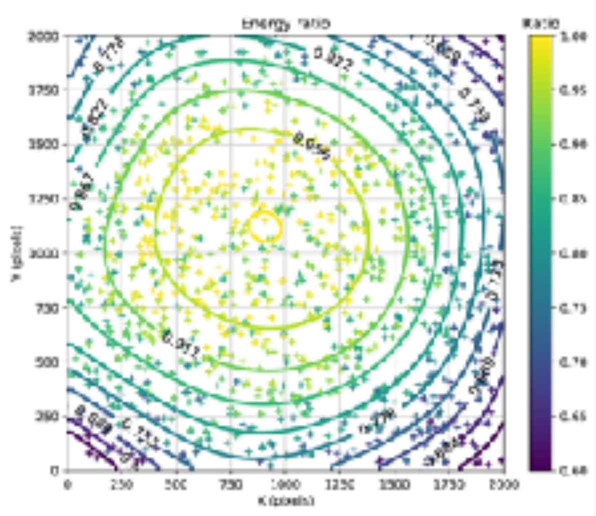
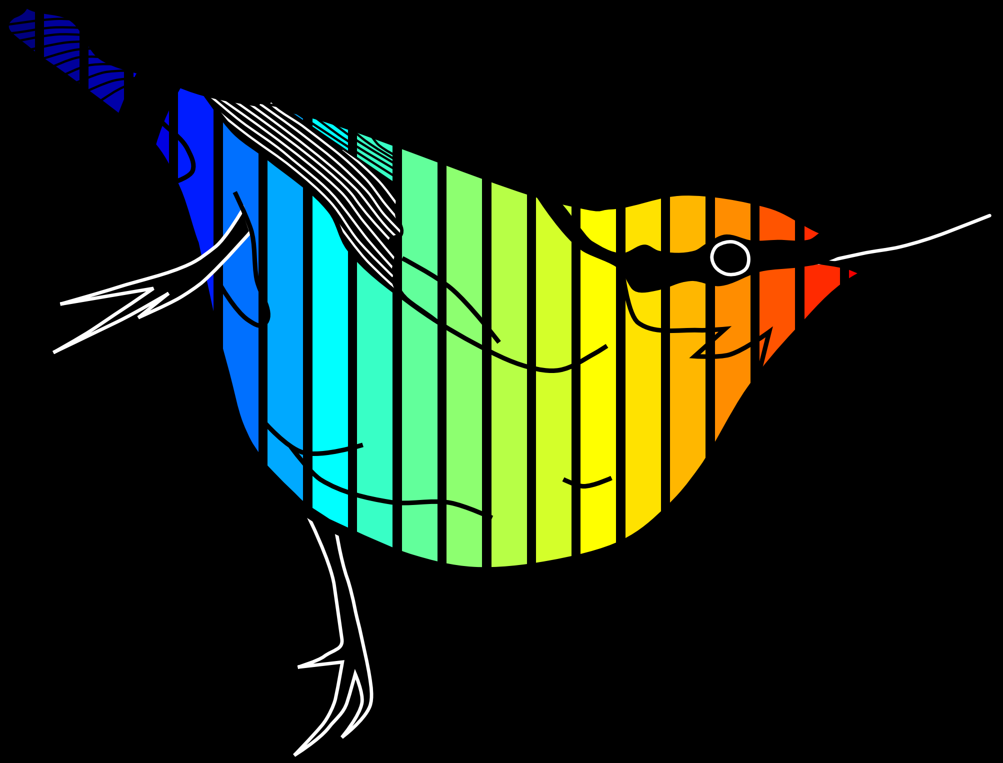
News from SITELLE…

Laurent Drissen

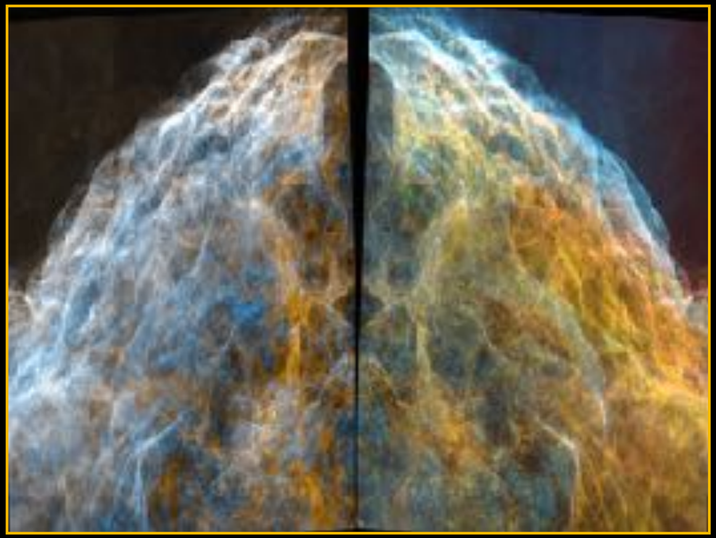


Engineering

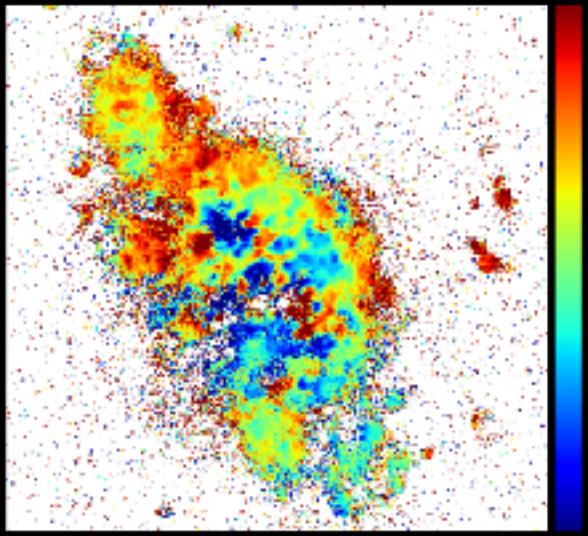
Software



0,001 Mpc

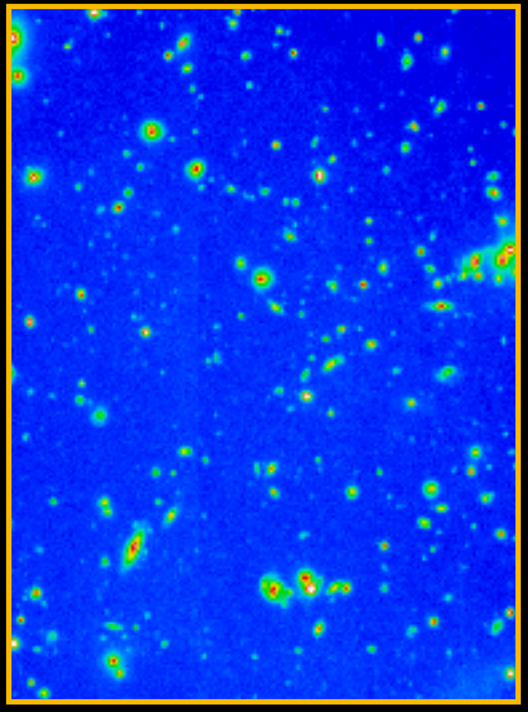


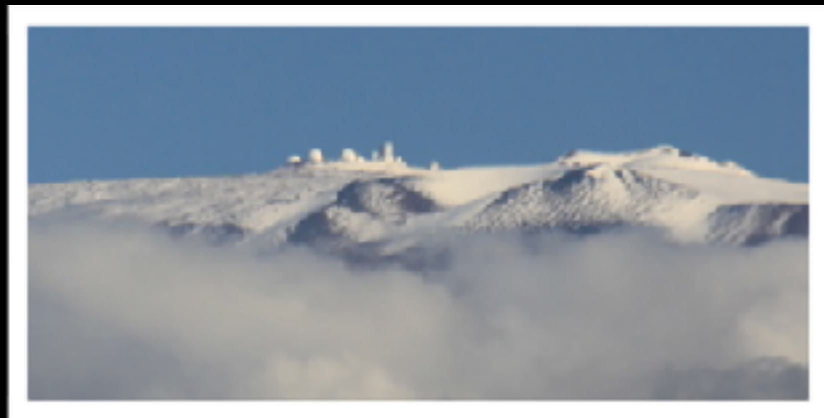
6.4 Mpc

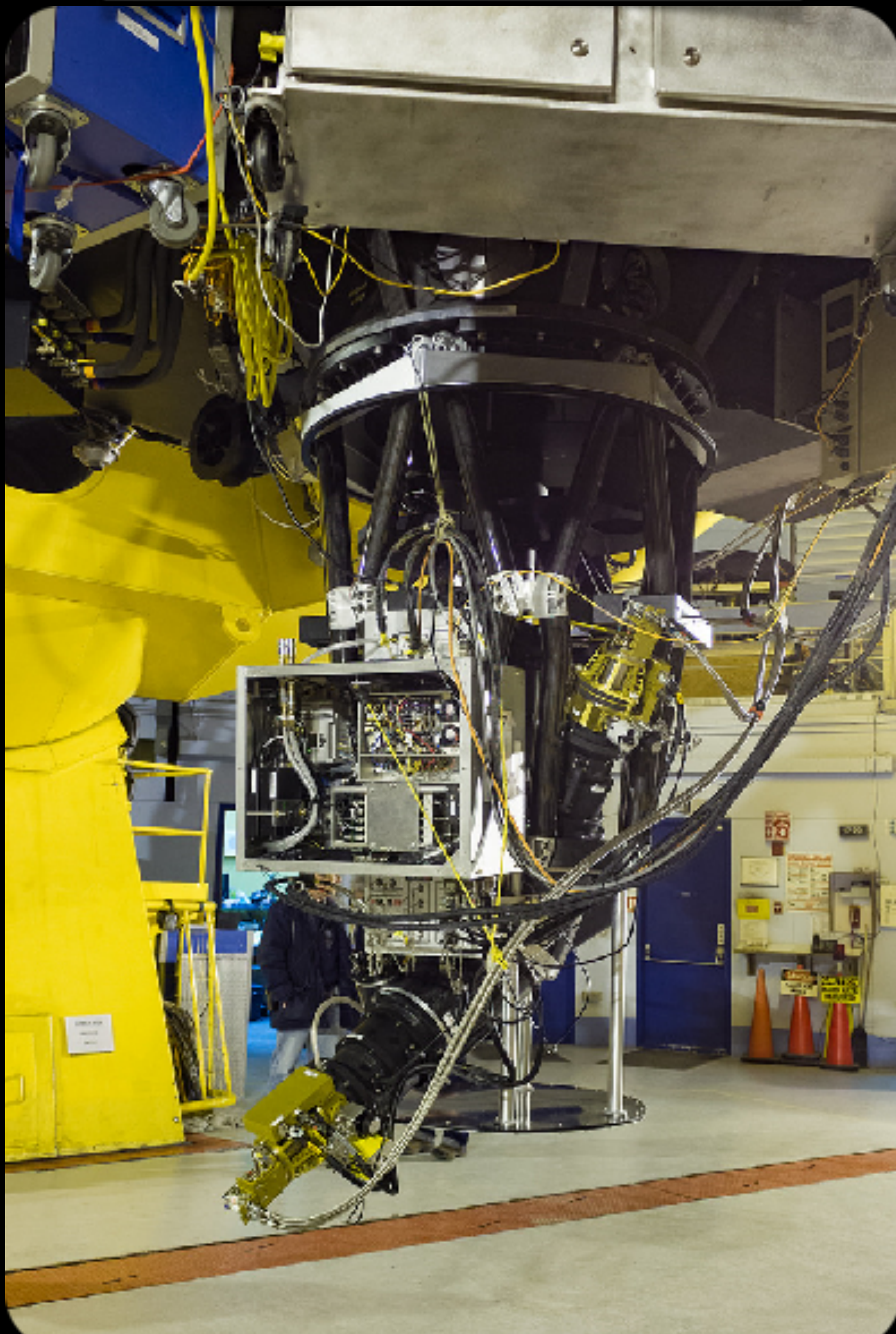


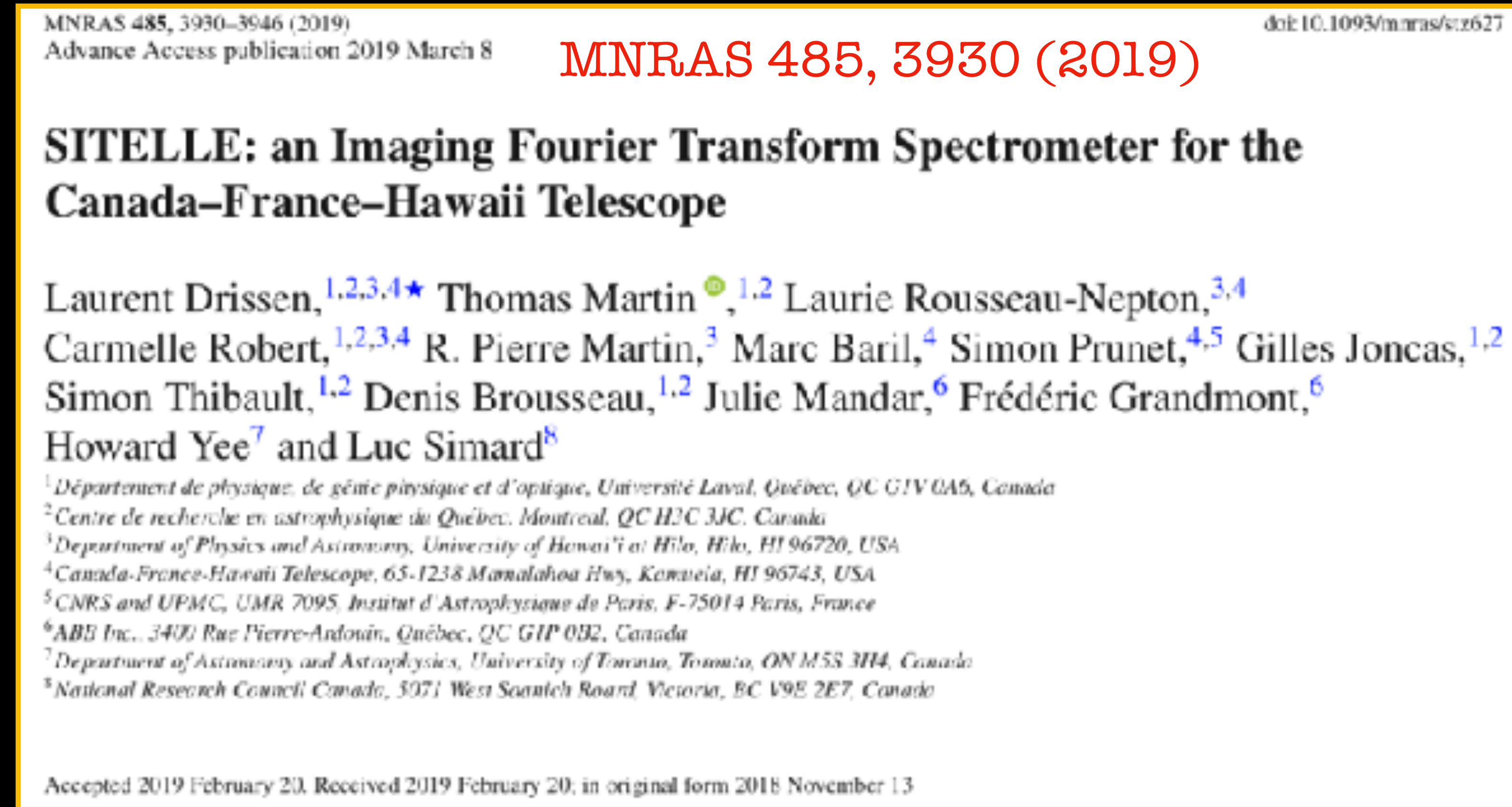
100 Mpc

950 Mpc









MNRAS 485, 3930–3946 (2019)
Advance Access publication 2019 March 8
doi:10.1093/mnras/stz627

MNRAS 485, 3930 (2019)

SITELLE: an Imaging Fourier Transform Spectrometer for the Canada–France–Hawaii Telescope

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[5] CNRS and UPMC, UMR 7095, Institut d'Astrophysique de Paris, F-75014 Paris, France
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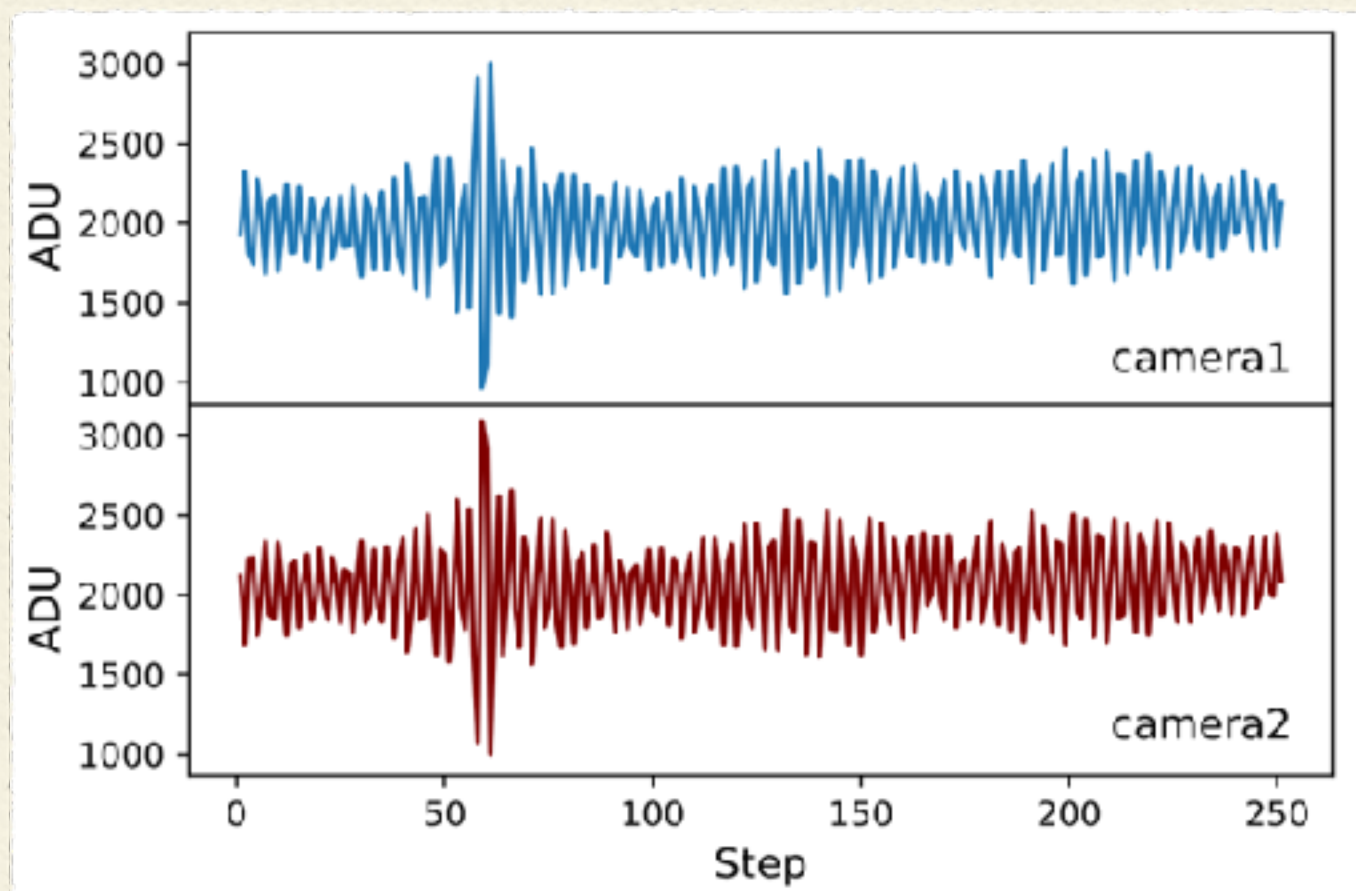
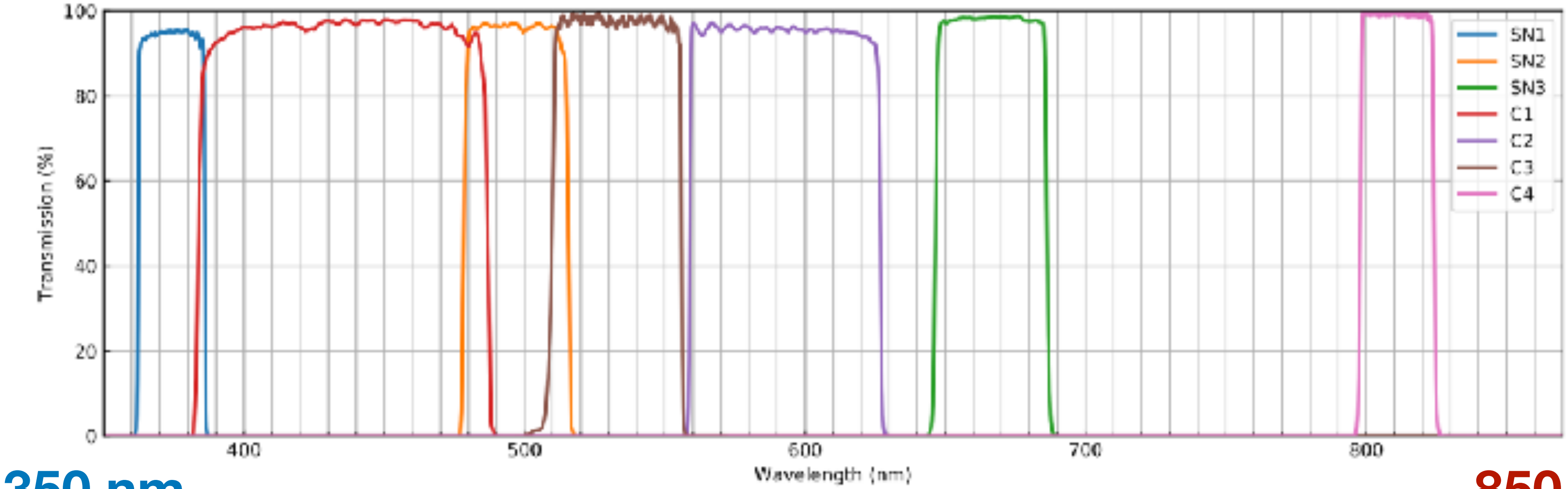
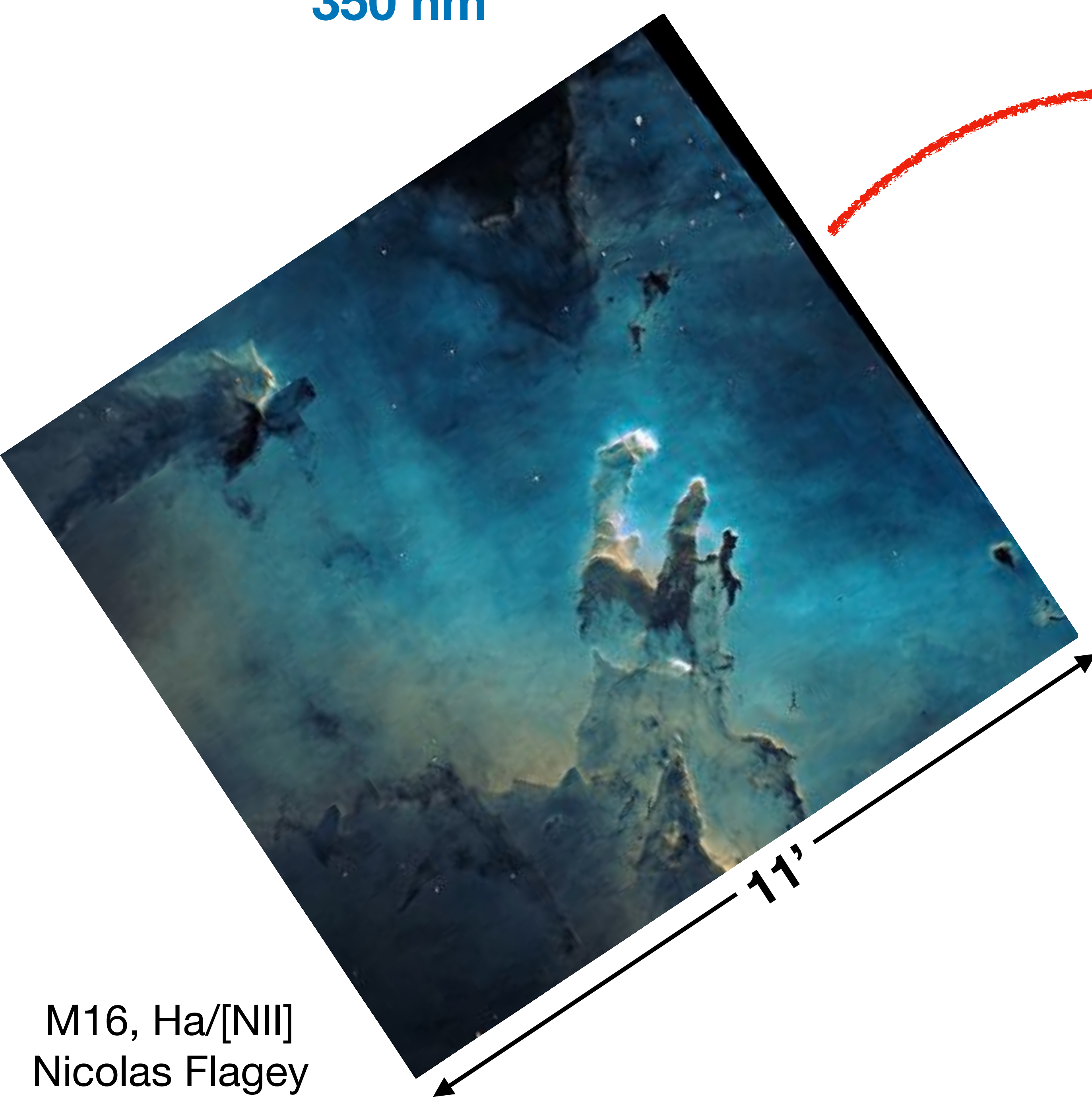
[8] National Research Council Canada, 5071 West Saanich Road, Victoria, BC V9E 2E7, Canada

