Lyα Emission in Low Metallicity Galaxies at z~2

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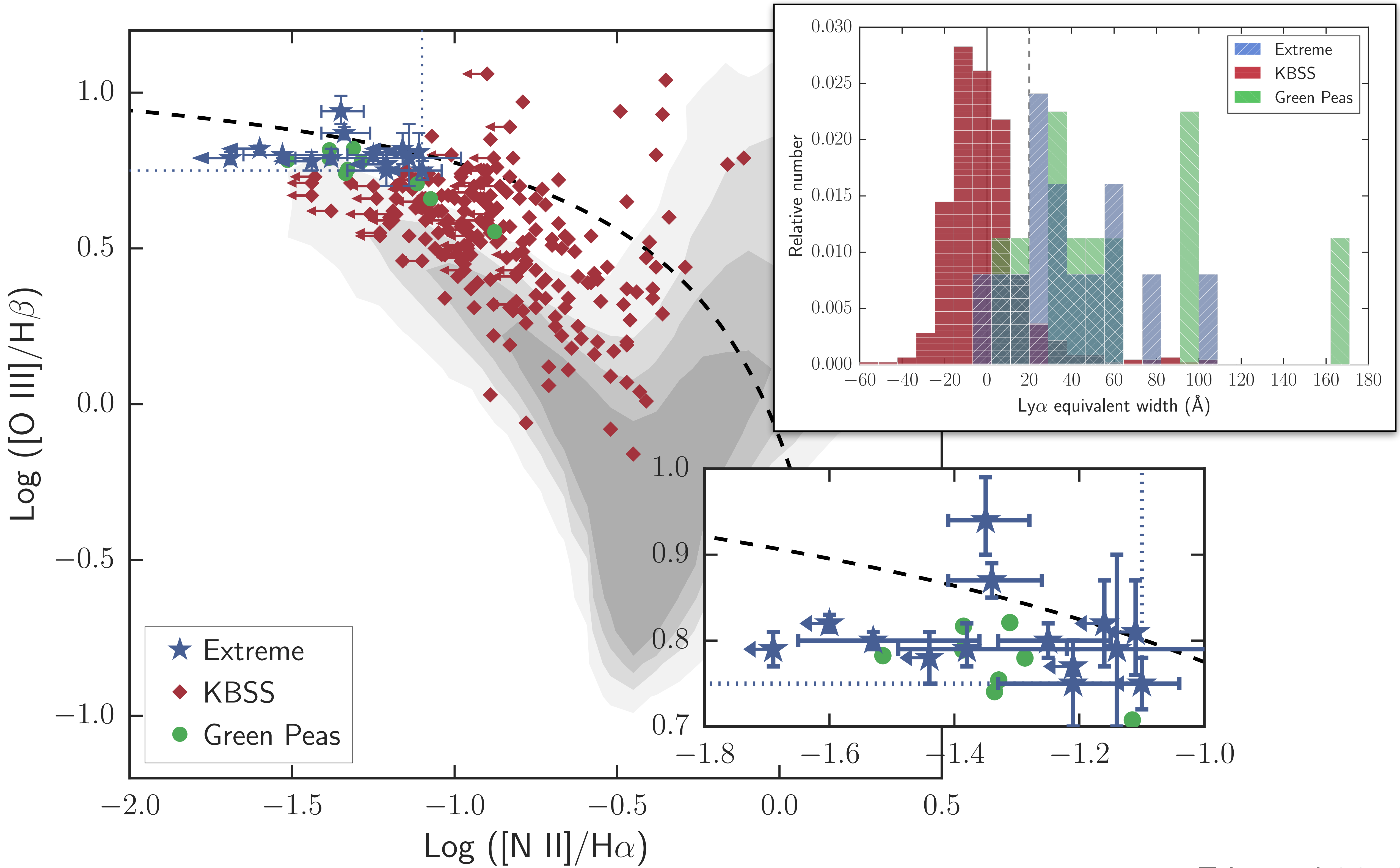
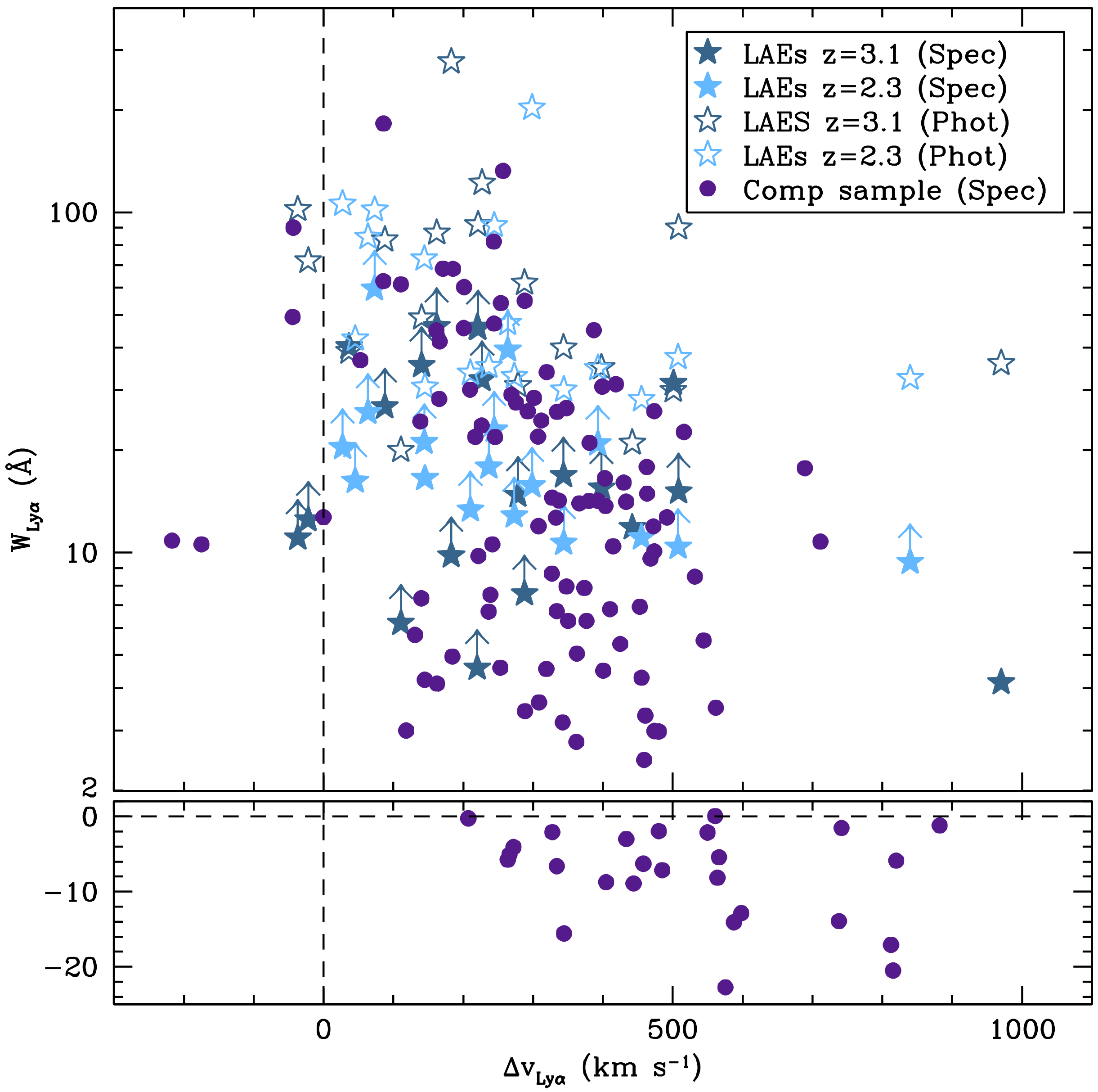
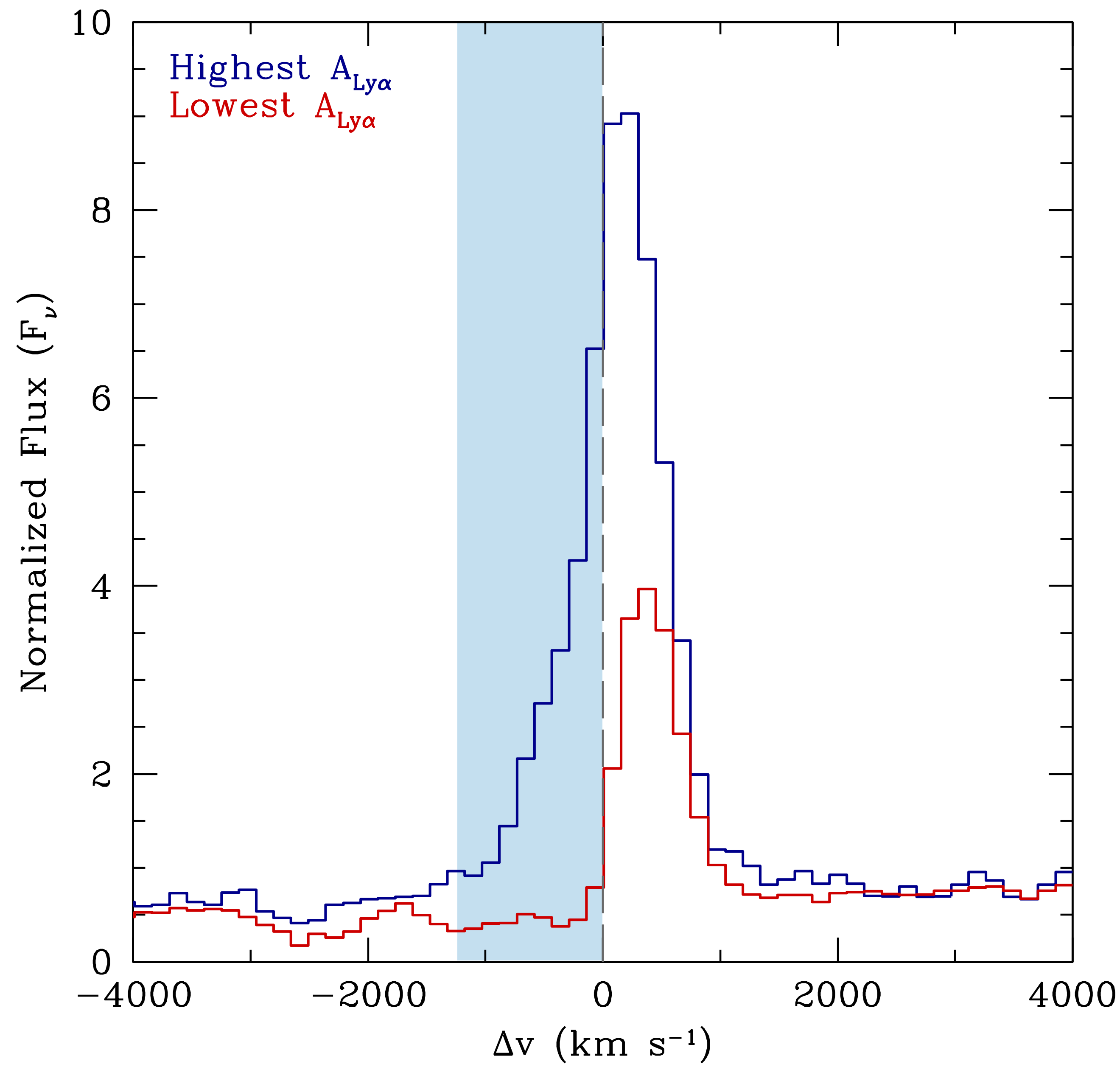
Lyα emission stronger at low metallicity



