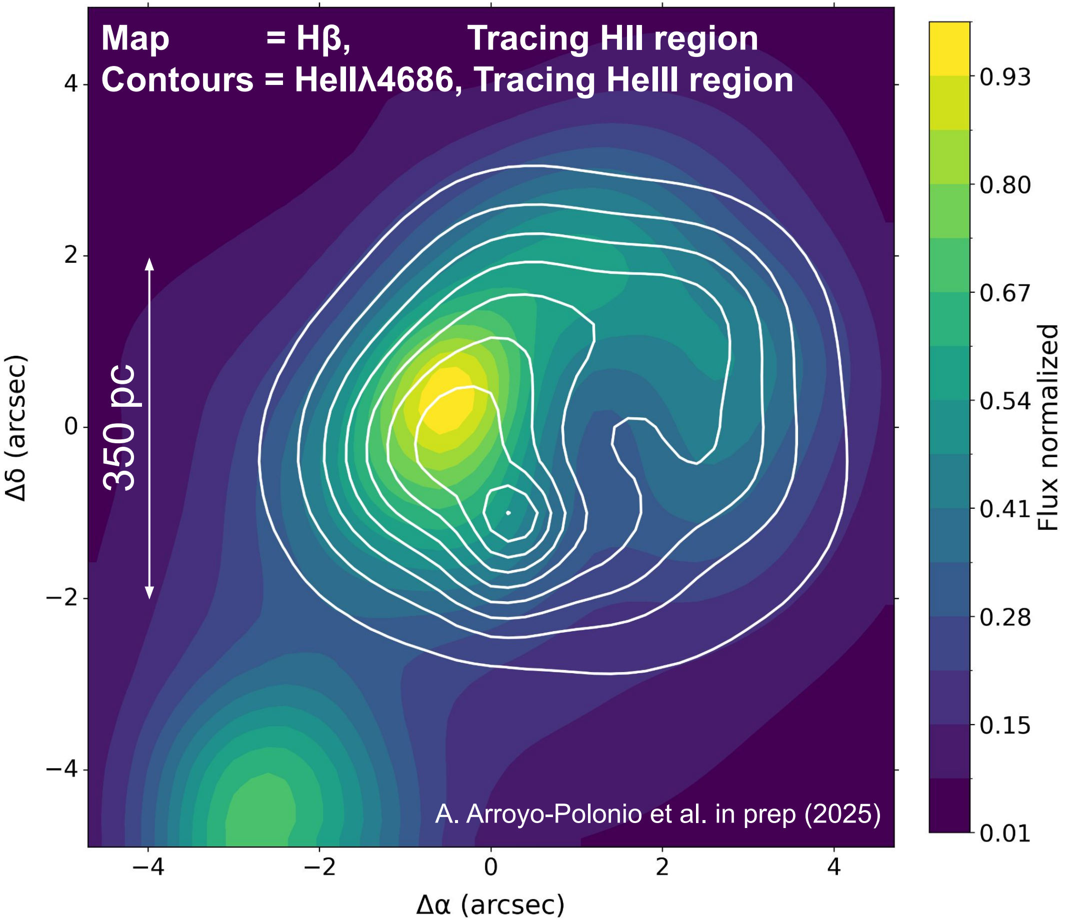

L. Hunt et al. (2005)
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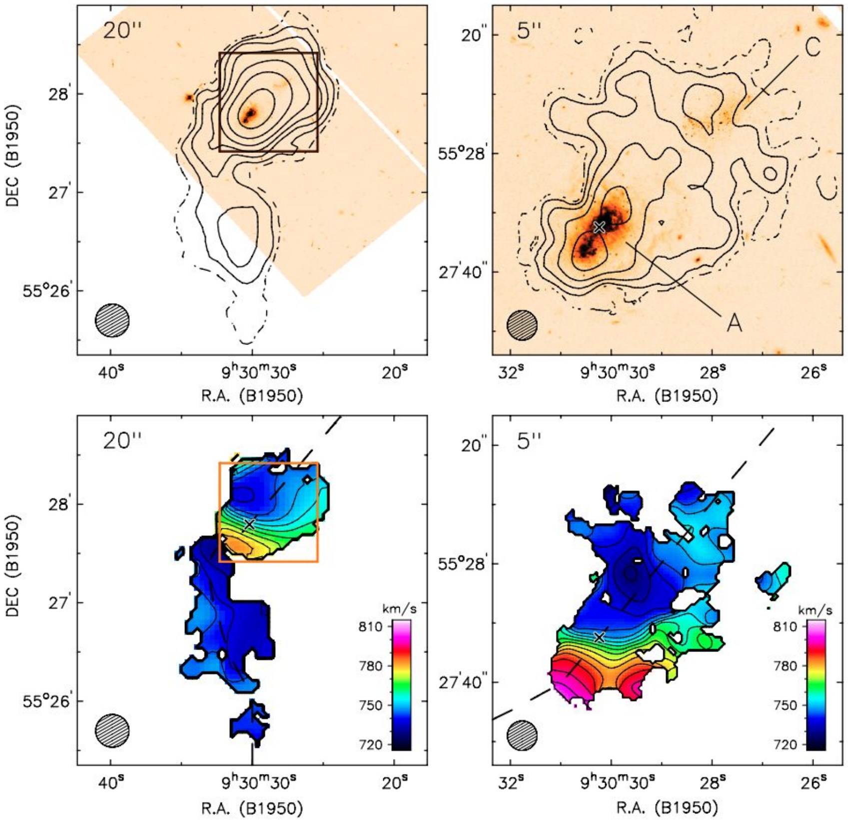
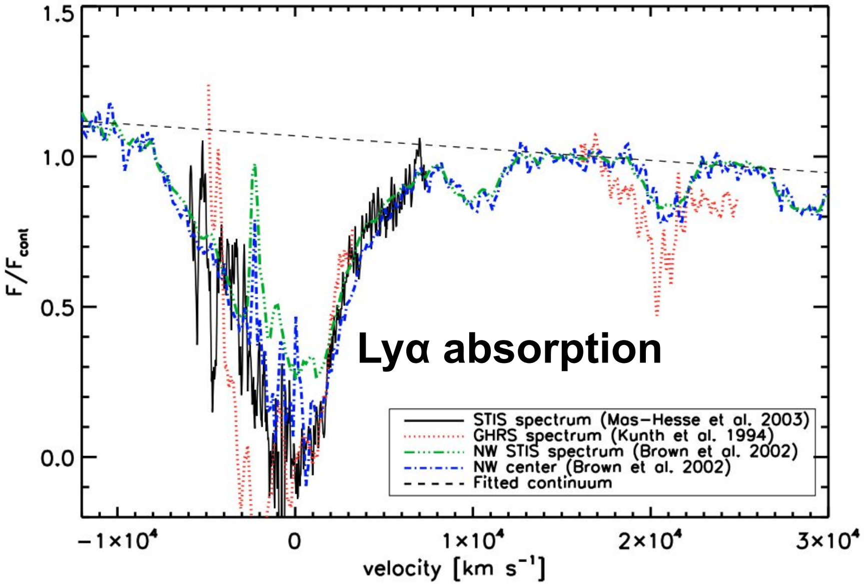
Lyα absorption due to a **high column density** of **neutral gas**:
$N_{HI} = 6.5 \times 10^{21}$ cm^{-2}, **τ>>1**





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No escape of **ionizing photons** in **IZw18**

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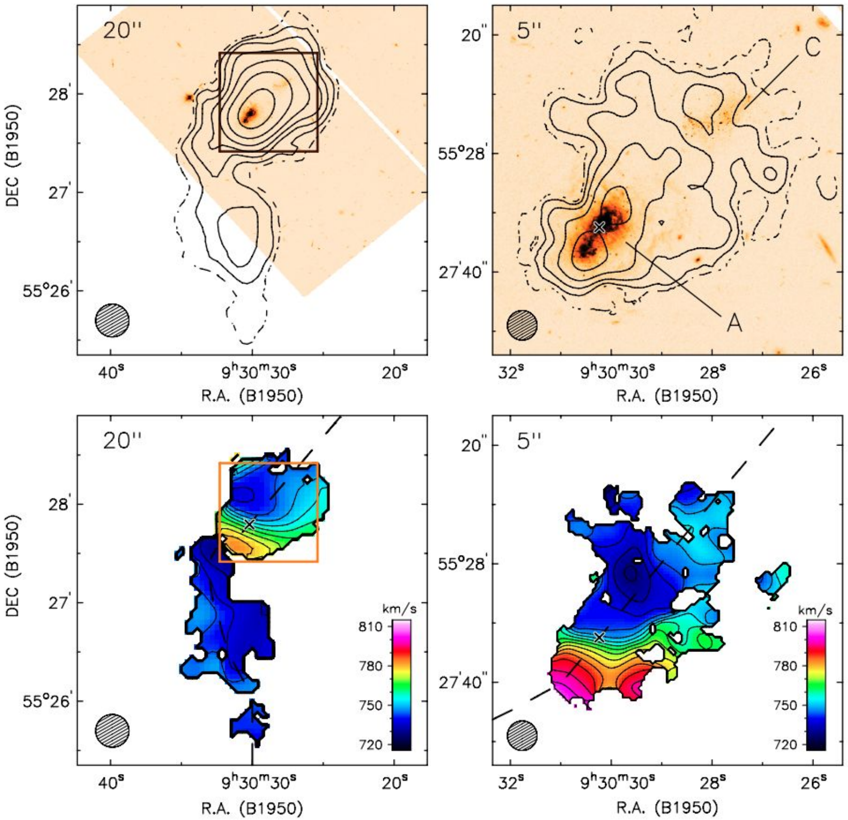