Accepted 2019 February 20. Received 2019 February 20; in original form 2018 November 13



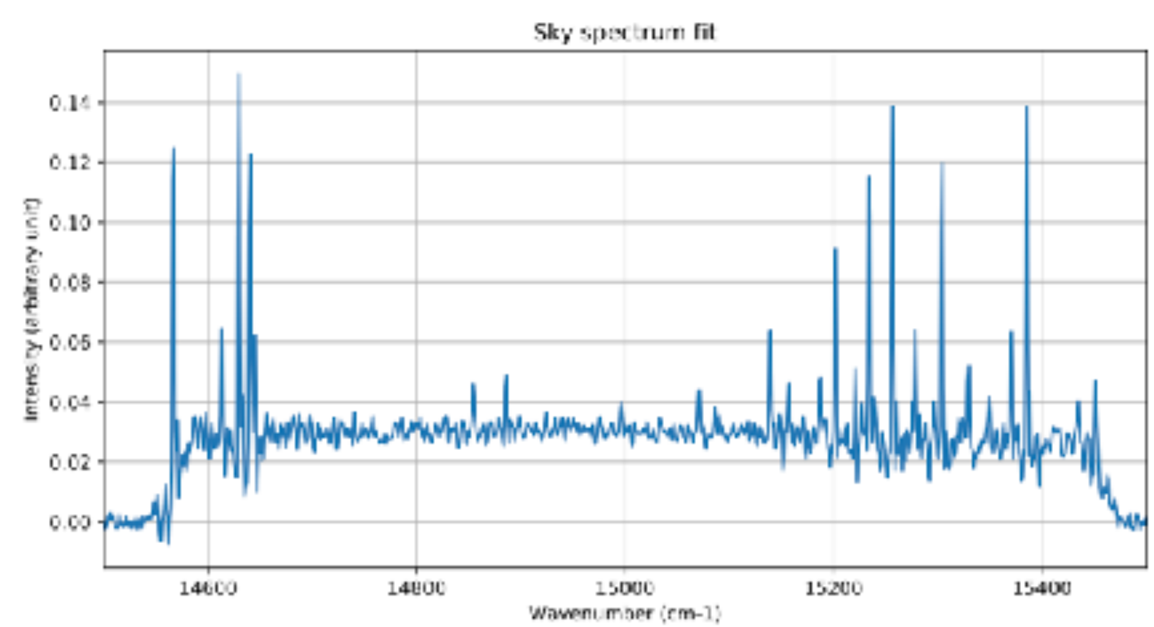


350 nm **850 nm**



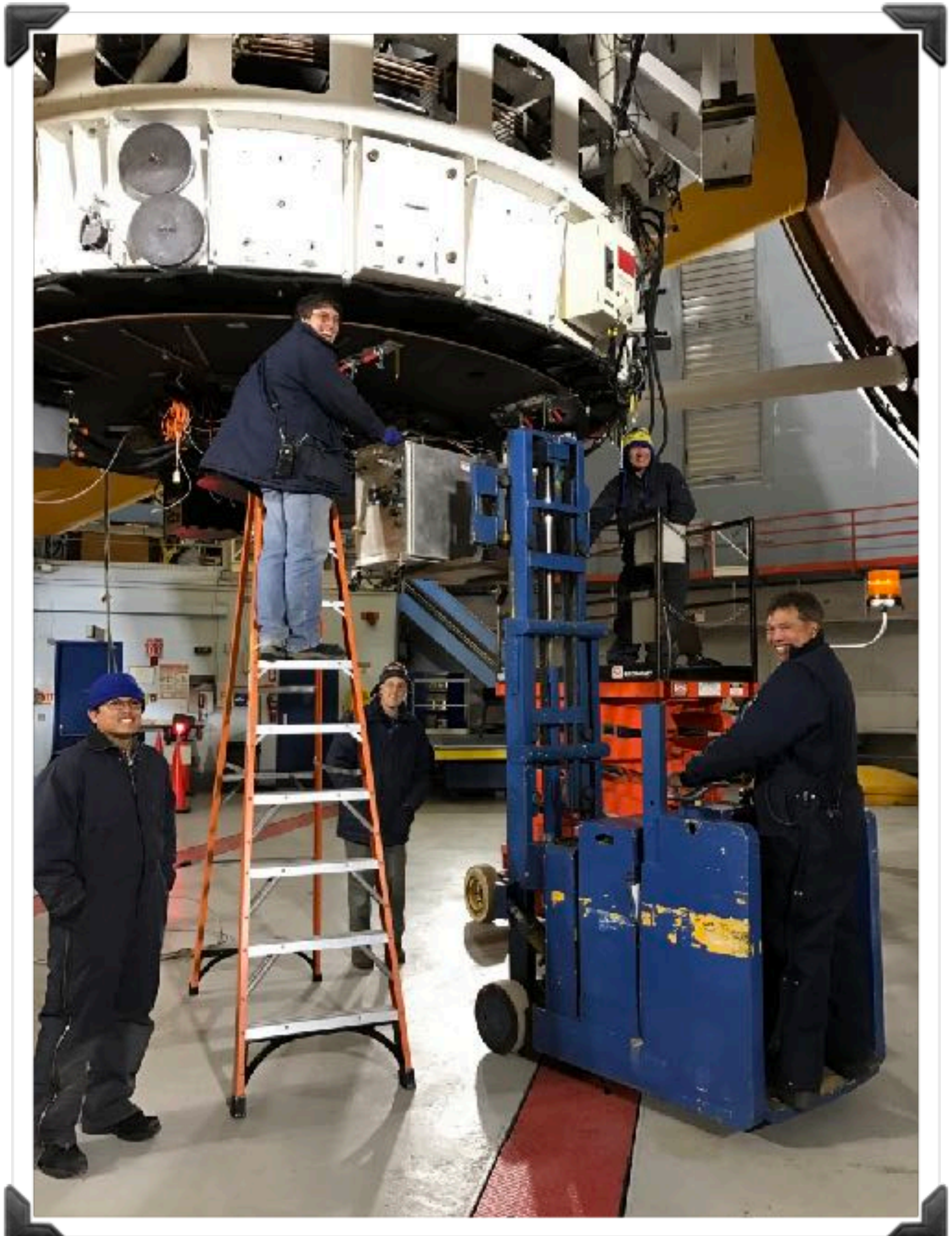
4 227 072 pixels

R=1 -10000



M16, Ha/[NII]
Nicolas Flagey

Mahalo nui loa, CFHT engineering, technical & science teams!



Marc Baril, Greg Barrick, Kevin Ho, Laurie Rousseau-Nepton, et al.

Mahalo nui loa, CFHT engineering, technical & science teams!

Simon Prunet (data reduction, software, filter scanning)

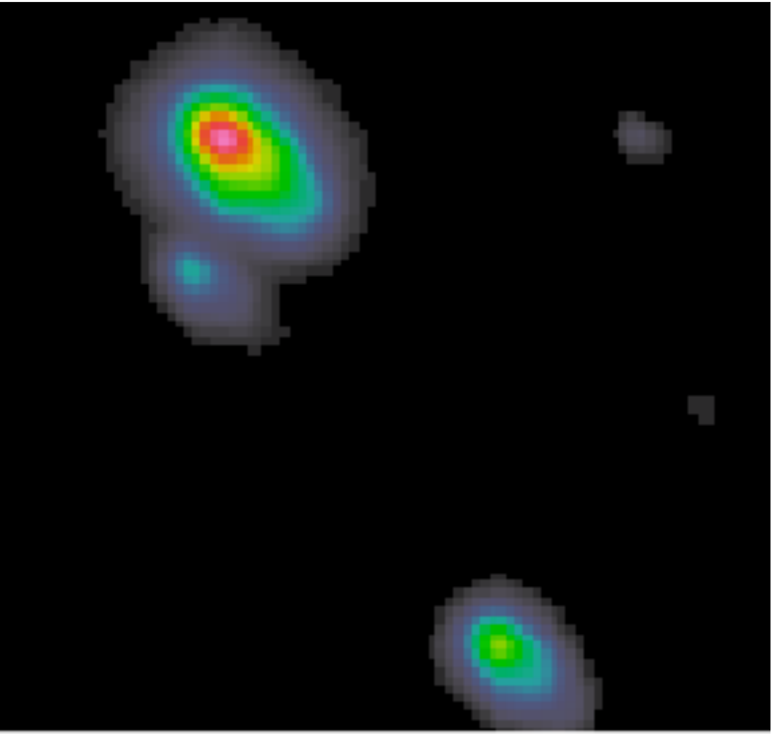
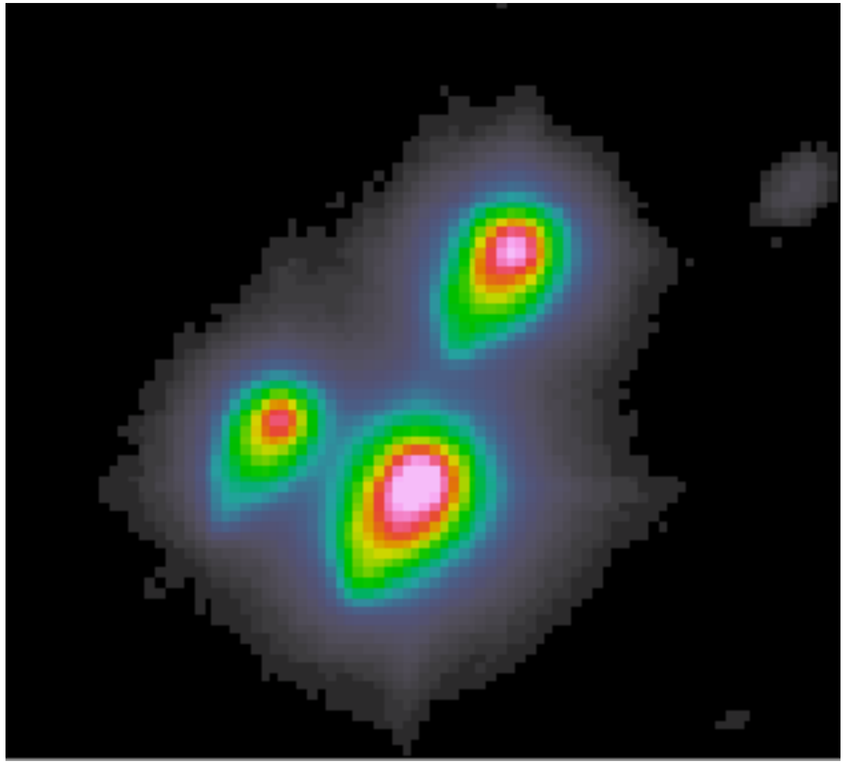
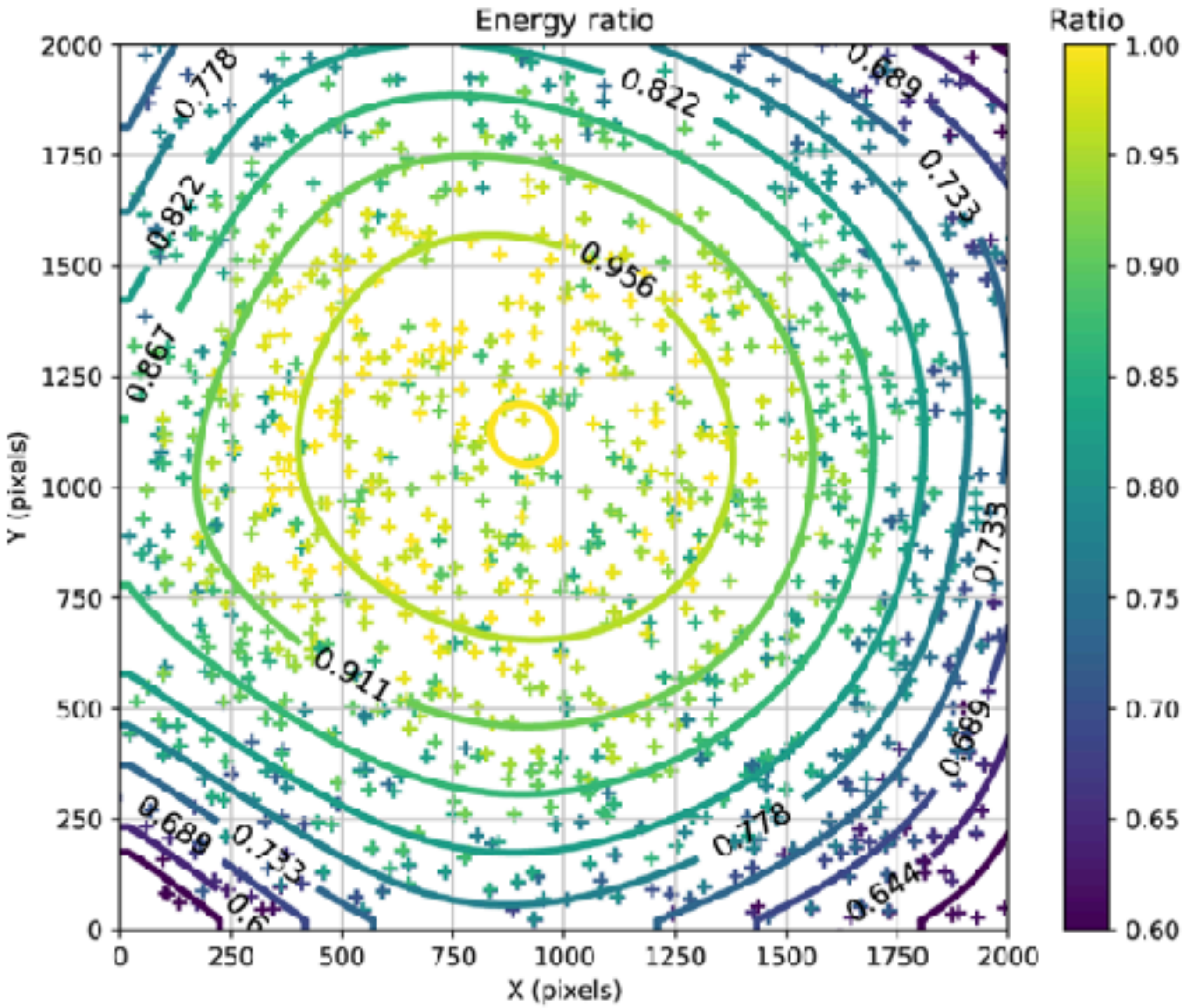
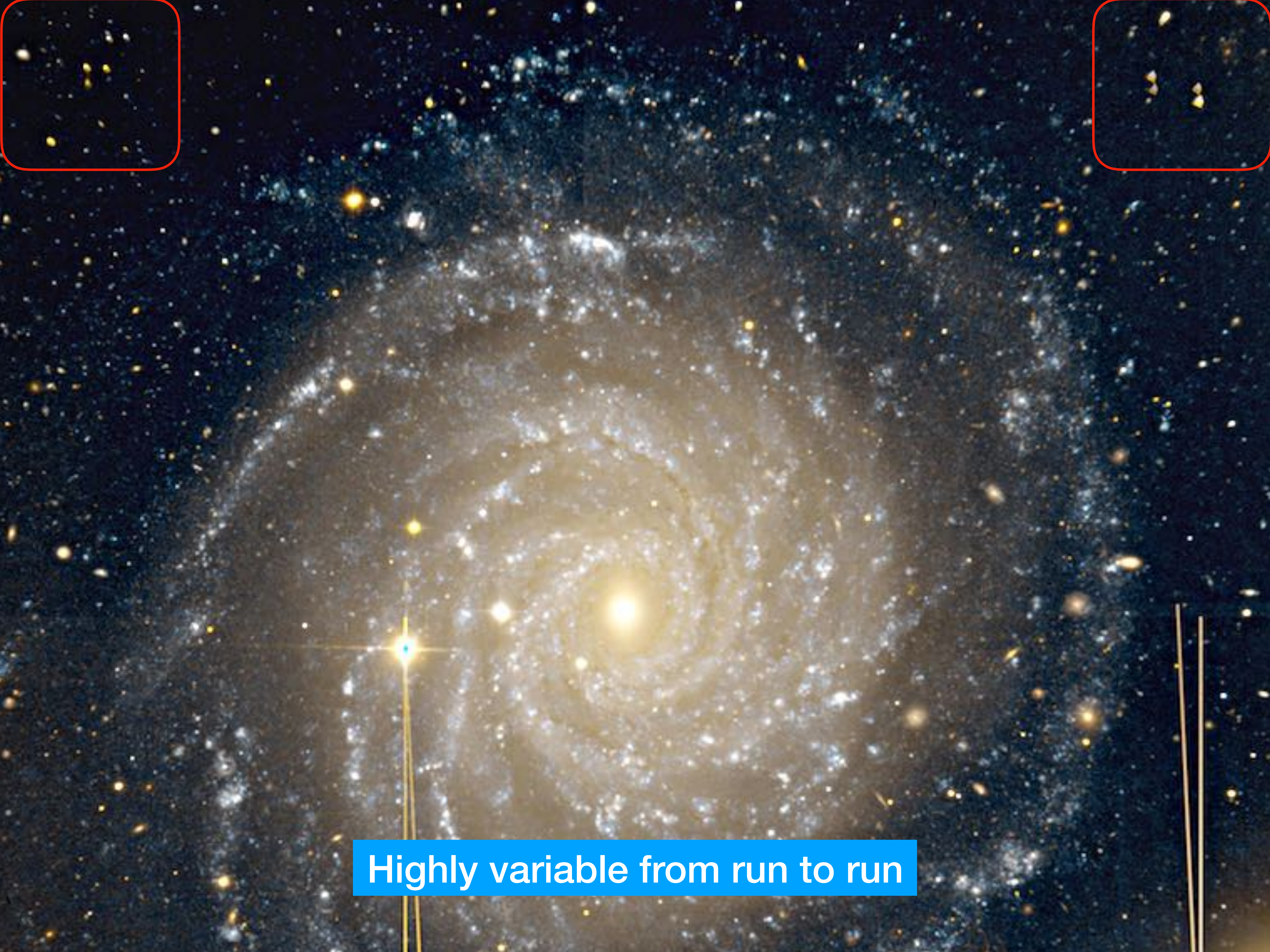