Erb et al 2016
see also Trainor et al 2016

Relationships between strength and line profile



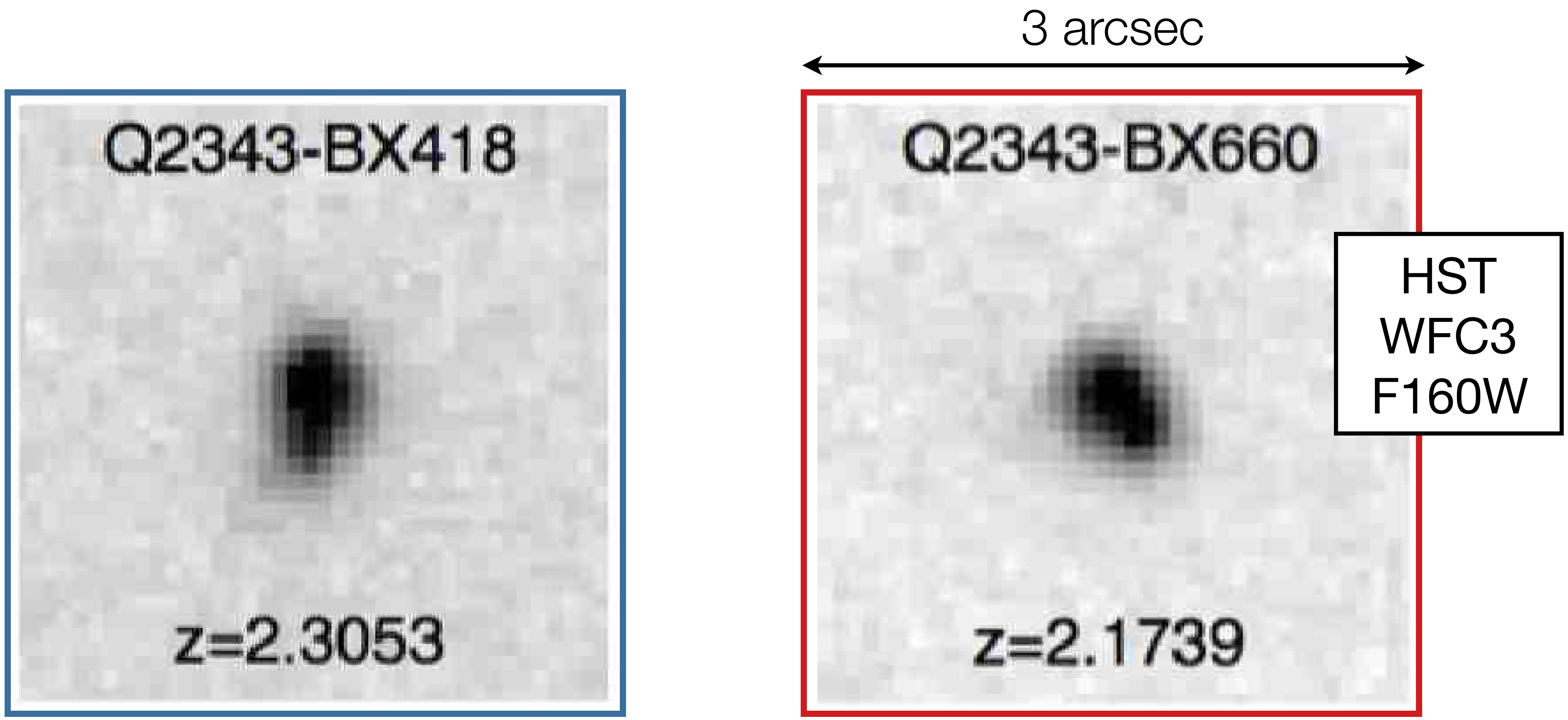


Lyα equivalent width anti-correlated with velocity offset

Double peaks unresolved at low resolution

Erb et al 2014

Diversity among Lyα-emitters



Law et al 2012

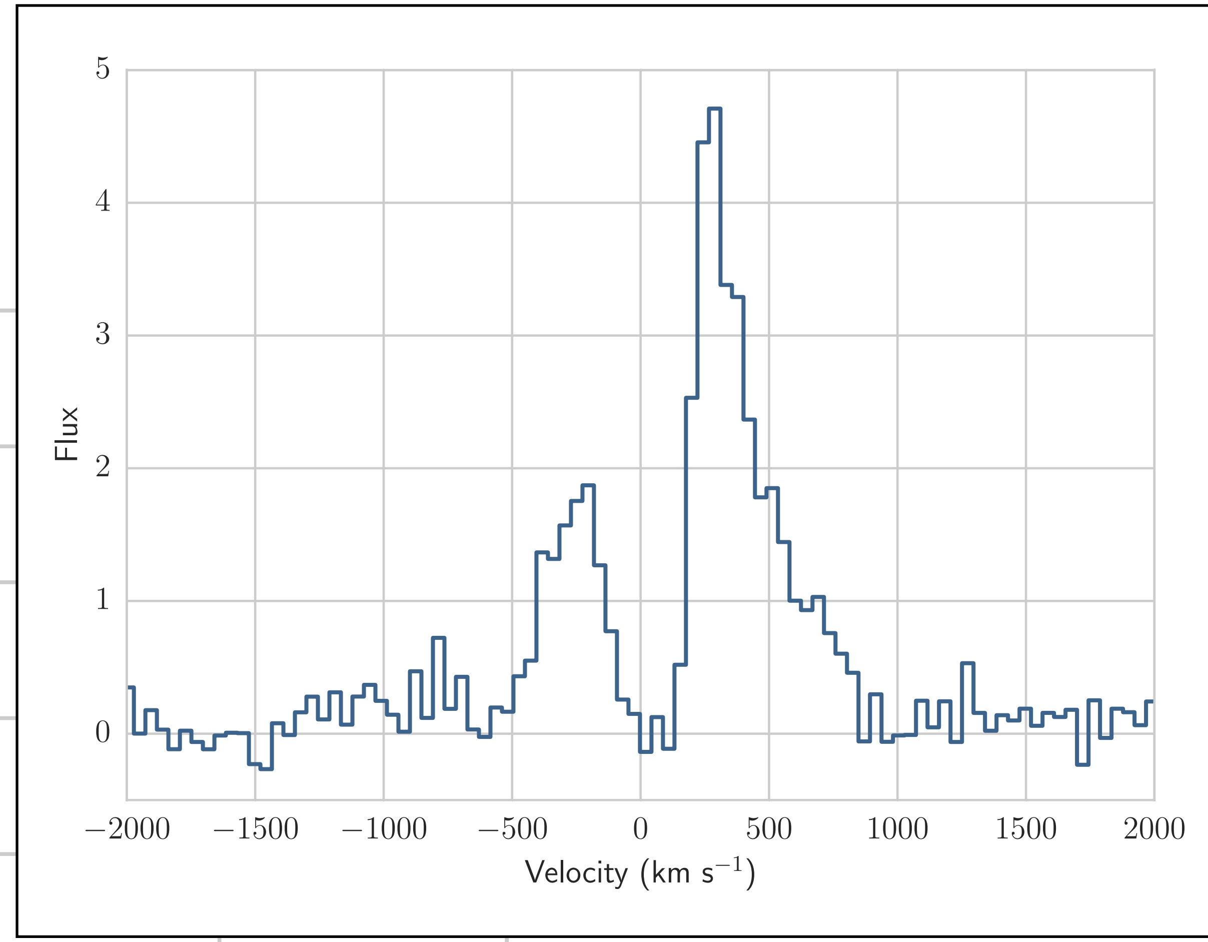
Q2343-BX418
$M_\star = 2 \times 10^9\ M_\odot$
SFR = 50 $M_\odot\ yr^{-1}$
SSFR = 18 Gyr^{-1}
12 + log(O/H) = 8.08 (T_e)
O32 = 9.66

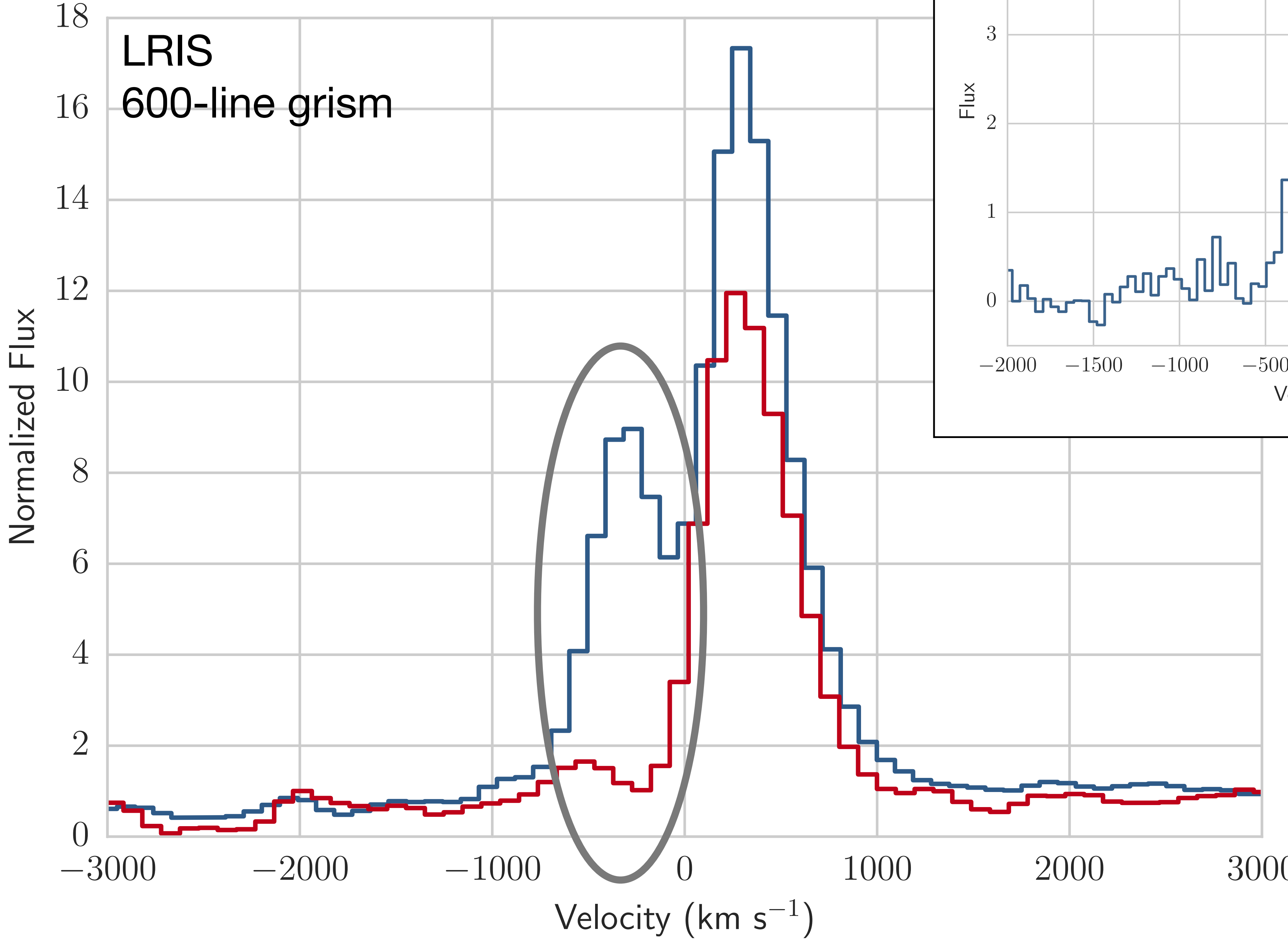
Q2343-BX660
$M_\star = 5 \times 10^9\ M_\odot$
SFR = 23 $M_\odot\ yr^{-1}$
SSFR = 4 Gyr^{-1}
12 + log(O/H) = 8.13 (T_e)
O32 = 10.98

