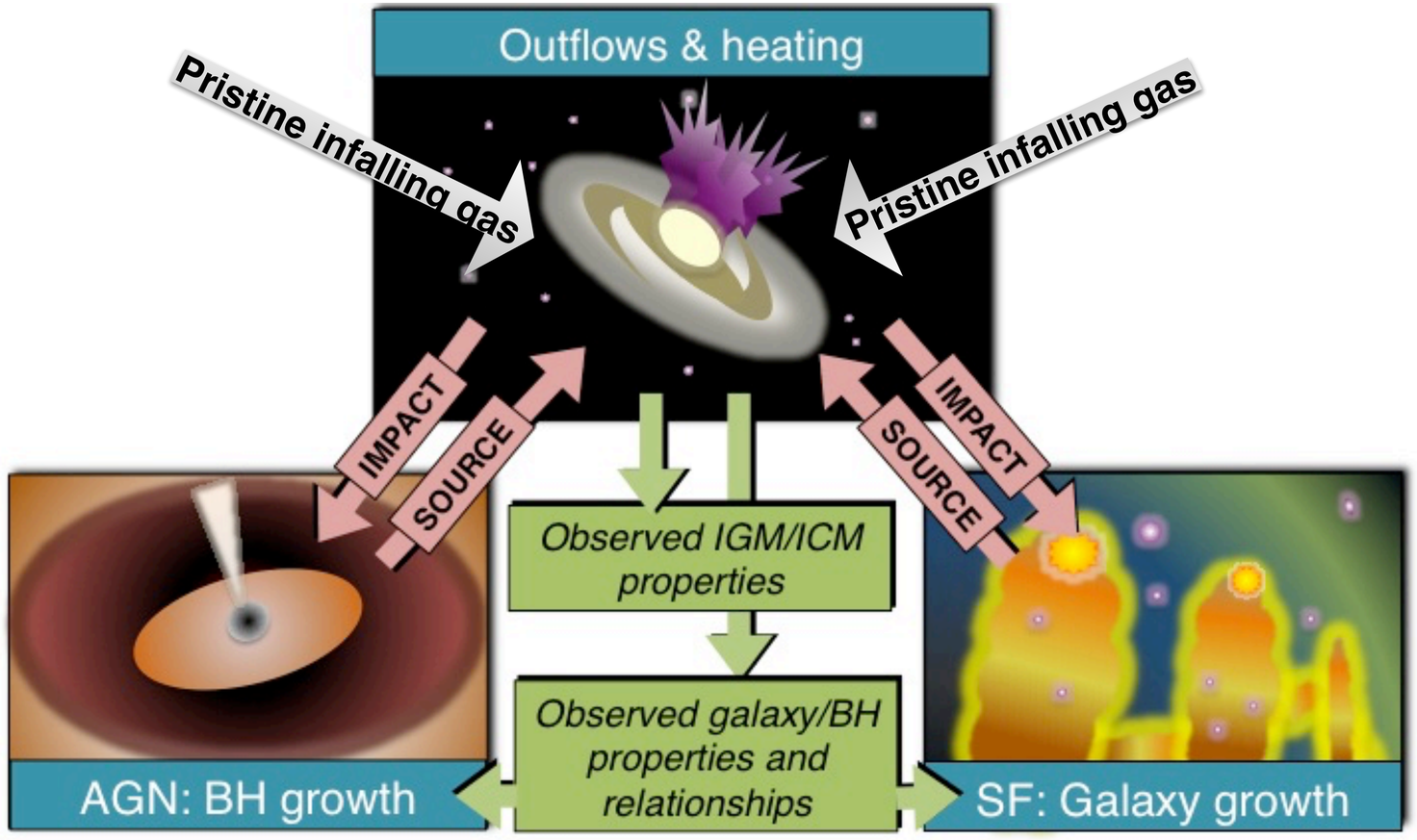
Curved slit spectroscopic observations of gravitational arc-like structures

Michele Perna
INAF - Osservatorio Astrofisico di Arcetri

Collaborators:
G. Cresci, F. Mannucci, M. Curti

Motivation

The baryonic assembly in galaxies is regulated by complex interactions between different astrophysical processes

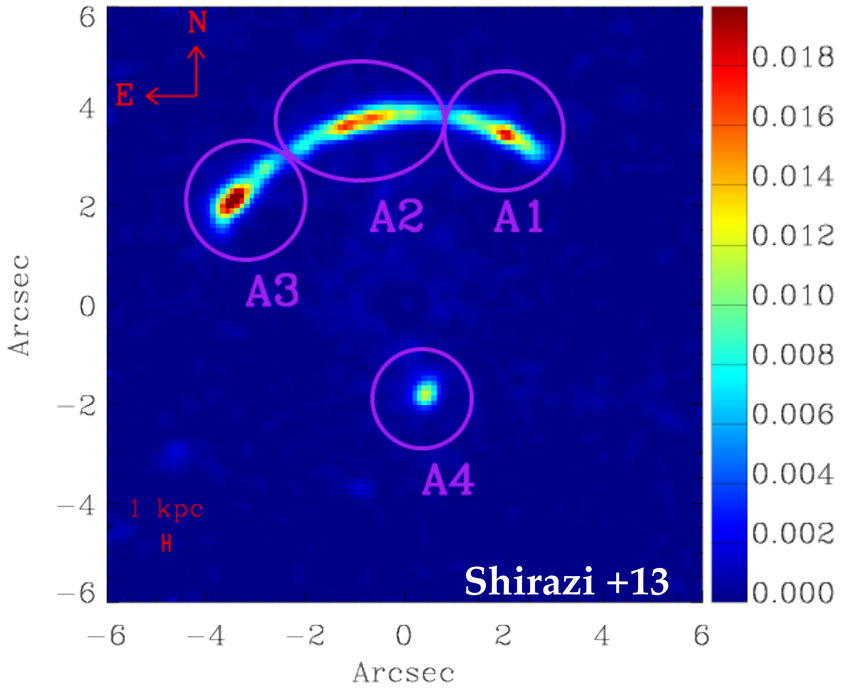


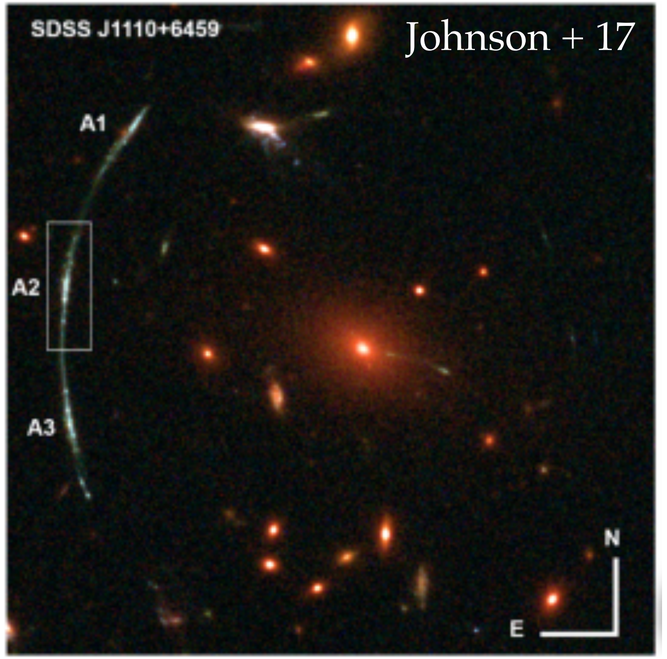
Adapted from Harrison thesis (2014)

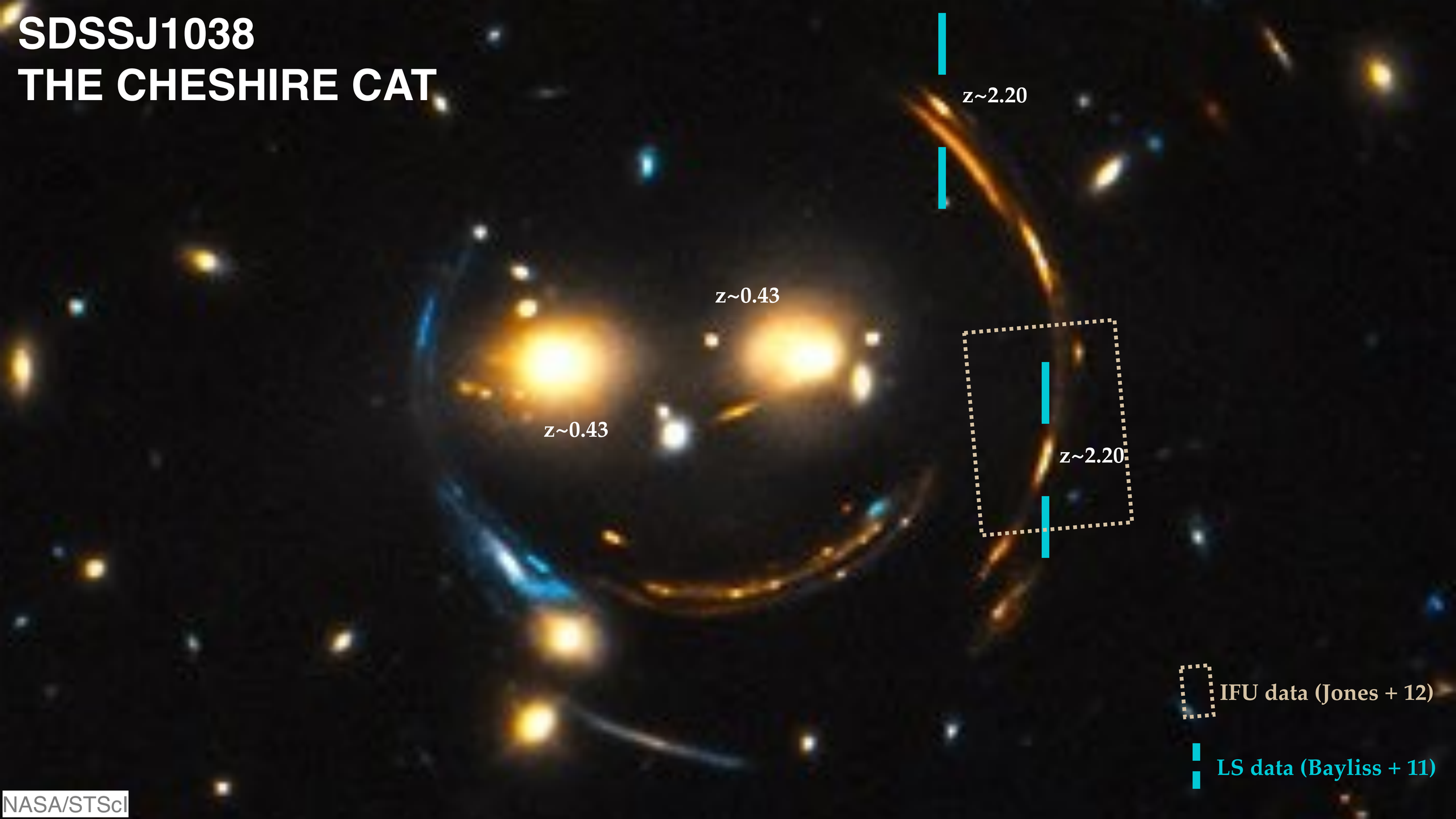
Motivation

Lensed galaxies and quasars offer a wealth of information to study galaxy evolution

Arc-like structures can extend over tens of arcsecs on the sky






SDSSJ1038
THE CHESHIRE CAT
z~2.20
z~0.43
z~0.43
z~2.20
IFU data (Jones + 12)
LS data (Bayliss + 11)
NASA/STScI