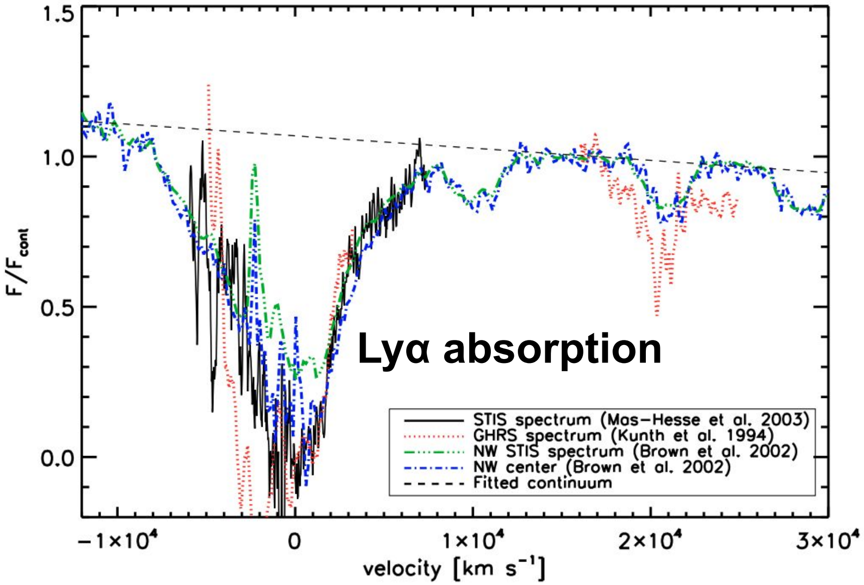

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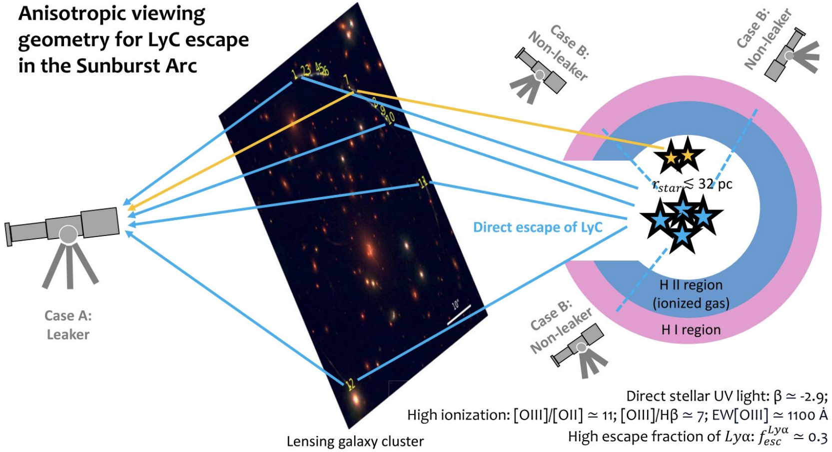
No escape of **ionizing photons** in **IZw18**
in the **line of sight** and at the **present moment**

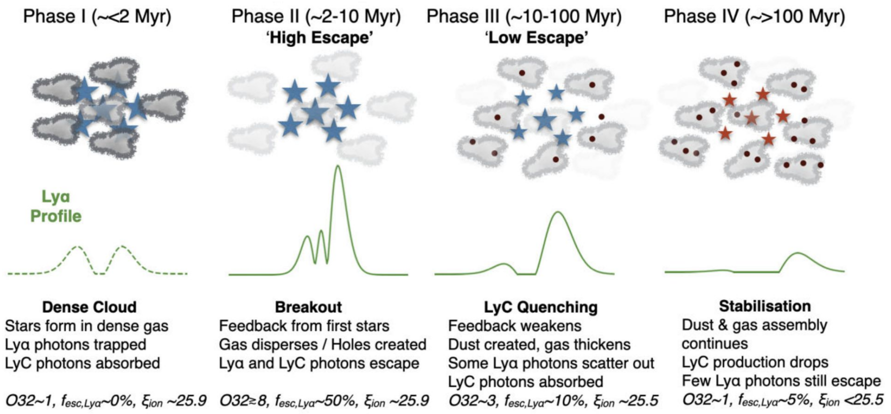
Escape anisotropy and evolution

Anisotropy in the HI / HII gas leaded by **feedback** and mergers



Keunho J. Kim et al. (2023)
Alexandra Le Reste et al. (2023)
Zheng Zheng and Joshua Wallace (2013)

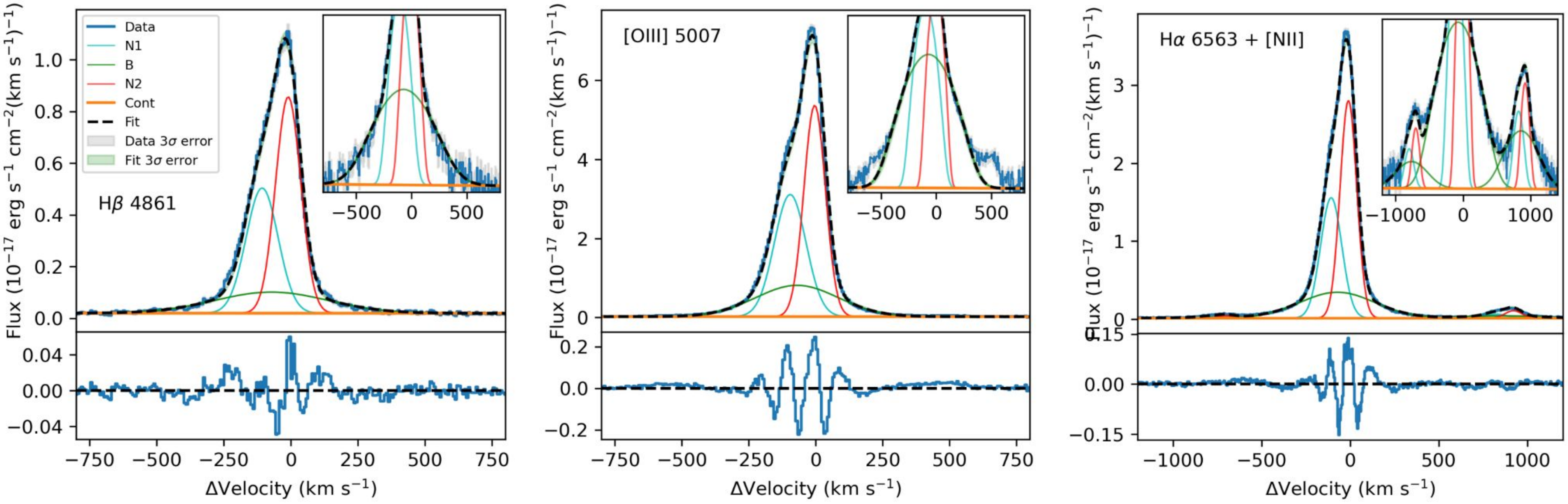
The escape **evolves** with **time**. High escape leaded by stellar **feedback**



Rohan P. Naidu et al. (2022)
Amorin R. et al. (2024)
Flury S. et al. (2024)
Cody A. Carr et al. (2025)

Escape, outflows and gas kinematics

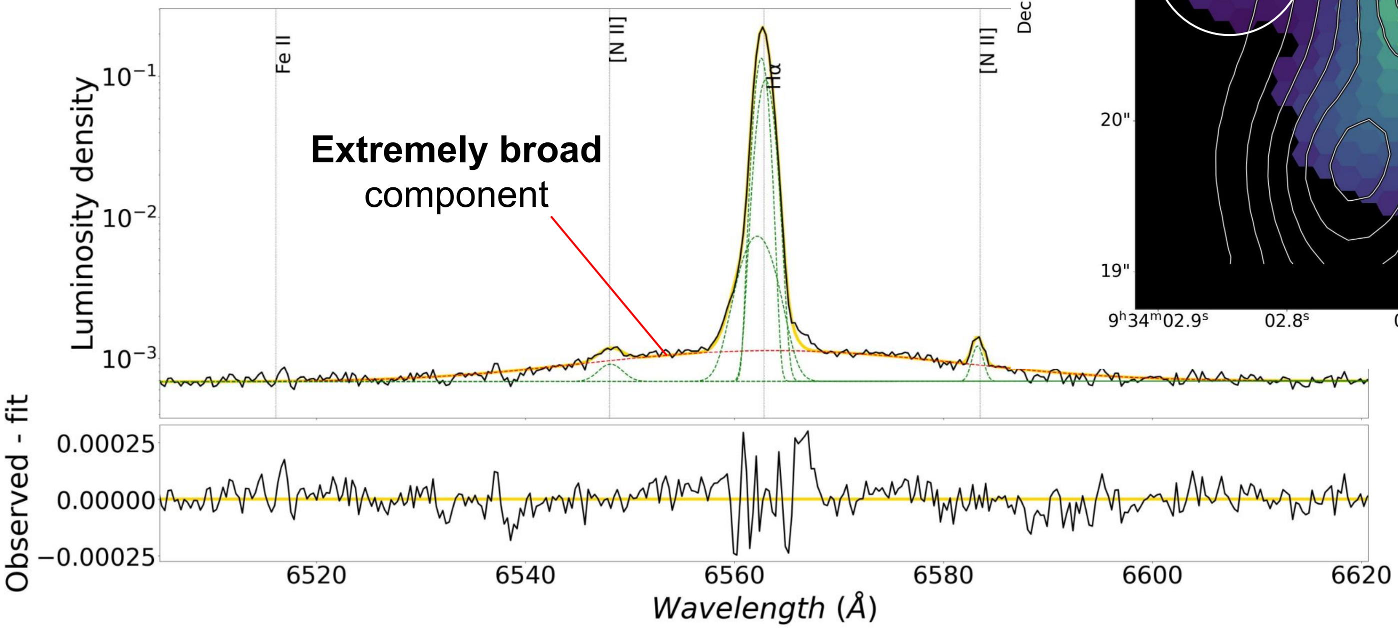
Stellar **feedback** repercussion in bright optical **emission lines**: **Broad blue-shifted components** in the profiles