O/H, O32 from Steidel et al 2014

Lyα profile variations

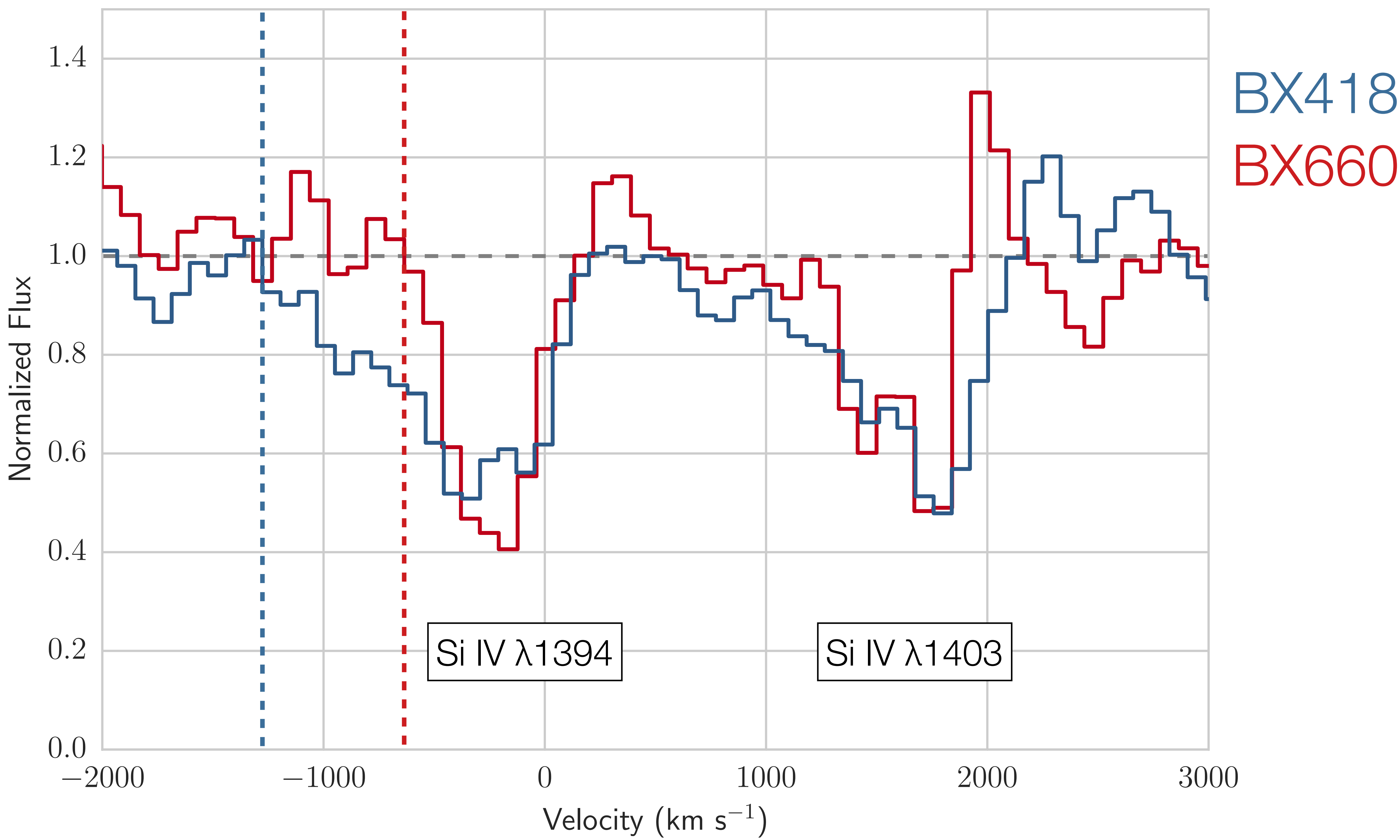
BX418 with VLT XSHOOTER
R=6200
Archival data, Terlevich et al 2015





Erb et al 2018a, in prep

Absorption lines trace variations in outflows



Erb et al 2018a, in prep

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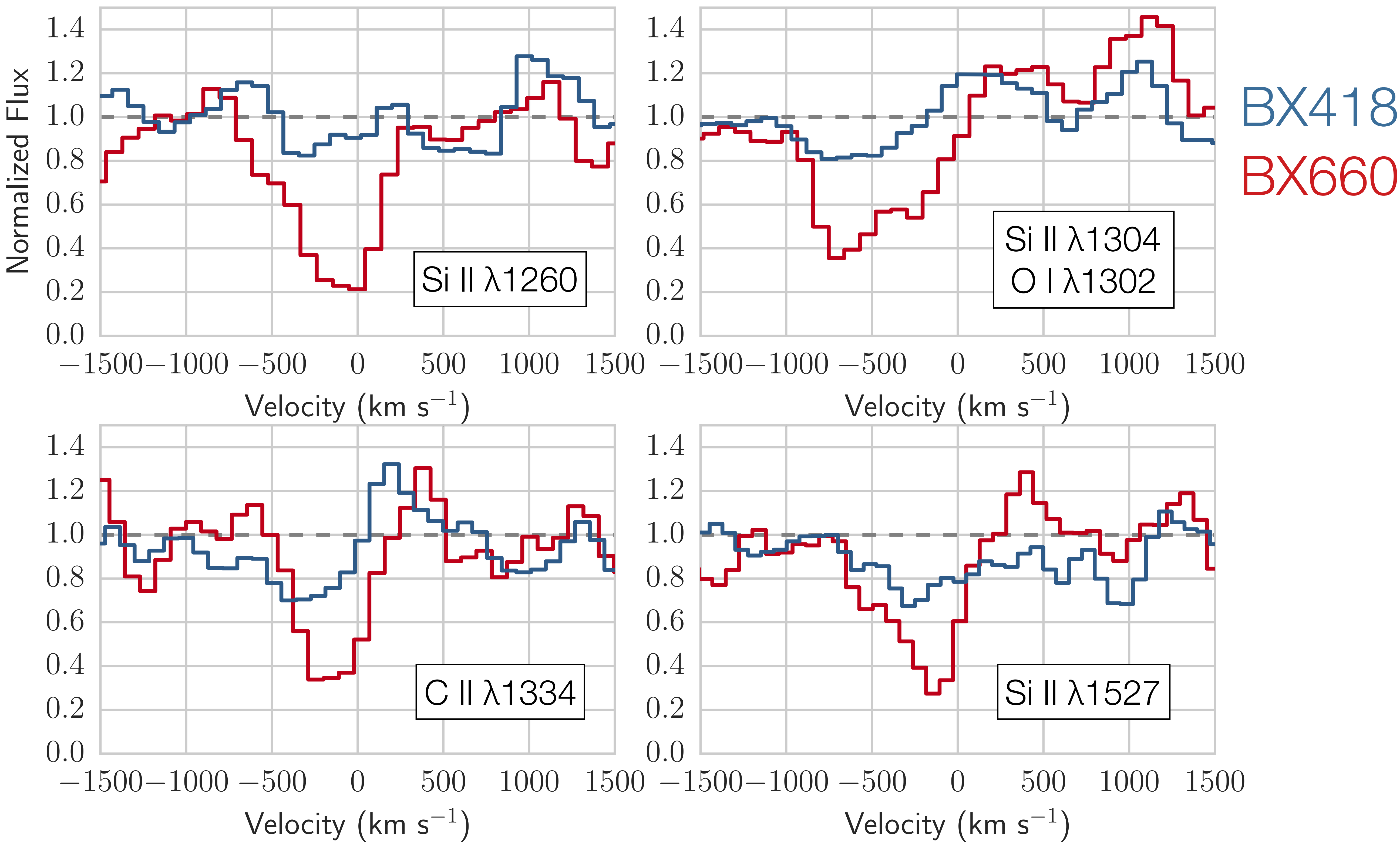
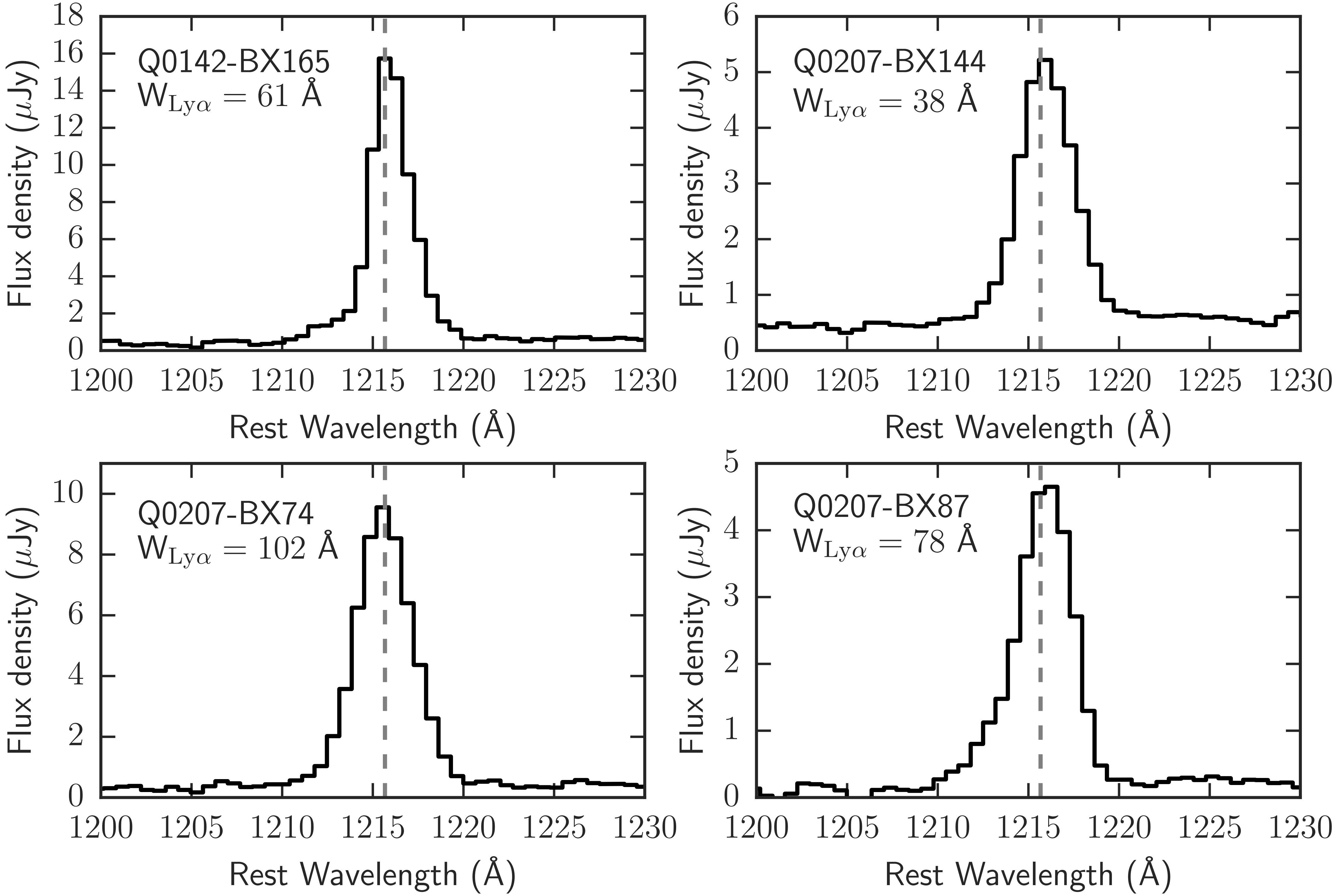