Image Quality

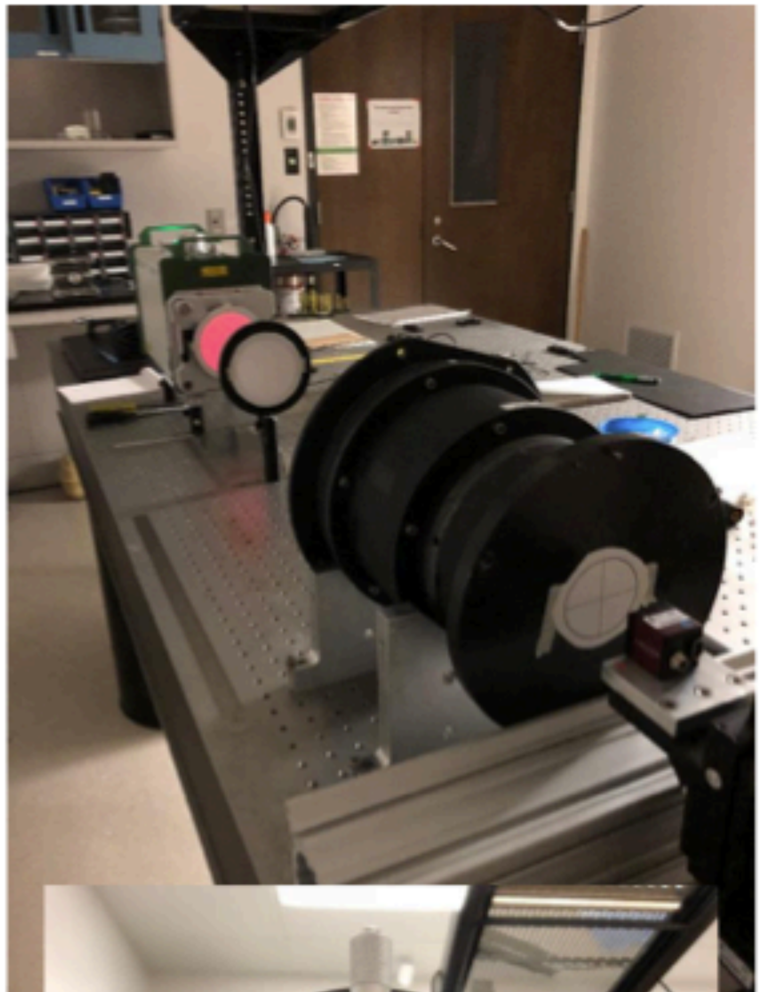


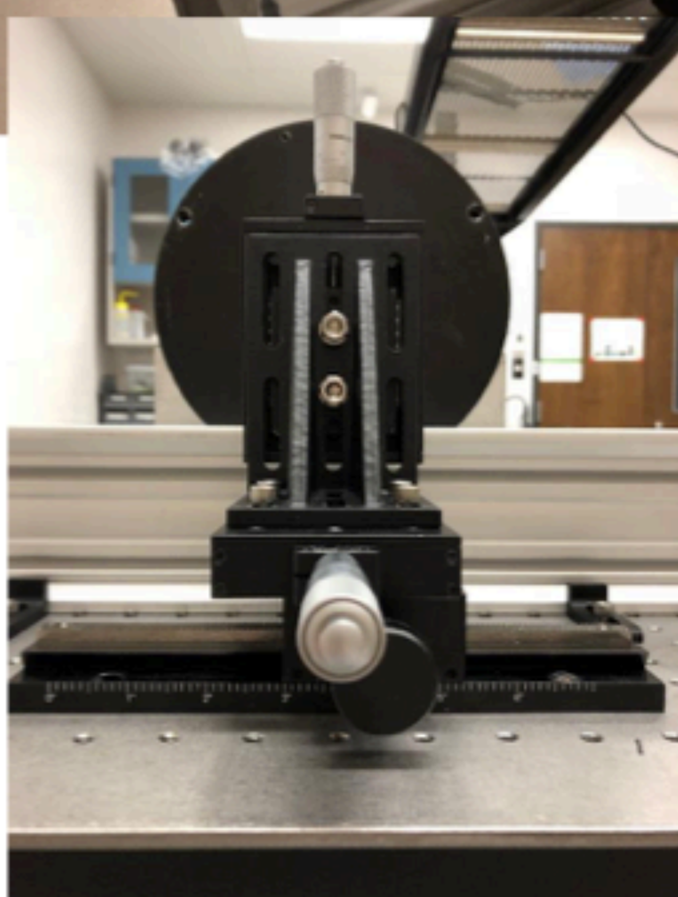


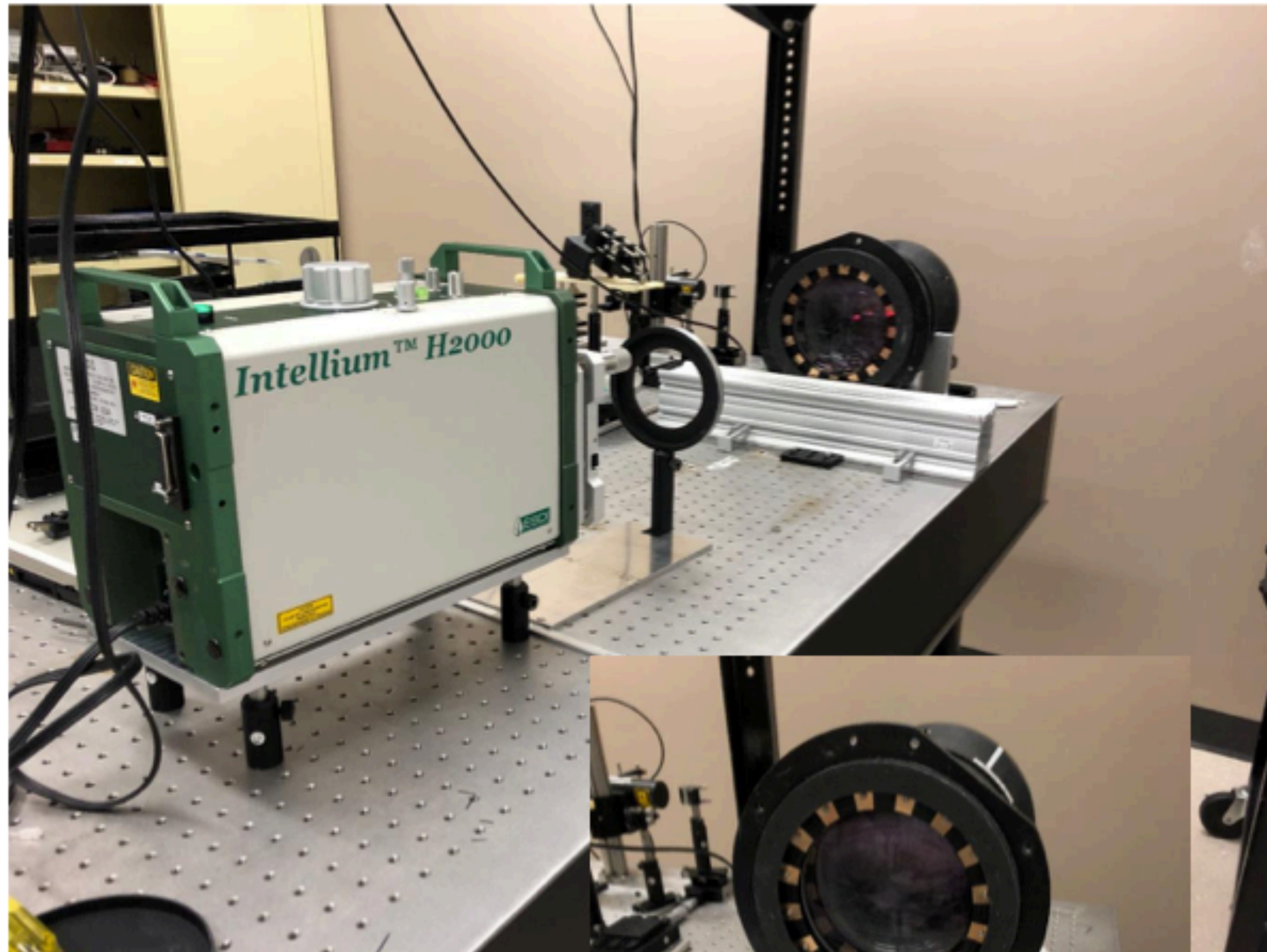

Highly variable from run to run

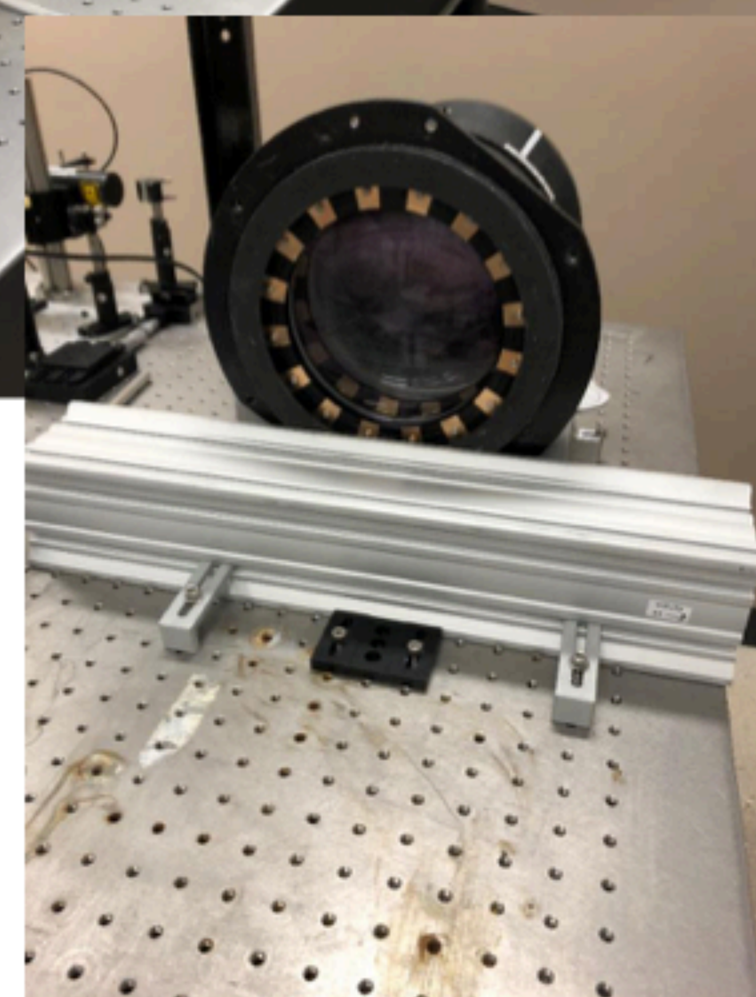
Optical tests (collimator), Mauna kea, Fall 2017

Optical tests (cameras), Laval, August 2018



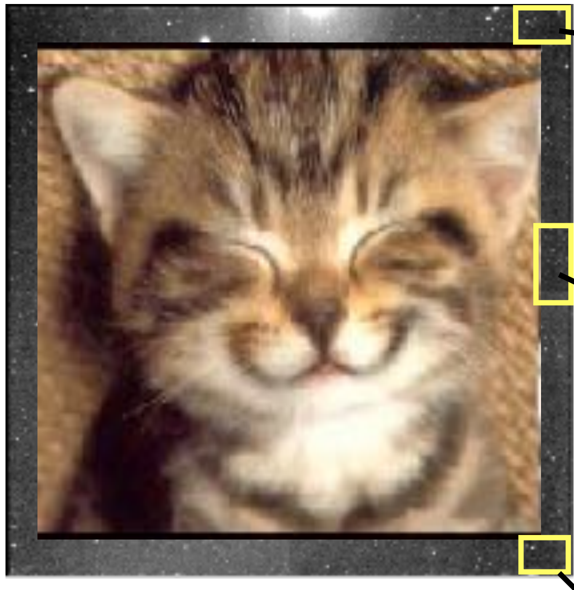






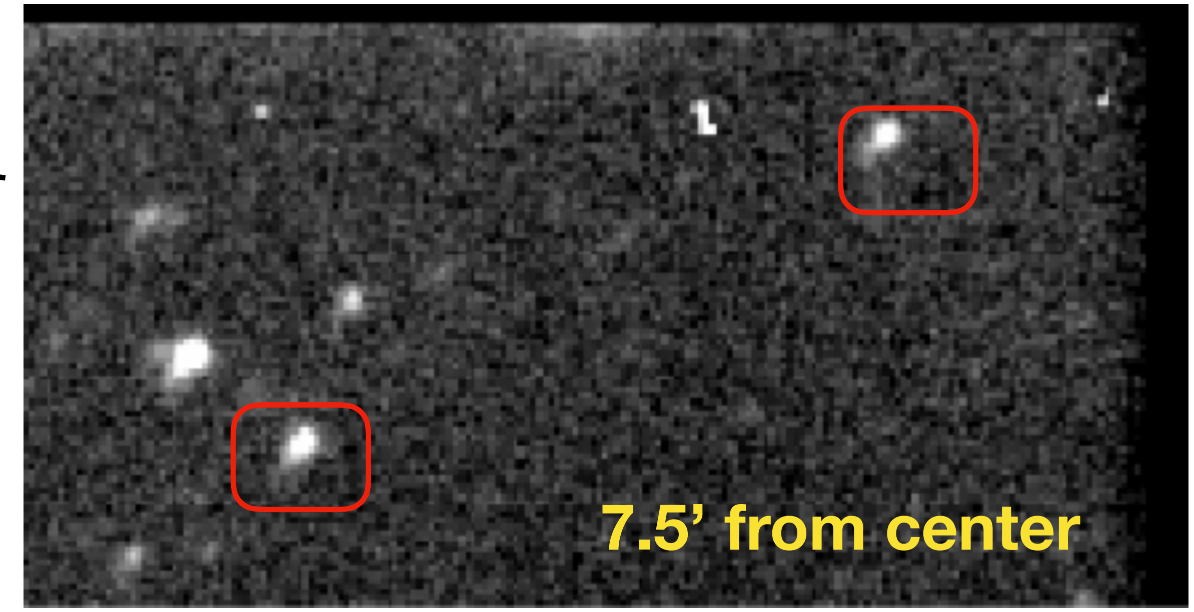
Telescope/SITELLE alignement work

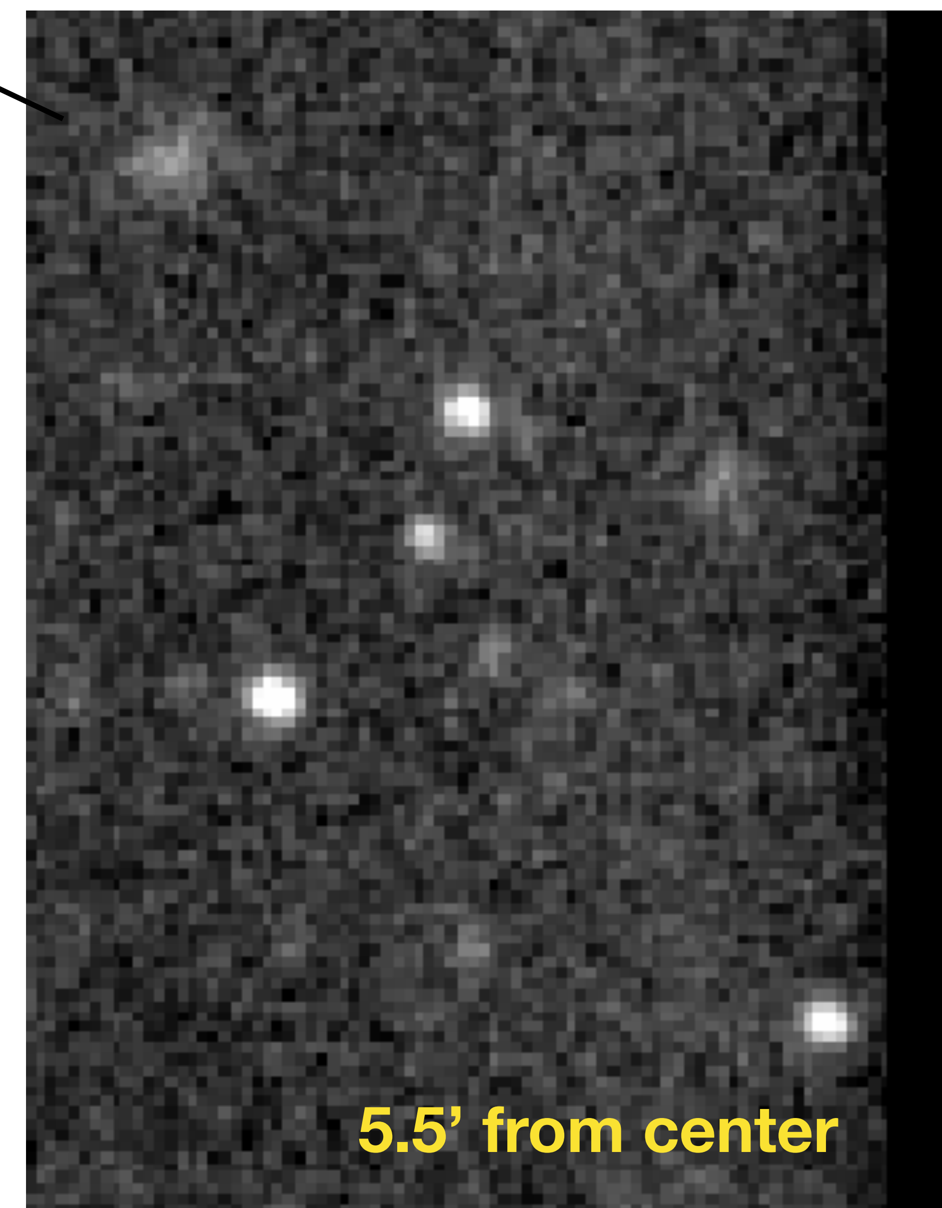
(SITELLE is the instrument with the largest FOV (11’ x 11’) ever installed at the Cassegrain - MOS was 10’ x 10’)

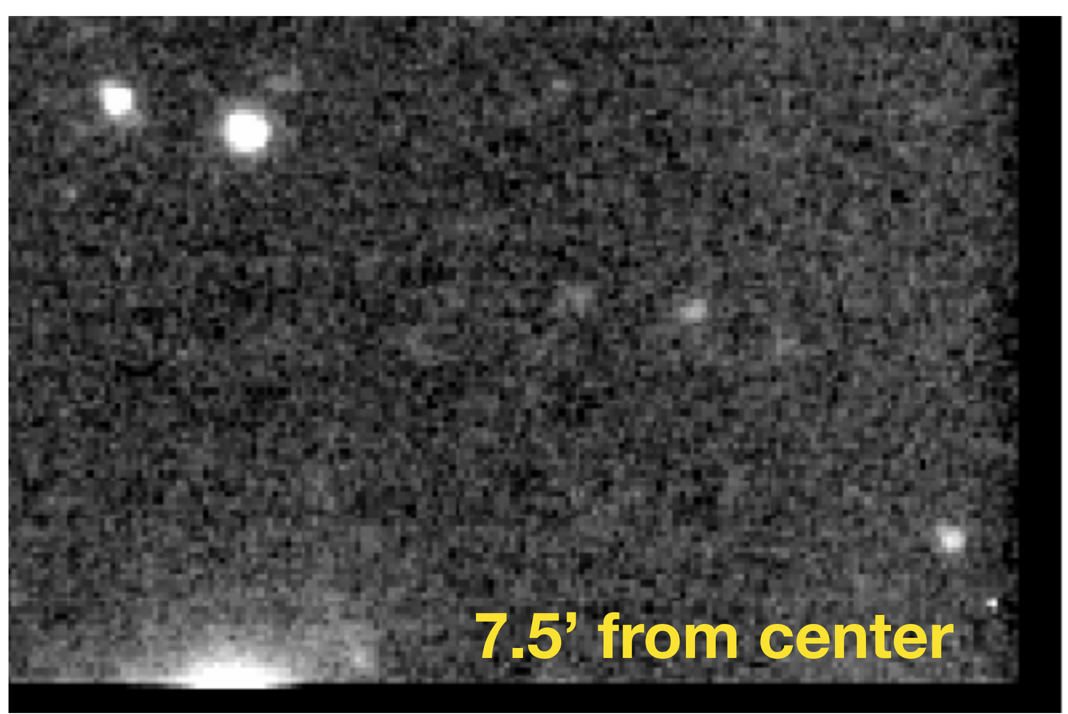


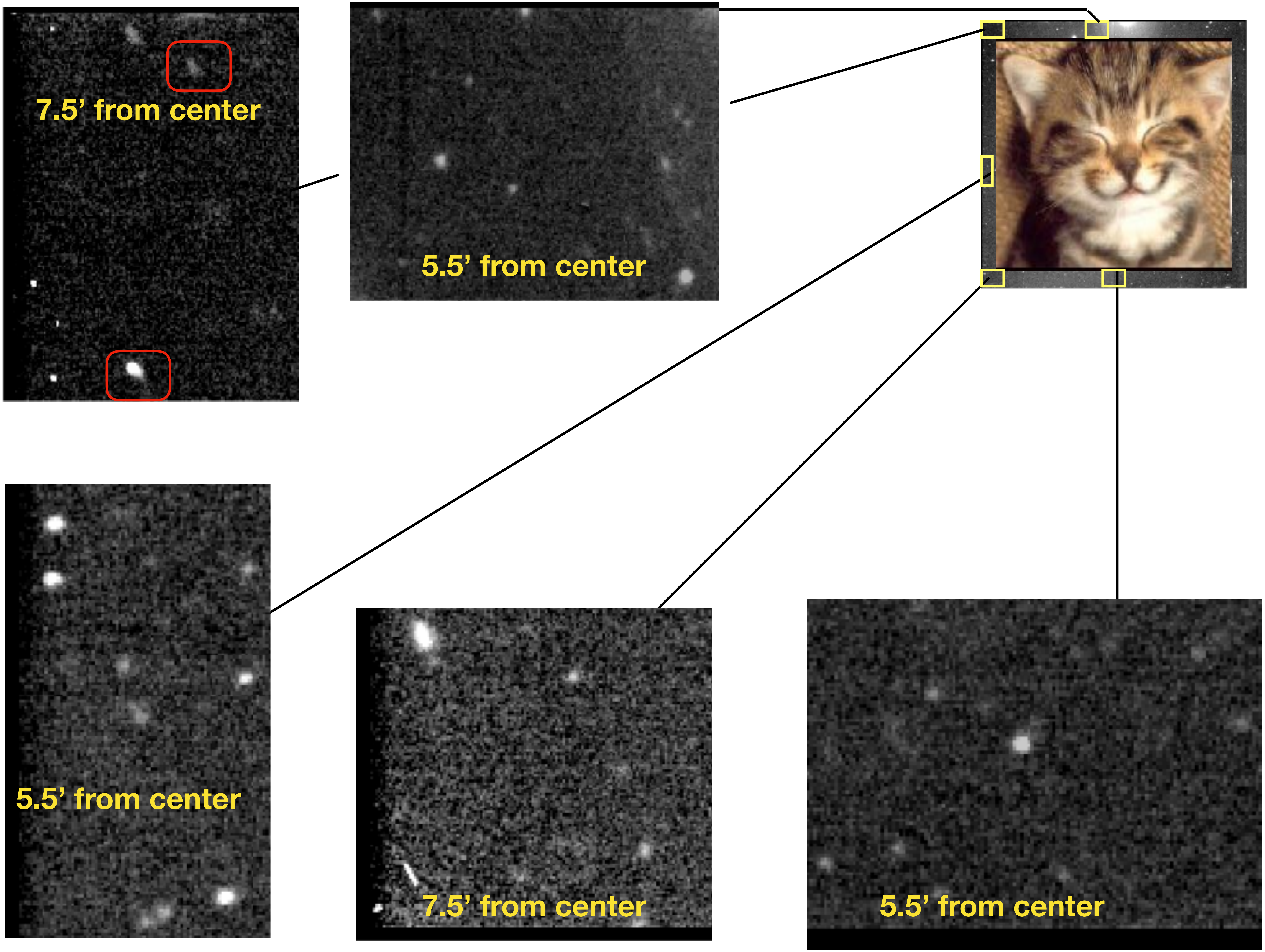
(The Happy Kitten Nebula)