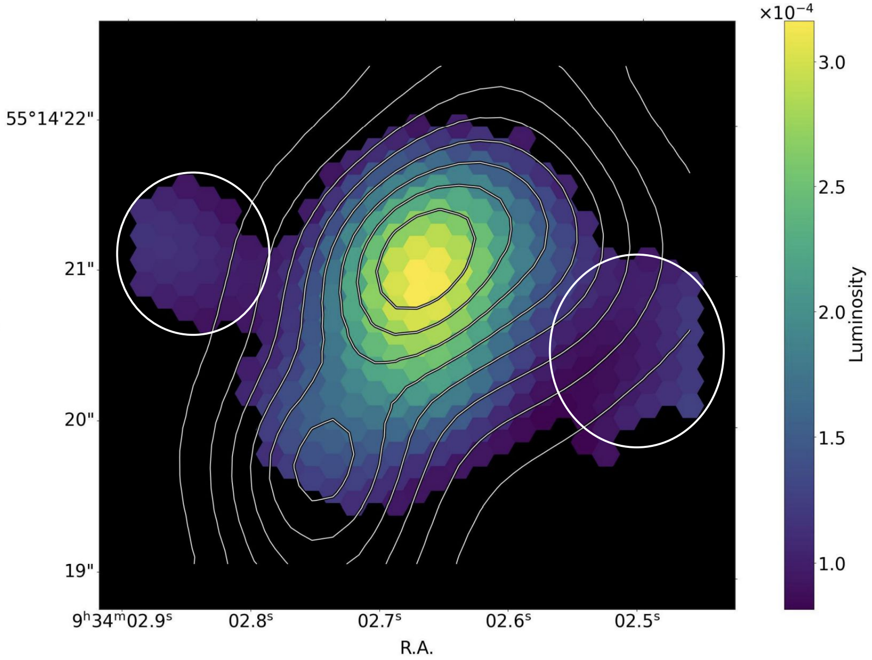


Amorin R. et al. (2024)

Potential ionizing photon escape / Direction

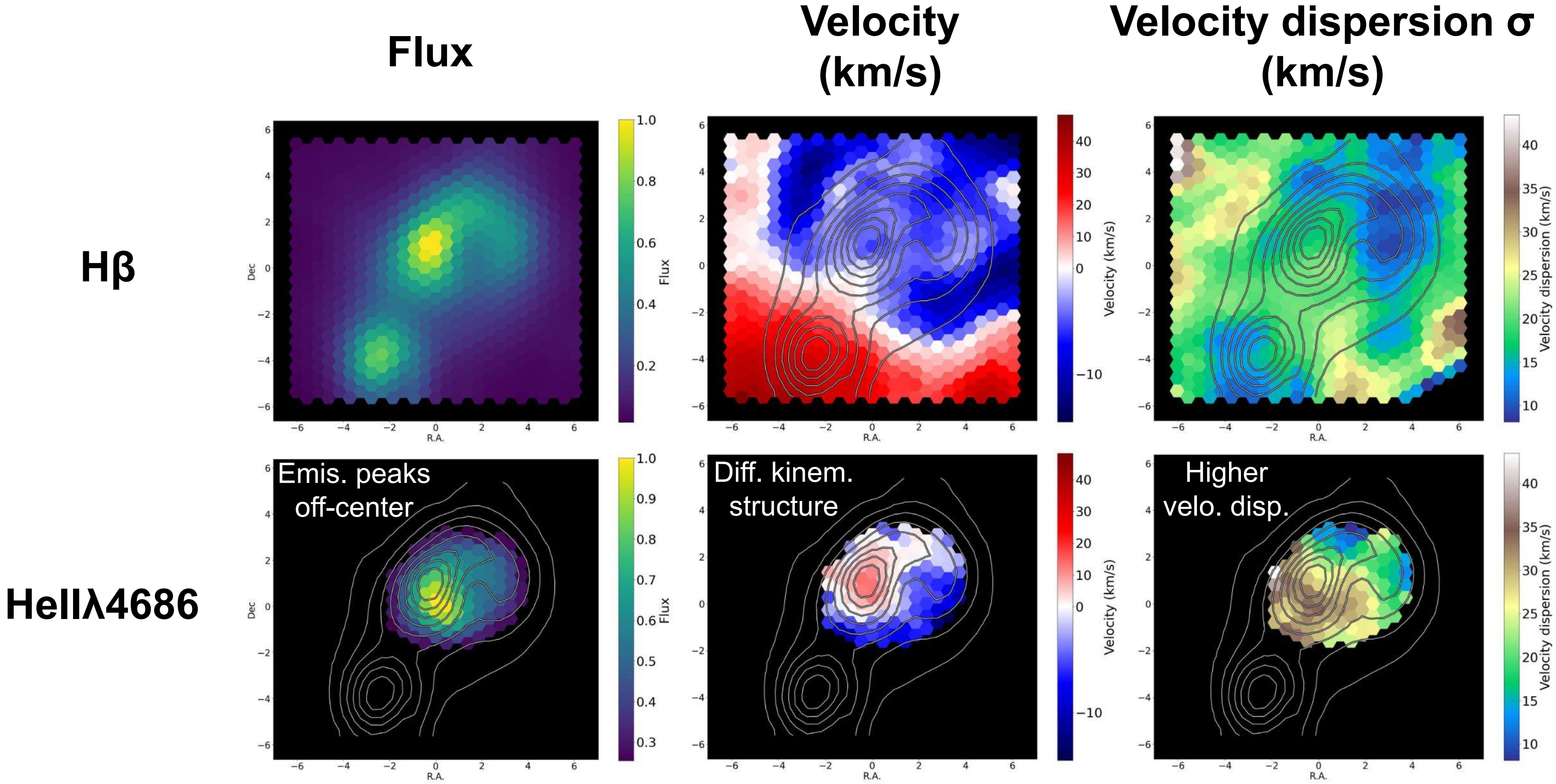
Extremely broad (σ = 600 - 850 km/s) component in **Hα**. **Spatially extended** away from the north knot.