Erb et al 2018a, in prep

Analysis of larger sample underway

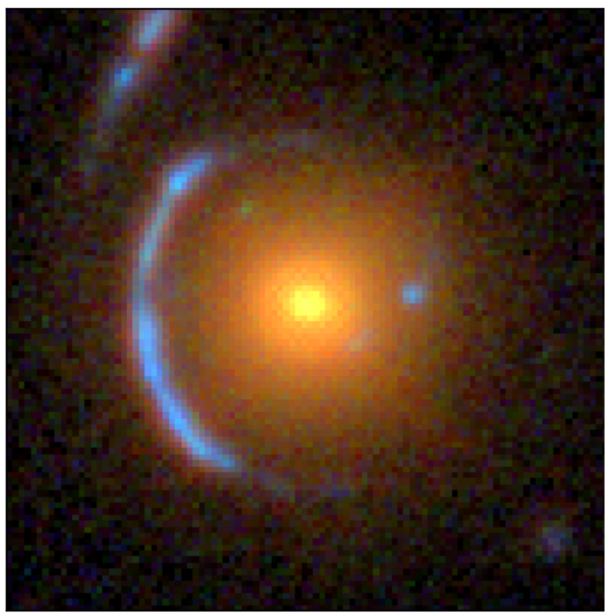


Erb et al 2018a, in prep

Implications and next steps

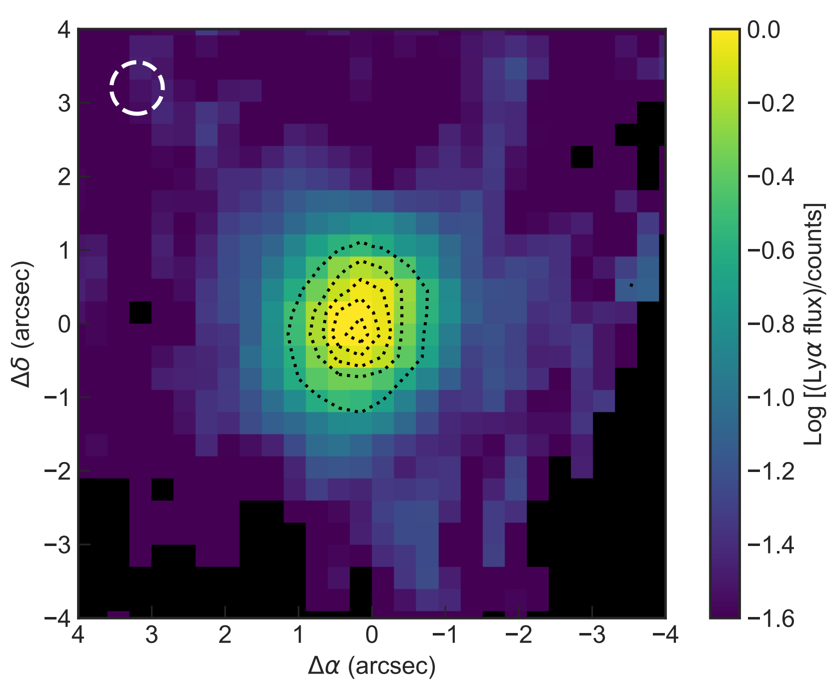
Otherwise similar low metallicity galaxies have varying CGM properties: relevant to LyC escape

Low metallicity and high ionization necessary but not sufficient



1

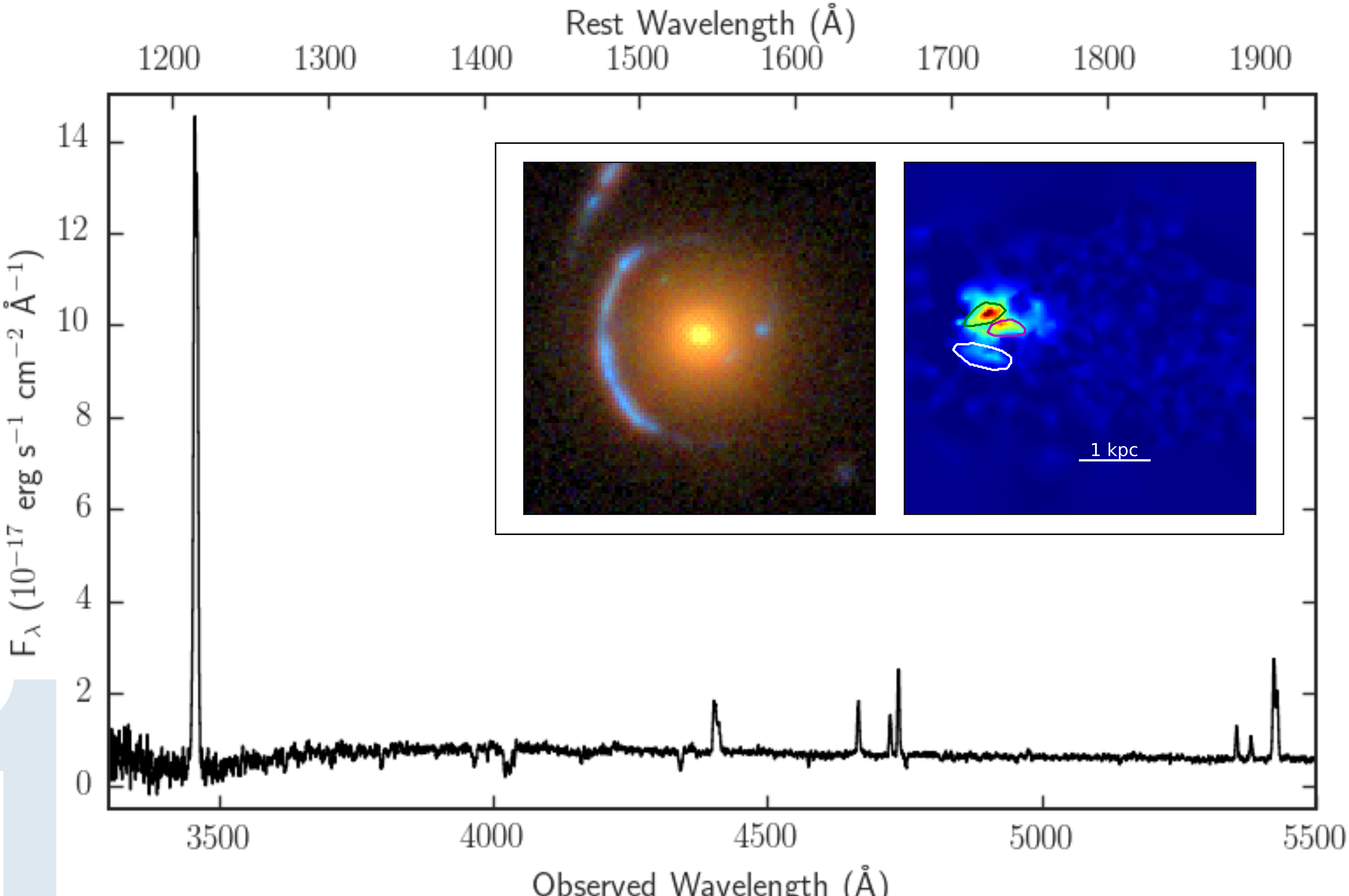
Expanding the sample:
what can we learn from the most extreme objects?



2

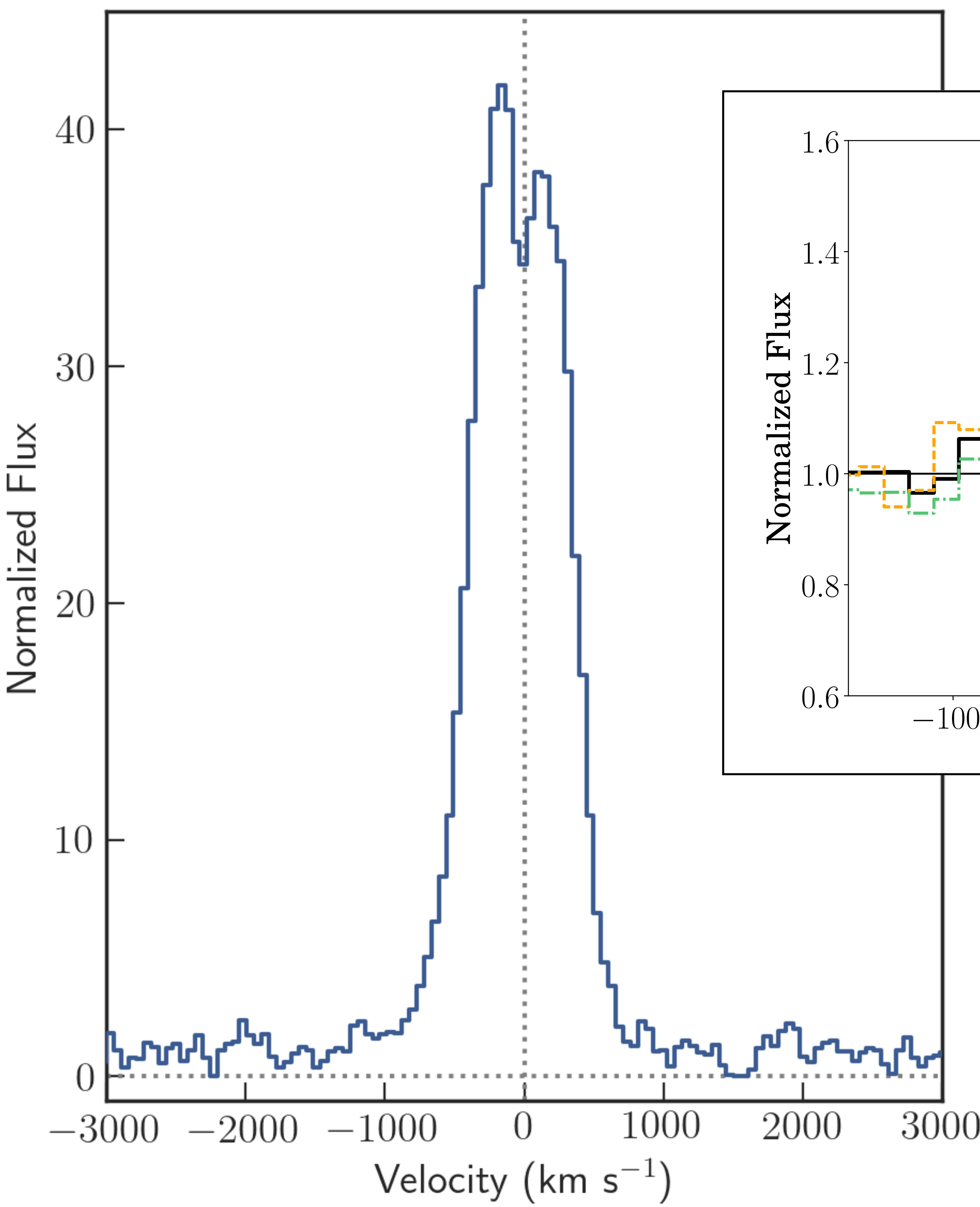
New results from KCWI:
what can we learn from integral field spectroscopy?