SN1 filter (375 nm),
2 hour cube,
April 2019



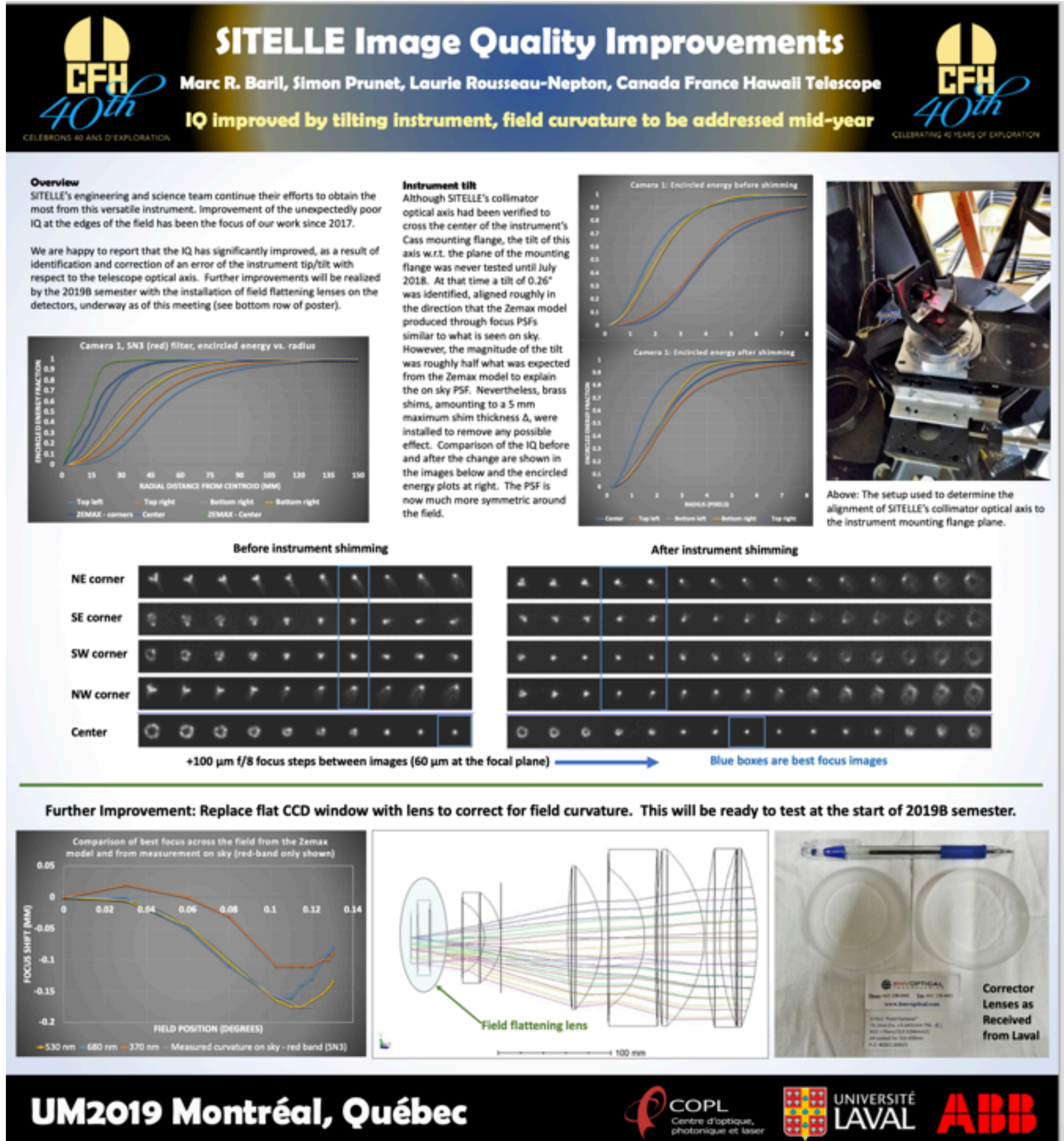




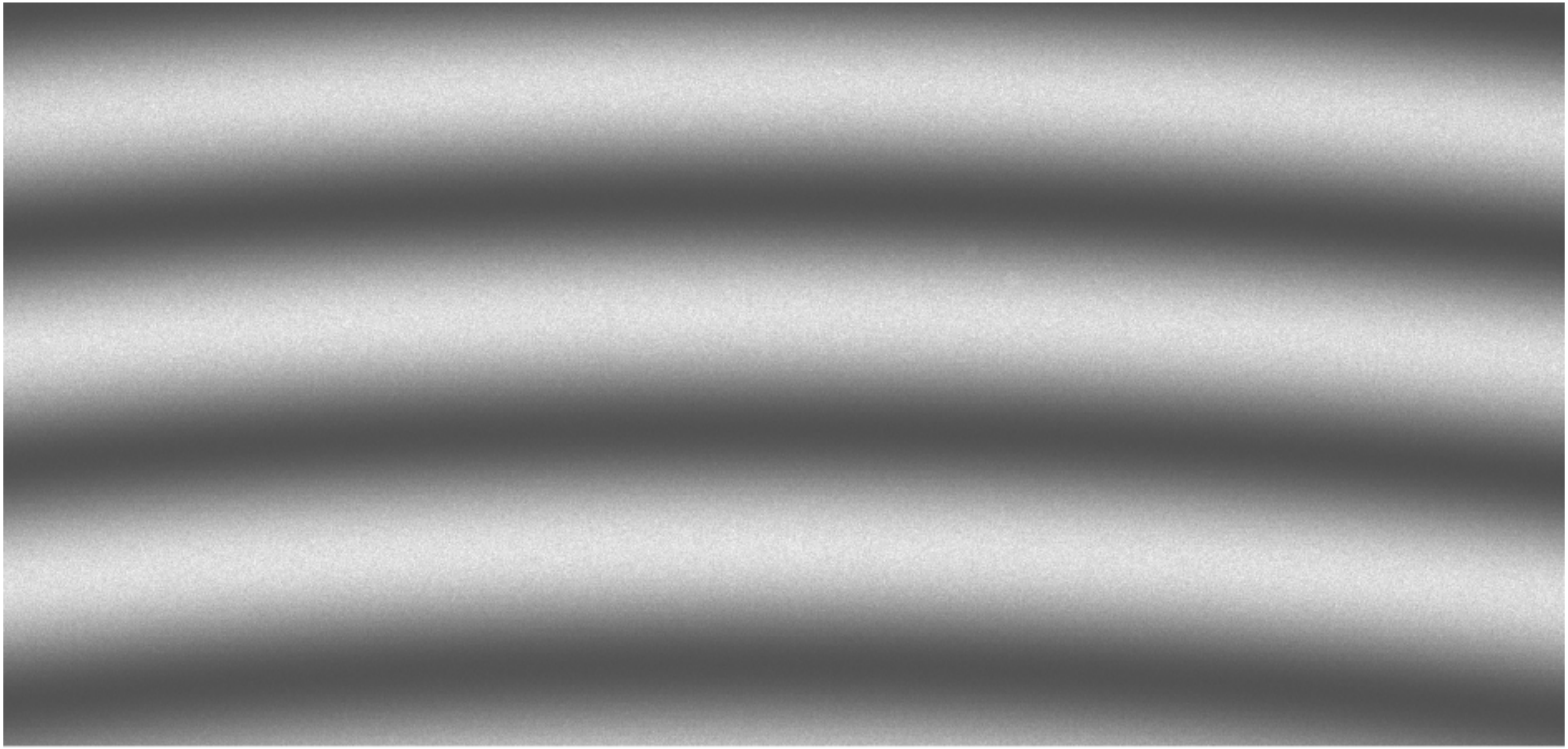


7.5’ from center
5.5’ from center
5.5’ from center
7.5’ from center
5.5’ from center

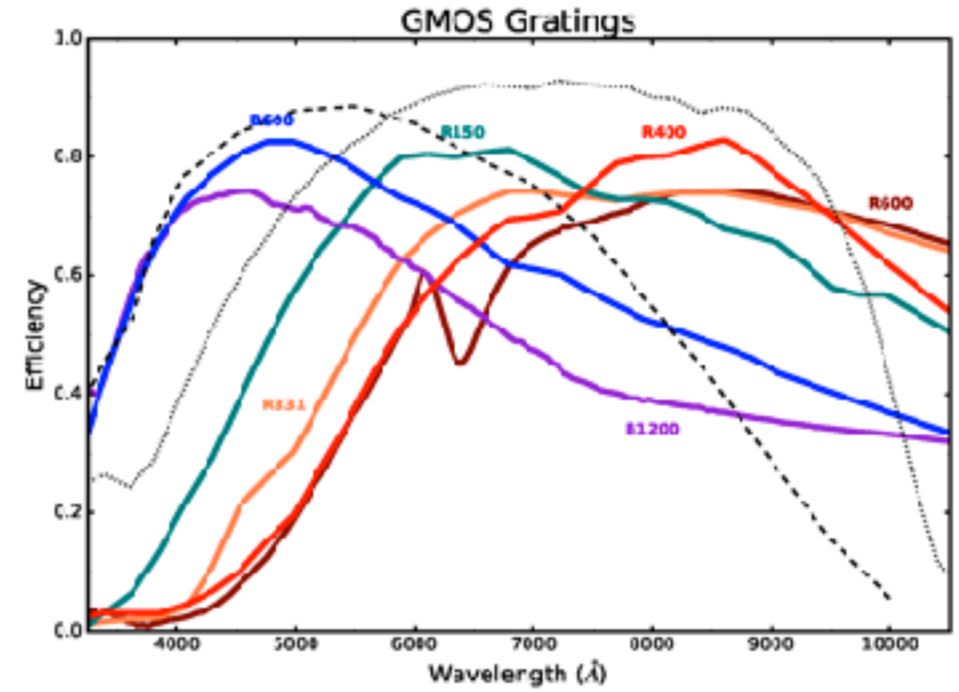
Image quality
(See Marc Baril's poster)

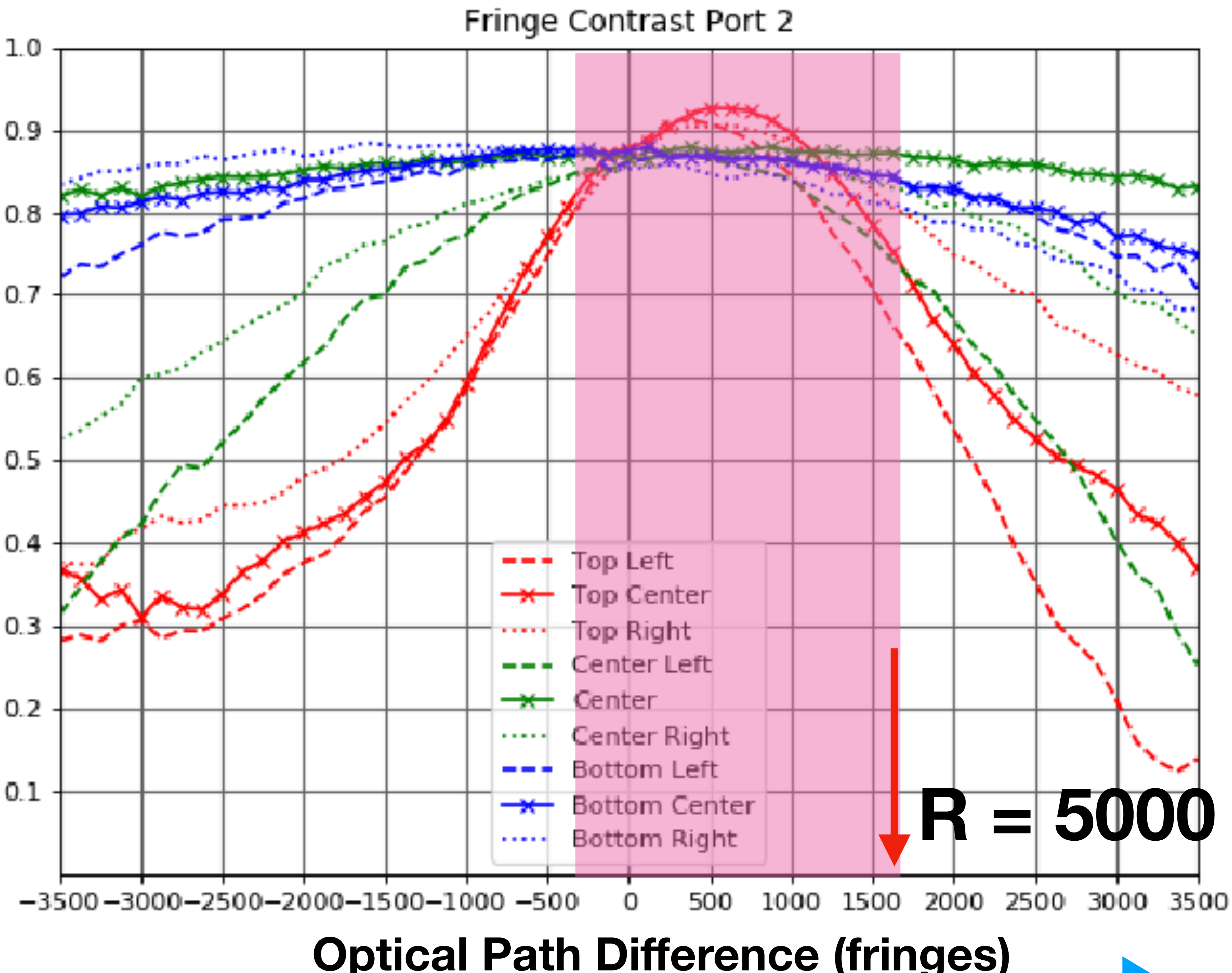


Modulation efficiency



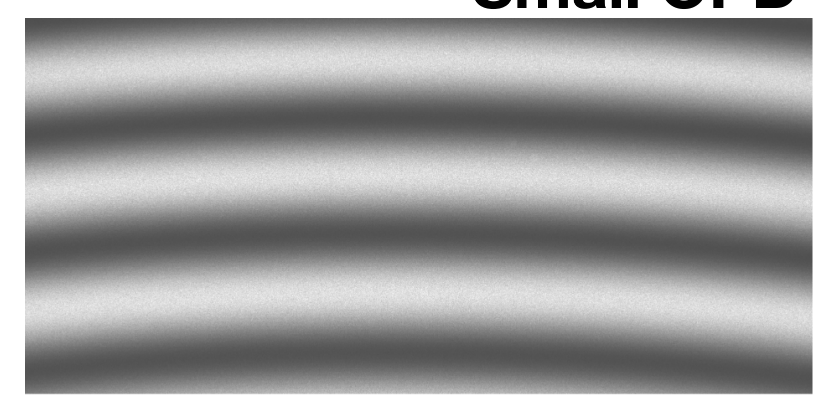
Modulation efficiency

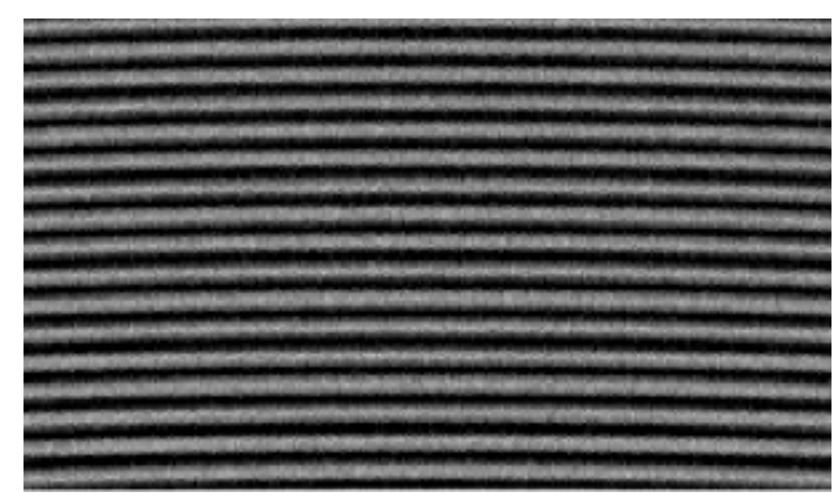




Spectral resolution

Small OPD





Large OPD

Software

ORBS
(data reduction)

ORCS
(analysis)

SITELLE's Level-1 data processing pipeline and calibration accuracy *(Level-2 now in use)*

T. Martin[1,2]*, L. Drissen[1,2], S. Prunet[3]

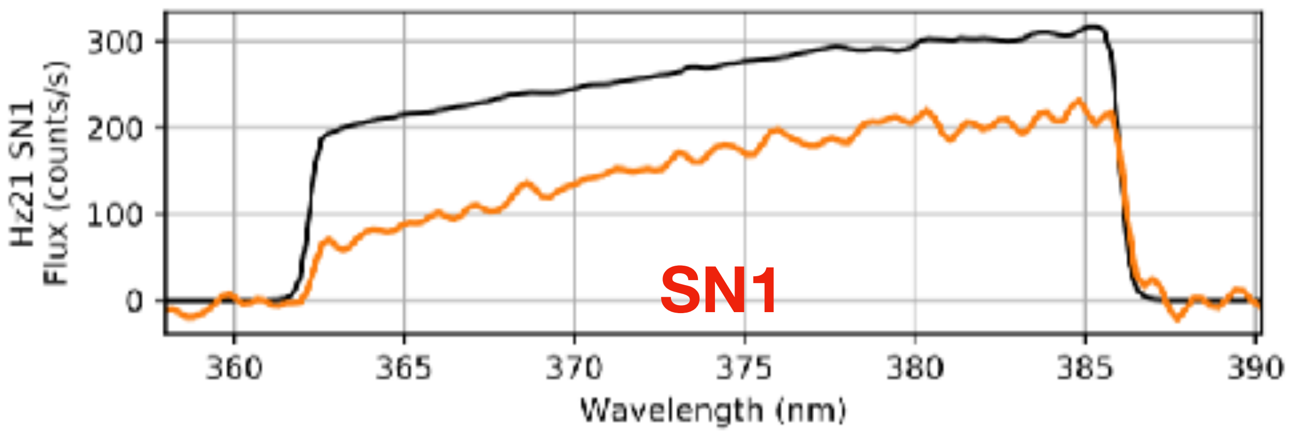
[1] *Département de physique, de génie physique et d'optique, Université Laval, 2325, rue de l'université, Québec (Québec), G1V 0A6, Canada*
[2] *Centre de Recherche en Astrophysique du Québec (CRAQ), Montréal (Québec), H3C 3J7, Canada*
[3] *Canada-France-Hawaii Telescope, 65-1238 Mamalahoa Hwy, Kamuela, Hawaii 96743, USA*

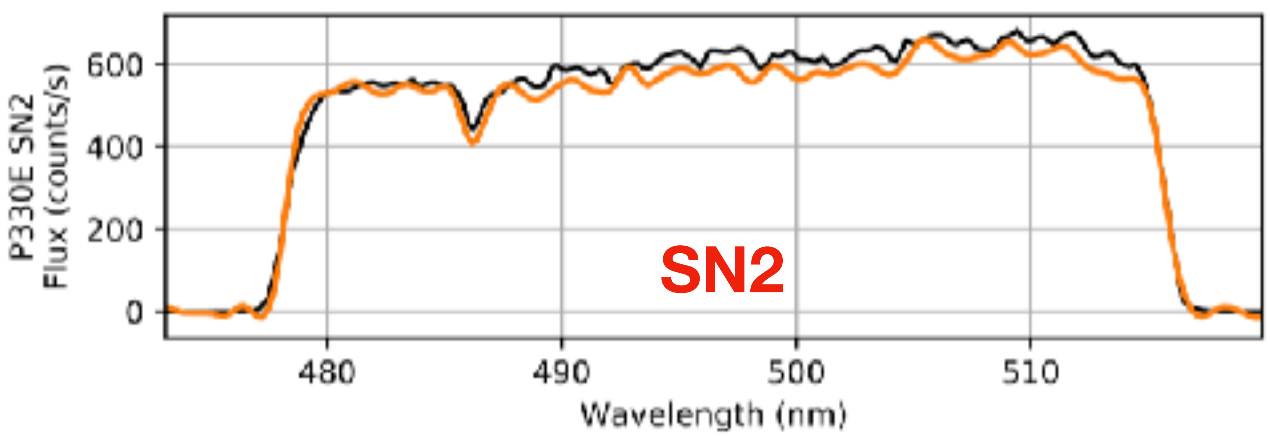
Simulations vs. real spectra

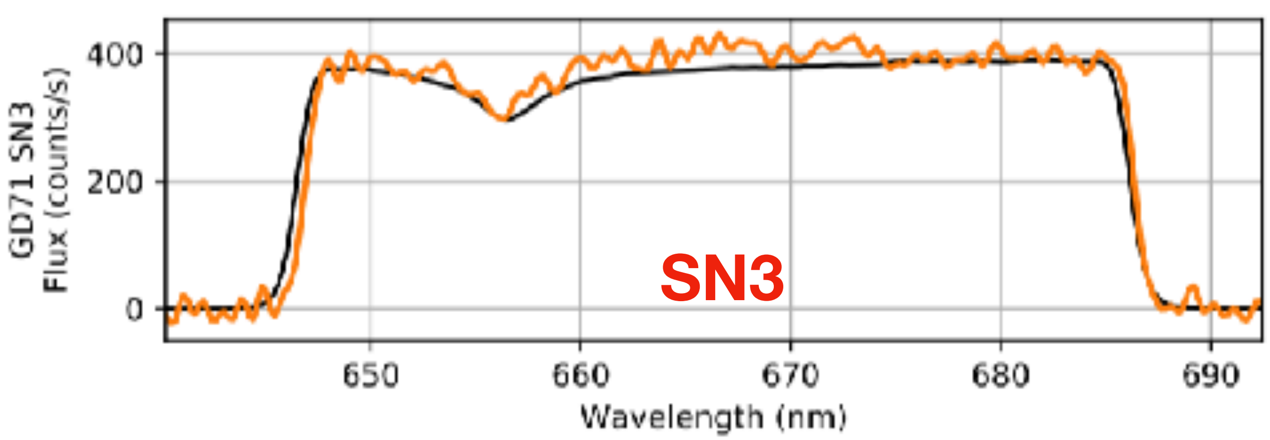
(see Thomas Martin for details)