SDSSJ1038
THE CHESHIRE CAT
z~2.20
LUCI curved slit
IFU data (Jones + 12)
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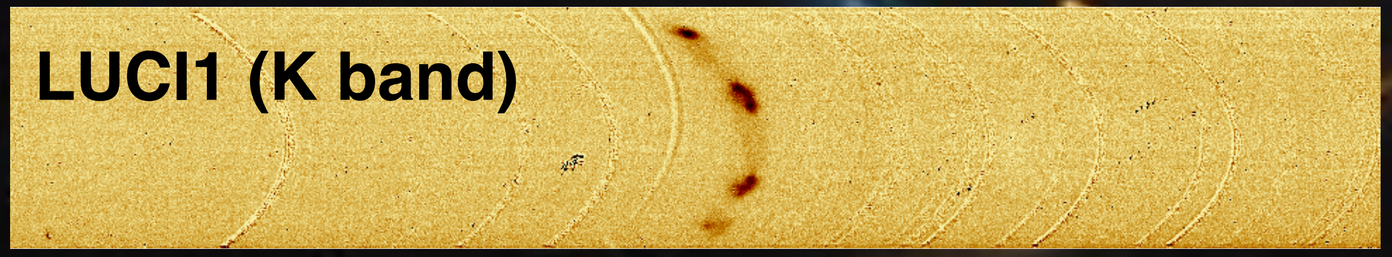
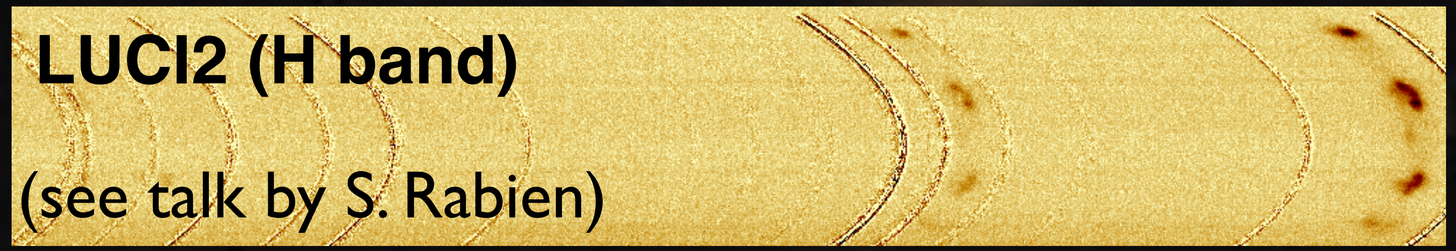
SDSSJ1038
THE CHESHIRE CAT

z~2.20

LUCI curved slit



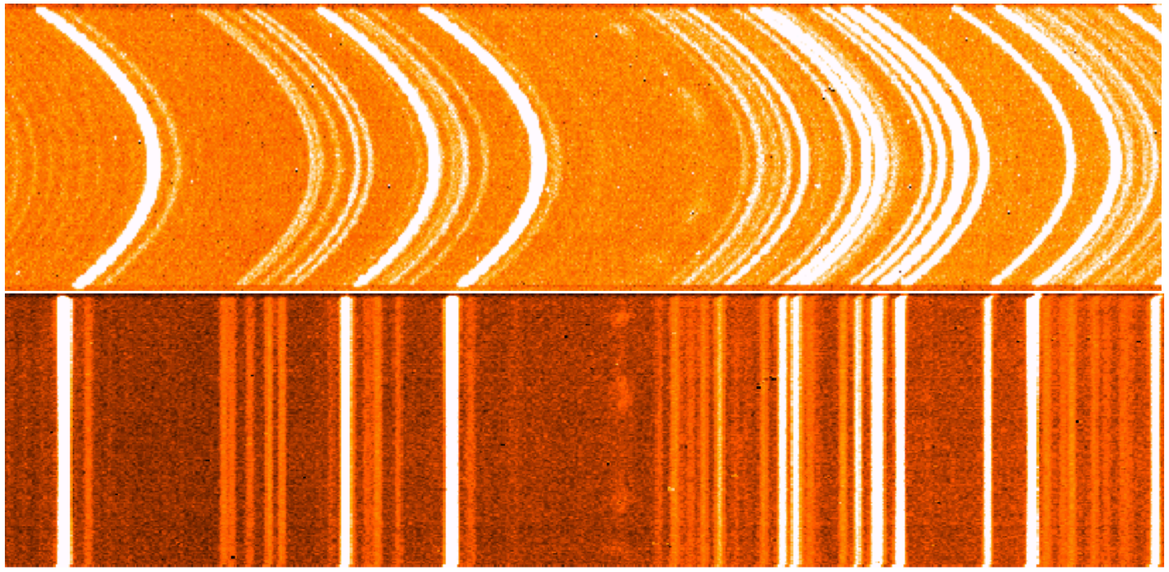


IFU data (Jones + 12)

LS data (Bayliss + 11)

Luci + ARGOS spectroscopic data

Six gravitational lensed systems at z~1.3-2.7 observed with 0.35-0.5'' wide curved-slit MOS masks (PI. S. Rabien)



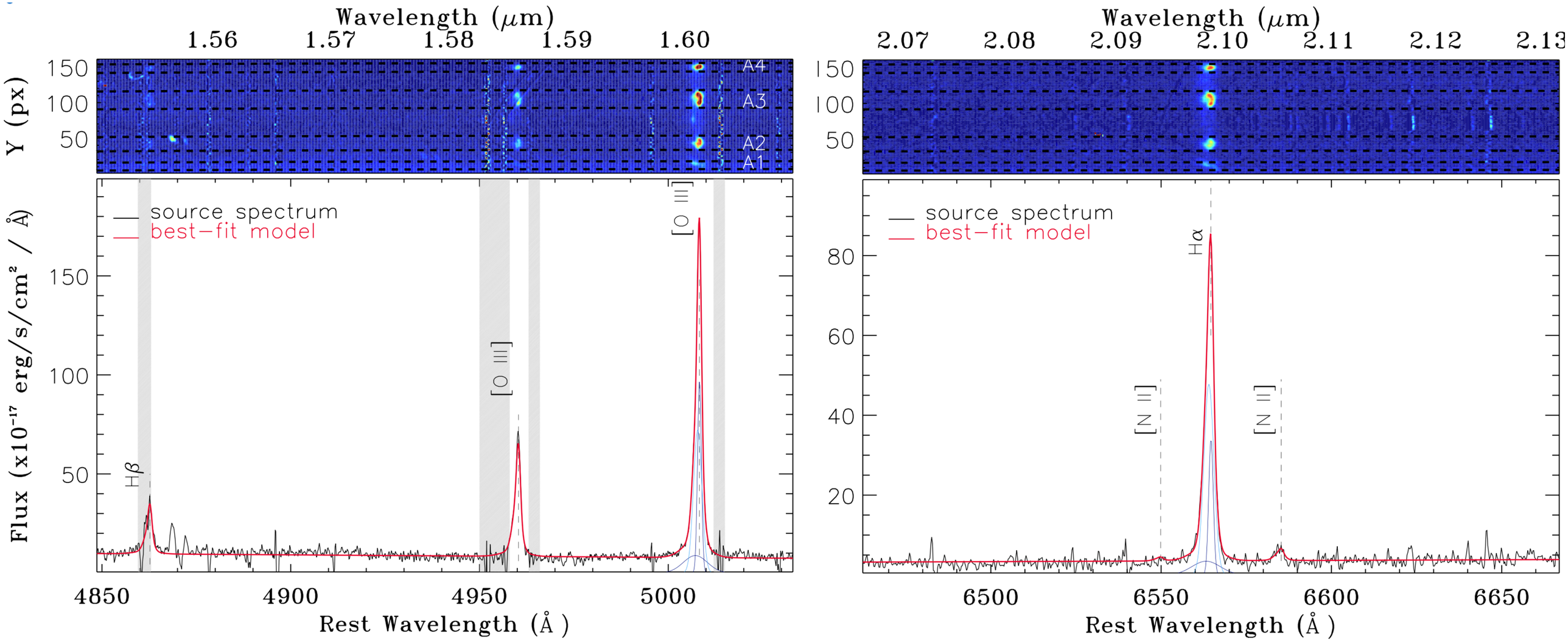
Data Reduction requires:
- 2D spectra rectification,
- corrections for grating and Y position of ref.star instabilities,

etc.

see talks by A.Contursi, S. Belli

Hb+[OIII] and/or Ha+[NII] lines (also in binocular mode)
Spectral resolution: few tens of km/s
Spatial resolution: 0.4 - 0.6 arcsec (3 - 5 pixels)

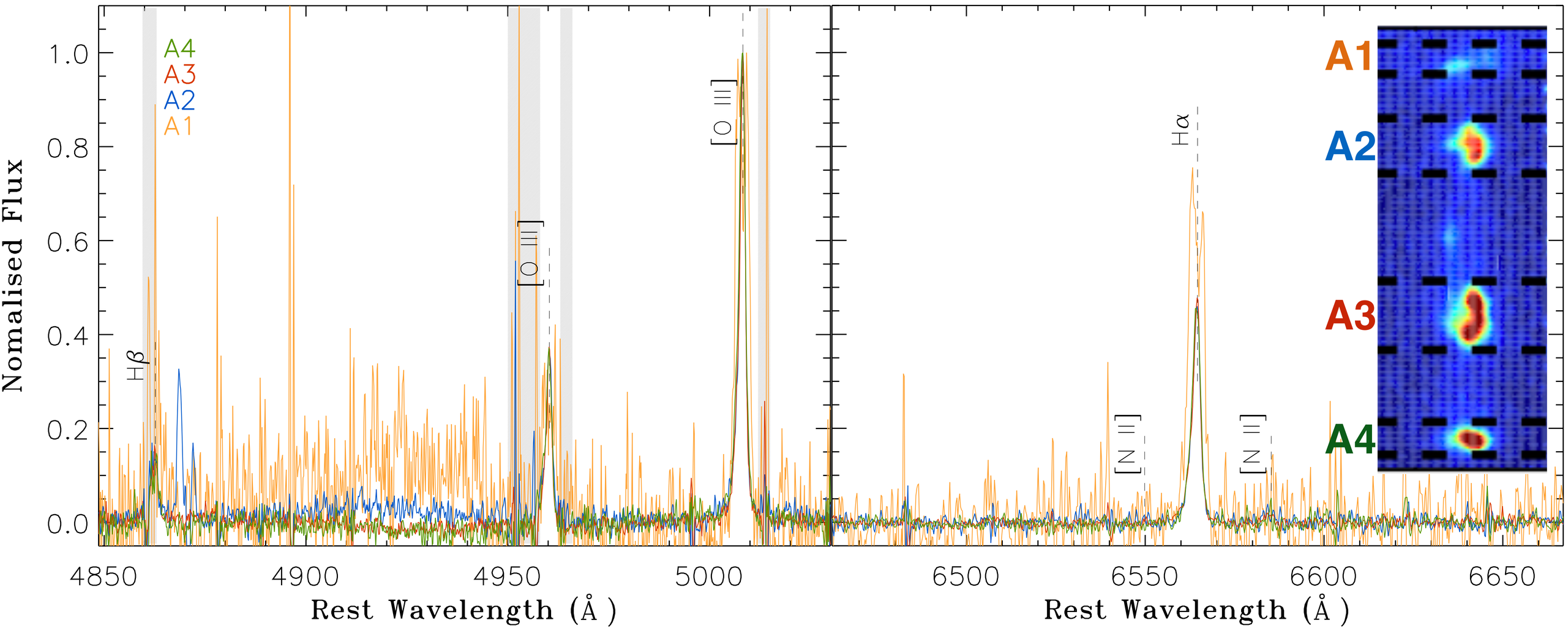
SDSSJ1038 (THE CHESHIRE CAT) - integrated spectrum



TOT: 4h 20min (Hband)
3h 47min (Kband)