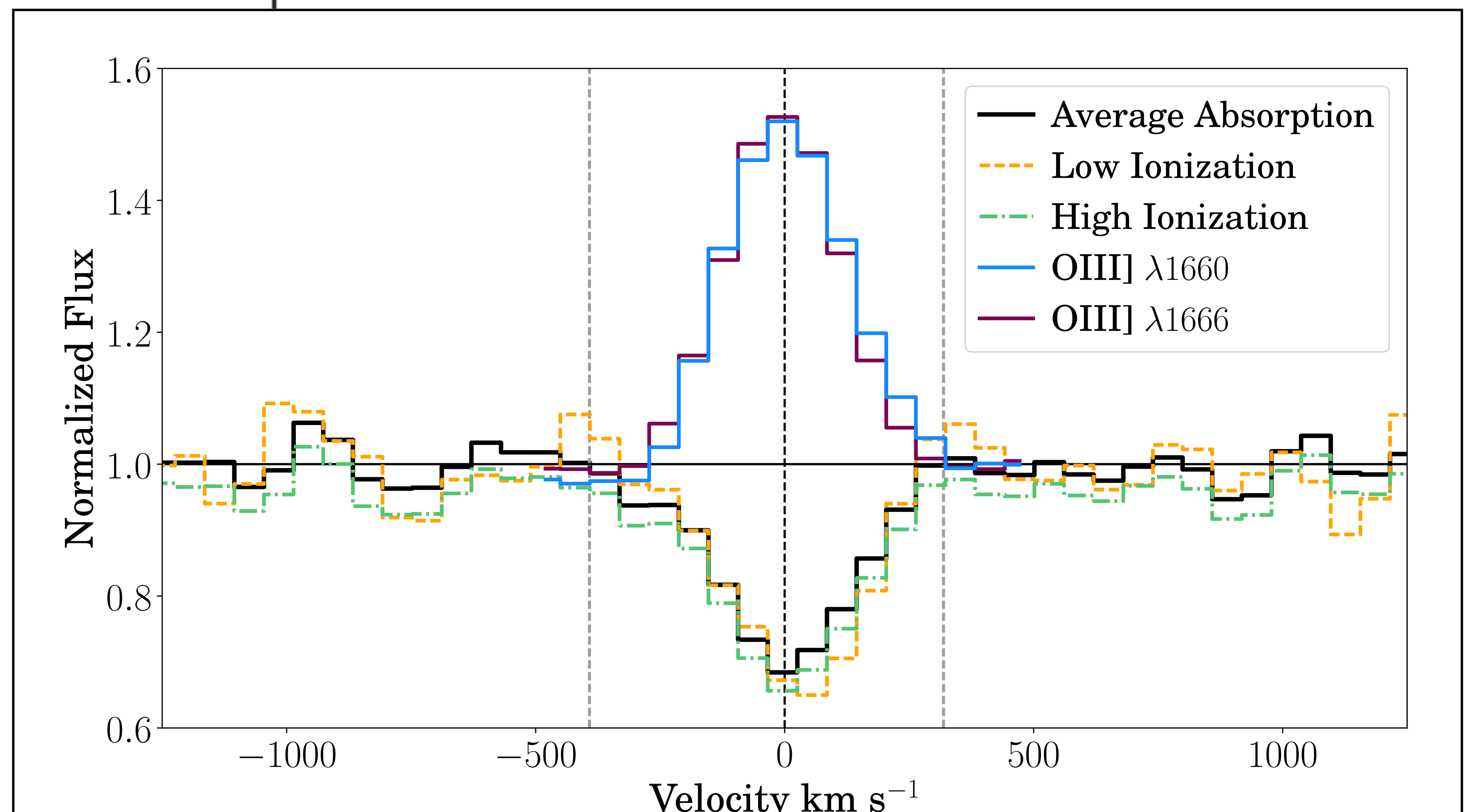
Low metallicity and high ionization at z=1.85



Berg et al 2018, arxiv:1803.02340

Lyα emission does not require outflows

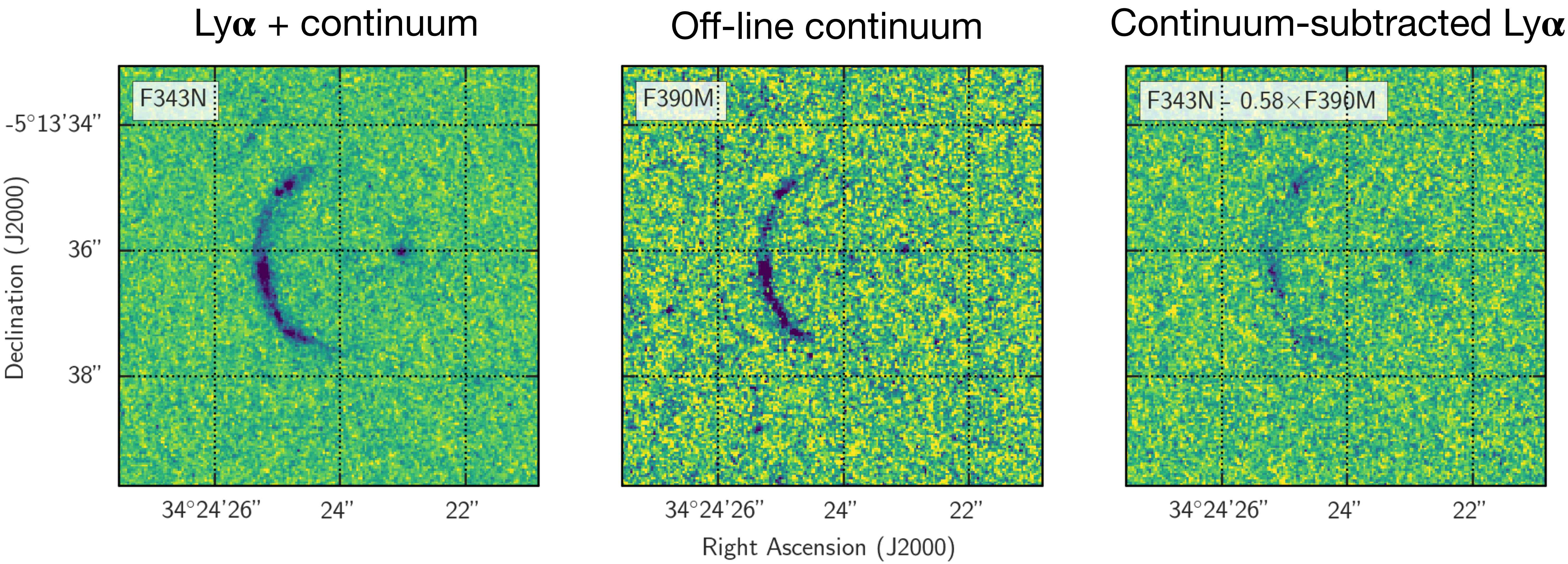




See also Jaskot et al 2017

Berg et al 2018, arxiv:1803.02340

Narrowband Lyα imaging with HST



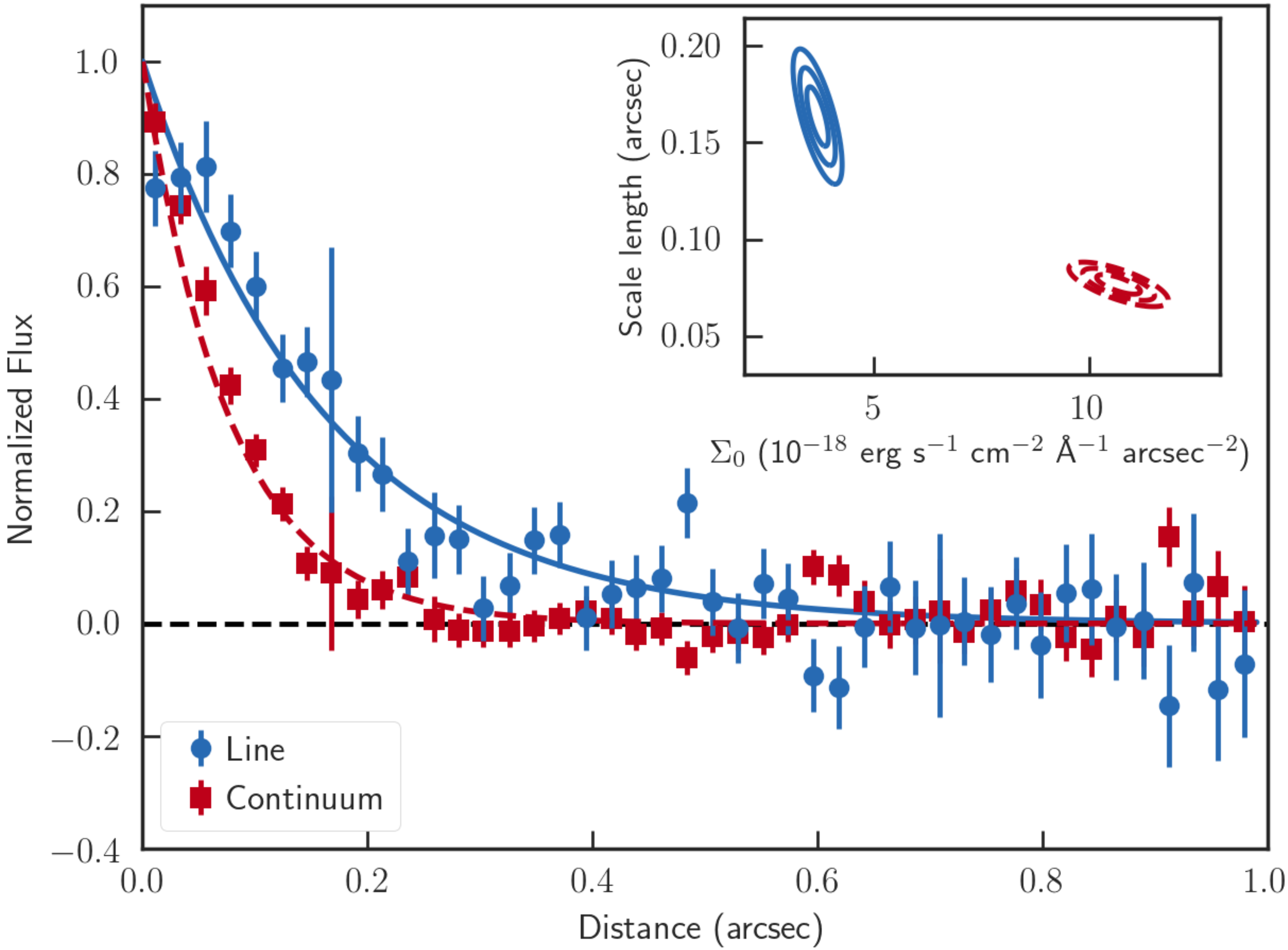
Spectroscopic slit losses ~30%

Lyα equivalent width 190 Å, escape fraction ~10%

Differential lensing magnification?