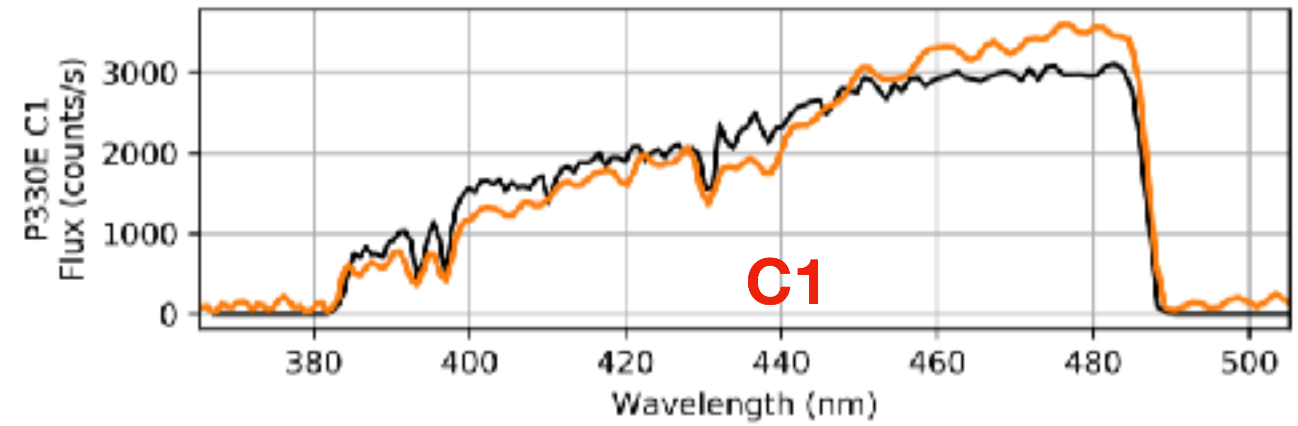
* Telescope
* SITELLE optics
* Michelson (ME)
* Filters
* CCDs

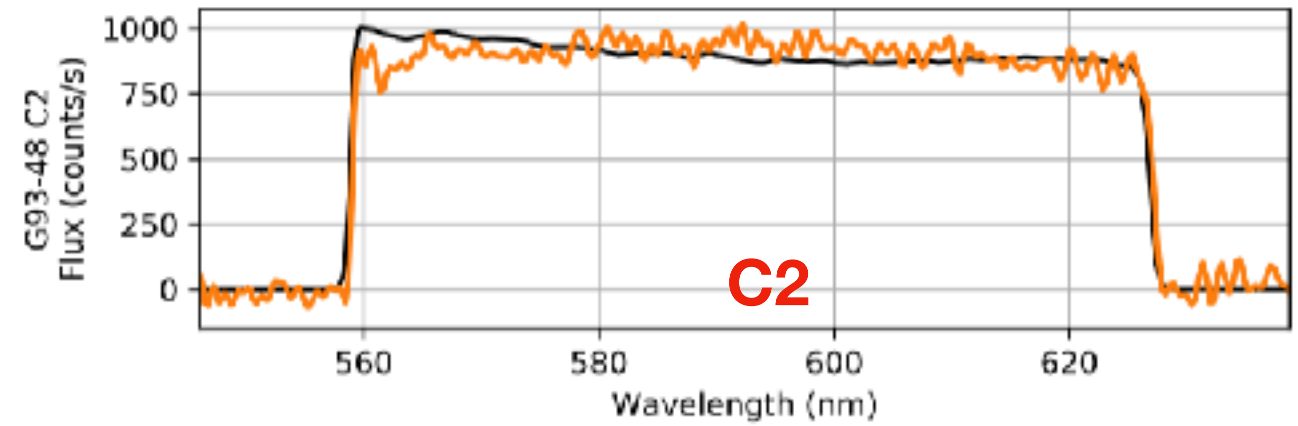
* Standard stars

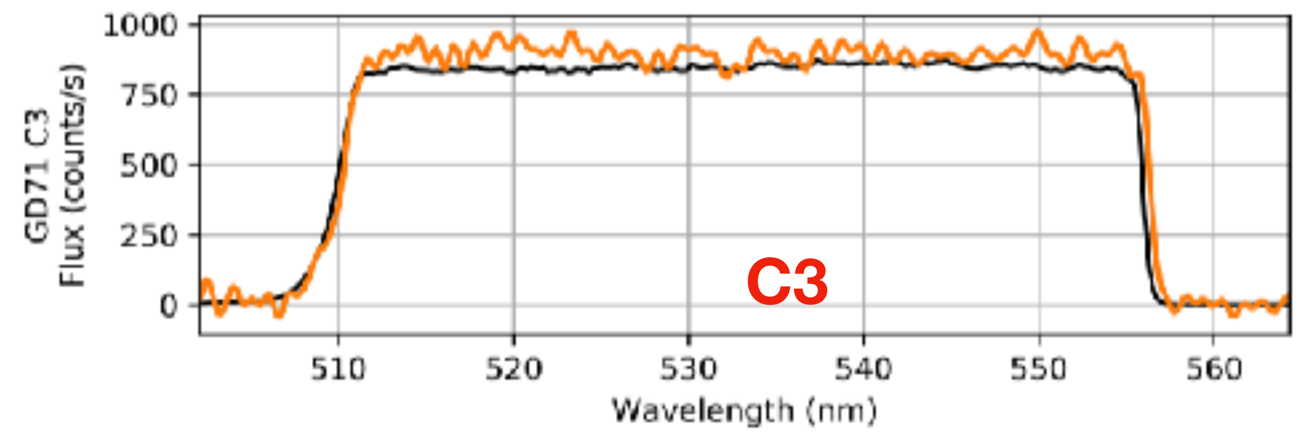


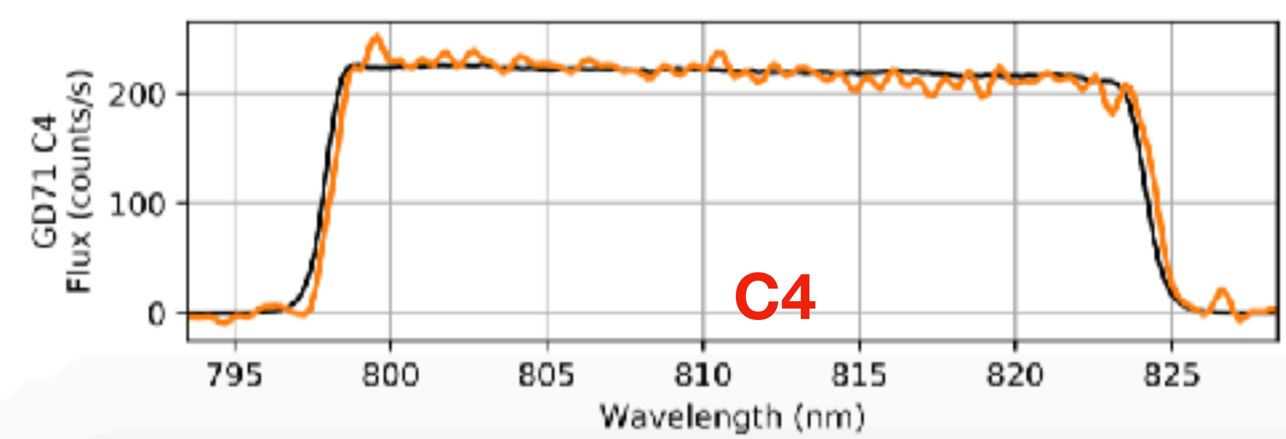












http://132.203.11.199/orcs-doc/installation.html

Orcs

2.4

Search docs

Installation

Introduction

Examples

First basic examples

Example of a single spectrum fit.

How precise must be the input velocity parameter ?

Extract the deep frame and use the WCS

Make a fit over an

Docs » Examples » Make a fit over an entire region of the field

View page source

Make a fit over an entire region of the field

This is a complete example of a fit over an entire region of interest (ROI). The different steps covered are :

1. Extraction of a deep frame and the WCS
2. Definition of the ROI with DS9
3. Fit of a single spectrum in order to get an initial guess on the velocity of the gas
4. Fit of the entire ROI
5. Visualization of the resulting maps

In [1]:

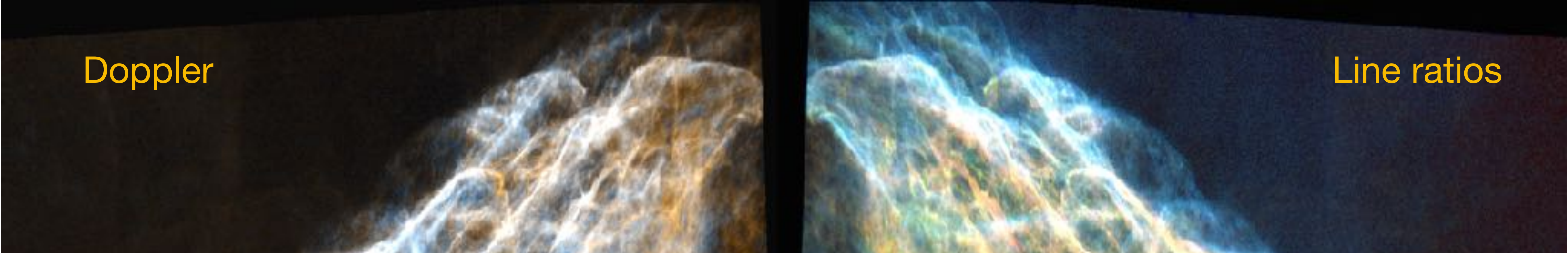
```
%matplotlib inline
from orcs.process import SpectralCube
import pylab as pl
import orb.utils.io
import numpy as np
```

In [2]:

```
cube = SpectralCube('/home/thomas/M57_SN3.merged.cm1.1.0.hdf5', debug=False)
```

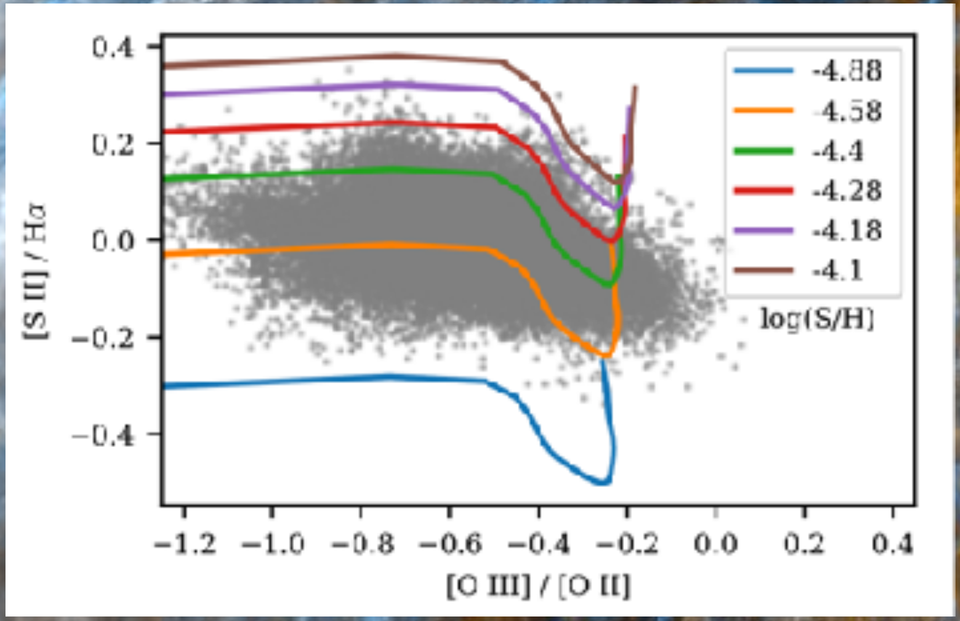
```
INFO| Data shape : (2048, 2064, 593)
INFO| Cube is in WAVENUMBER (cm-1)
INFO| Cube is CALIBRATED in wavenumber
```

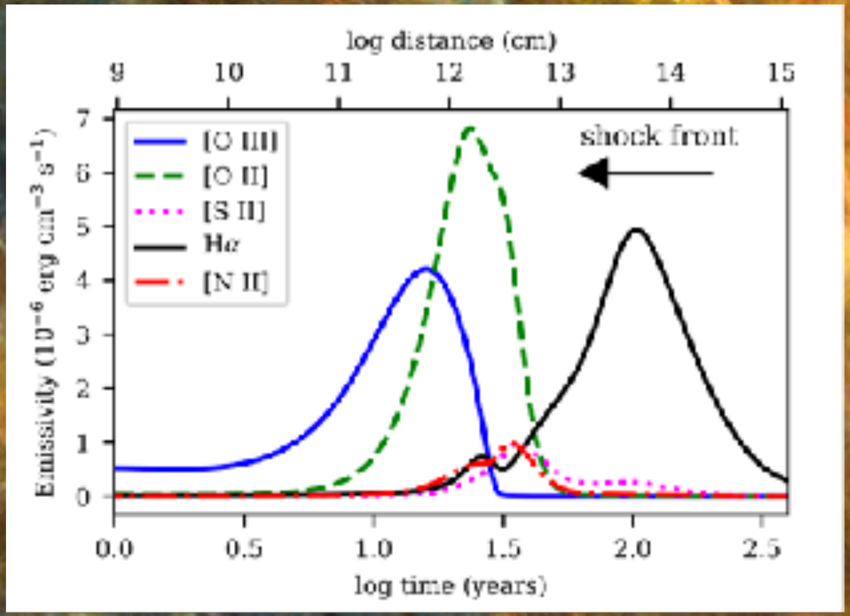
Computer intensive!



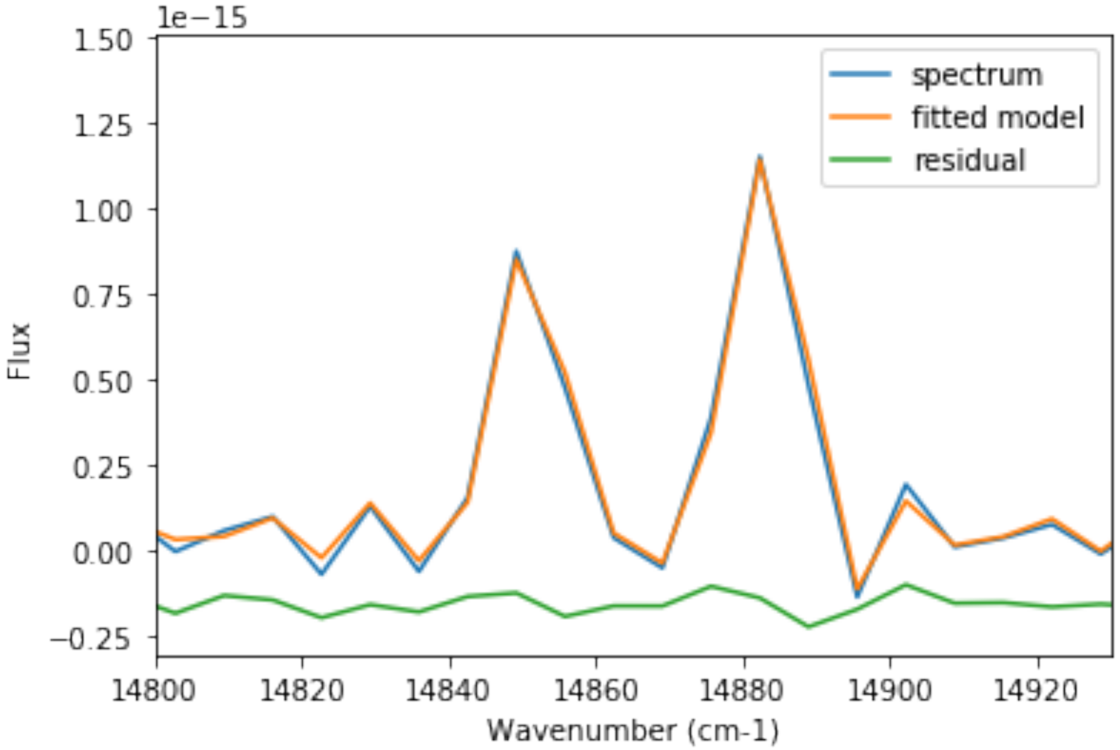
A multispectral analysis of the northeastern shell of IC 443

Alexandre Alarie,[1⋆] Laurent Drissen,[2,3]
[1] *Instituto de Astronomía, Universidad National Autónoma de México, Apdo. Postal 70264, 04510 Mexico D.F., Mexico*
[2] *Département de physique, de génie physique et d'optique, Université Laval, Québec, Canada*
[3] *Centre de Recherche en Astrophysique du Québec, QC, G1V 0A6, Canada*





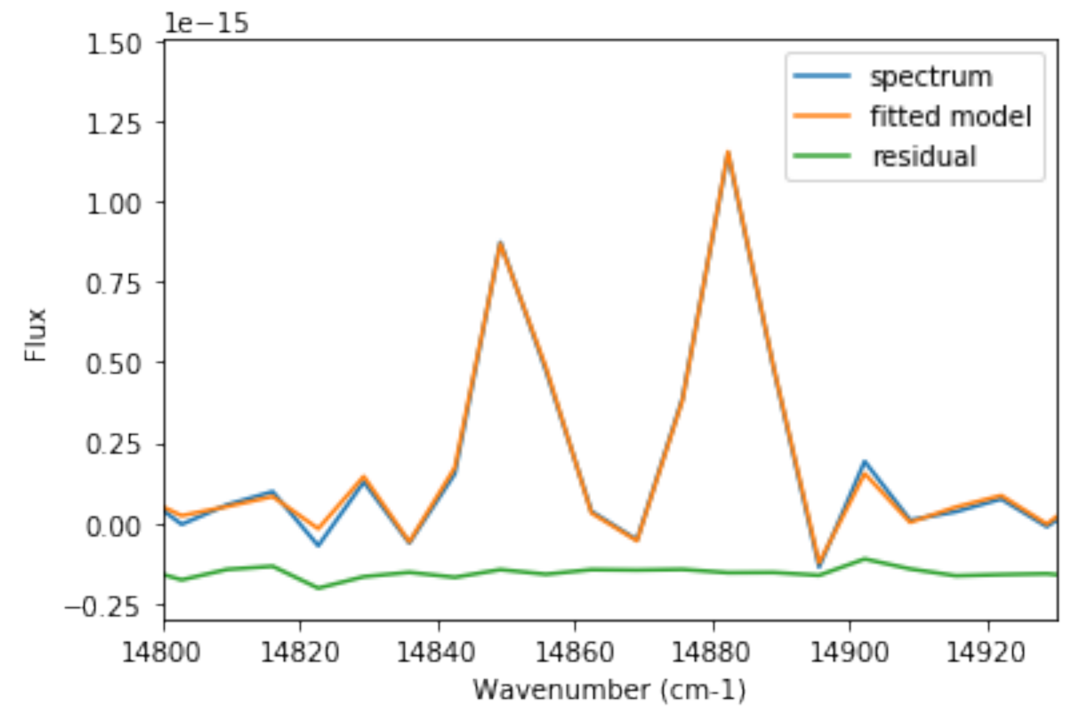
[SII] 6717,31 doublet



$\sigma = 120\,\mathrm{km/s}$

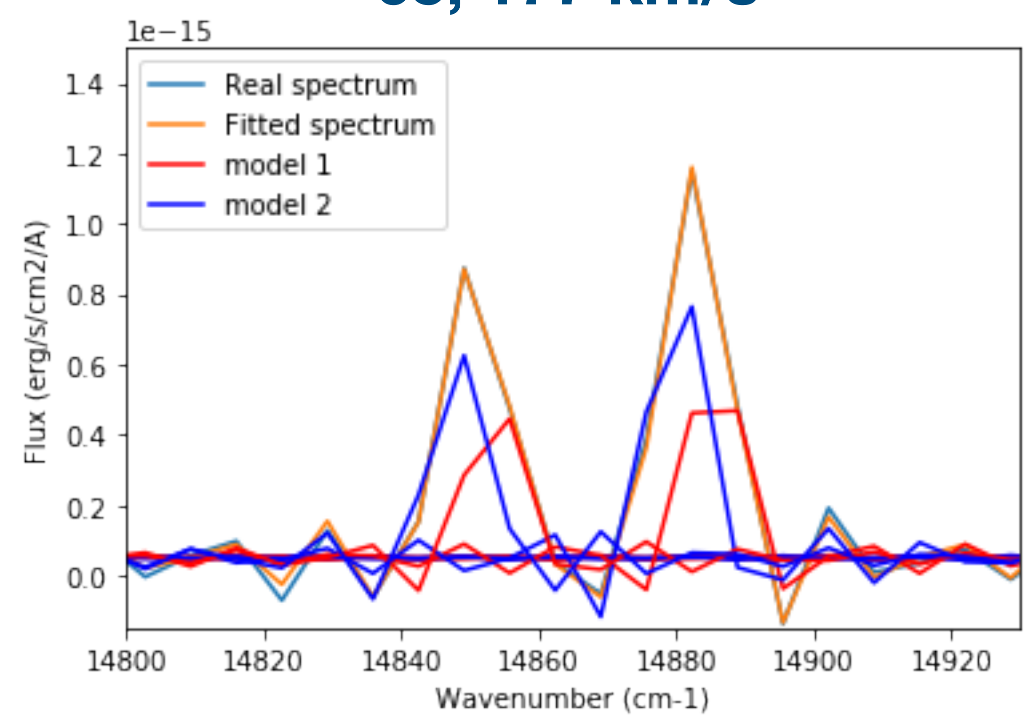
sincgauss

SN3 filter, R = 1500 (fwhm ~ 200 km/s)