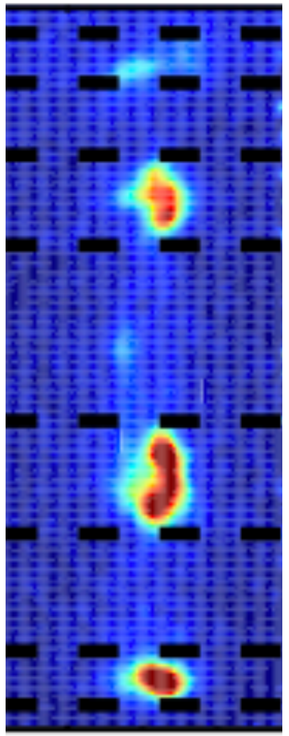
z = 2.197

SDSSJ1038 - comparison between different blobs

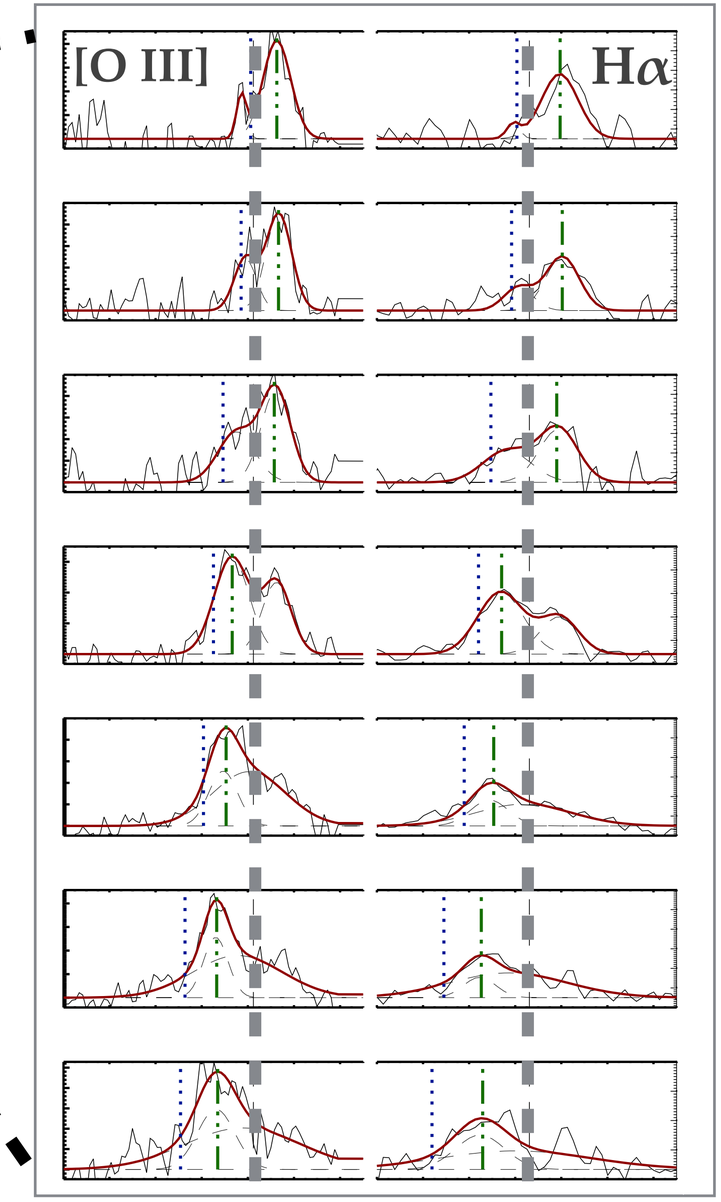


SDSSJ1038 - spatially resolved analysis

V10

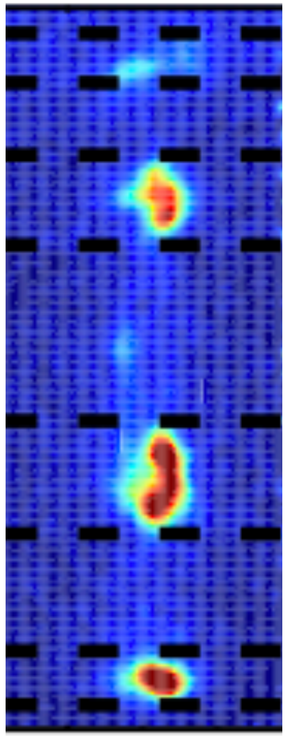


A1

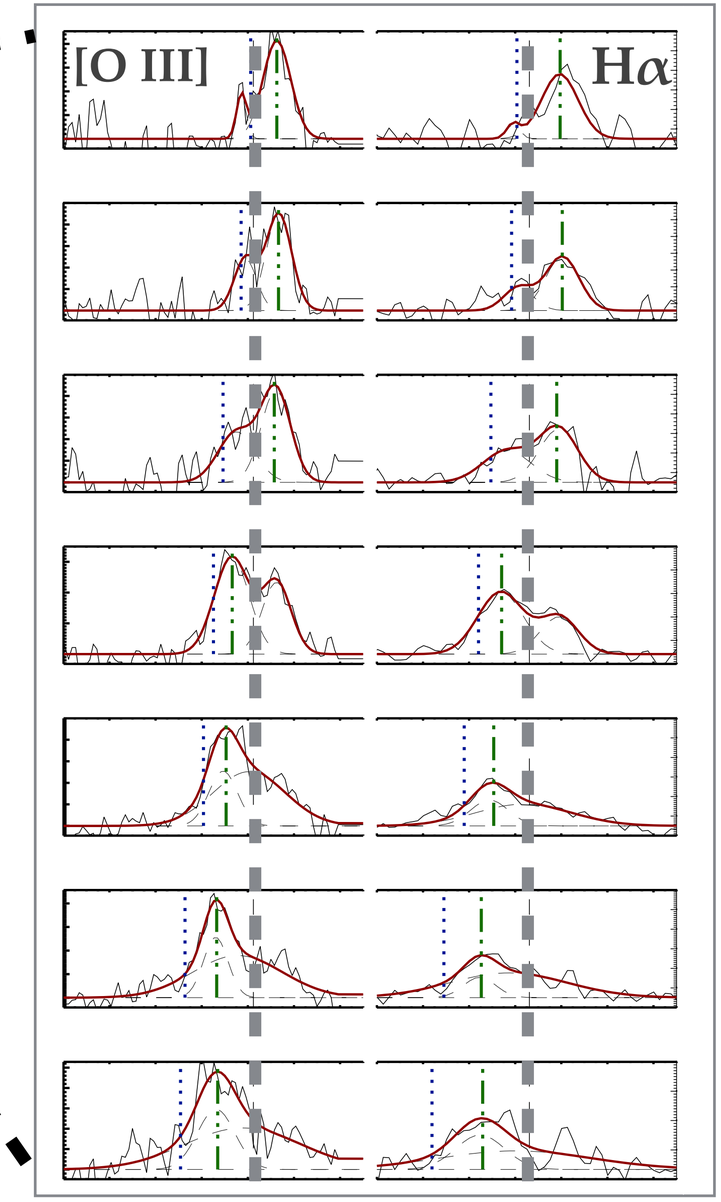


SDSSJ1038 - spatially resolved analysis

V10



A1

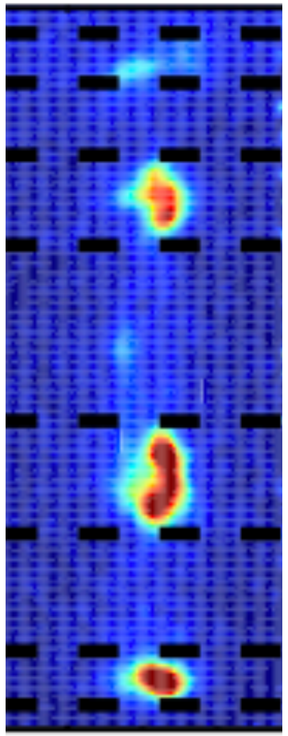


from top to bottom:

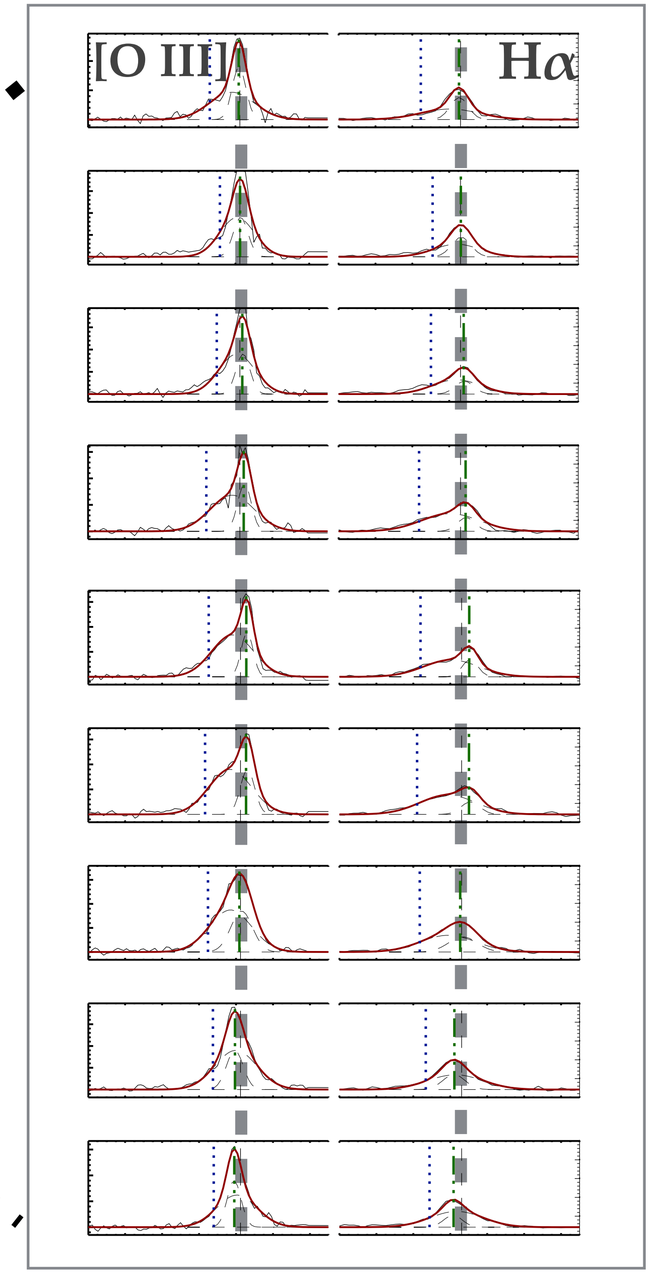
- line peak from positive to negative velocities
- broad profiles

SDSSJ1038 - spatially resolved analysis

V10

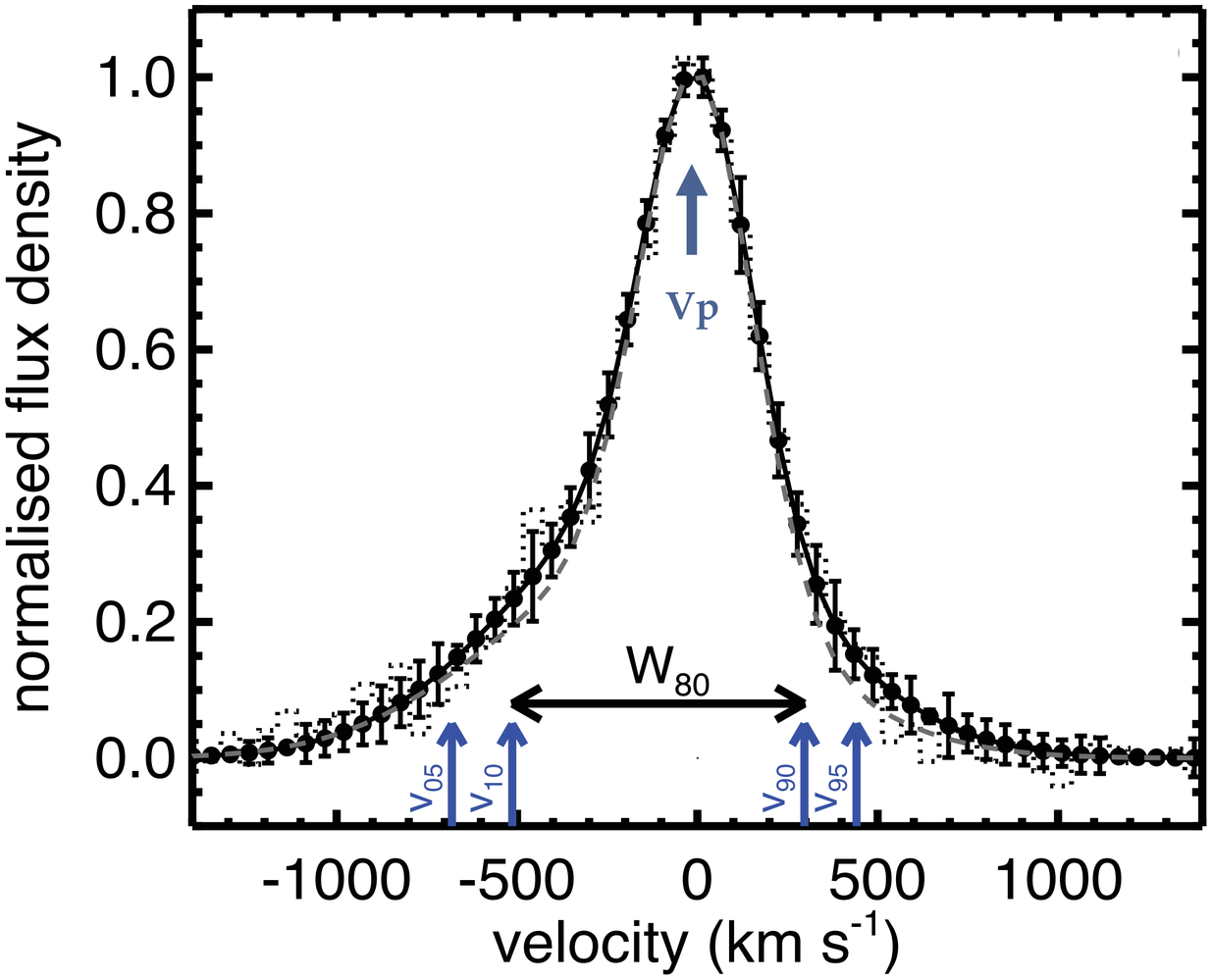


A3



broad, asymmetric profiles

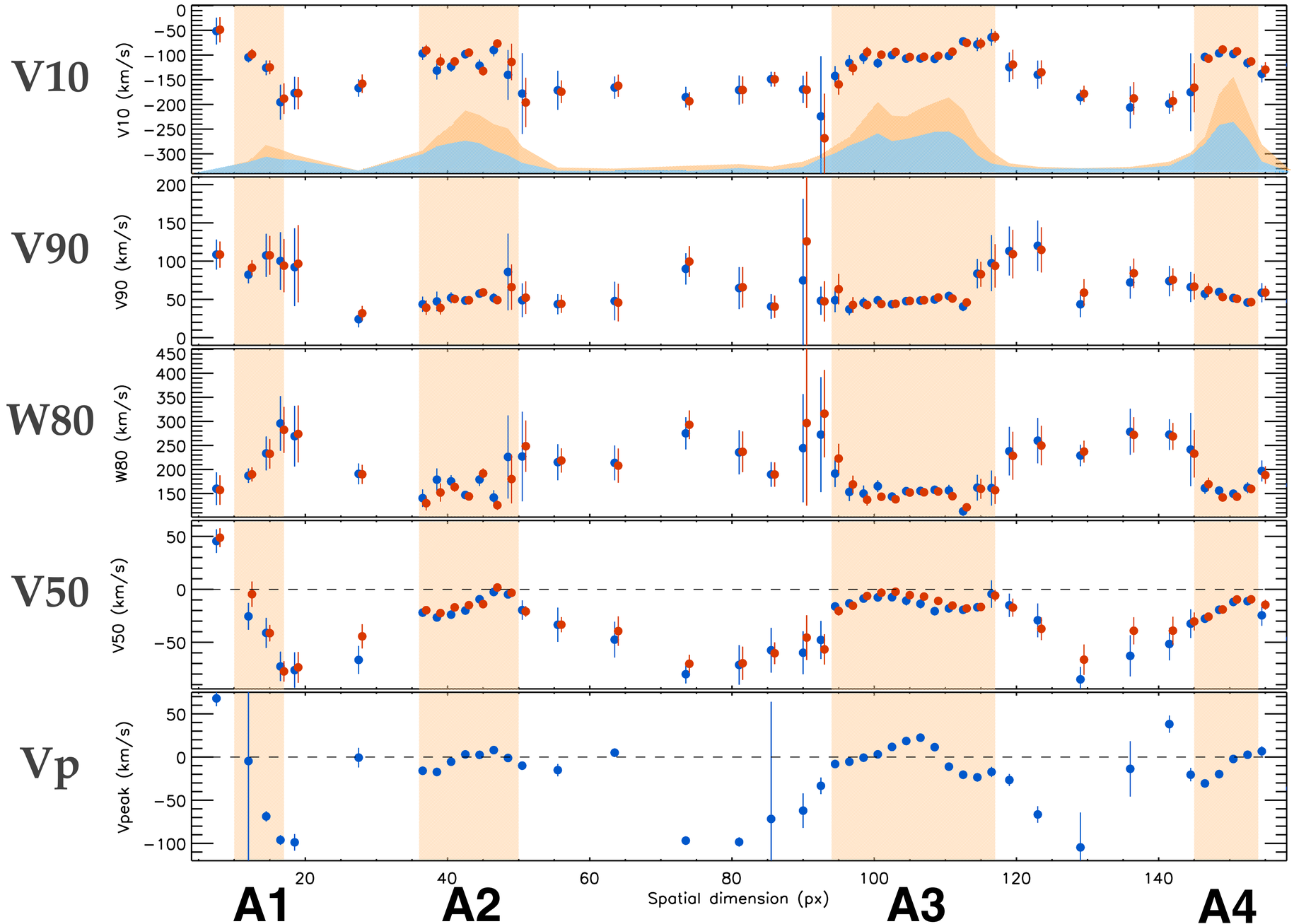
Non-parametric velocity estimators

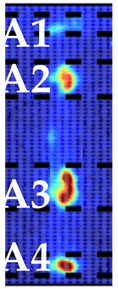


SDSSJ1038 - spatially resolved analysis

Halpha

[OIII]