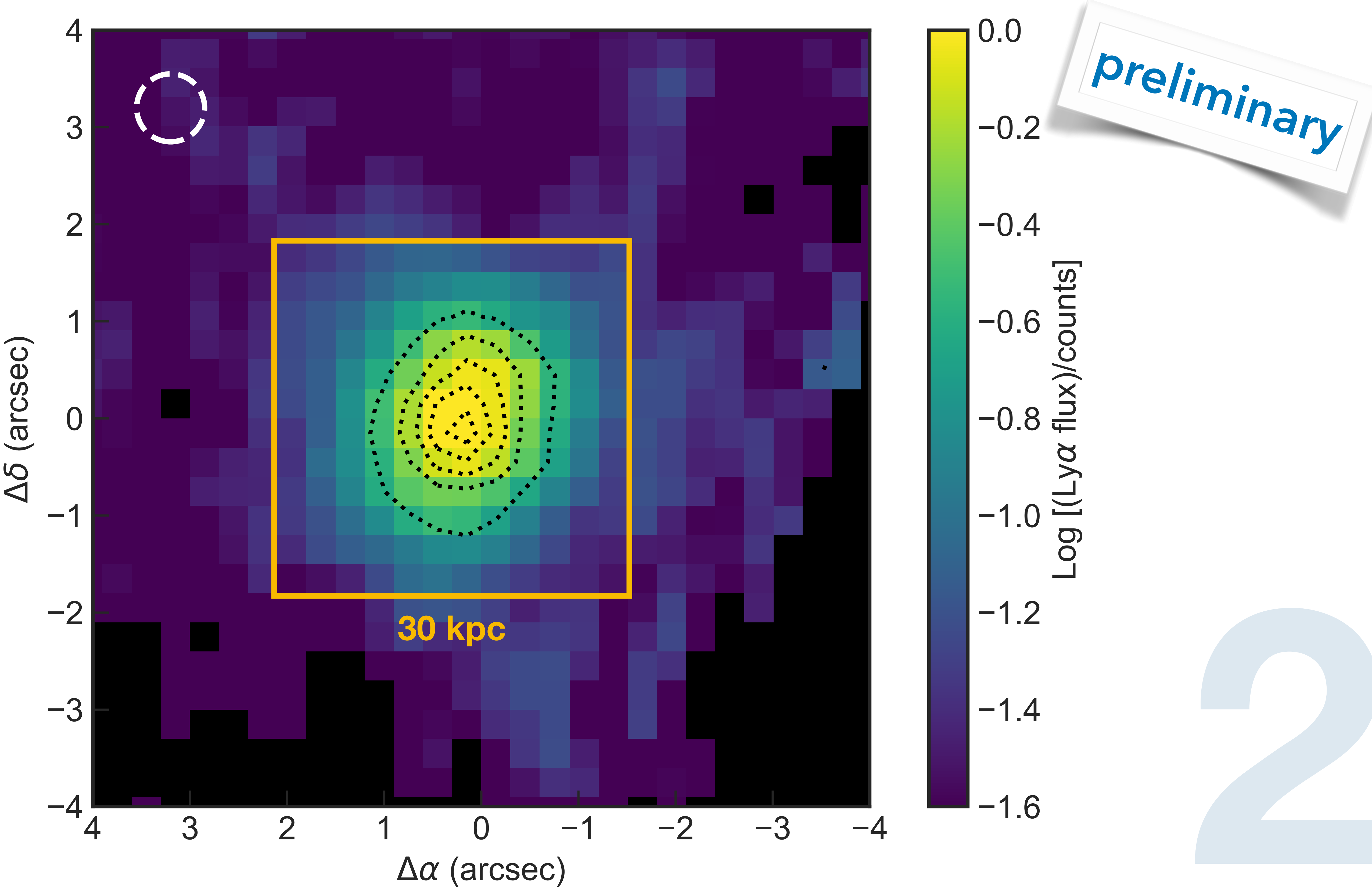
Erb et al 2018b, in prep

Spatially extended Lyα



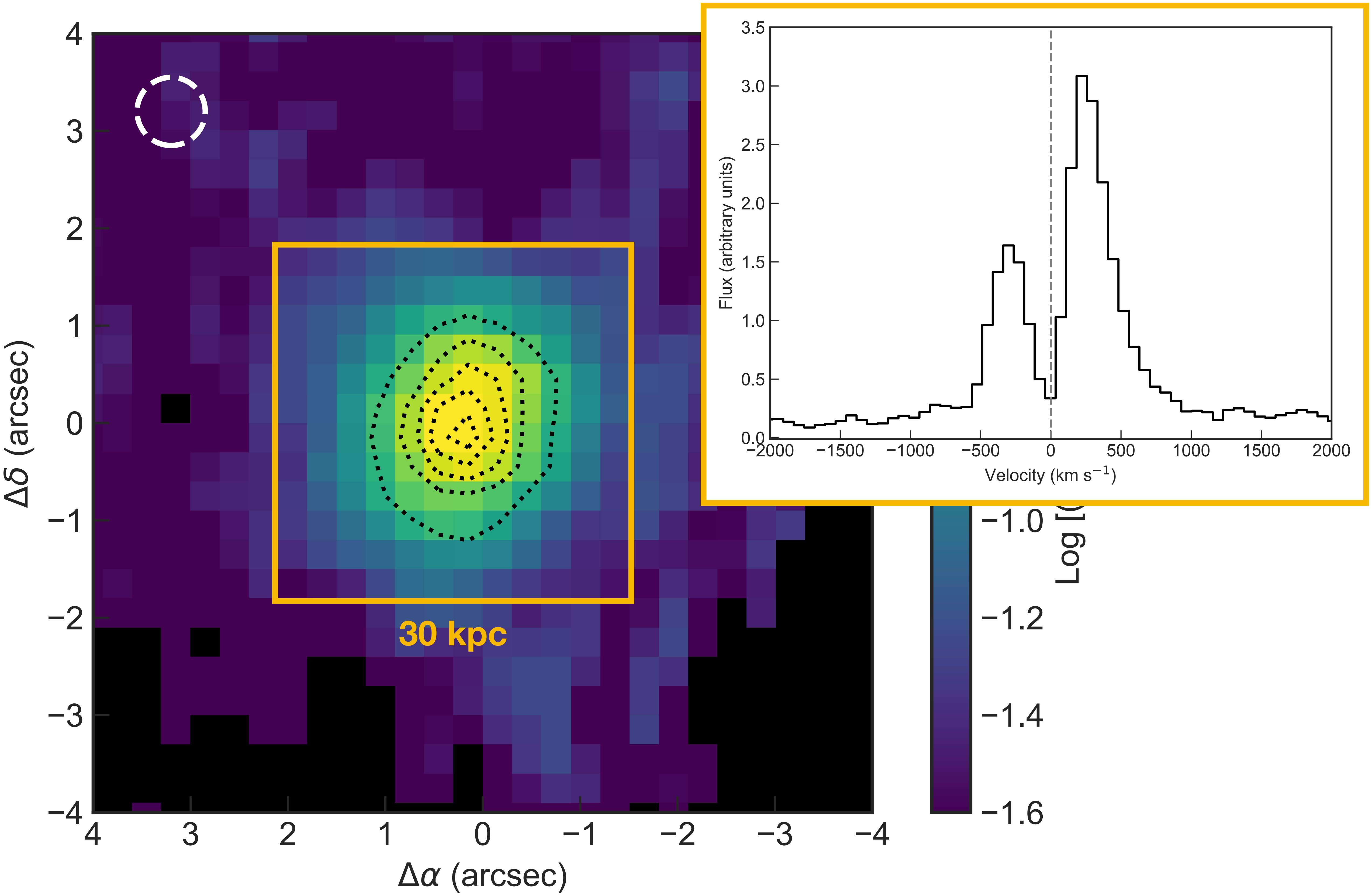
Erb et al 2018b, in prep

Q2343-BX418 with KCWI



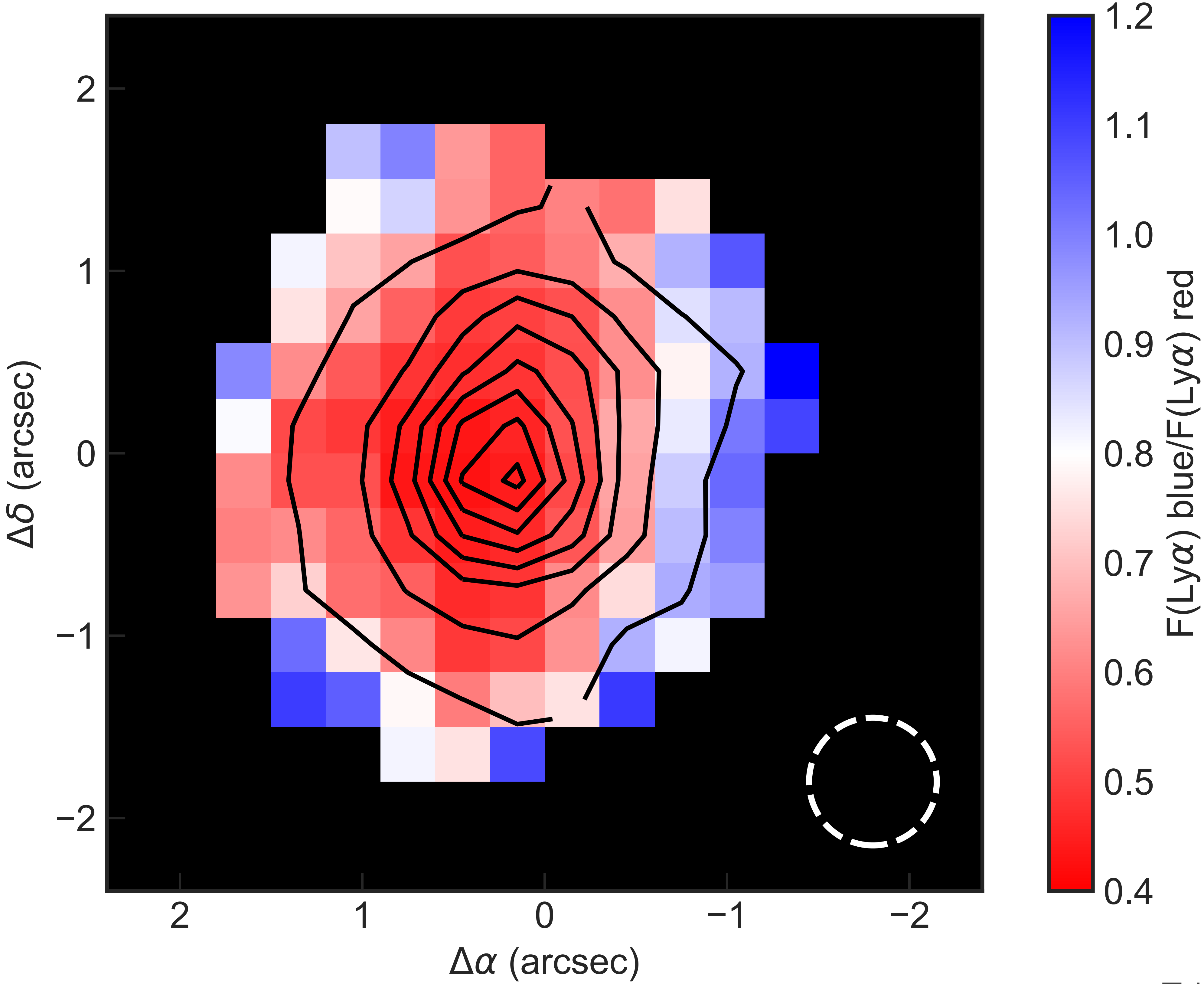
Erb et al 2018c, in prep

Q2343-BX418 with KCWI