A. Arroyo-Polonio et al. (2024)

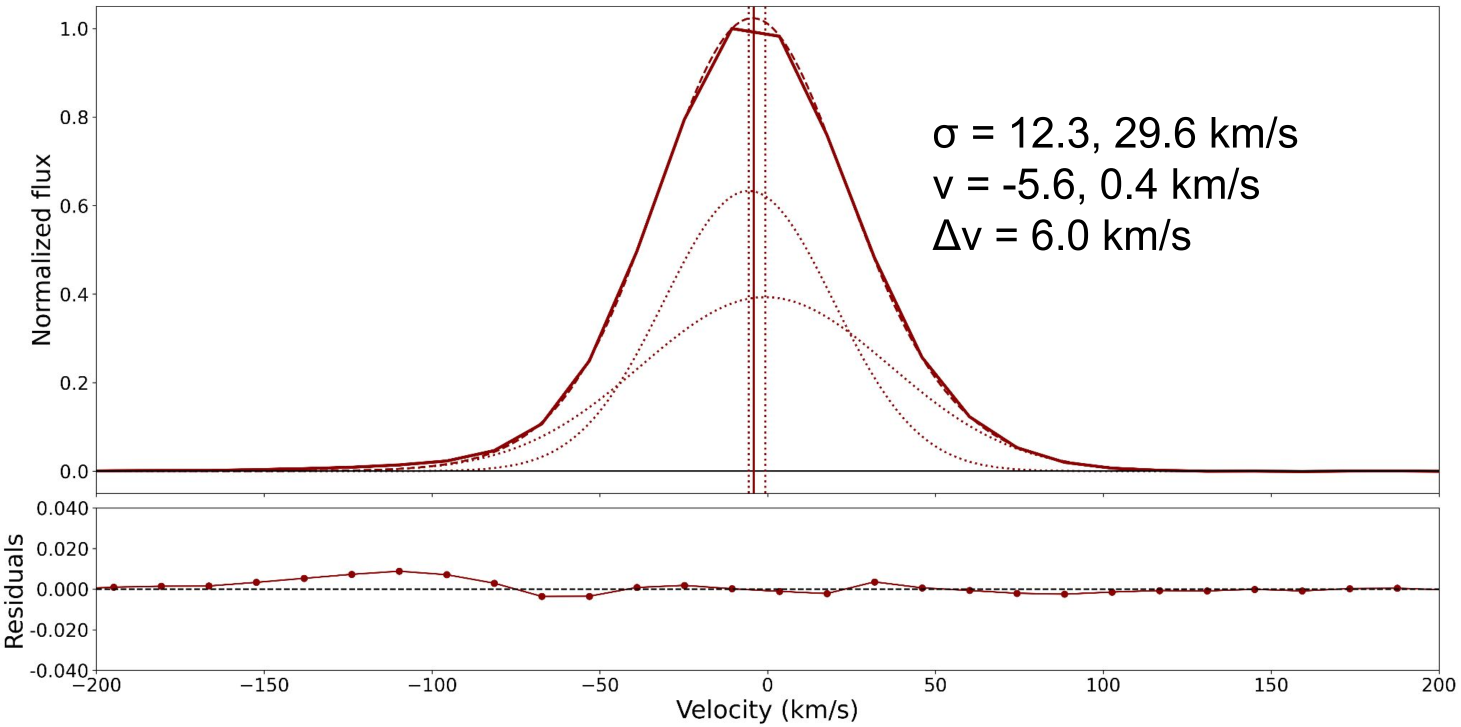
HII and HeIII regions in IZw18



A. Arroyo-Polonio et al. in prep (2025)

Potential ionizing photon escape / Time

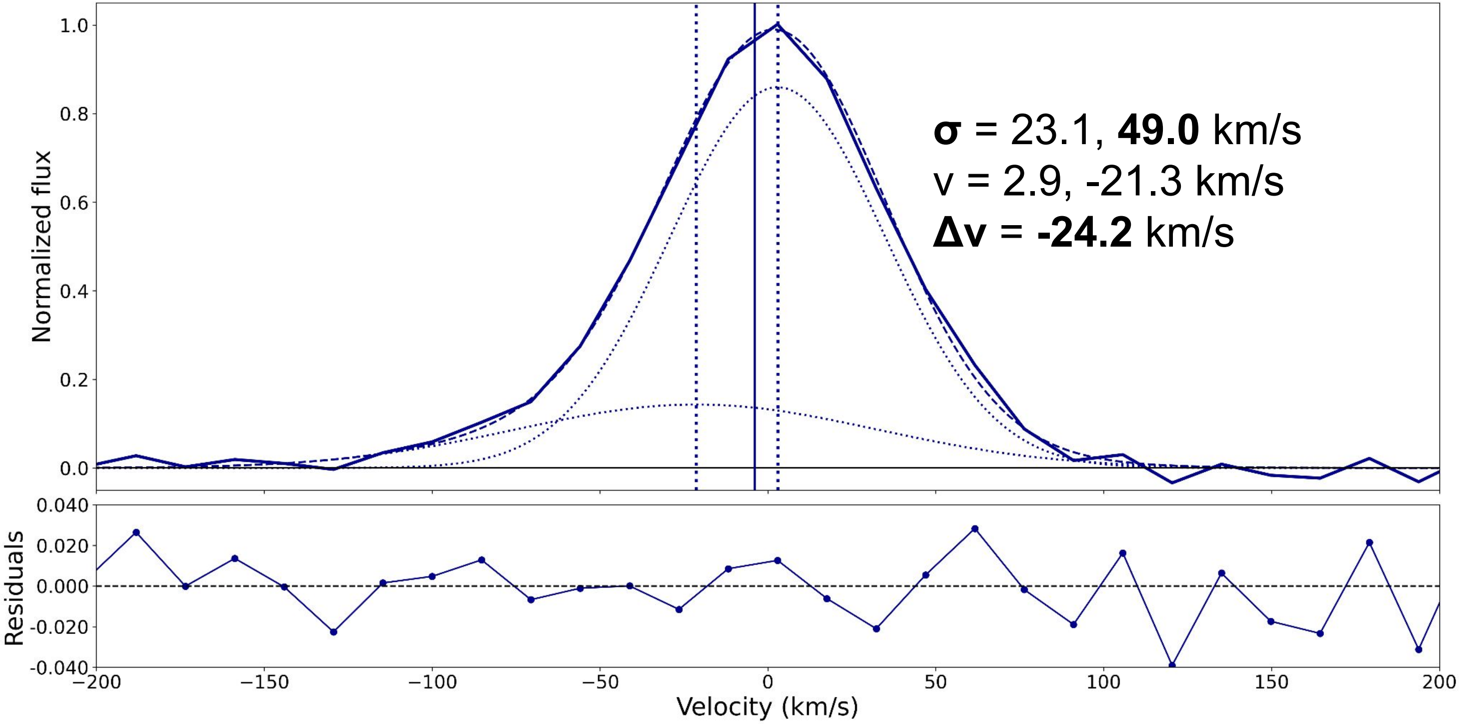
Hβ profile: Narrow and symmetric



A. Arroyo-Polonio et al. in prep (2025)

Potential ionizing photon escape / Time

HeIIλ4686 profile: **Broader** and **asymmetric** - **First stage** of an **outflow**?