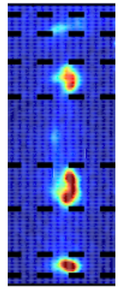




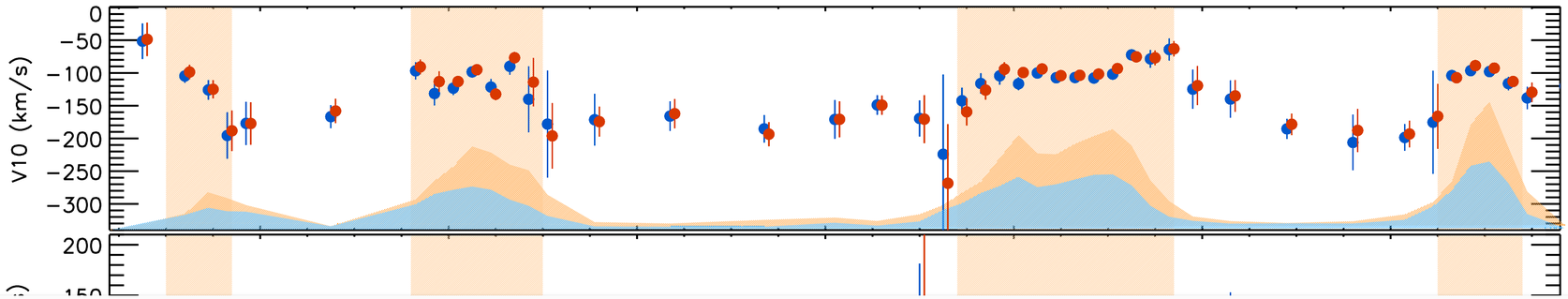
SDSSJ1038 - spatially resolved analysis

Halpha

[OIII]

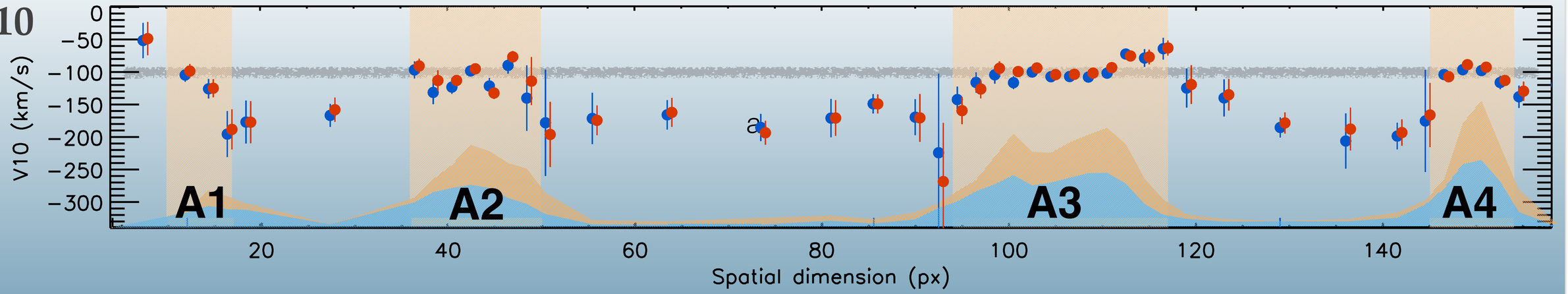


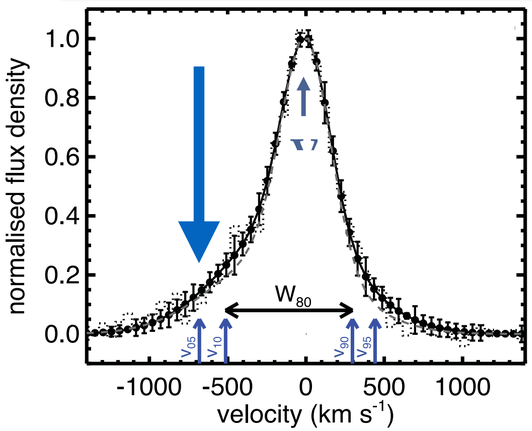
V10



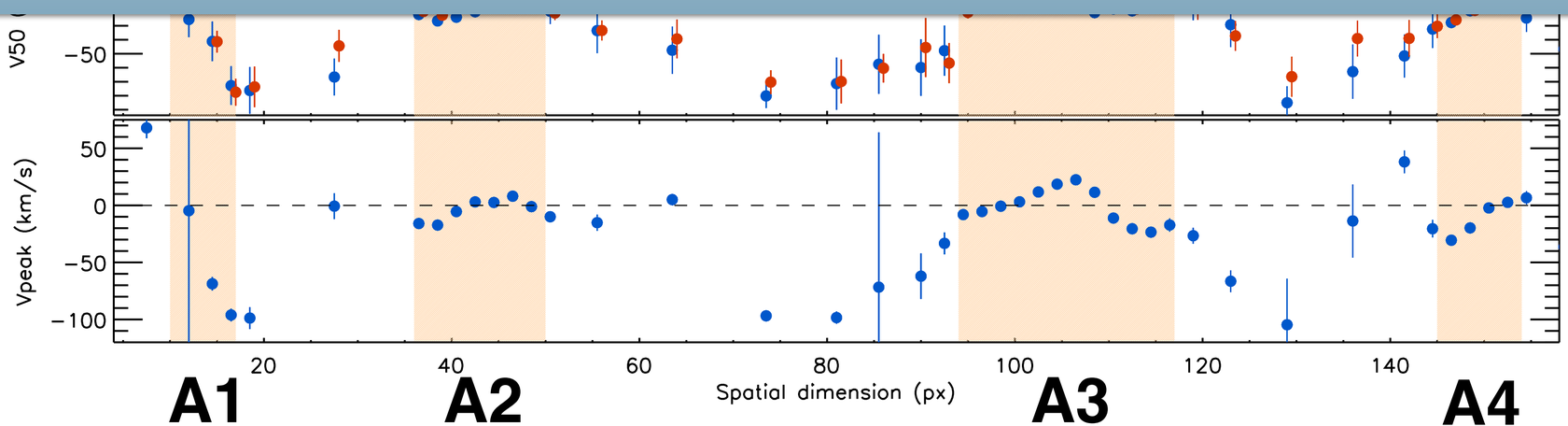
blue wing

V10





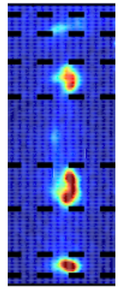
Vp



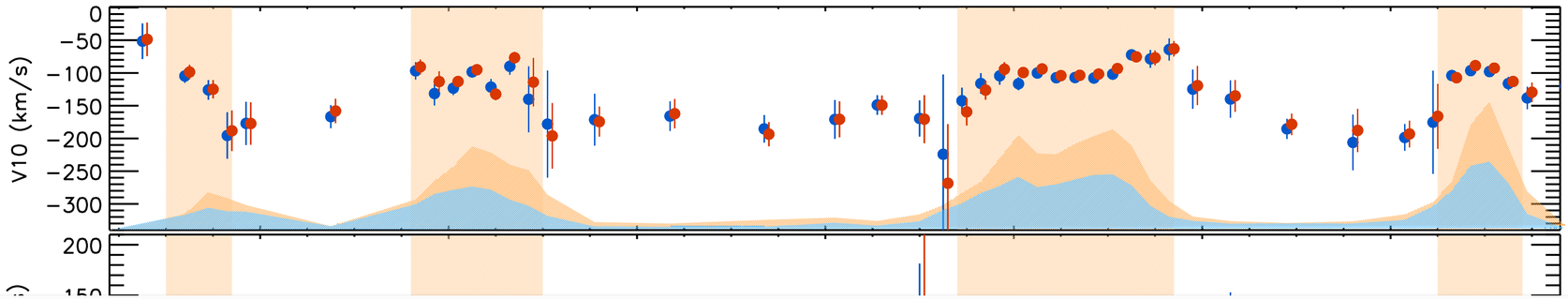
SDSSJ1038 - spatially resolved analysis

Halpha

[OIII]

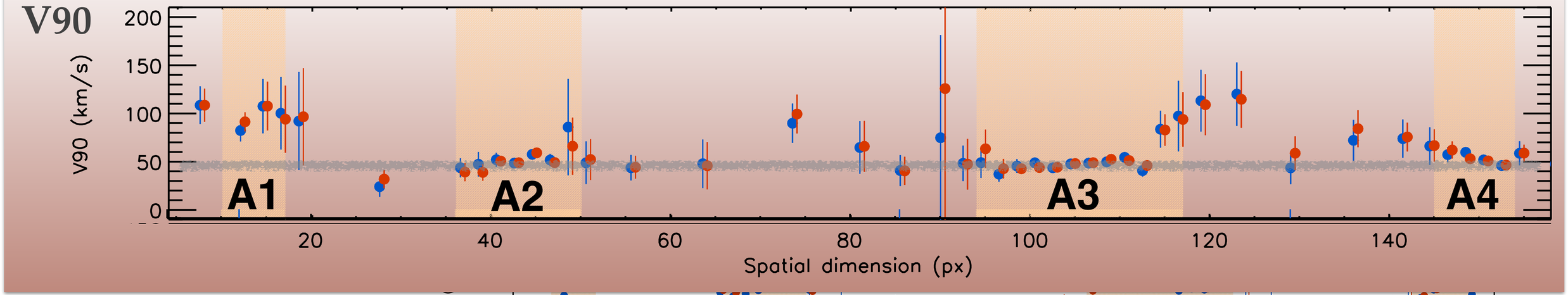


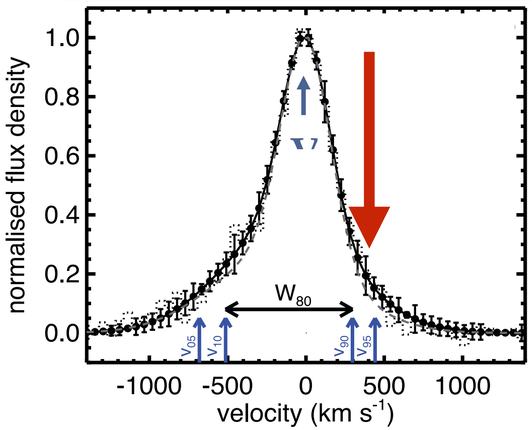
V10



V90

red wing





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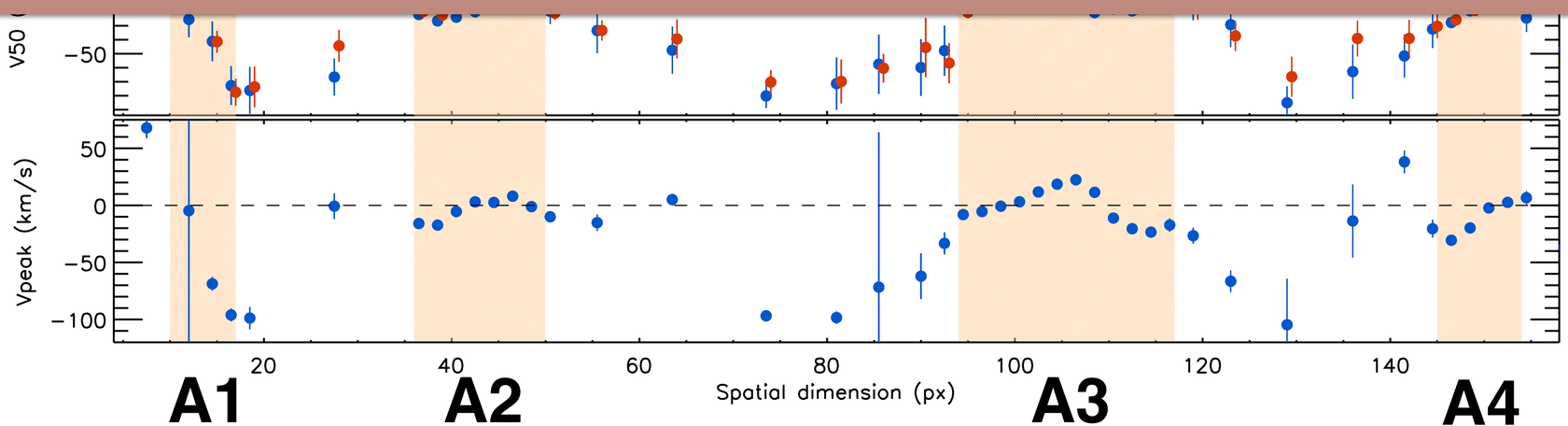
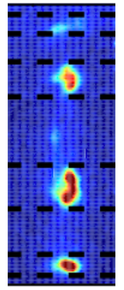