Erb et al 2018c, in prep

Mapping the Lyα peak ratio



Erb et al 2018c, in prep

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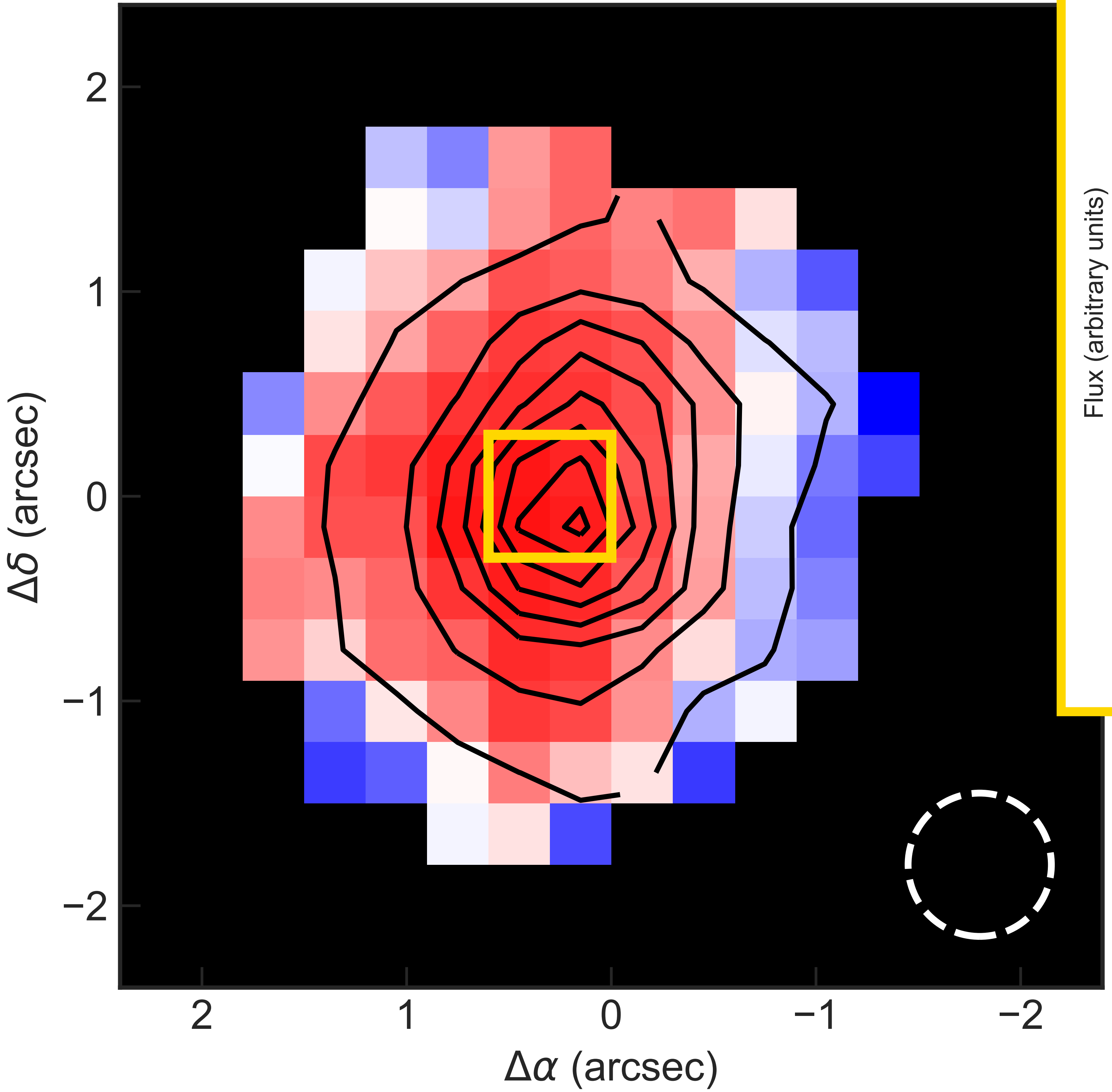
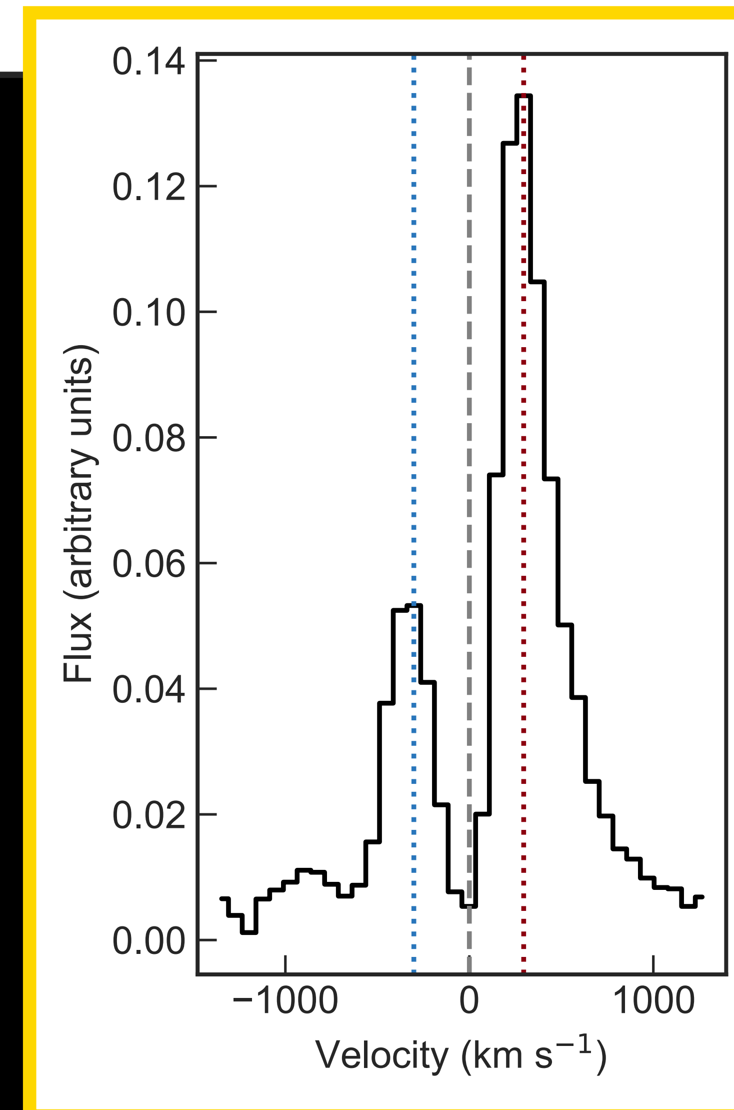
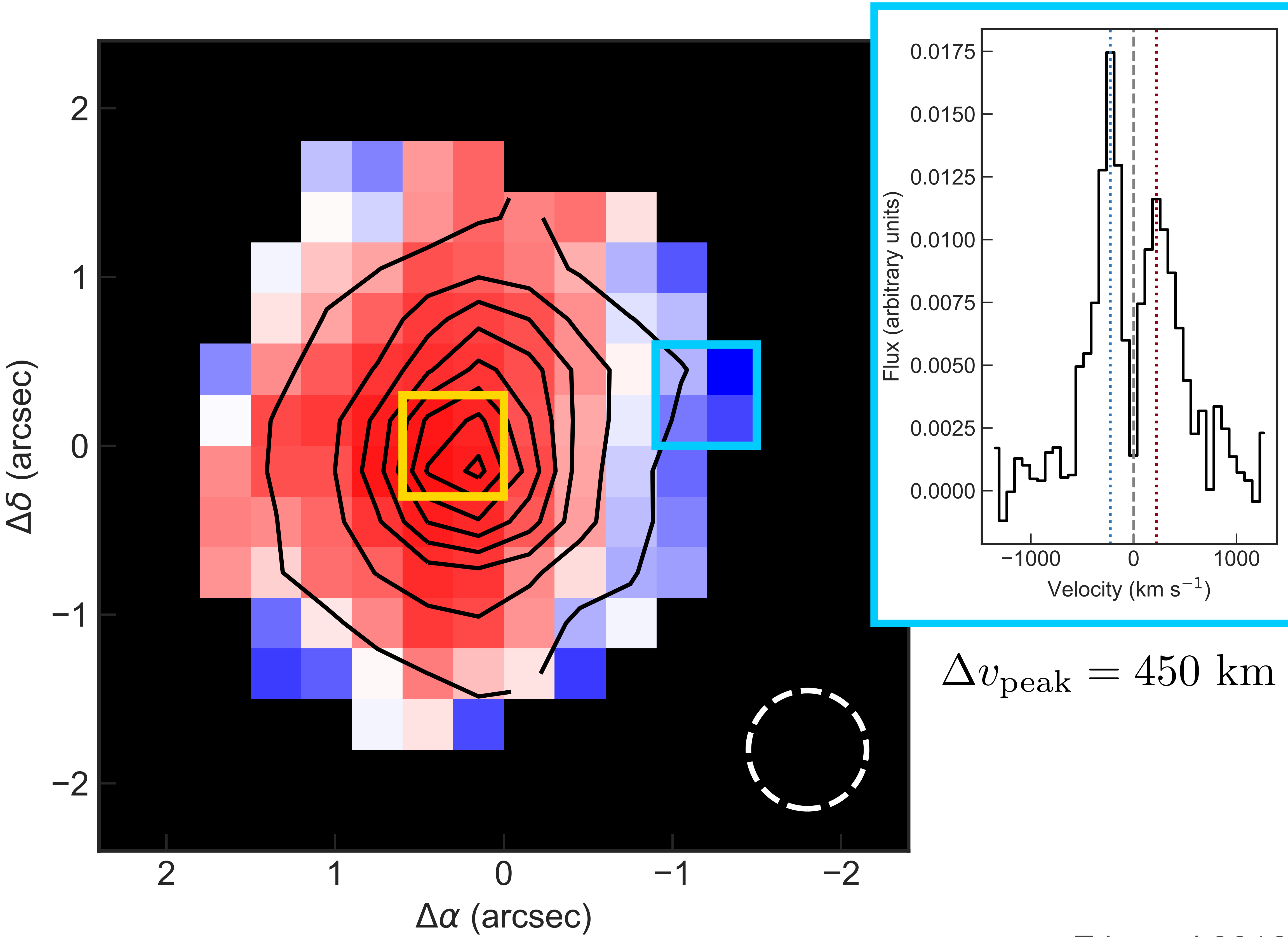