Two sincs

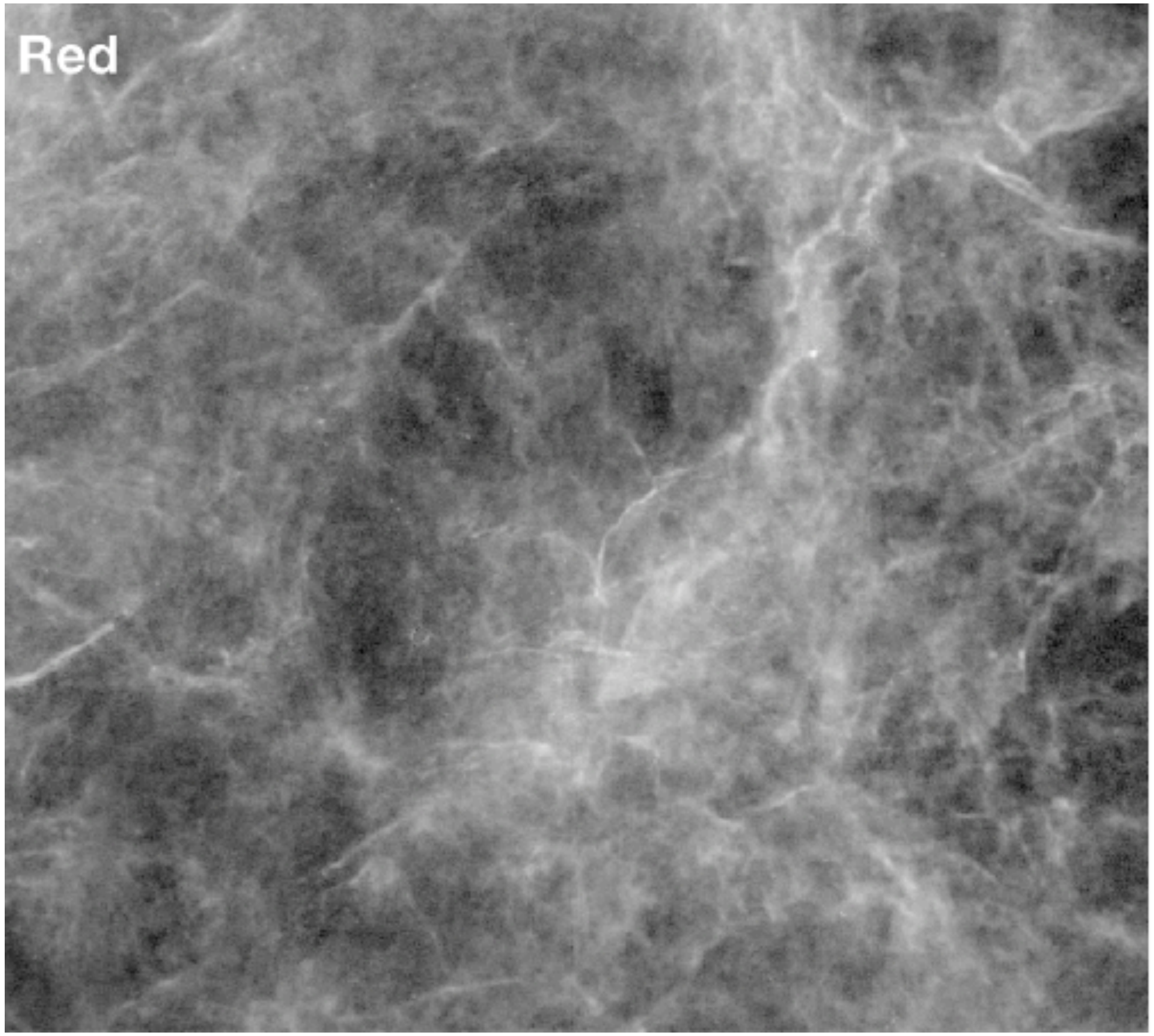
65, 177 km/s

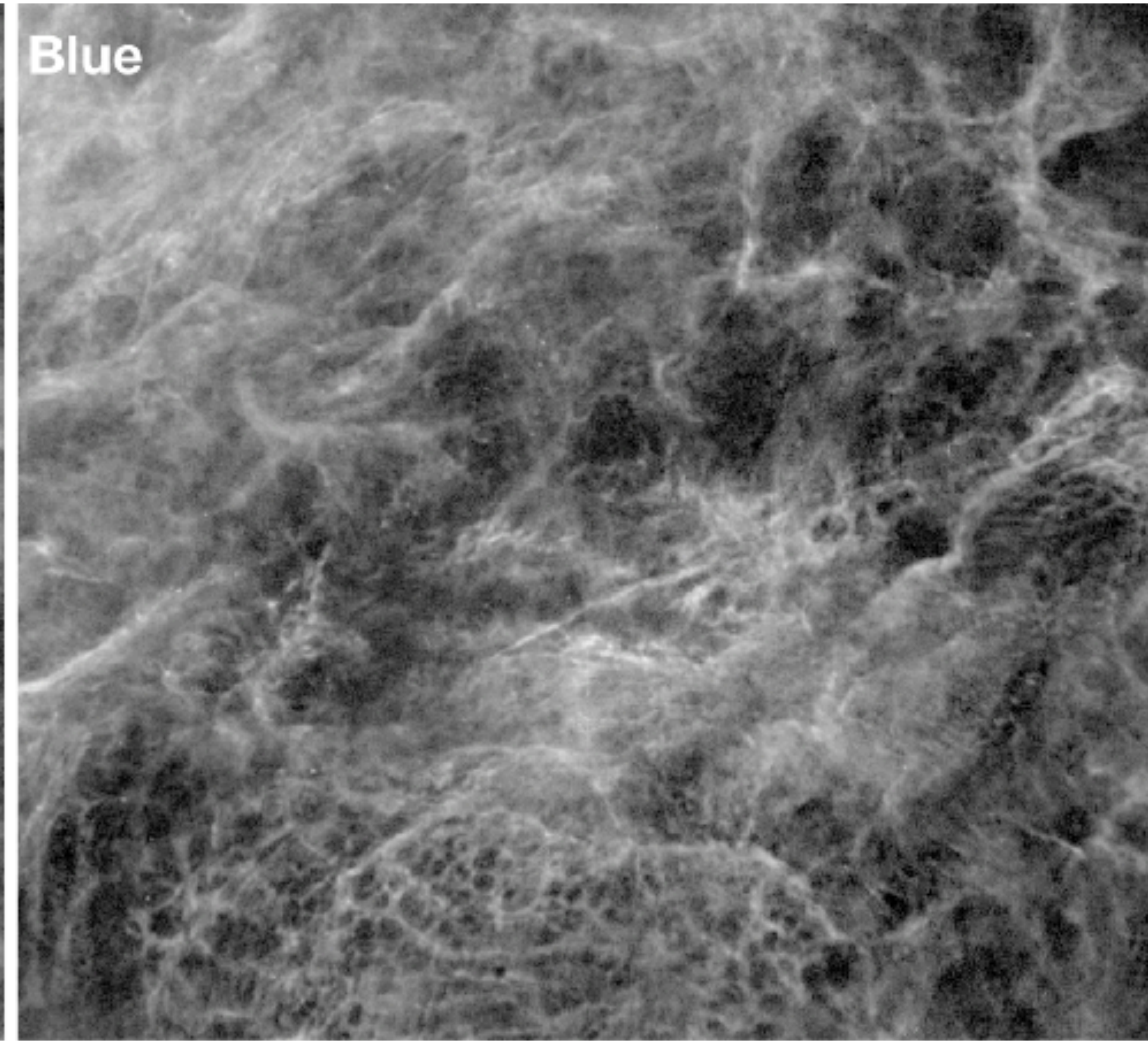


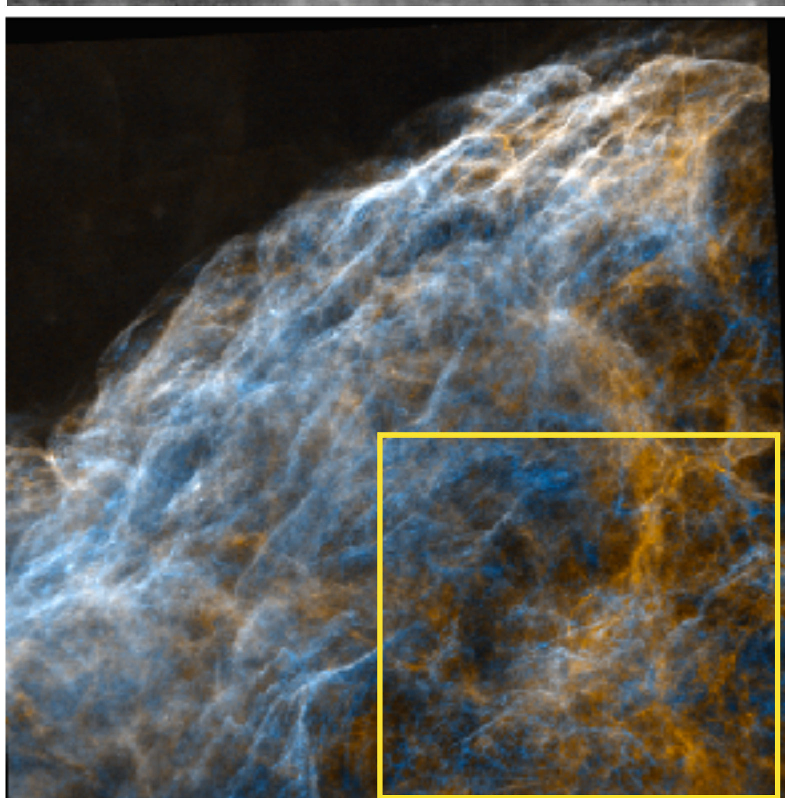
MNRAS 463, 4223–4238 (2016) doi:10.1093/mnras/
Advance Access publication 2016 September 14

Optimal fitting of Gaussian-apodized or under-resolved emission lines in Fourier transform spectra providing new insights on the velocity structure of NGC 6720

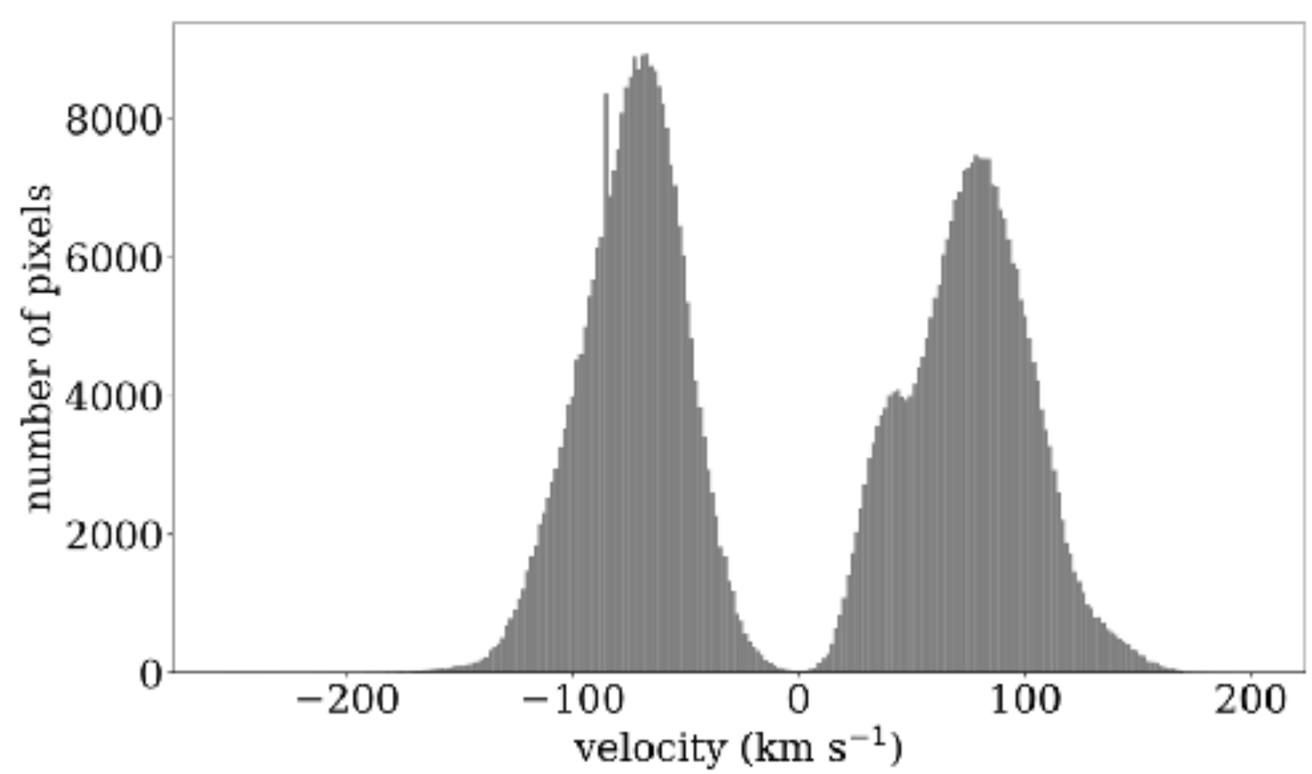
Thomas B. Martin,[1★] Simon Prunet[2] and Laurent Drissen[1]
[1]Université Laval, 2325, rue de l'université, Québec (Quebec), G1V 0A6, Canada
[2]Canada–France–Hawaii Telescope, 65-1238 Mamalahoa Hwy, Kamuela, HI 96743, USA