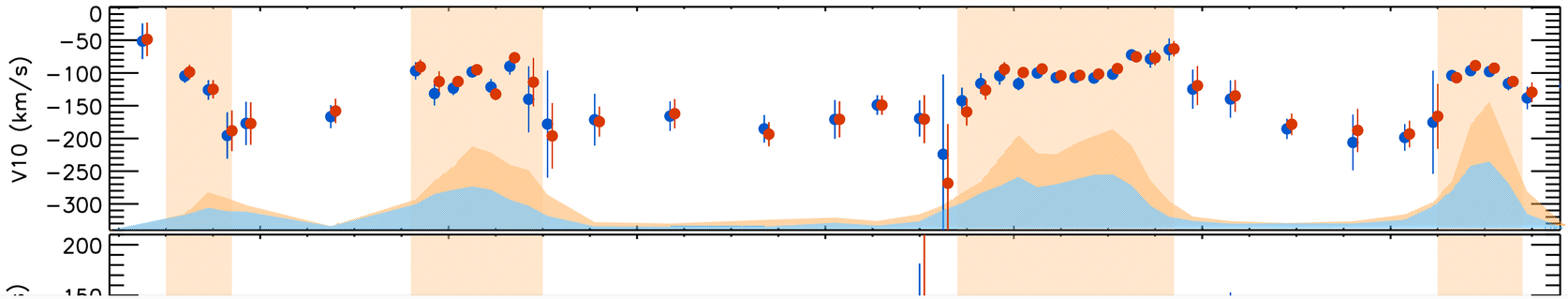
SDSSJ1038 - spatially resolved analysis

Halpha

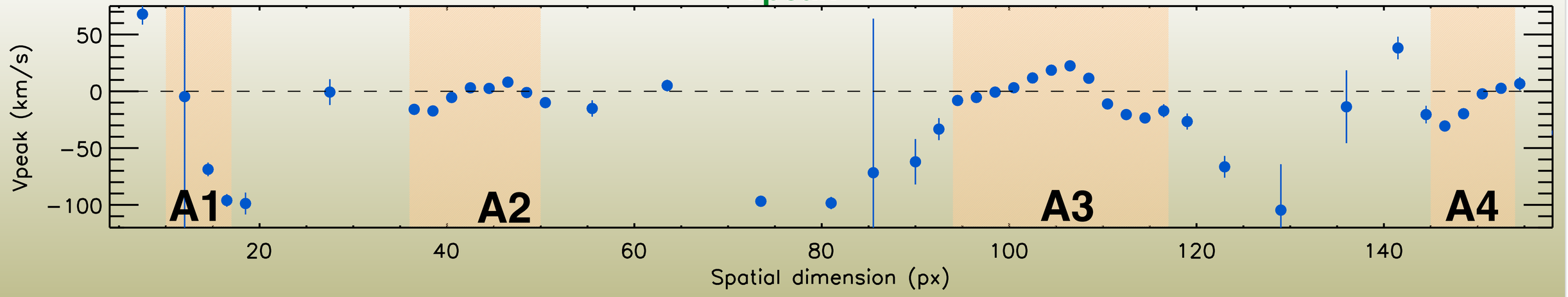
[OIII]