$$\Delta v_{\rm peak} = 600 \ {\rm km\ s^{-1}}$$

Erb et al 2018c, in prep

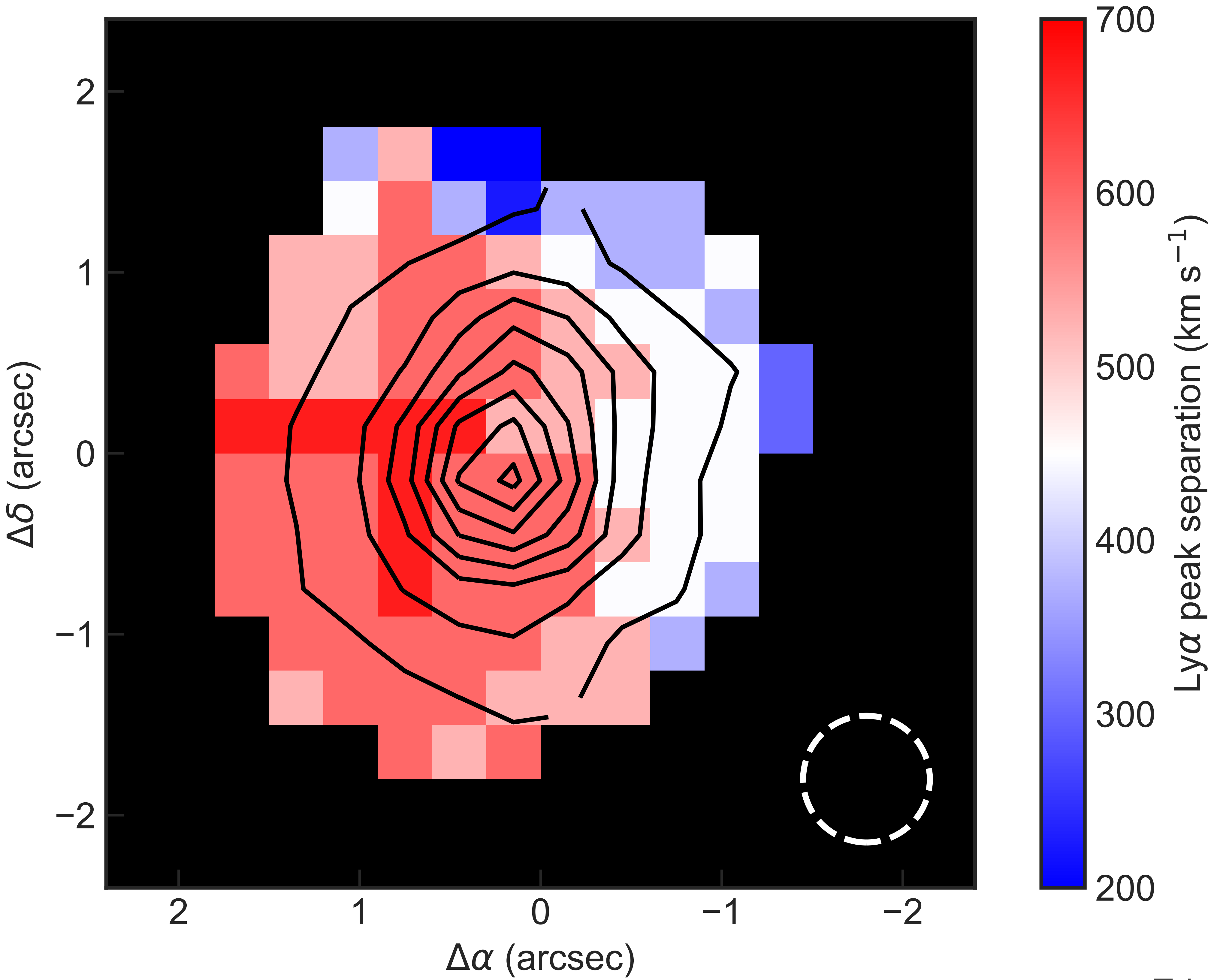
Mapping the Lyα peak ratio



$\Delta v_{\rm peak} = 450$ km s^{-1}

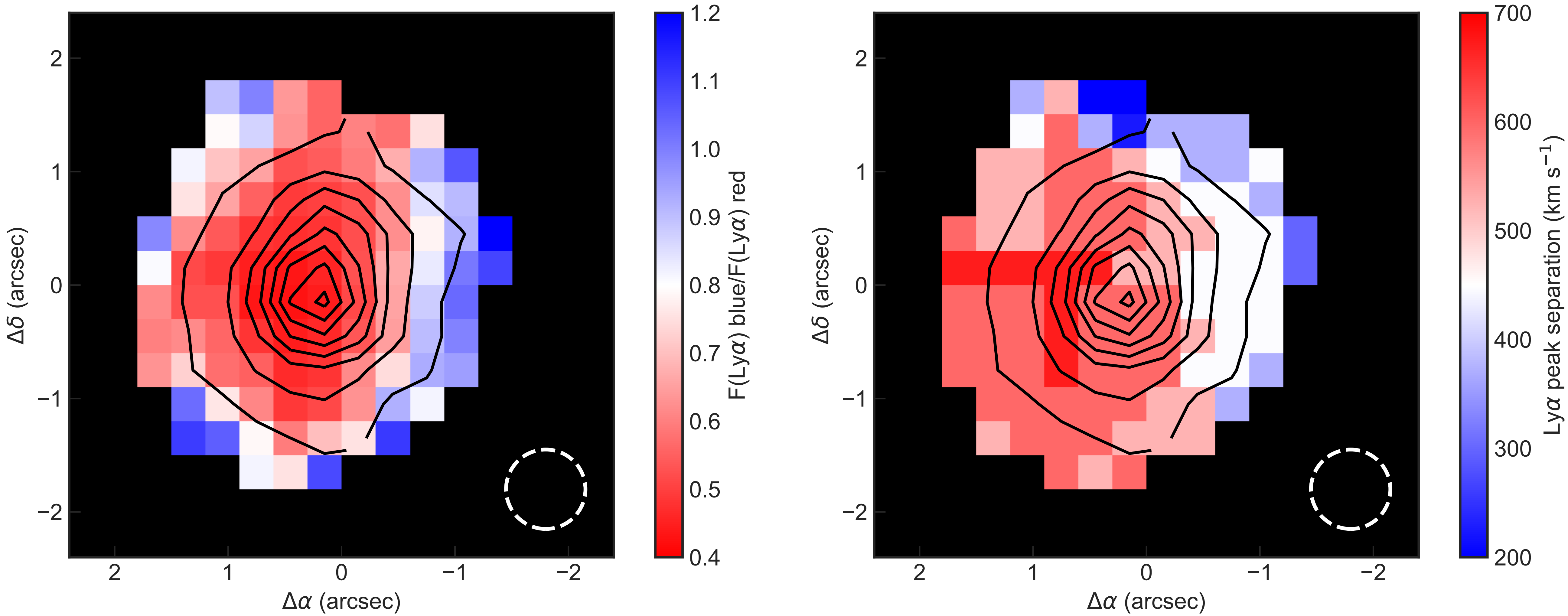
Erb et al 2018c, in prep

Mapping the Lyα peak separation



Erb et al 2018c, in prep

What does it mean?

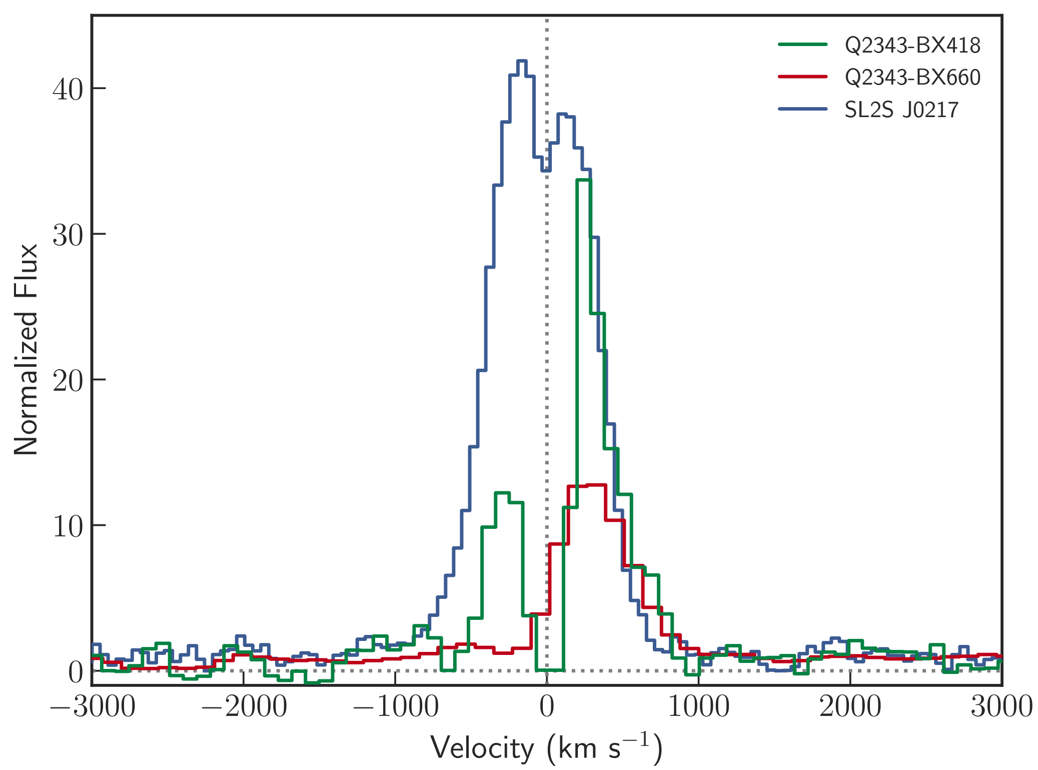


Spatial variations in Lyα profile depend on

- column density and covering fraction of neutral hydrogen
- variations in outflow velocity, including projection effects

Full modeling required

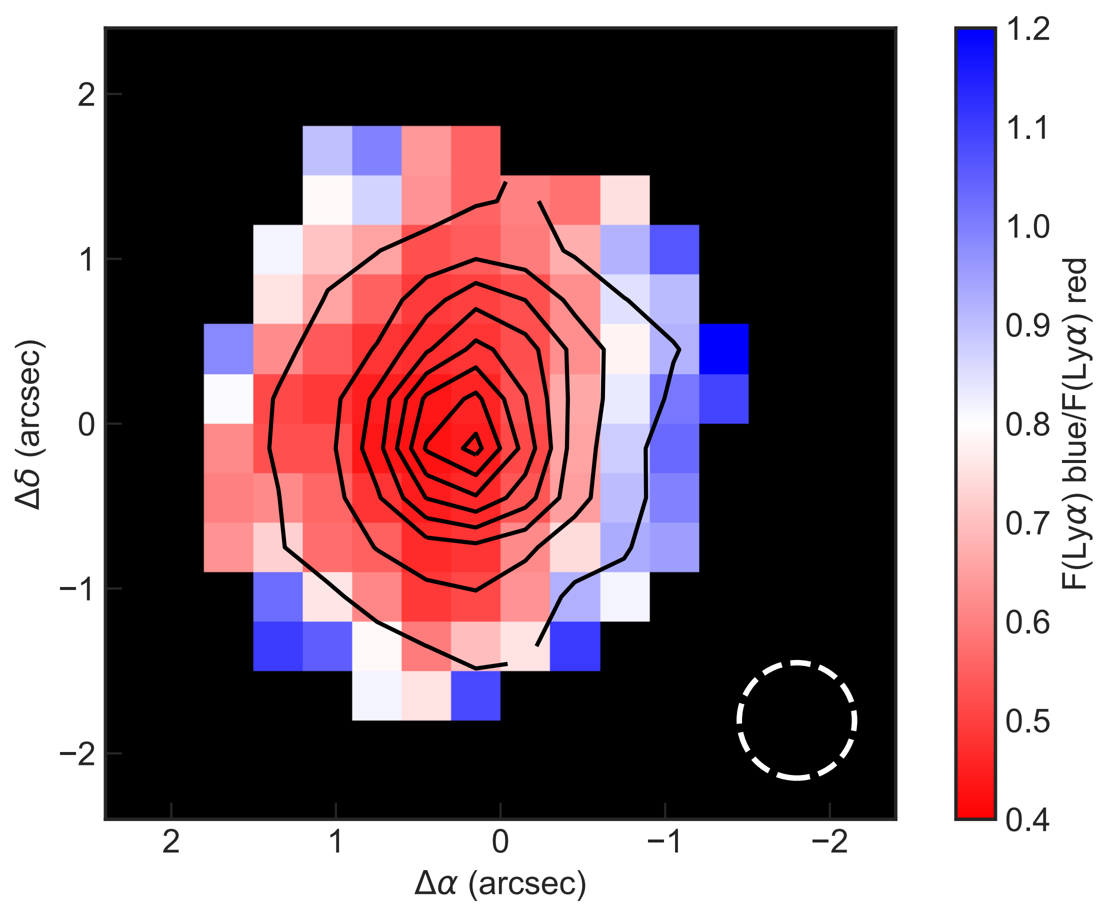
Summary



Lyα emission stronger at low metallicity, but CGM properties vary widely

Important for LyC escape

Low metallicity and high ionization necessary but not sufficient



Next steps:

Quantify diversity in low mass samples

Expand dynamic range to most extreme objects

Map the CGM with Lyα emission