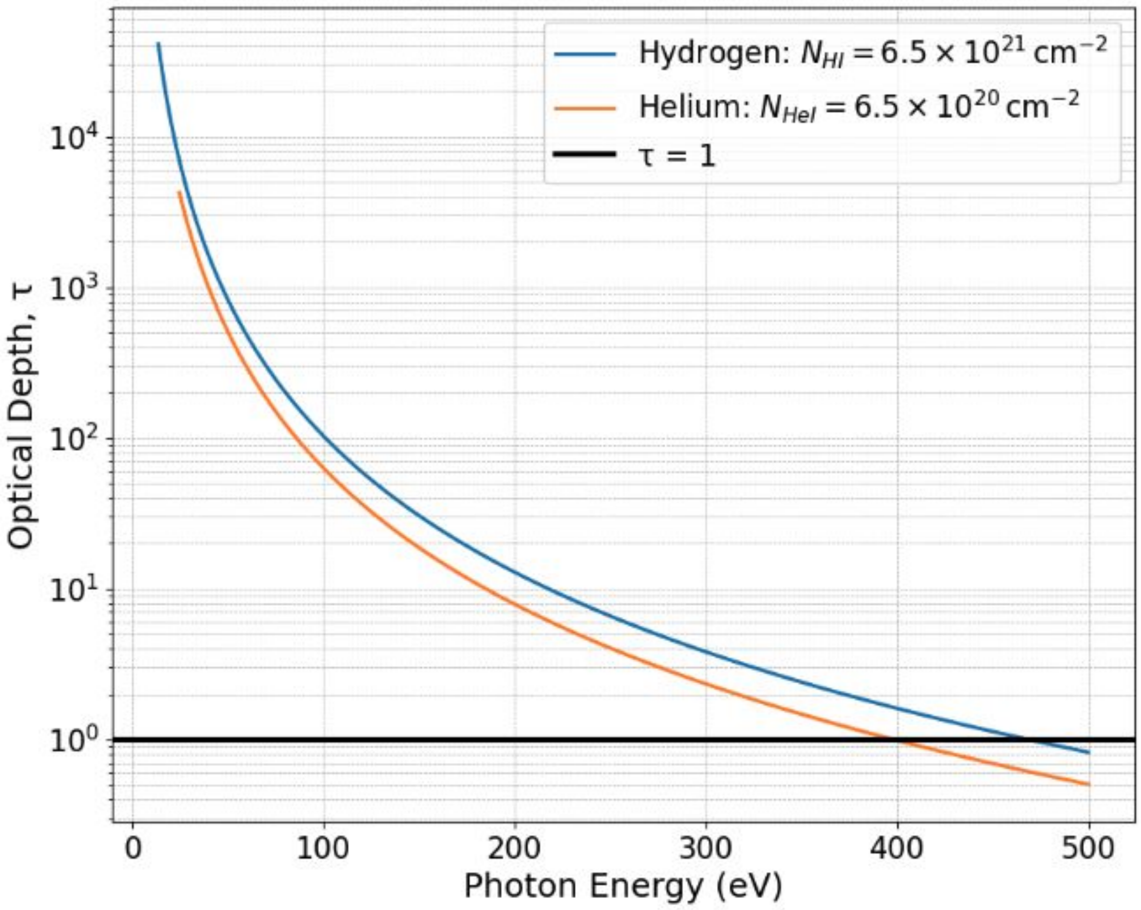


A. Arroyo-Polonio et al. in prep (2025)

Conclusions

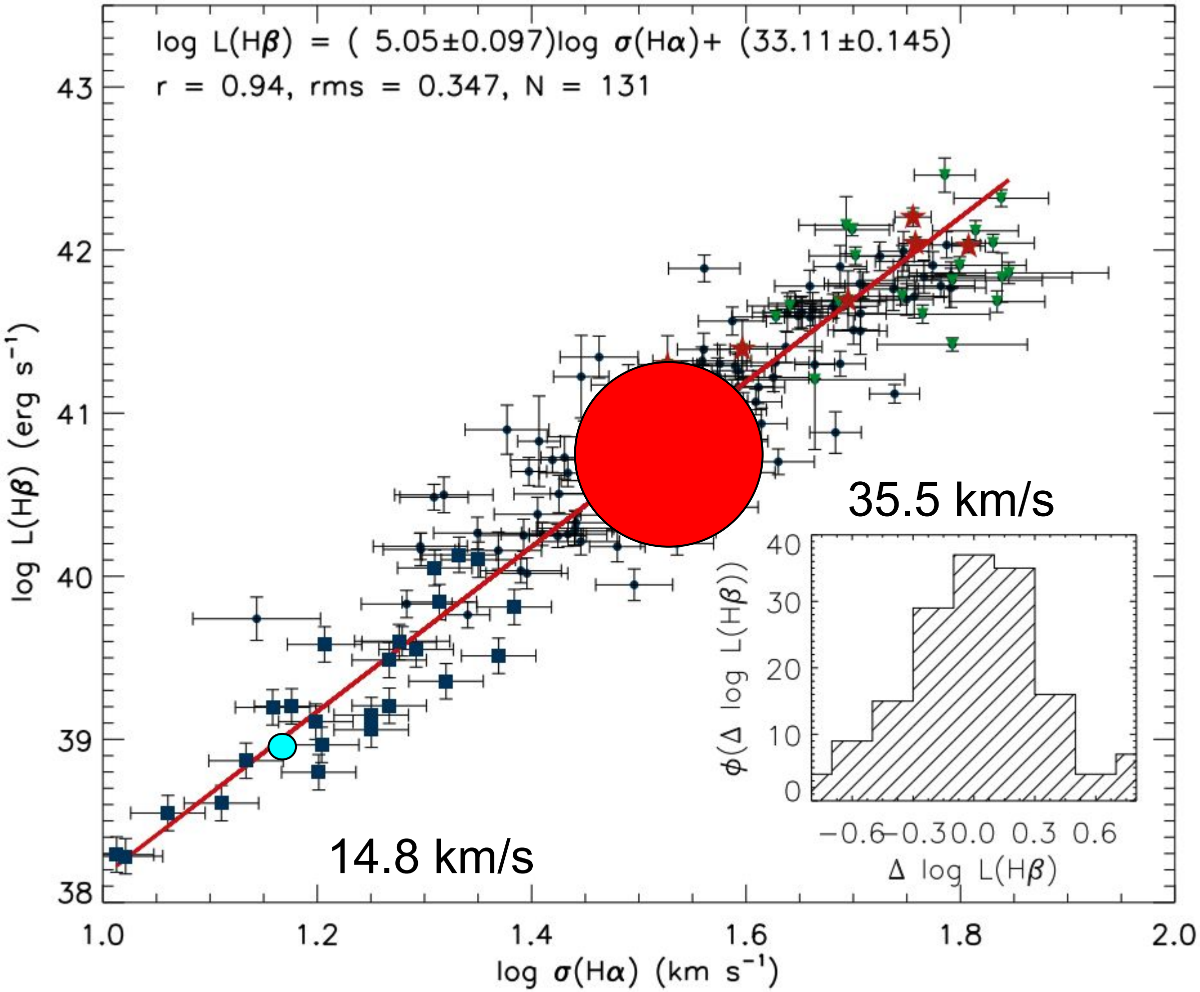
-**High ionizing photon production** in **IZw18** (HI to HII, HeI to HeII and HeII to HeIII) (LyC, HeIC and HeIIC). (13.6 eV, 24.6eV and 54.4eV).
-**Now** and in our **line of sight IZw18** does **not emit ionizing photons** due to the presence of a **HI gas wall**.
-The **escape** of **ionizing photons** is **anisotropic** and **time dependent**. Here **feedback** plays a key role and influences the **gas kinematics**.
-**HII** and **HeIII** regions in **IZw18** present **different structures** and **kinematics**.
-In **IZw18 escape** of **ionizing photons** in **other channels** or in the **future** might be feasible

Thank you!



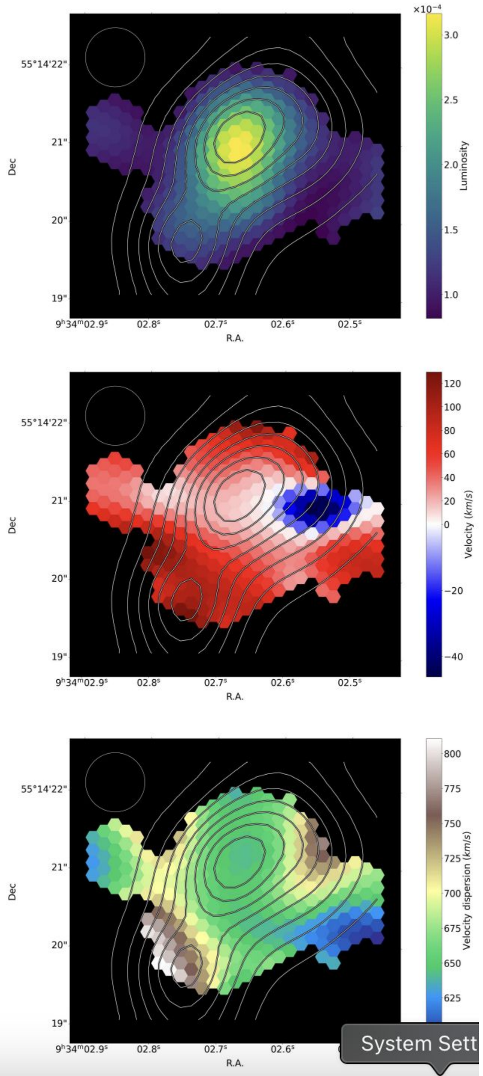
> 4 dex

$N_{HI} = 10^{17}\,\mathrm{cm}^{-2}$

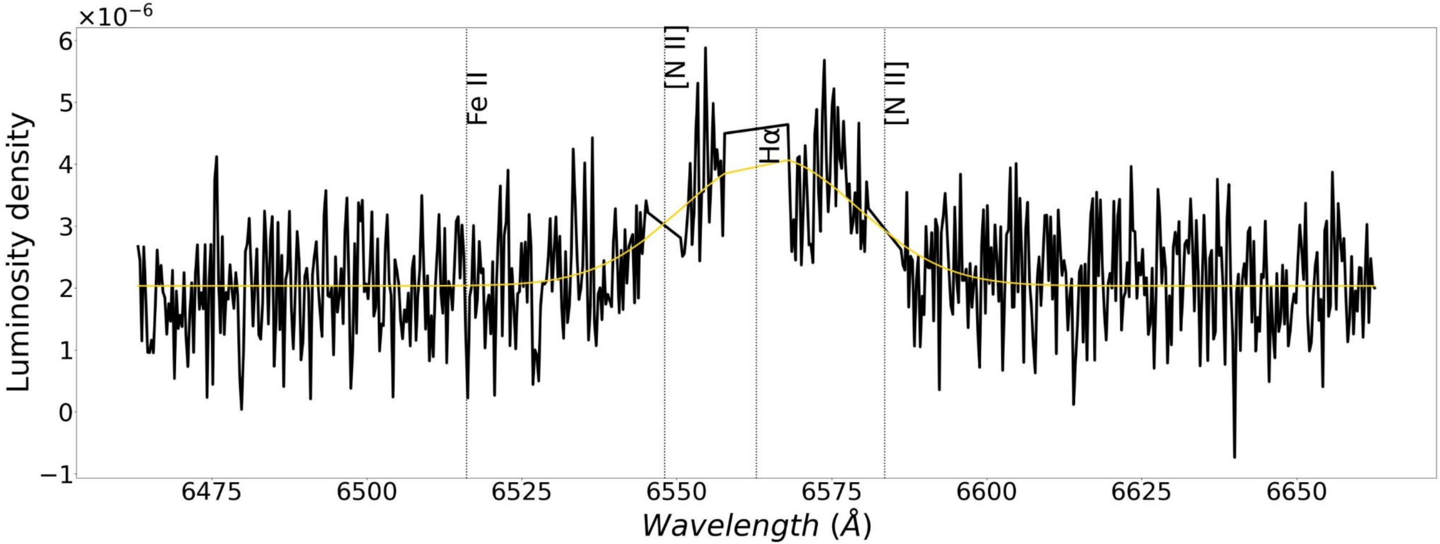


ratio 2.4

Narrow:
40-100 km/s Amorin et al. (2024)
17-42 km/s IZw18
Broad:
100-300 km/s Amorin et al. (2024)
42-125 km/s IZw18



×10⁻⁴
Luminosity
Velocity (km/s)
Velocity dispersion (km/s)
55°14'22"
21"
20"
19"
Dec
9h34m02.9s
02.8s
02.7s
02.6s
02.5s
R.A.
System Sett

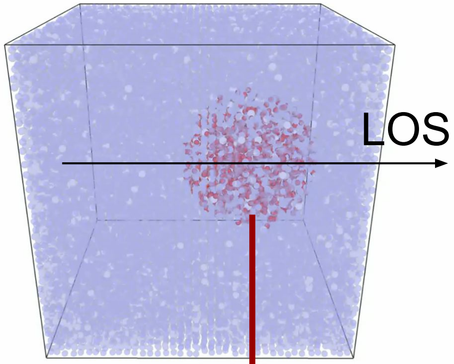


×10⁻⁶
Luminosity density
Fe II
[N II]
Hα
[N II]
Wavelength (Å)