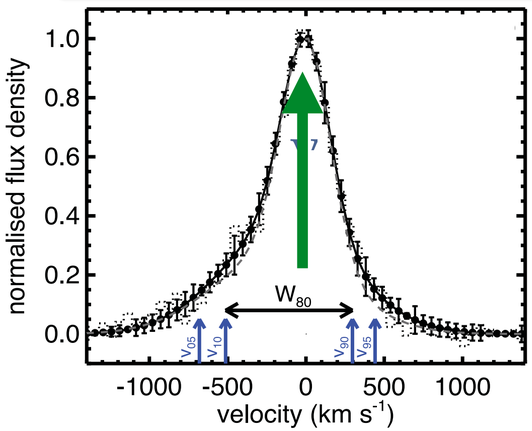


V10

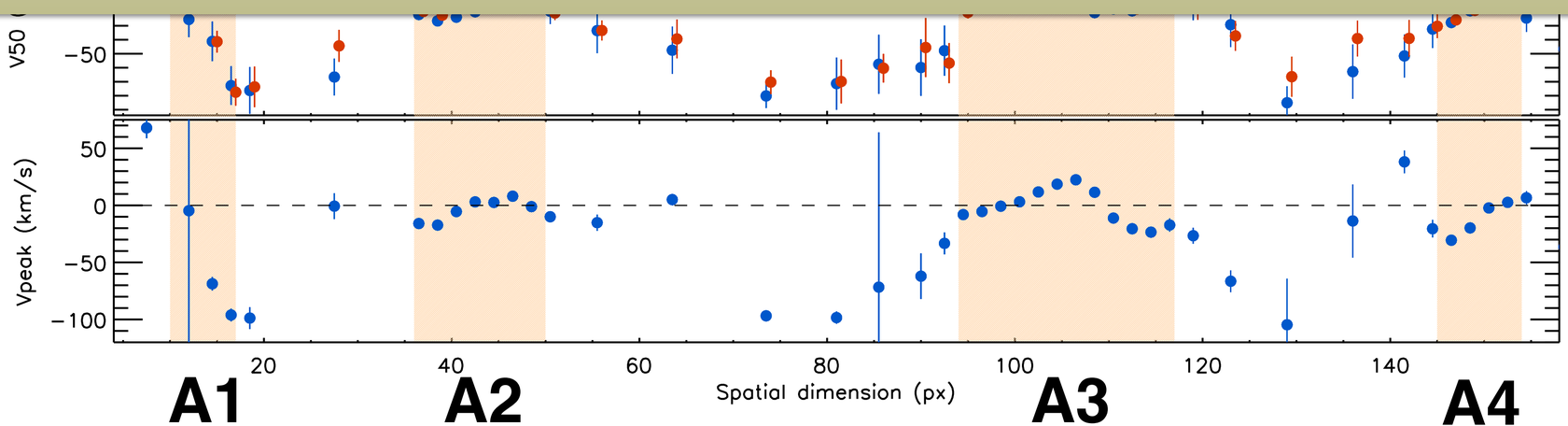


Vpeak





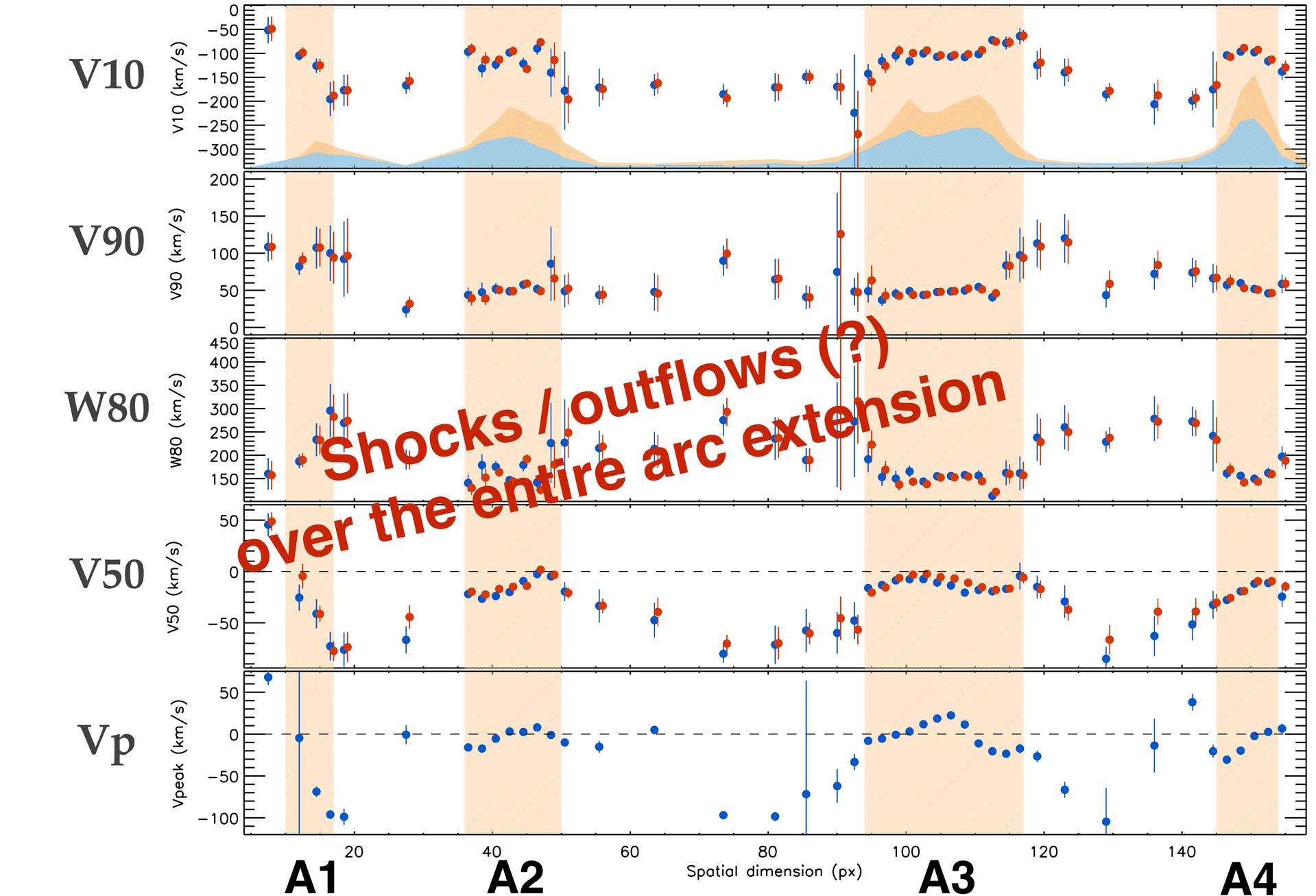
Vp

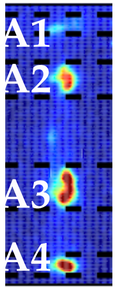


SDSSJ1038 - spatially resolved analysis

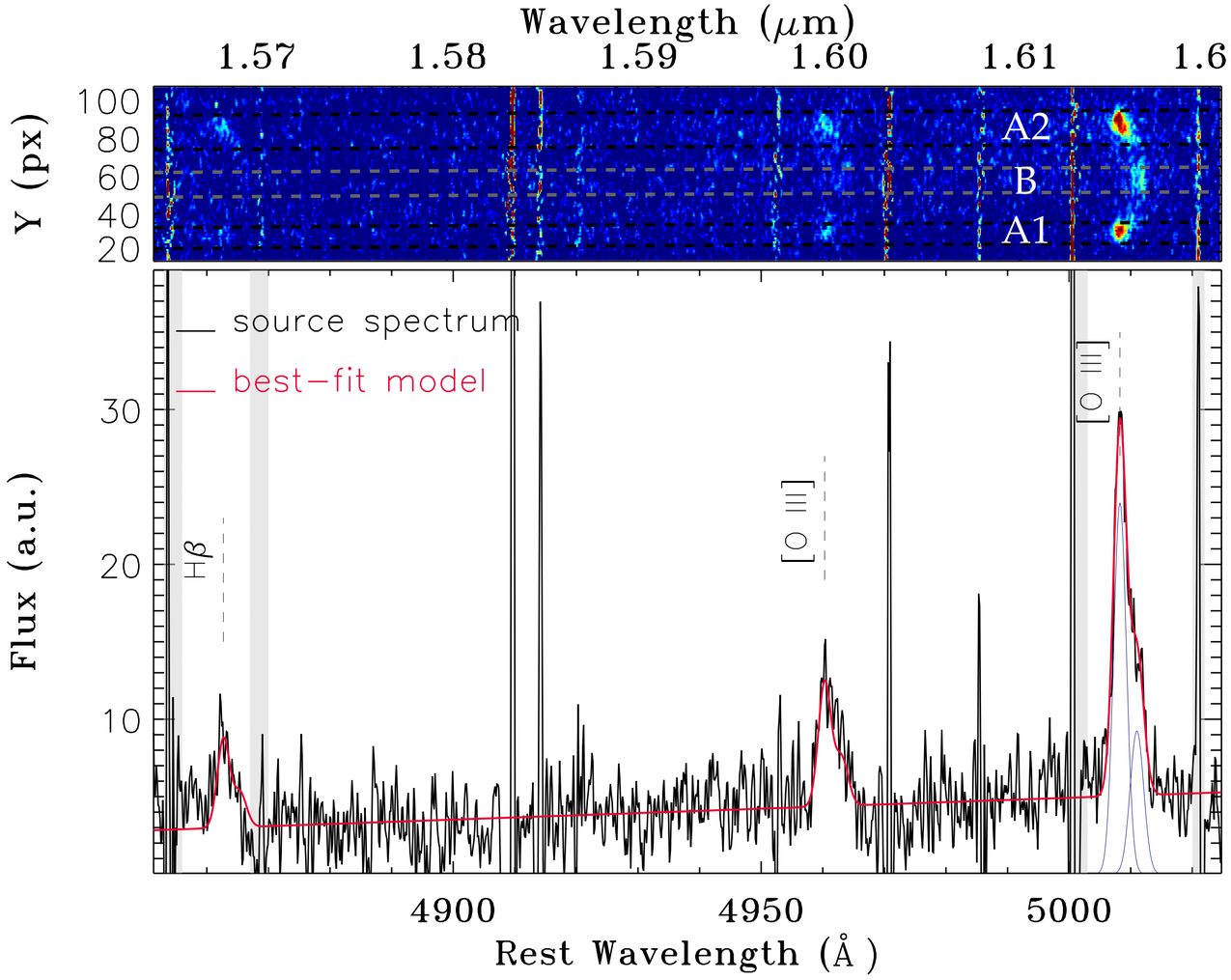
Halpha

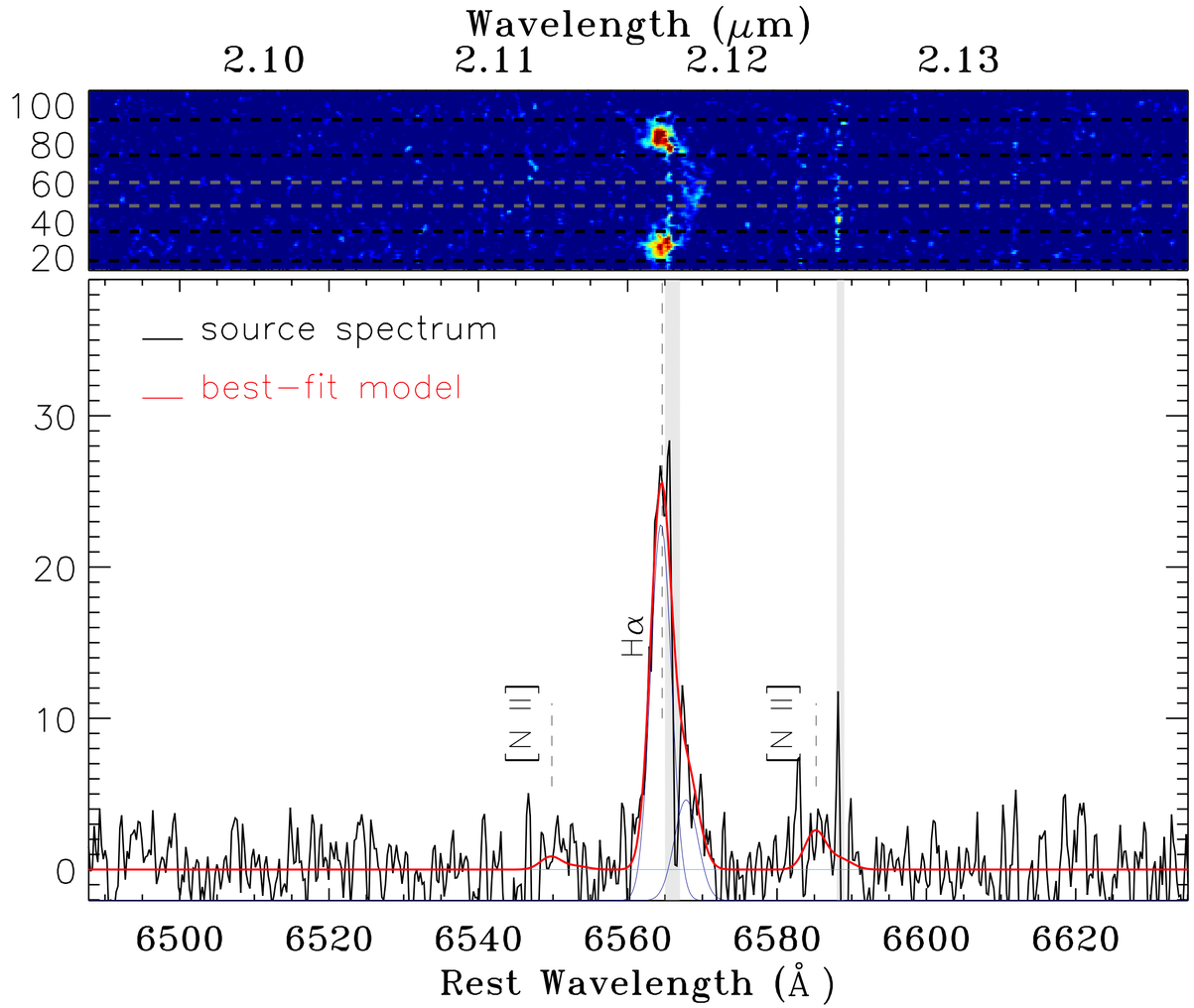
[OIII]





J1958 - integrated spectrum

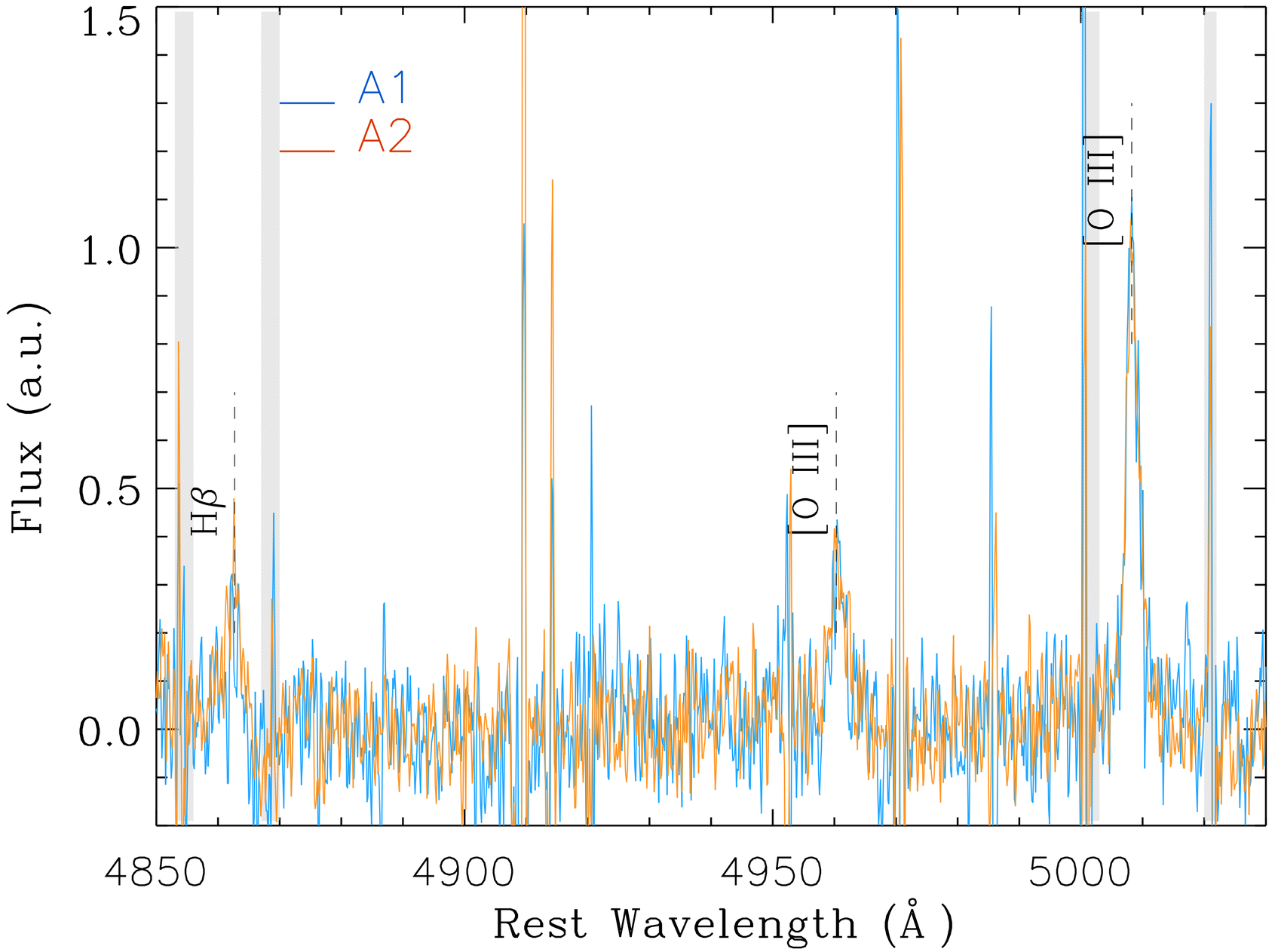


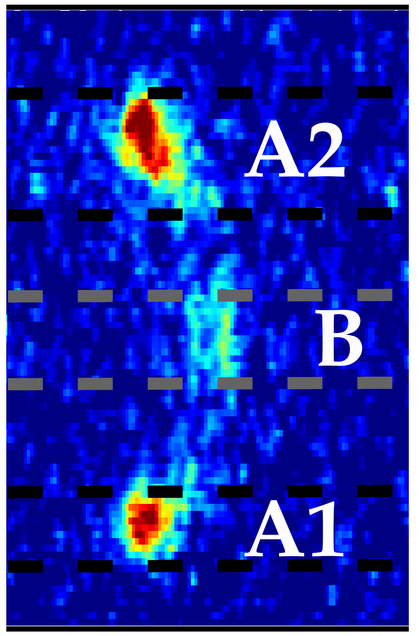


TOT: 30min (Hband)
27min (Kband)

z = 2.225

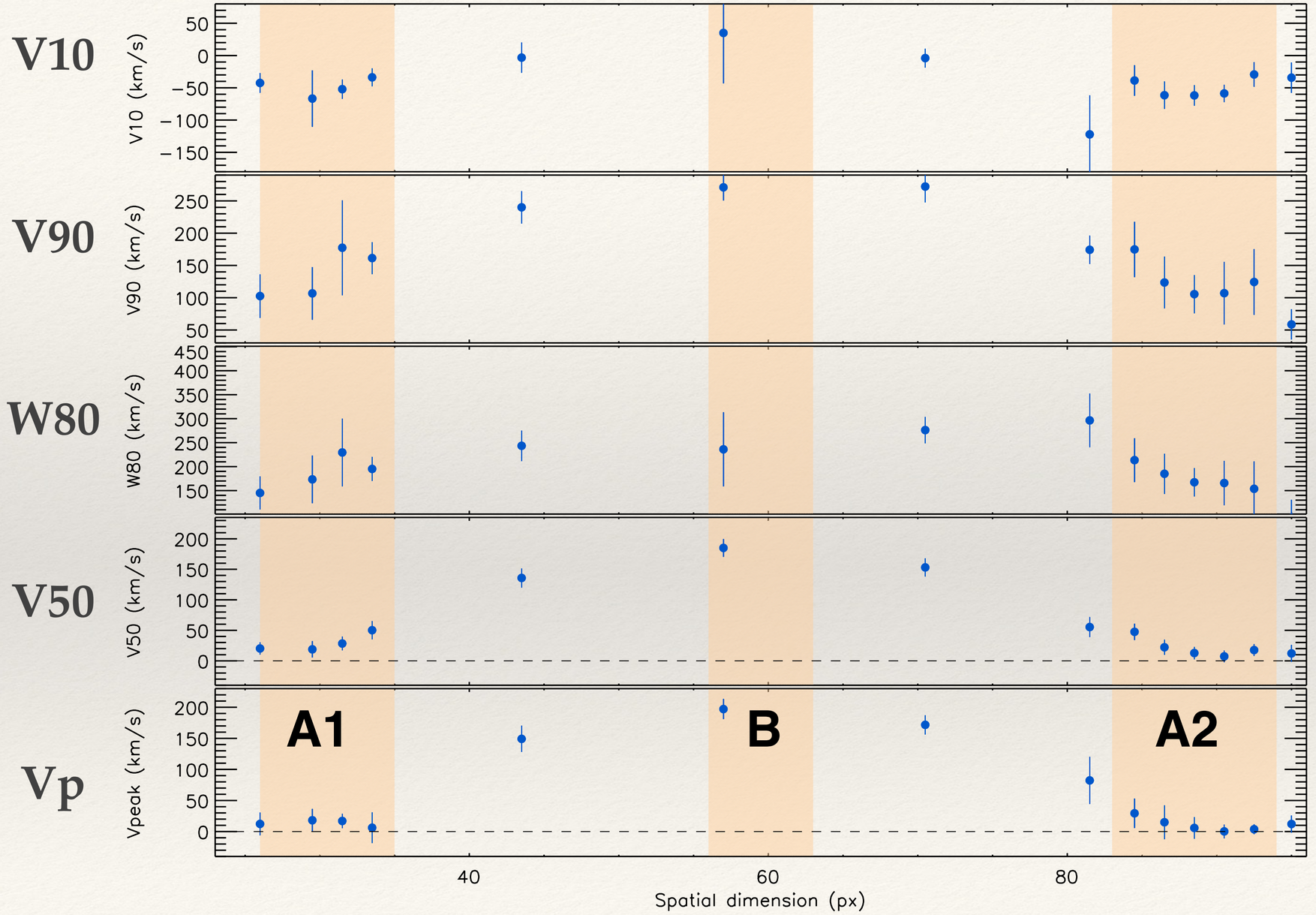
J1958 - comparison between different blobs

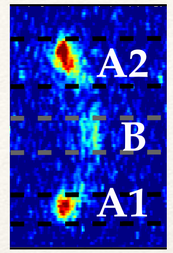




J1958 - spatially resolved analysis

[OIII]

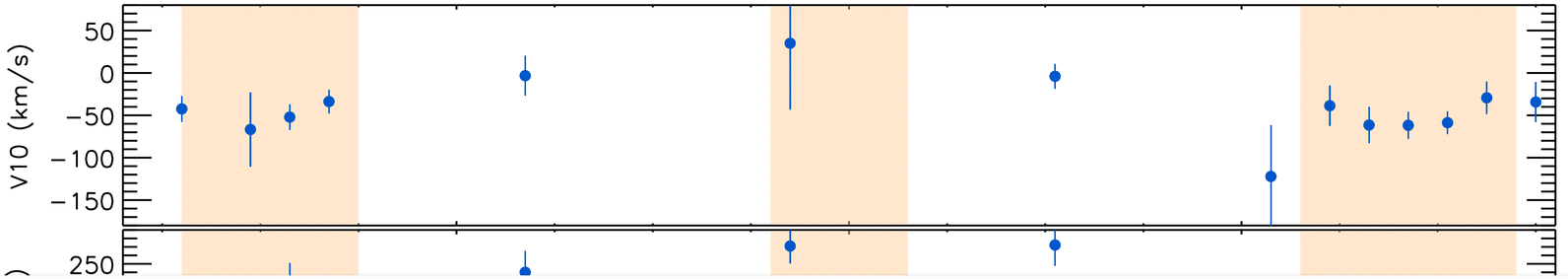


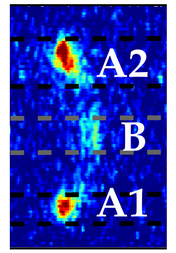


J1958 - spatially resolved analysis

[OIII]

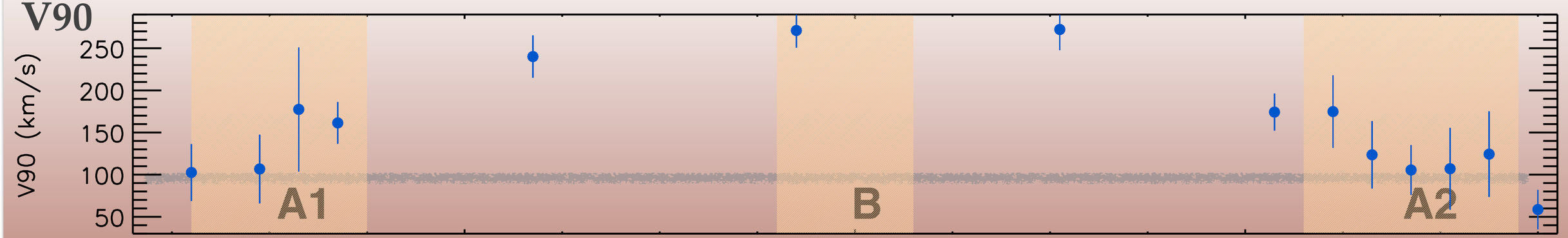
V10

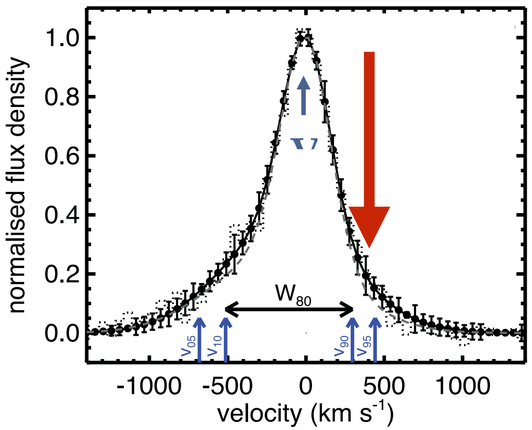




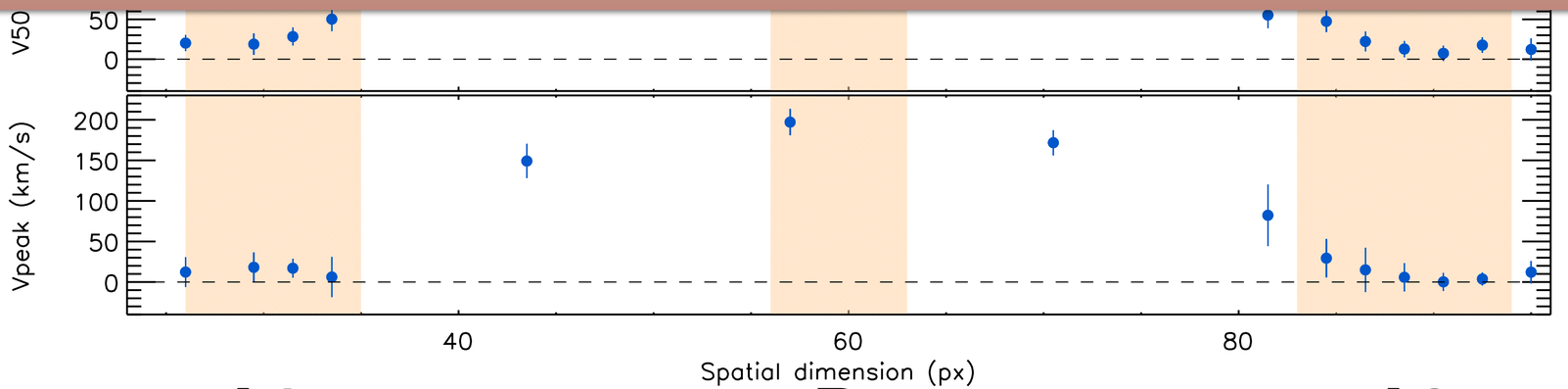
red wing

V90





Vp

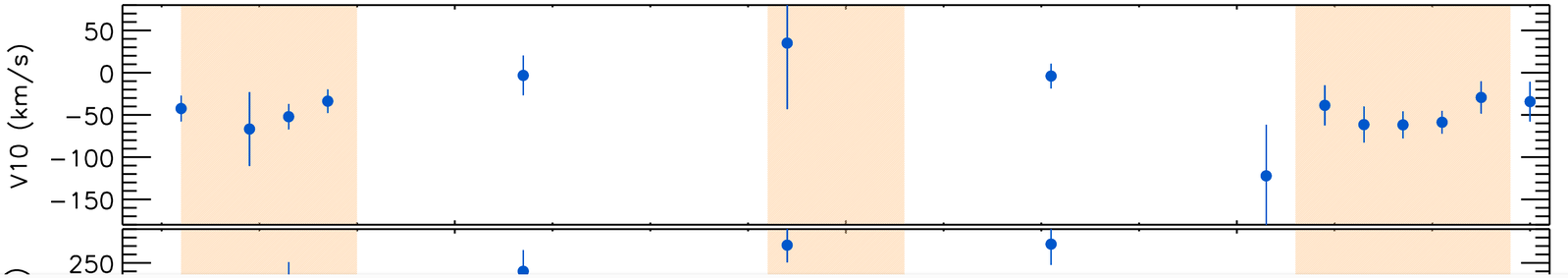


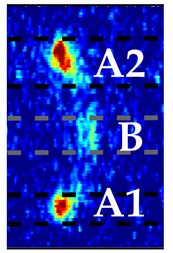
A1 B A2

J1958 - spatially resolved analysis

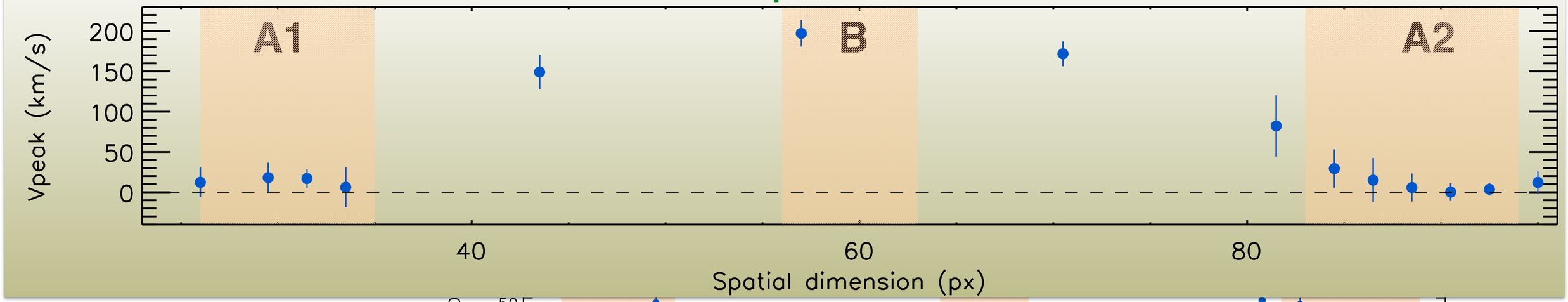
[OIII]

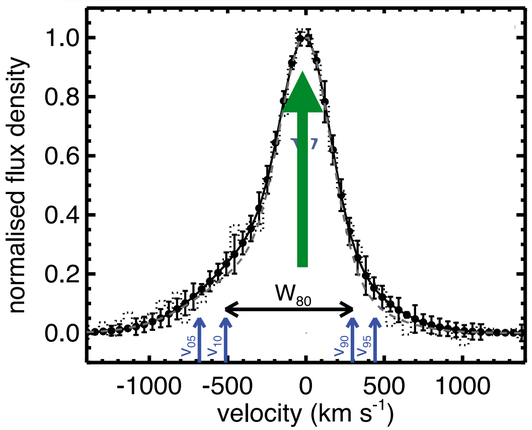
V10



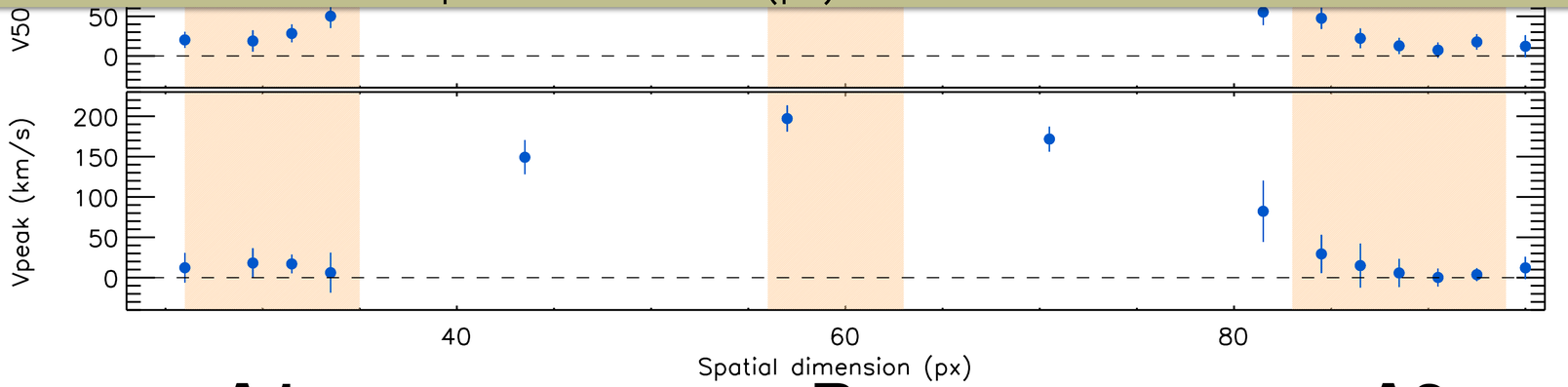


Vpeak





Vp

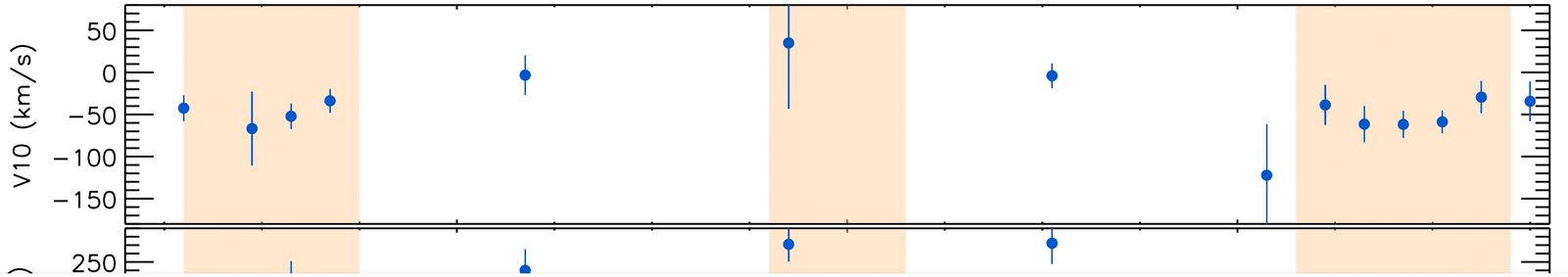


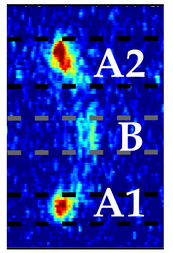
A1 B A2

J1958 - spatially resolved analysis

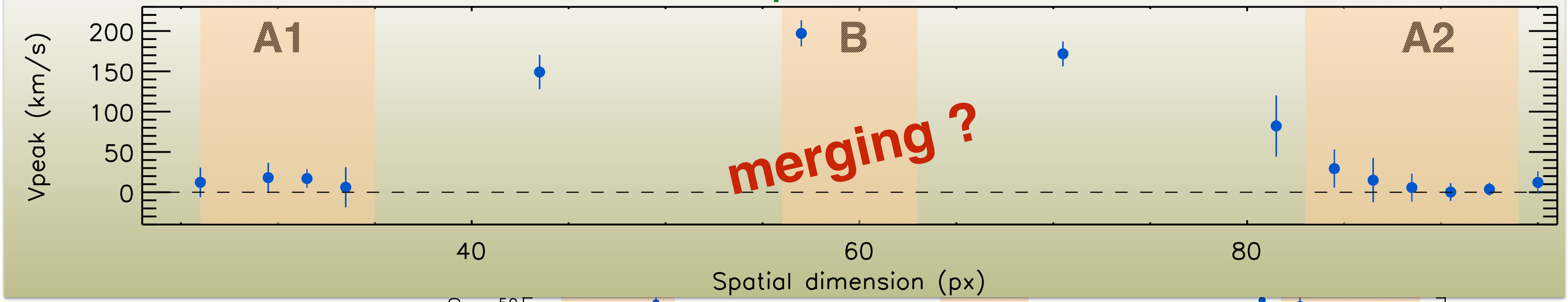
[OIII]