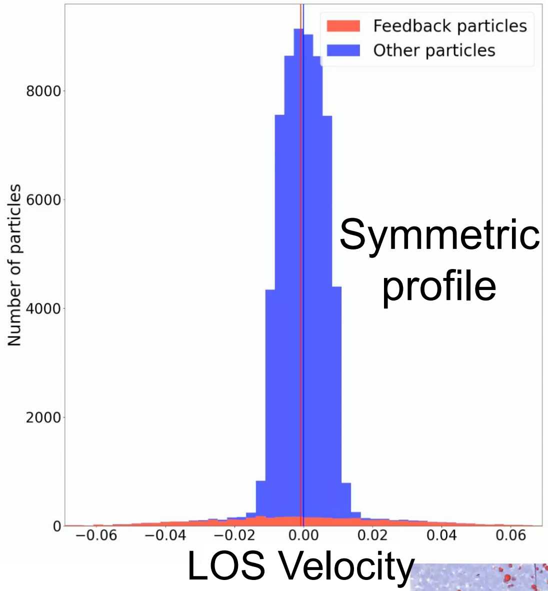
Interpretation: Off-center feedback

*

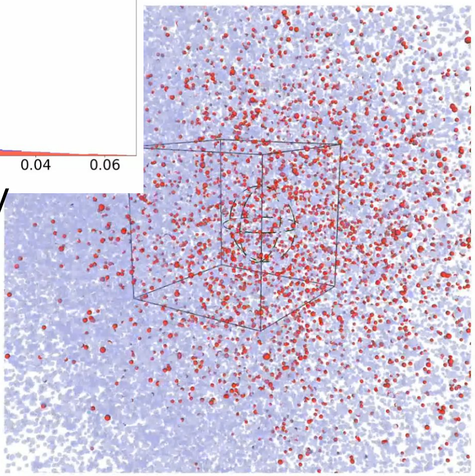
Initial state

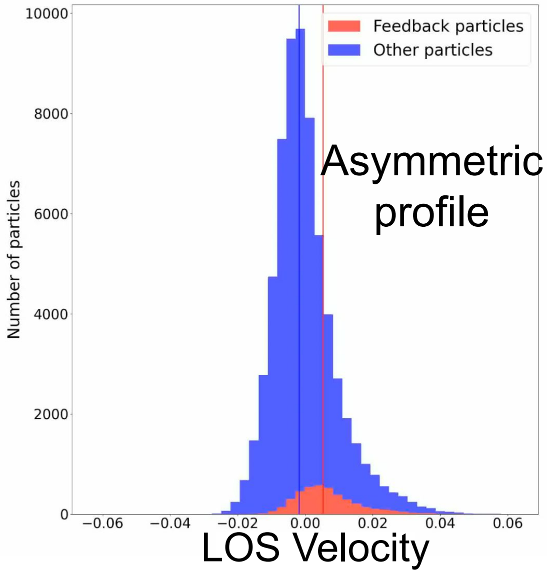


Off-center feedback



Final state





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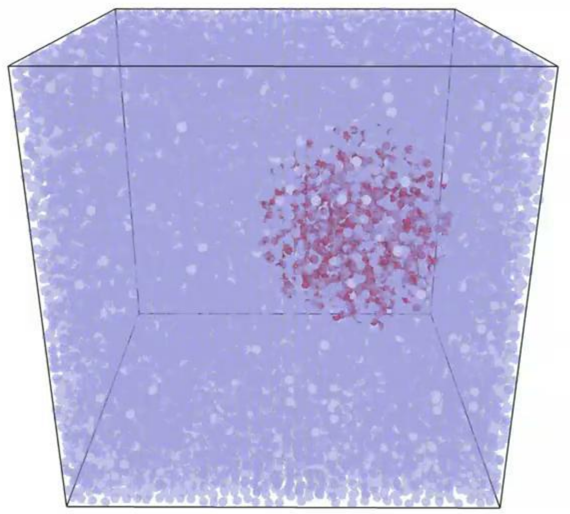

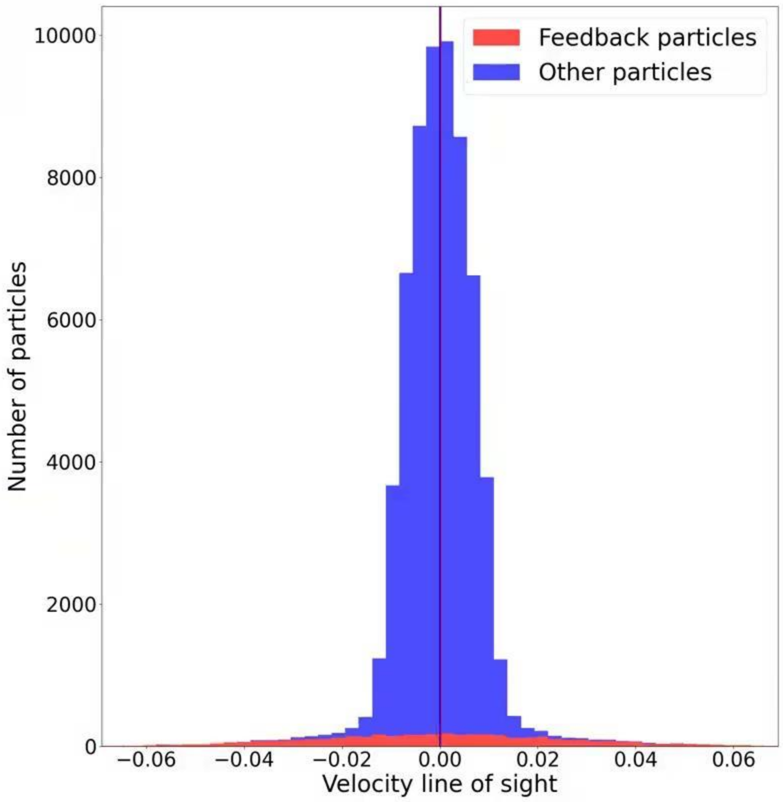

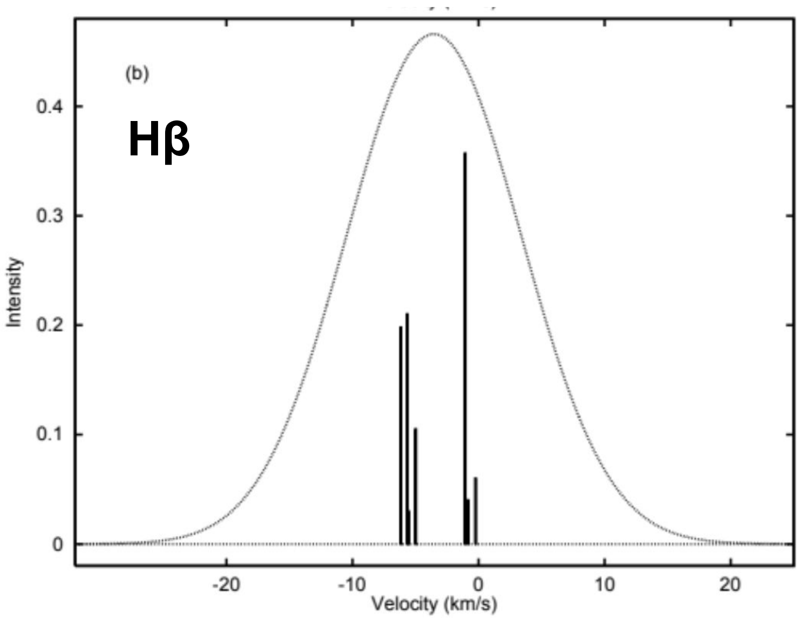

Fig. 1. Profiles of the H I emission lines in velocity space: **a)** – H α, **b)** – H β, **c)** – H γ. The vertical bars show the position and the relative intensity of the seven components of these lines for the Case B, $T_e = 5000\,\mathrm{K}$ and $N_e = 10^4\,\mathrm{cm}^{-3}$. The smooth curve shows these intensities convolved with a velocity of 15.1 $\mathrm{km\,s^{-1}}$, the $FWHM$ for thermal broadening of H at 5000 K

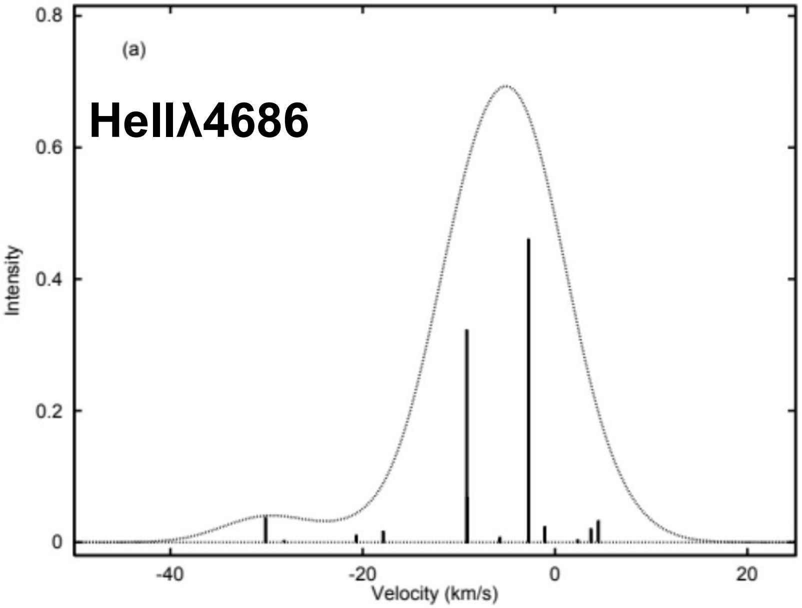

Fig. 2. Profiles of the He II emission lines in velocity space for the Case B, $T_e = 10\,000\,\mathrm{K}$ and $N_e = 10^4\,\mathrm{cm}^{-3}$: **a)** – He II 4686 Å line, **b)** – He II 3203 Å line, **c)** – He II 1215 Å line, **d)** – He II 1640 Å line. The smooth curve shows the component intensities convolved with a velocity of $10.7\,\mathrm{km\,s^{-1}}$, the $FWHM$ for thermal broadening of He at 10 000 K

The Spectral Energy Distribution of Galaxies
Proceedings IAU Symposium No. 284, 2011
R.J. Tuffs & C.C. Popescu, eds.

doi:10.1017/S174392131200871X

What can the UV SED tell us about primitive galaxies?

Sara R. Heap

NASA's Goddard Space Flight Center, Code 667, Greenbelt Maryland, U.S.A.
email: `Sally.Heap@NASA.gov`

Abstract. We use the full SED of a well observed dwarf galaxy, I Zw 18, to evaluate what inferences can be made about very high-redshift galaxies from their UV SED's alone.

Keywords. galaxies: evolution, dwarf, individual (I Zw 18), high-redshift, stellar content

UV-faint galaxies at $z = 7$, which are the bluest galaxies in the WFC3 high-redshift sample, have $\beta = -2.7$ (Bouwens *et al.* 2011). Our studies of the northwest ionizing star cluster in I Zw 18 (Heap *et al.*, in preparation) suggest a stellar CSF age of 10-15 Myr and a metallicity, $[M/H] = -1.7$. Thus, the stellar component should have a $\beta = -2.9$, but its observed value (corrected for foreground reddening) is $\beta = -2.4$. The redder observed UV color may be due to our neglect of possible UV flux contributions from old stars ($\geqslant$ 1 Gyr) in the outskirts of I Zw 18 (Aloisi *et al.* 2007, Contreres Ramos *et al.* 2011). More likely, it is due to nebular continuum emission and/or dust absorption, a topic we take up in the next section.

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Anisotropy:

pequeña region < 100pc en sunburst arc donde se escapan LyC photons. destancan anisotropia y feedback estelar
https://iopscience.iop.org/article/10.3847/2041-8213/acf0c5/meta

haro 11 merger quitando HI de en medio y facilitando produccion de LyC, fuente de anisotropias y evolucion temporal
https://academic.oup.com/mnras/article/528/1/757/7491076

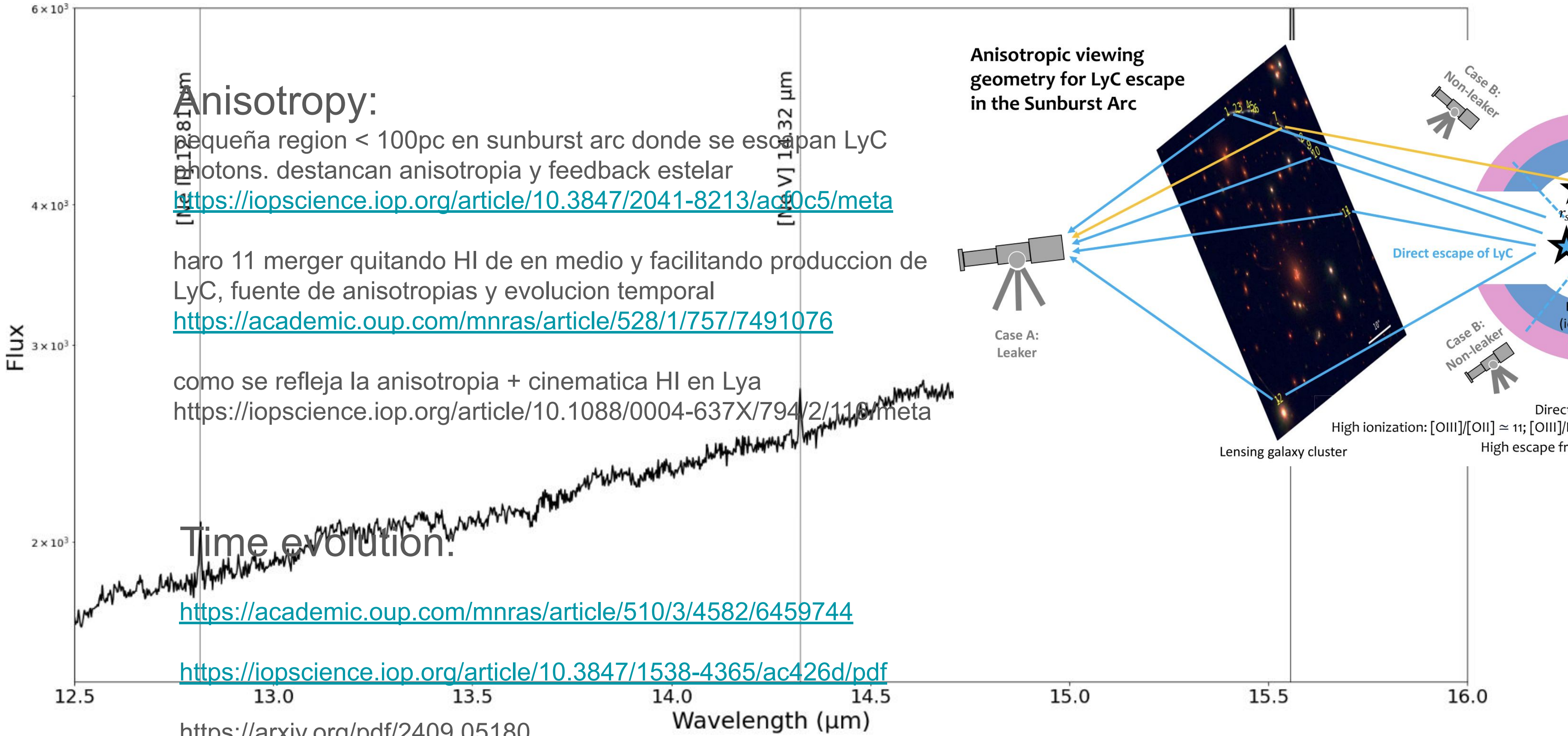
como se refleja la anisotropia + cinematica HI en Lya
https://iopscience.iop.org/article/10.1088/0004-637X/794/2/116/meta

Time evolution:

https://academic.oup.com/mnras/article/510/3/4582/6459744

https://iopscience.iop.org/article/10.3847/1538-4365/ac426d/pdf

https://arxiv.org/pdf/2409.05180



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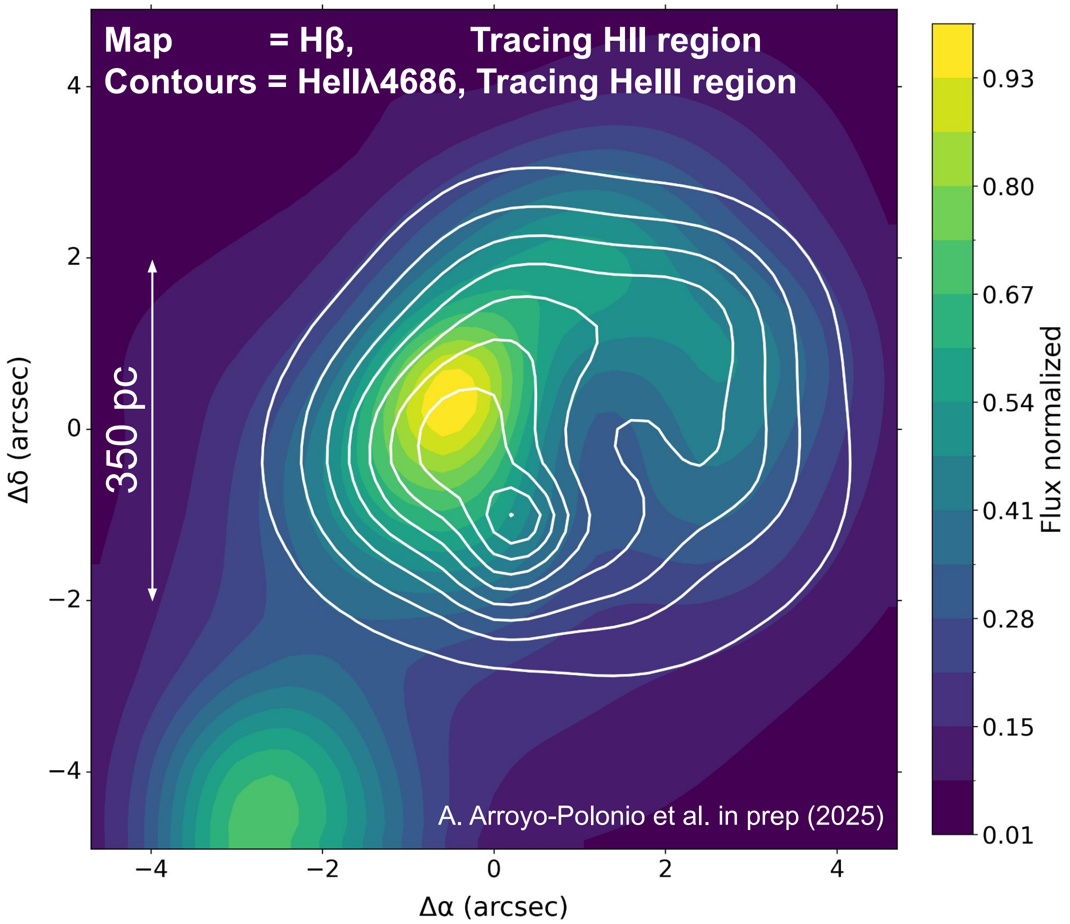