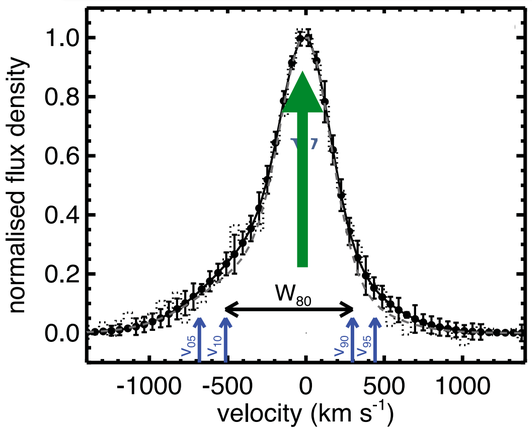
V10



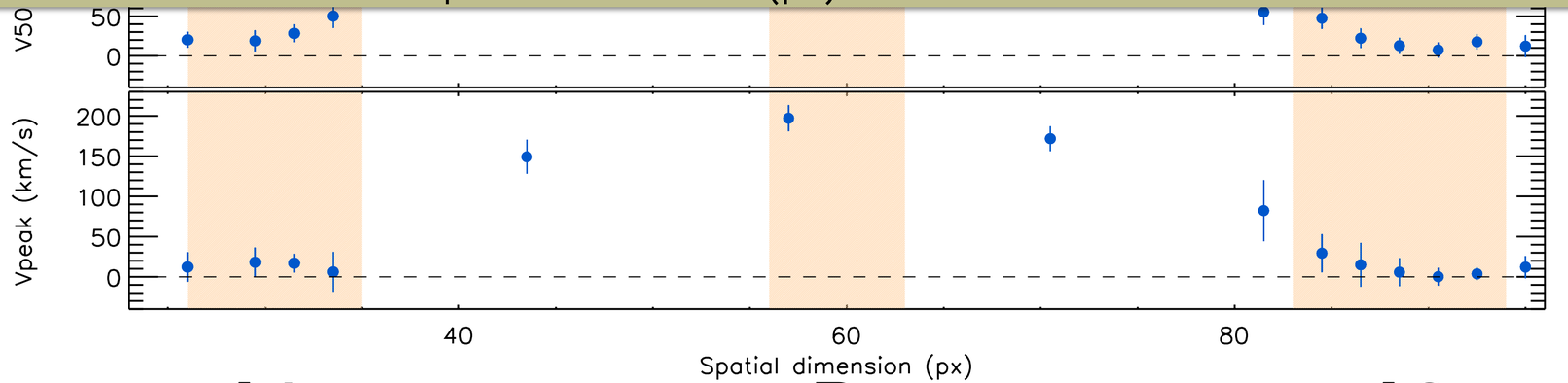


Vpeak



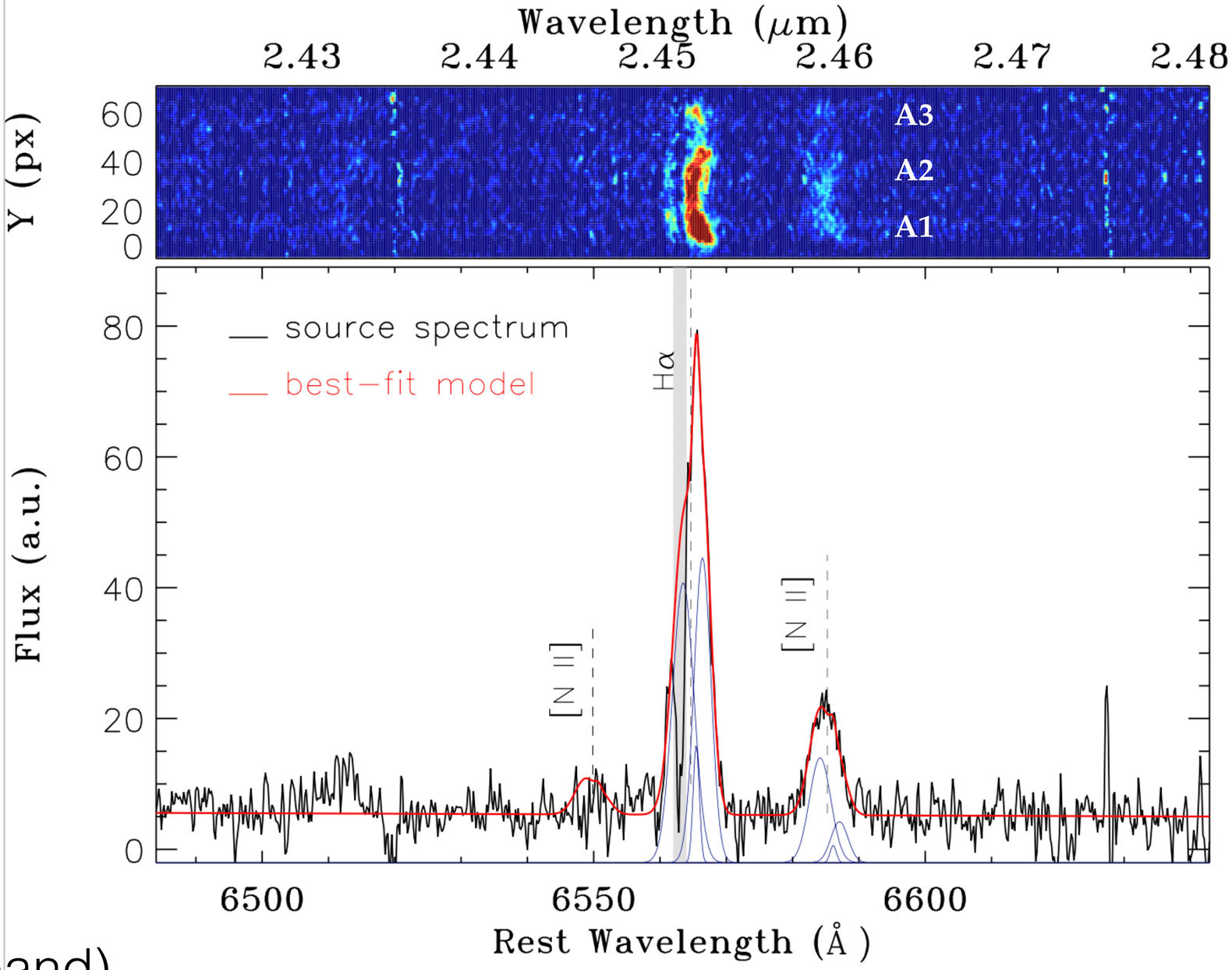


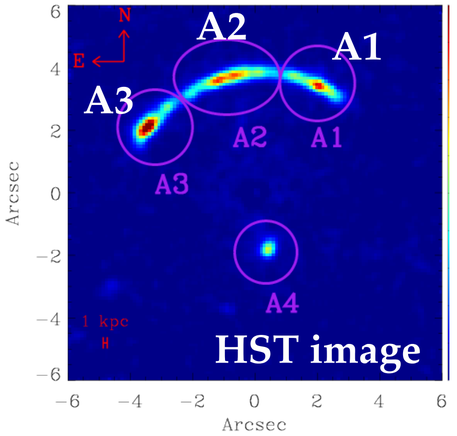
Vp



A1 B A2

J0022 (8 O'CLOCK) - integrated spectrum

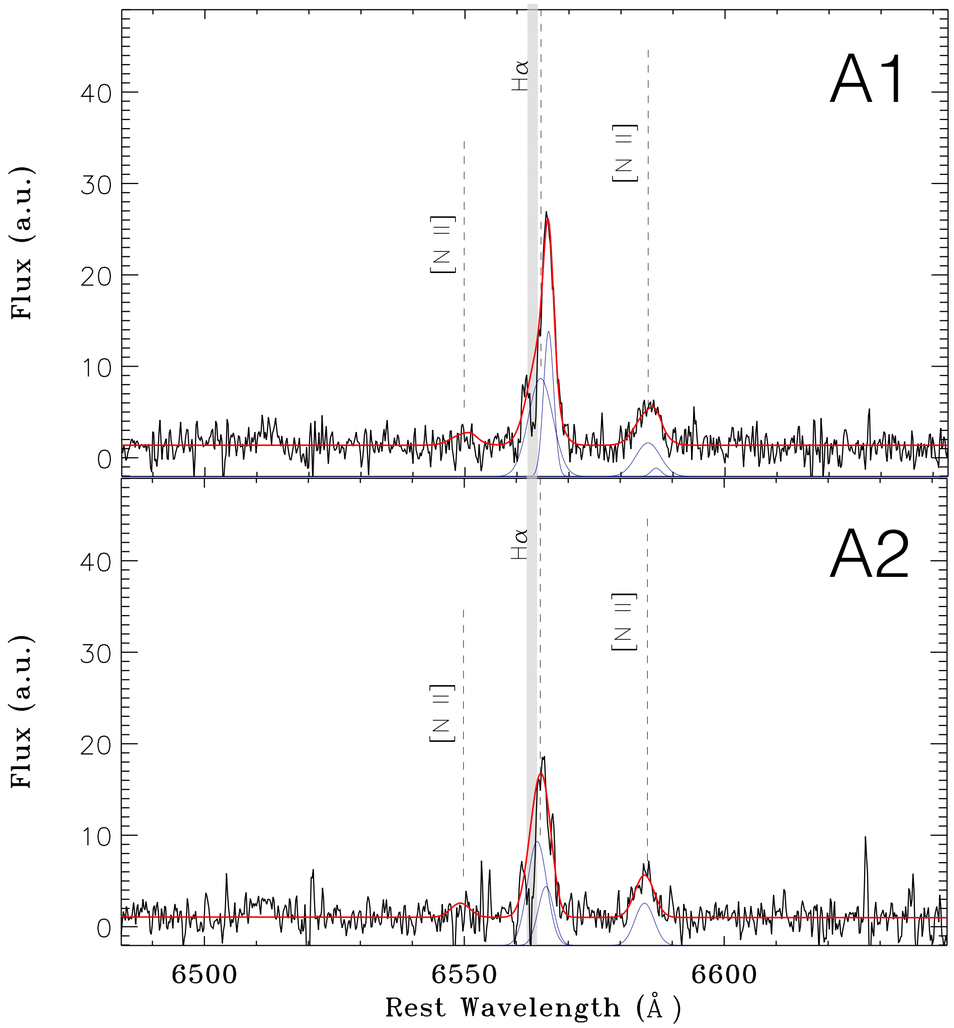




TOT:
3h 10min (Kband)

z = 2.735

J0022 - comparison between different blobs



V10 ([NII]) = -130 ± 34 km/s
W80 ([NII]) = 270 ± 50 km/s

V10 ([NII]) = -130 ± 16 km/s
W80 ([NII]) = 180 ± 50 km/s

A3 : V10 ([NII]) = -140 ± 70 km/s
W80 ([NII]) = 265 ± 80 km/s

(preliminary) Results and perspectives

Curved-slits allow us to follow the (entire) extension of arc-like structures

Thanks to the very good spatial (~0.5”) and spectral (Dv ~ 30 km/s) resolutions we are able to study the kinematic along the curved-slit direction;

We found complex clumpy and filamentary structures in ionised gas. Merging events (SDSSJ1958) and outflows (SDSSJ1038 and J0022) could be responsible of the observed perturbed kinematics.

With improved DR procedures and additional data it will be possible to optimise the analysis (better S/N, smaller sky-line residuals, …). Gas physical properties (e.g. ionisation, metallicity) can also be spatially resolved

Lens models are required to reconstruct the spatial distribution in the source plane