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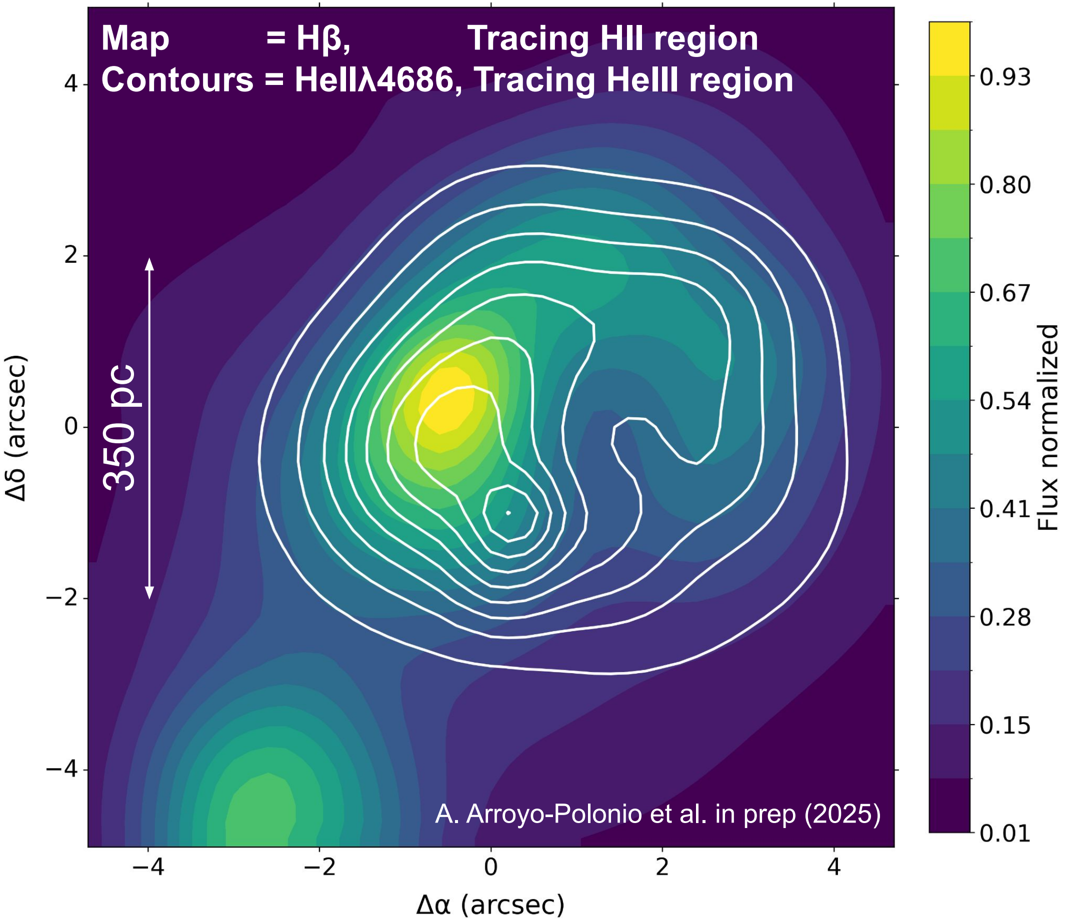

Potential ionizing photon escape / Time

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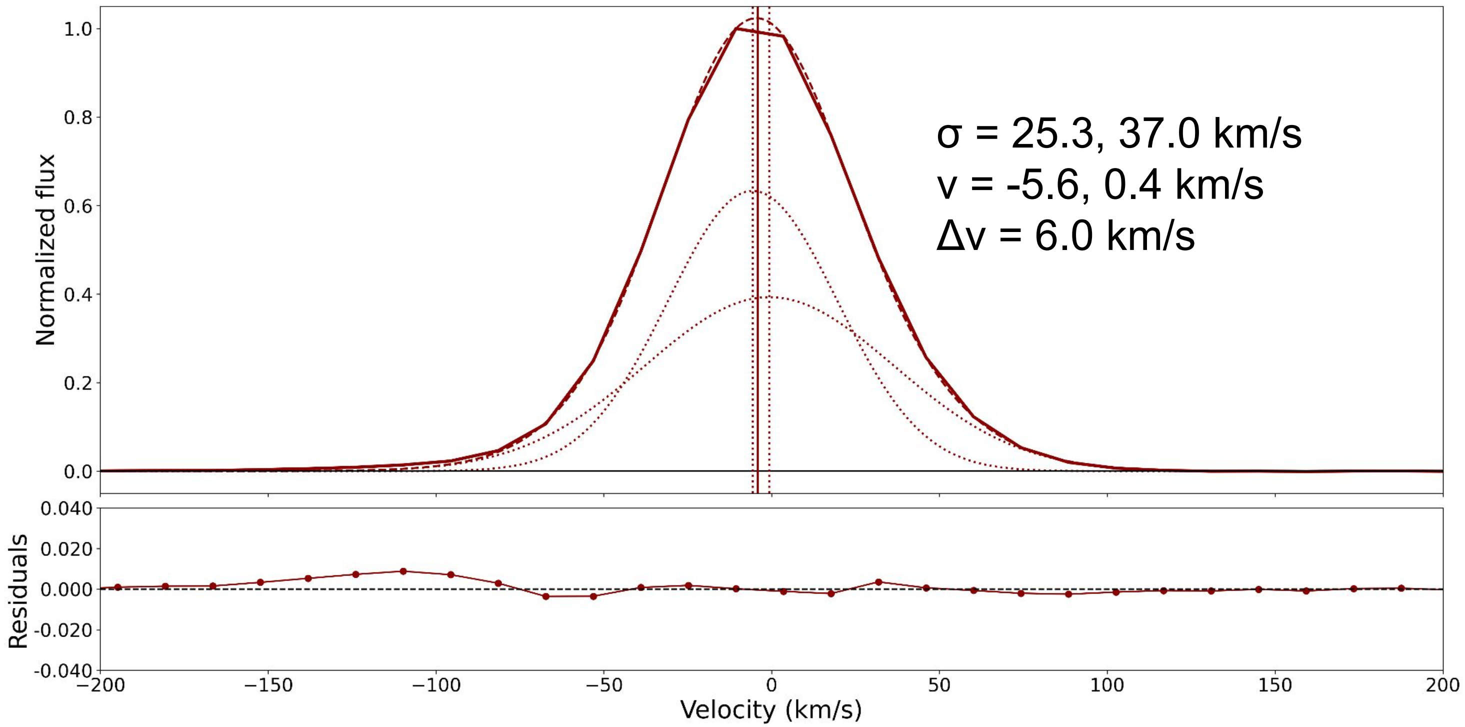

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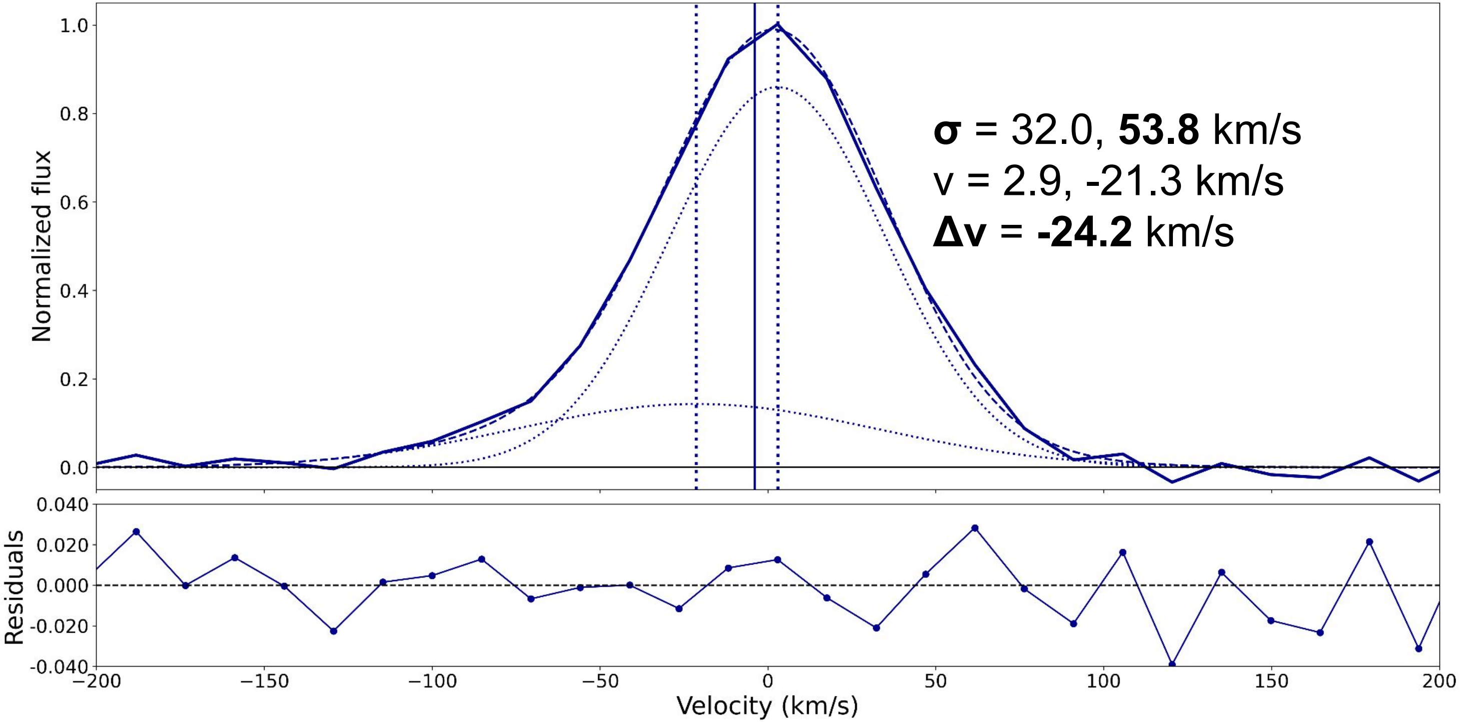

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