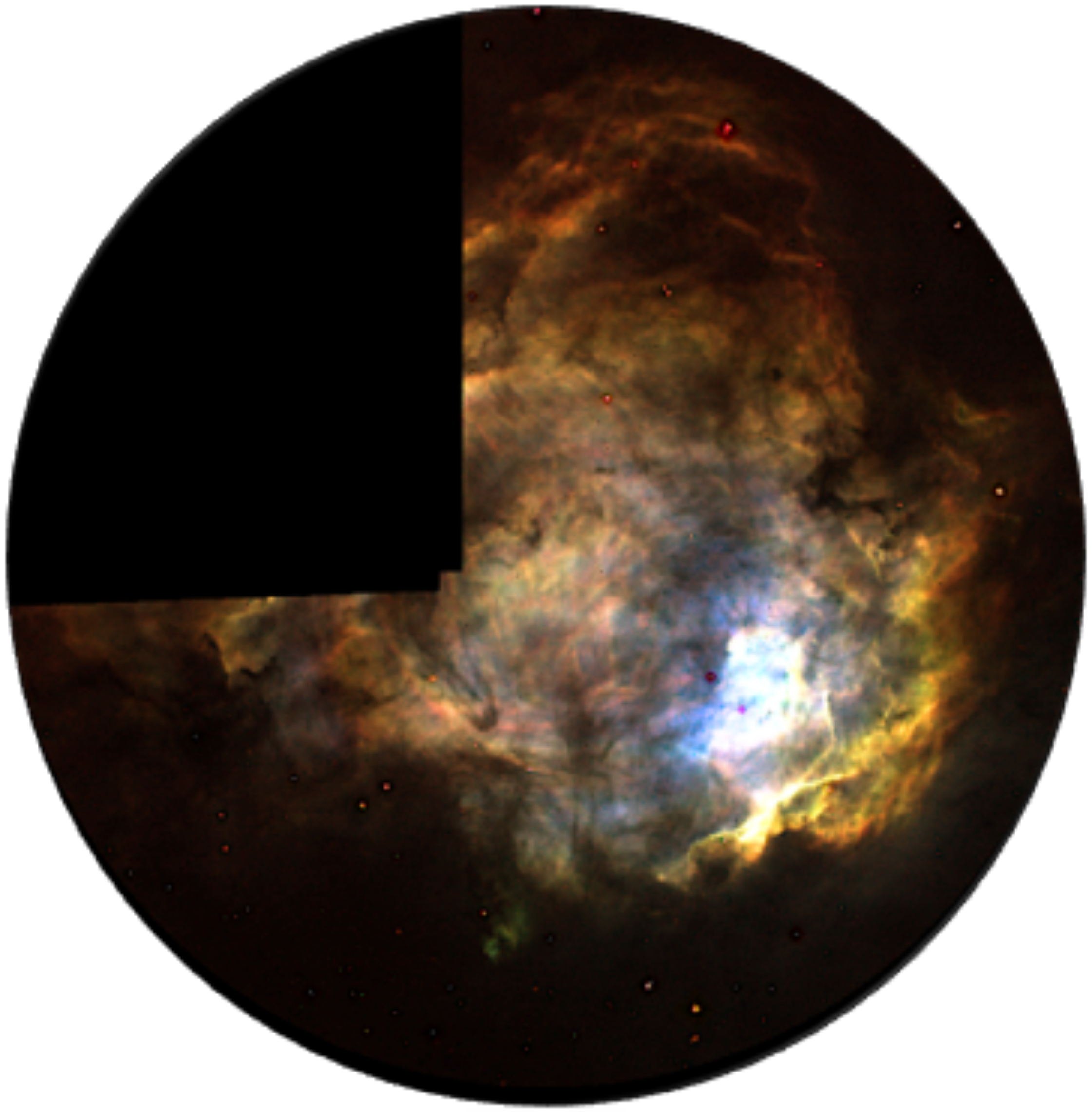


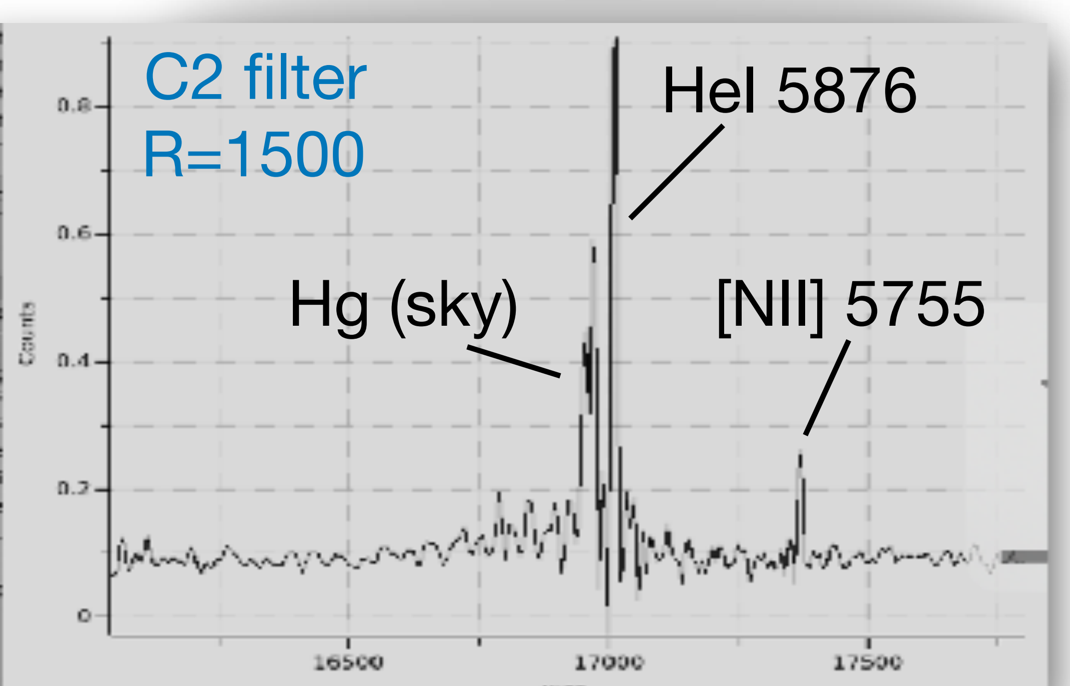
2 velocity components

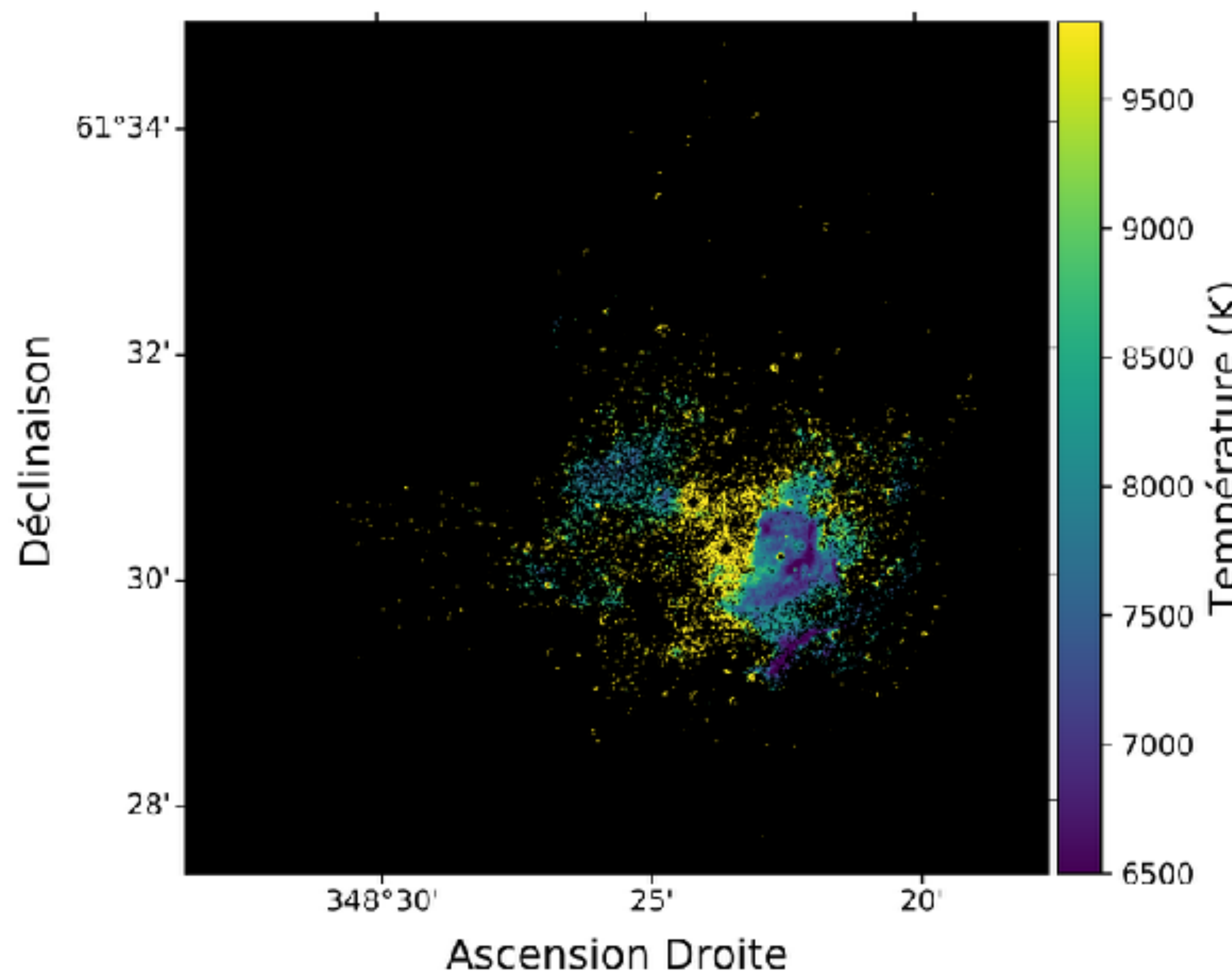


Thermodynamic study of the HII region Sh2-158

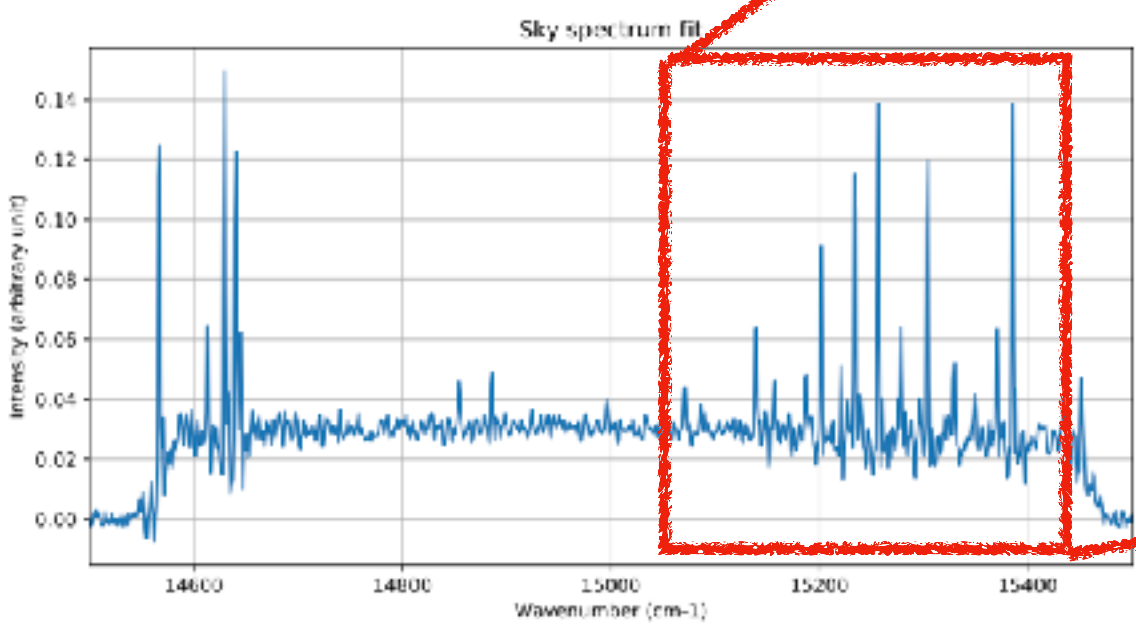
Maxime Royer & Gilles Joncas
(U. Laval, Québec)

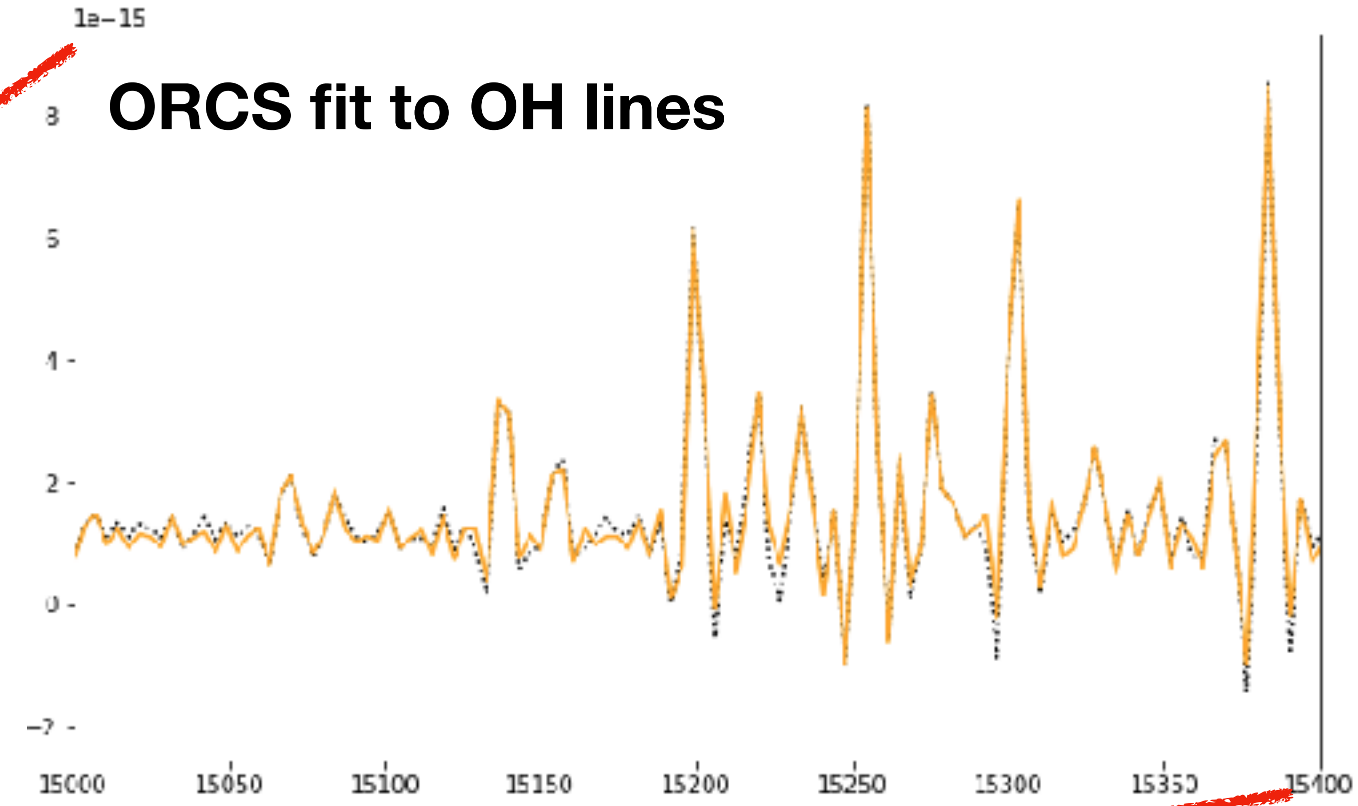


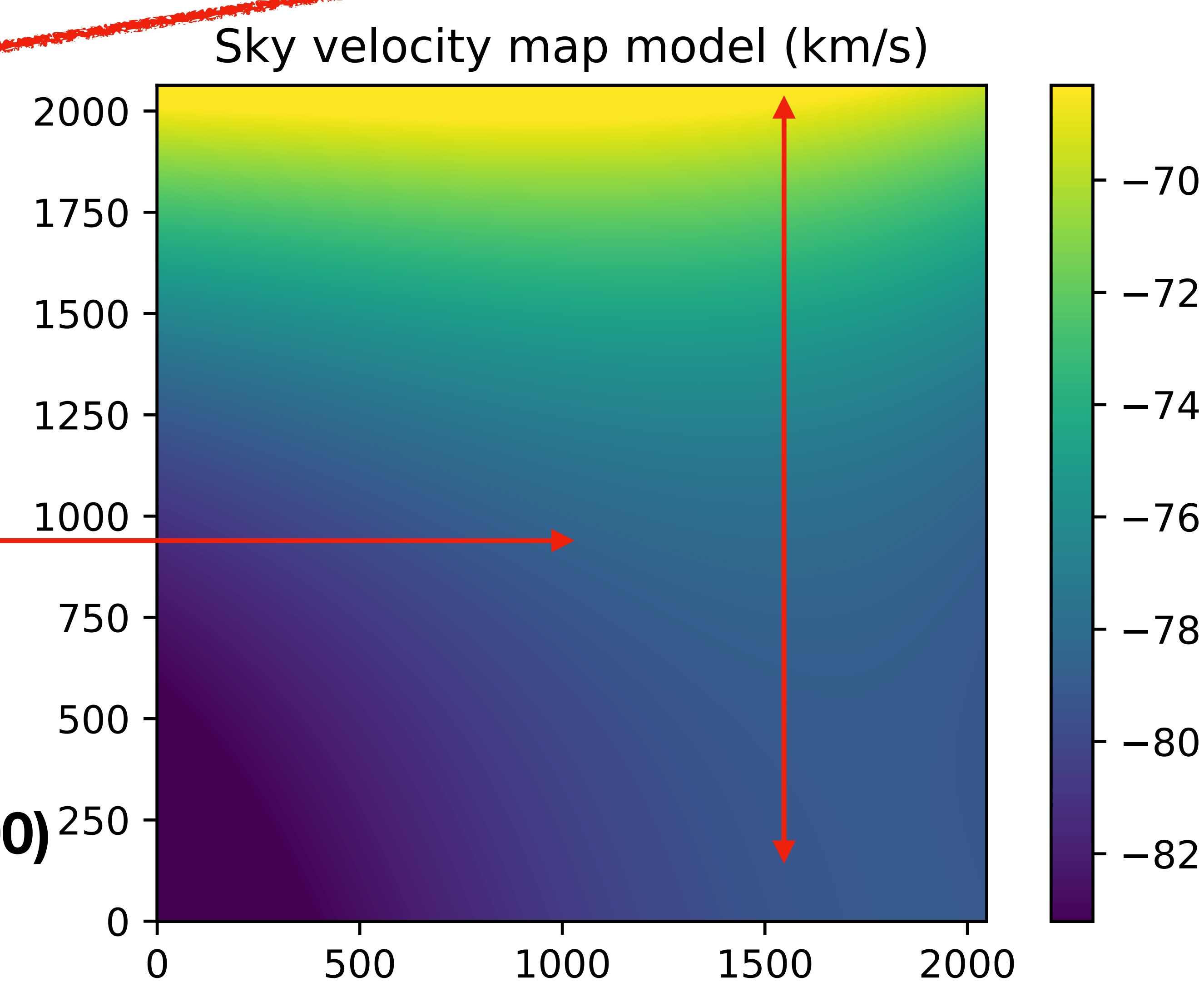




Velocity calibration using atmospheric OH lines (SN3 filter)





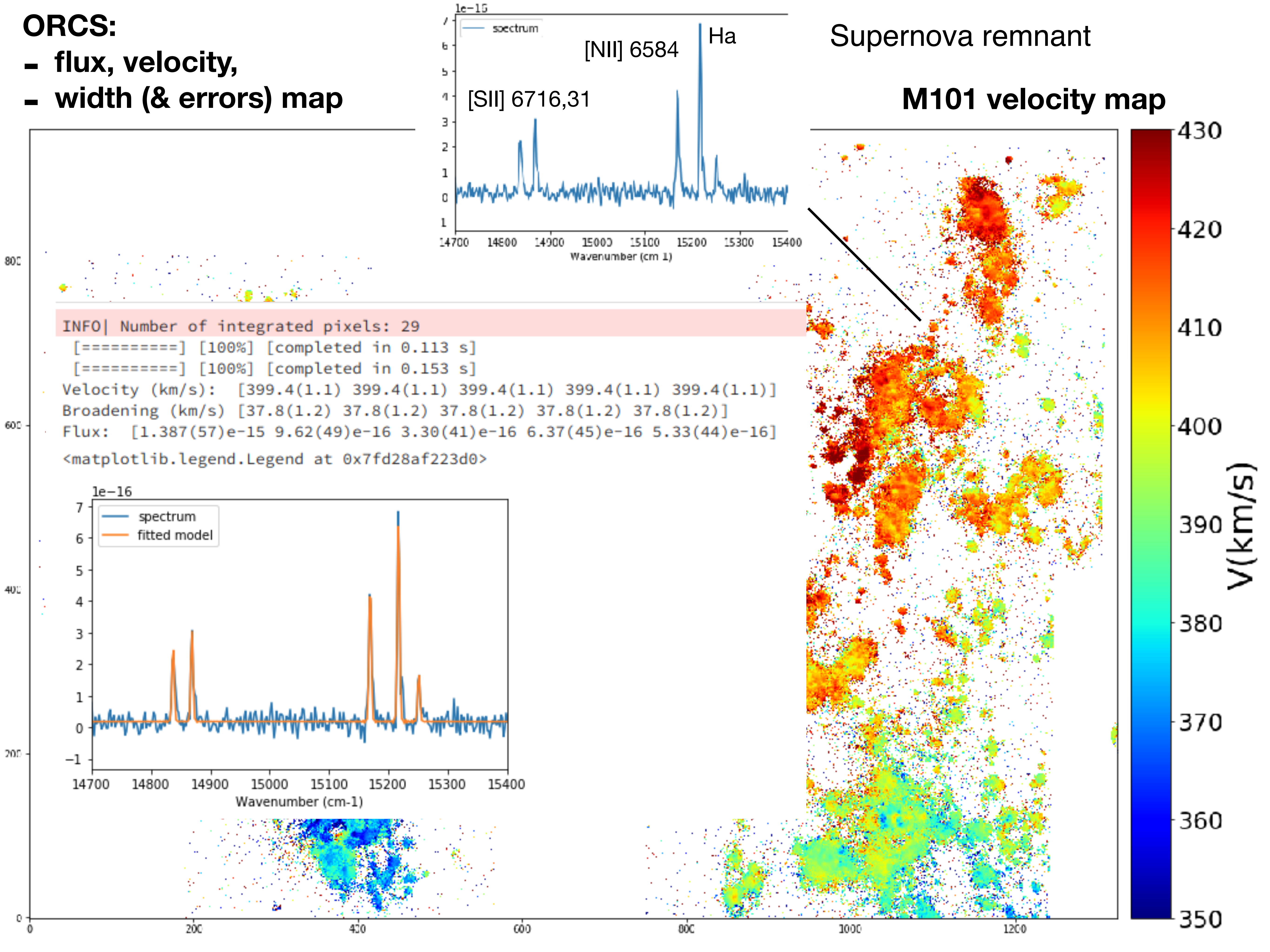


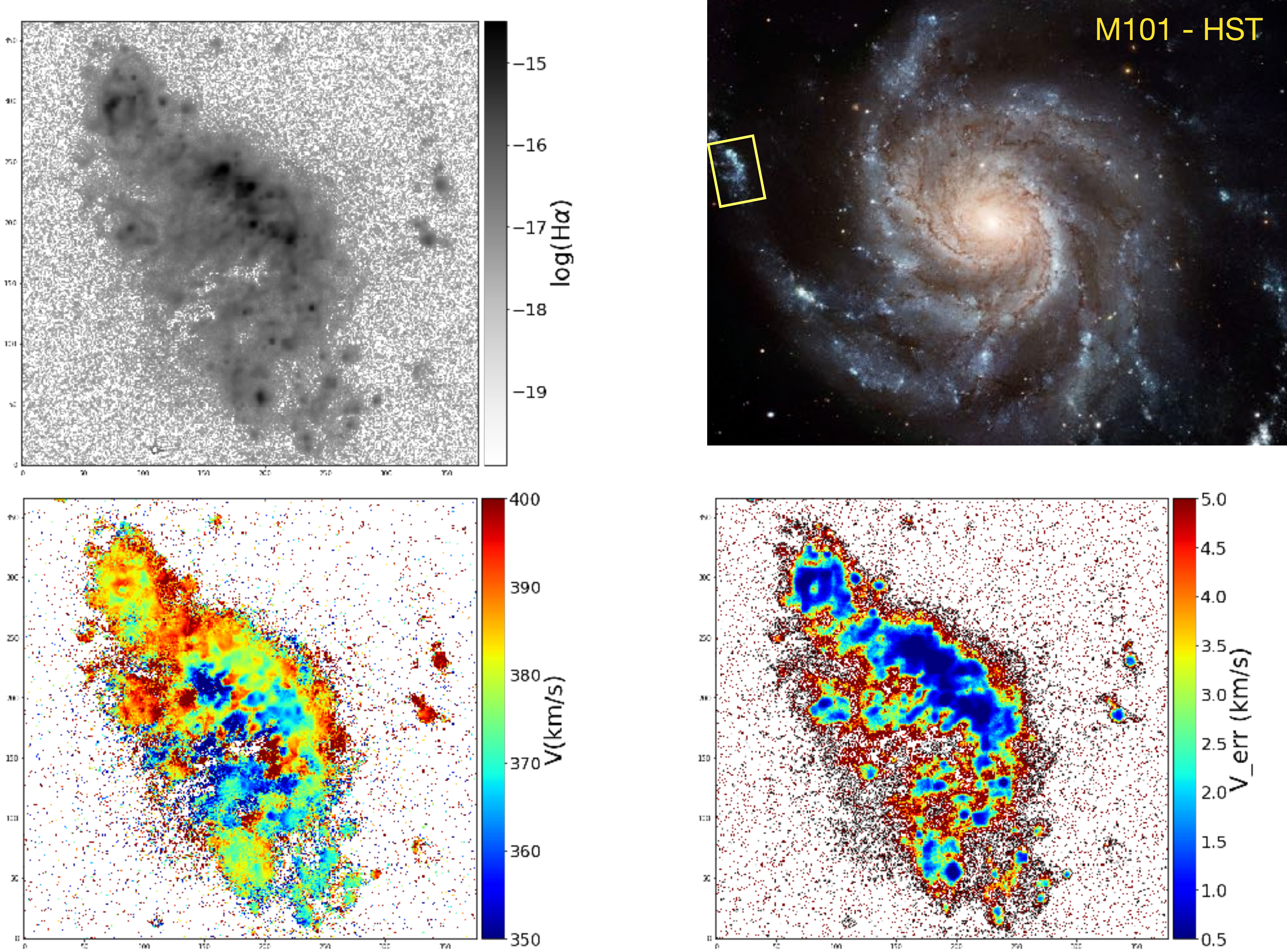
Zero point (75 km/s): laser wavelength

Gradient: instrument flexure
(Max. amplitude: 20% of ILS-FWHM @ R=5000)
(Central 8’: 5%of ILS-FWHM @ R=5000)

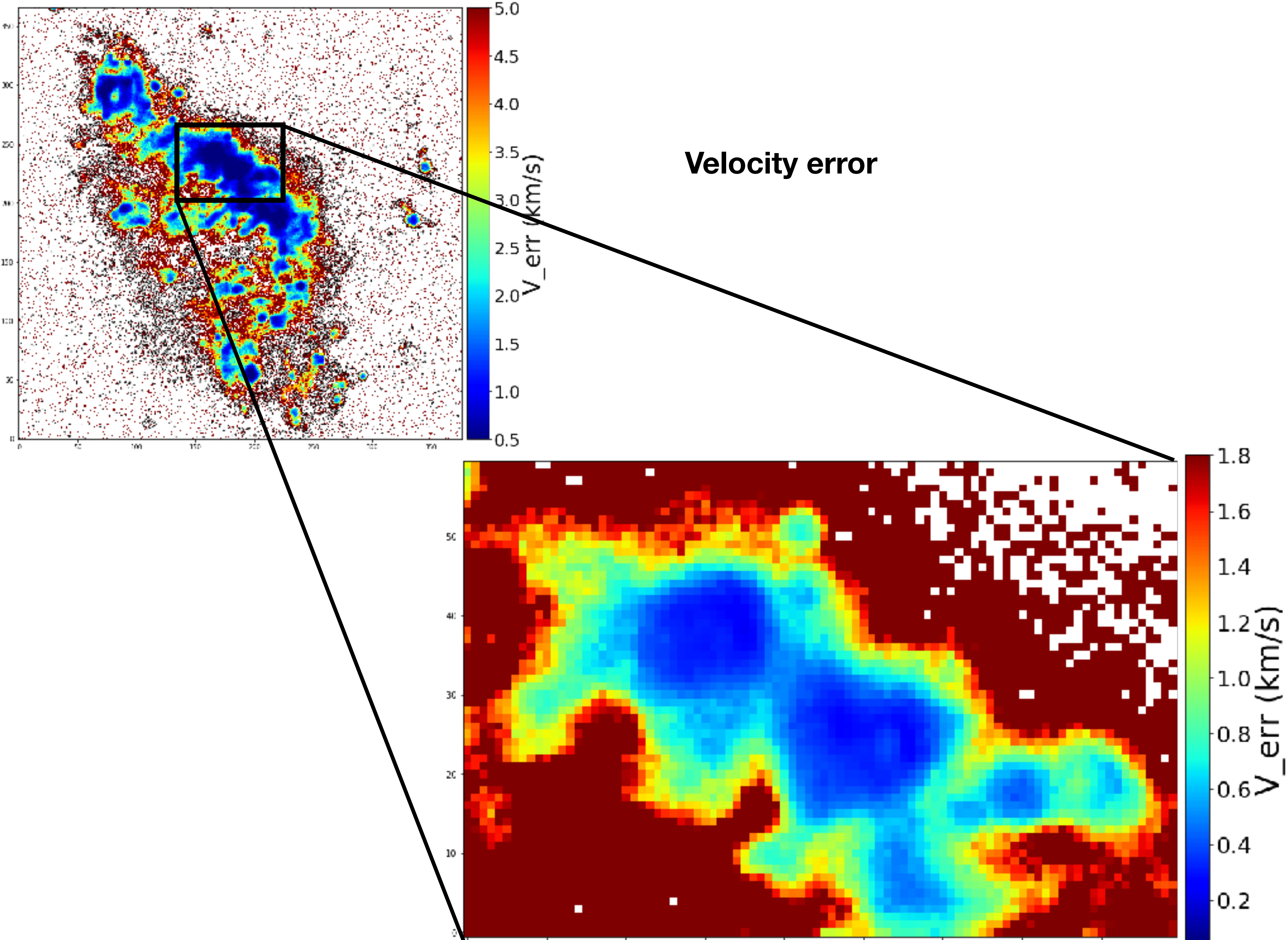
ORCS:

- **flux, velocity,**
- **width (& errors) map**



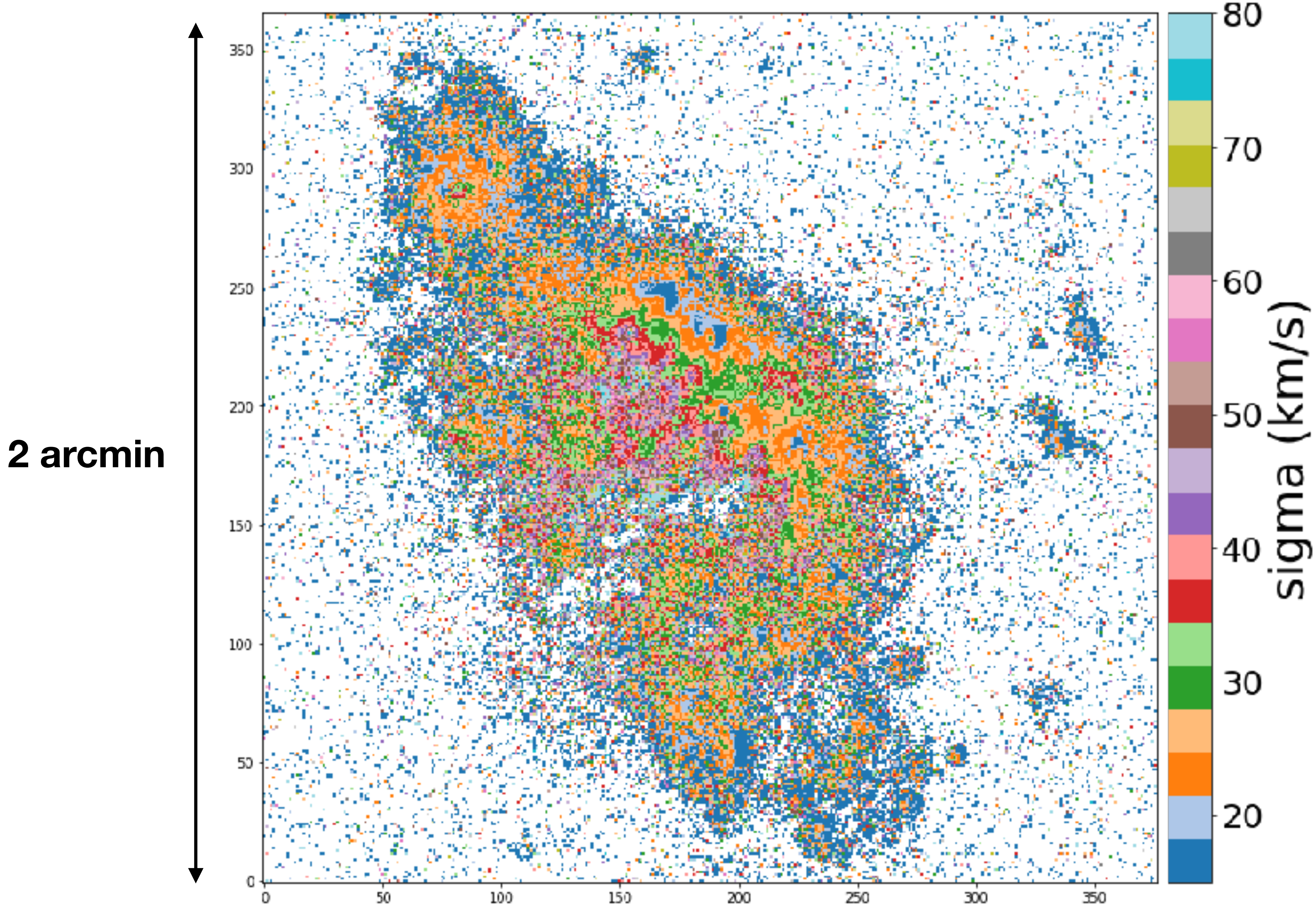


M101 - HST
log(Hα)
−15
−16
−17
−18
−19
V(km/s)
400
390
380
370
360
350
V_err (km/s)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5



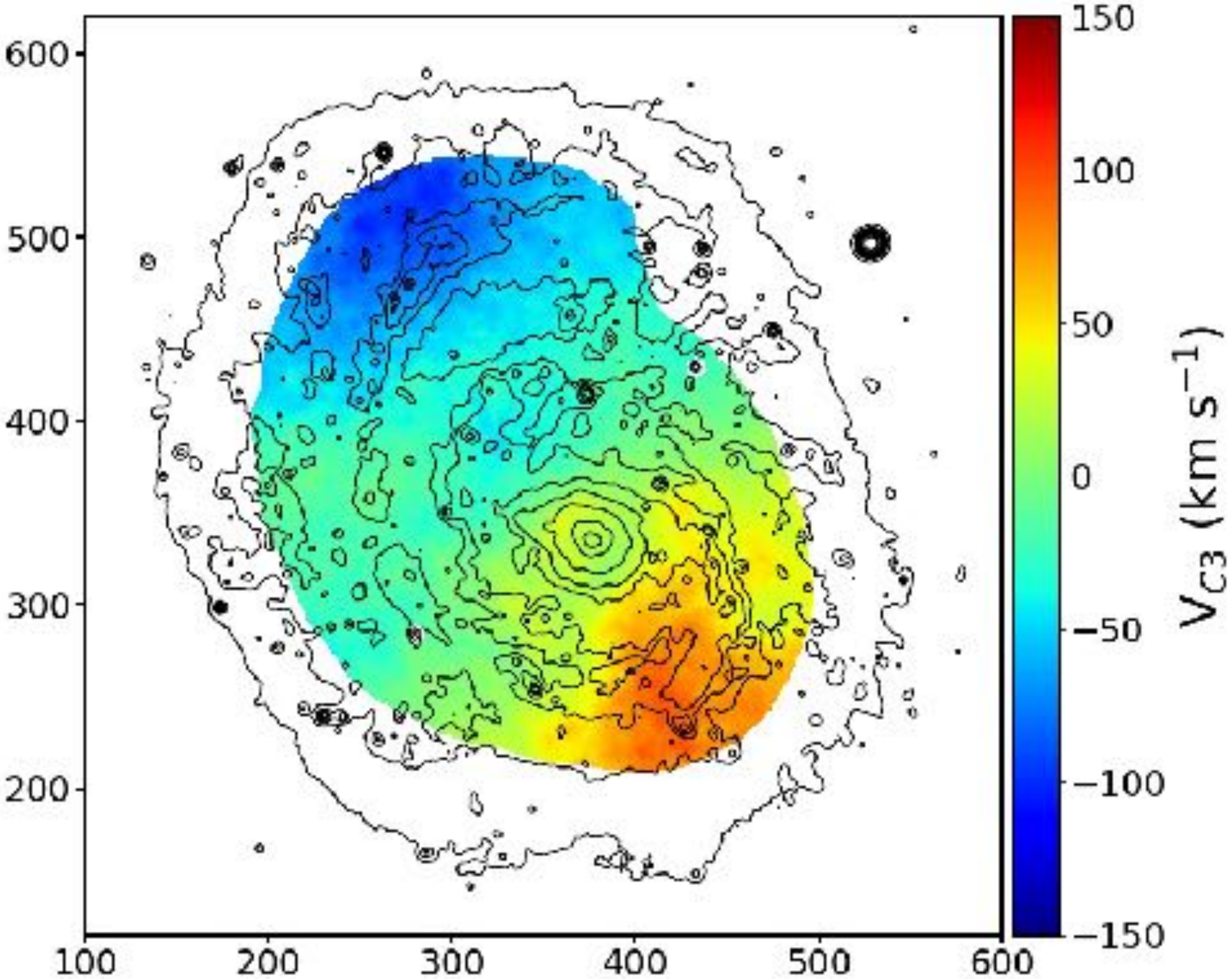
Velocity error
V_err (km/s)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
V_err (km/s)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2

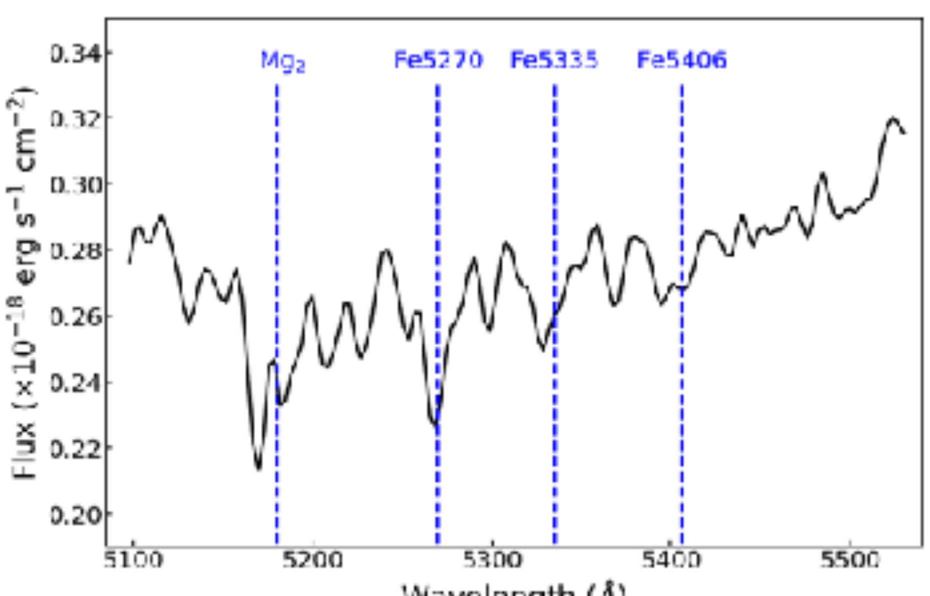
Line width

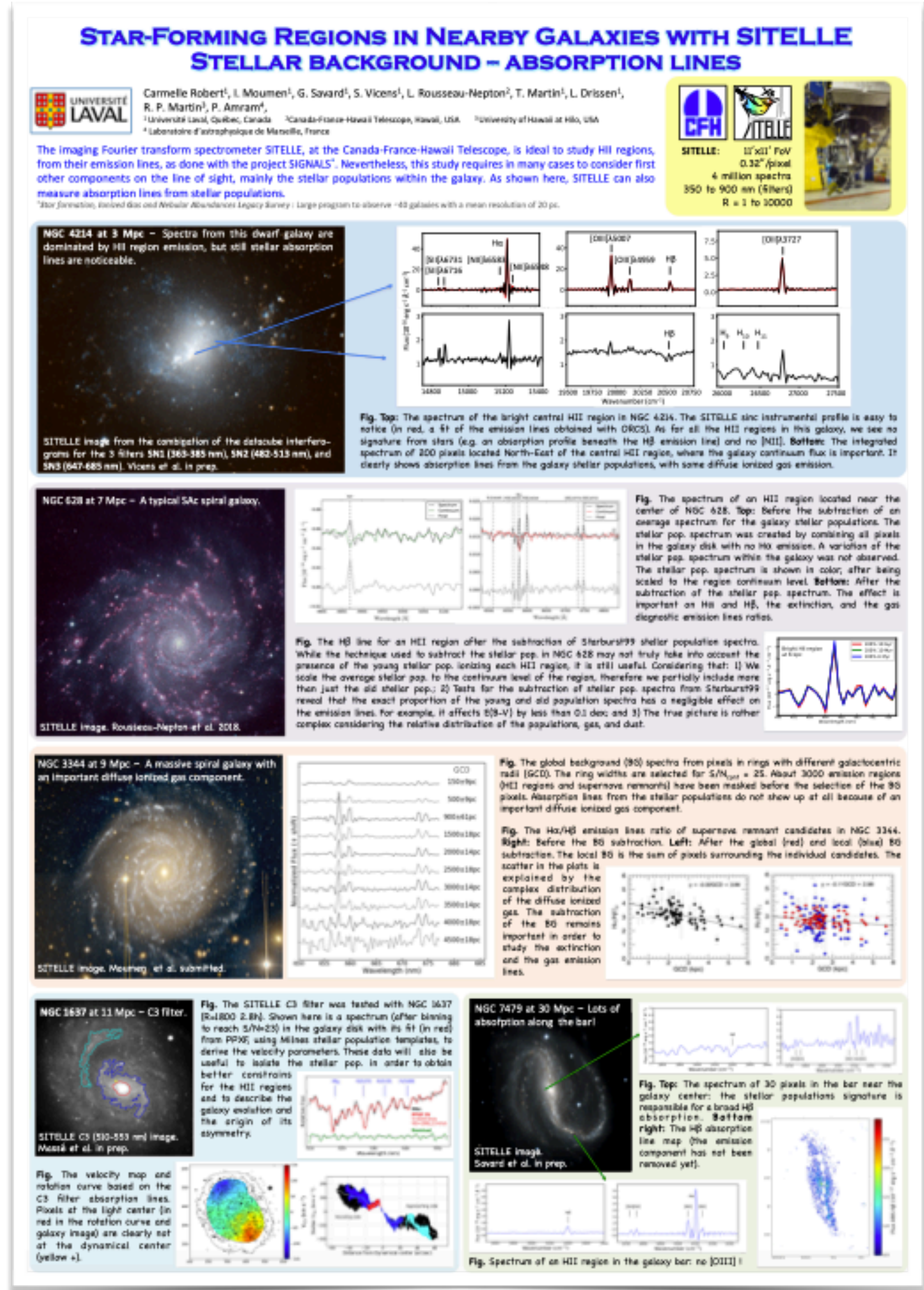


2 arcmin
350
300
250
200
150
100
50
0
0
50
100
150
200
250
300
350
80
70
60
50
40
30
20
sigma (km/s)

Carmelle Robert
(U. Laval, Québec)





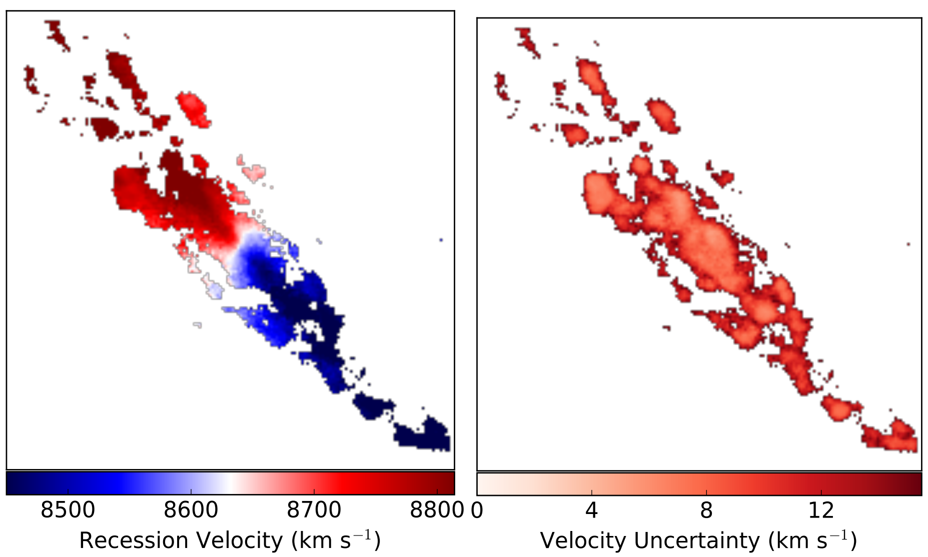


Kinematic Modeling of HIghMass Galaxies

Dhruv Bisaria (Queen's University, Kingston, Canada)

We investigate the late accretion hypothesis as an explanation for the unusual gas-richness of the HIghMass sample, which contains 34 galaxies with masses of at least 10^10 solar masses, but large atomic gas fractions (0.24 < GF < 9.2). 20/34 have GF greater than unity.
Accretion is vital to galaxy evolution and could explain the H I abundance within these galaxies (the other, non-mutually excluding, hypothesis being inefficient star formation). We obtained velocity fields for three galaxies with SITELLE for the Master's thesis and on another, UGC 9334, In April 2019.
We then analyzed the velocity fields with DiskFit by applying rotation-only, bisymmetric (bar-like), and radial flow models. UGC 7899 was found to most likely exhibit bar-like flows, which is what is reported here. This work further constrained the kinematics of these galaxies

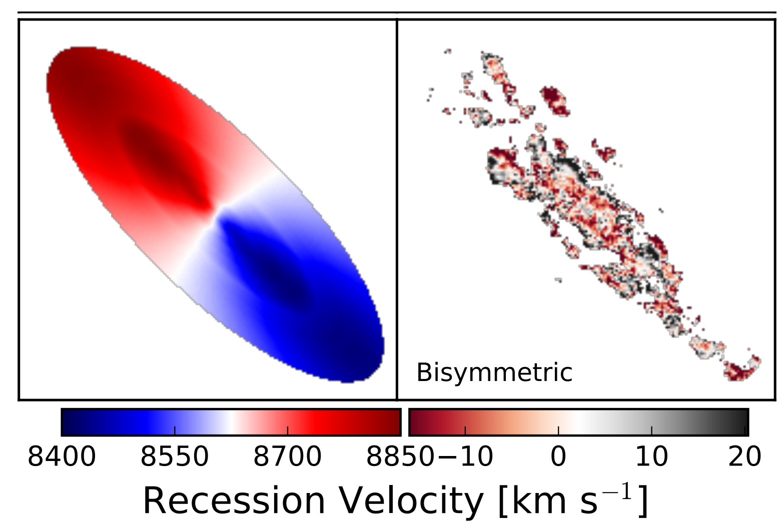
SITELLE Velocity Maps

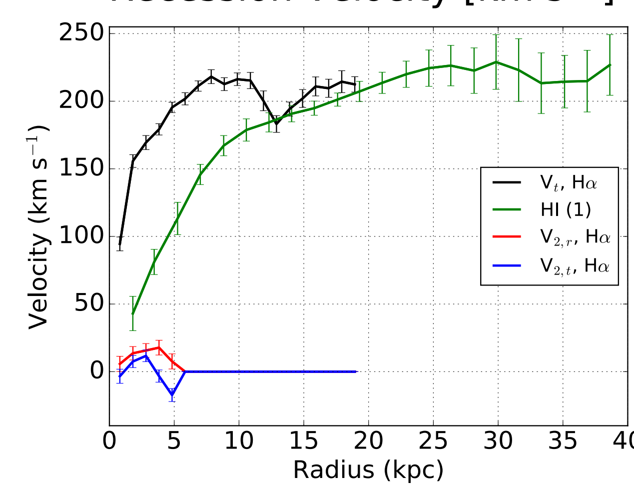


UGC 7899

+

DiskFit (KS+Sellwood 07 Sellwood+KS 15)





Rotation Curves

+ fitted position angle, inclination, center, bar position angle, etc

Other galaxies in this work: UGC 8475, UGC 9037, UGC 9334

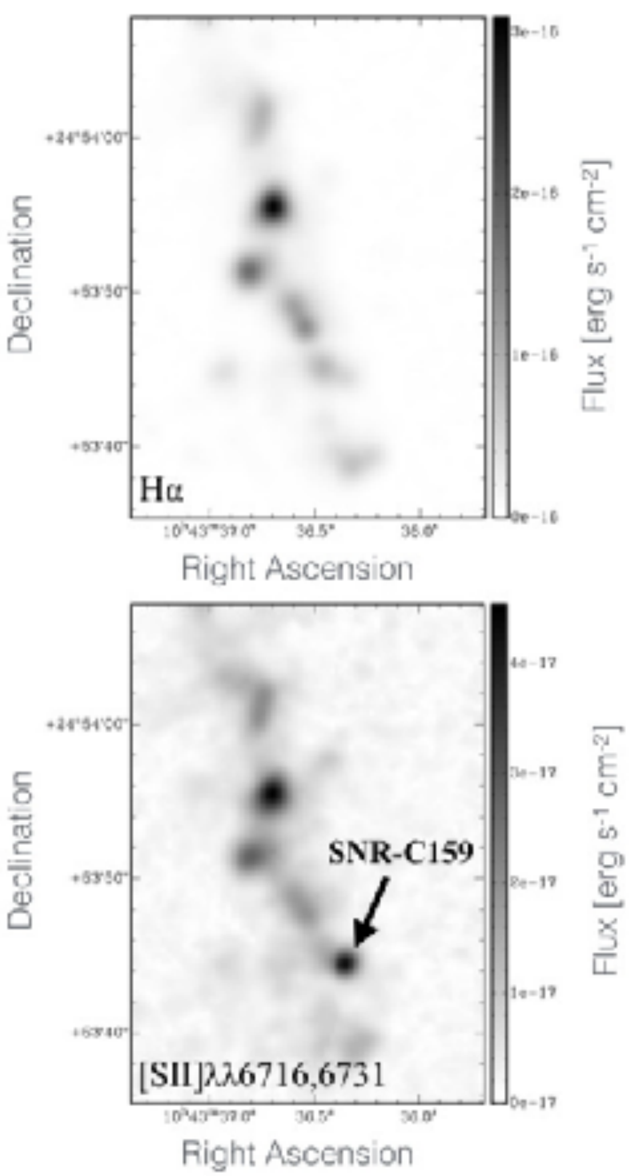
3D Optical Spectroscopic Study of NGC 3344 with SITELLE: I. Identification and Confirmation of Supernova Remnants

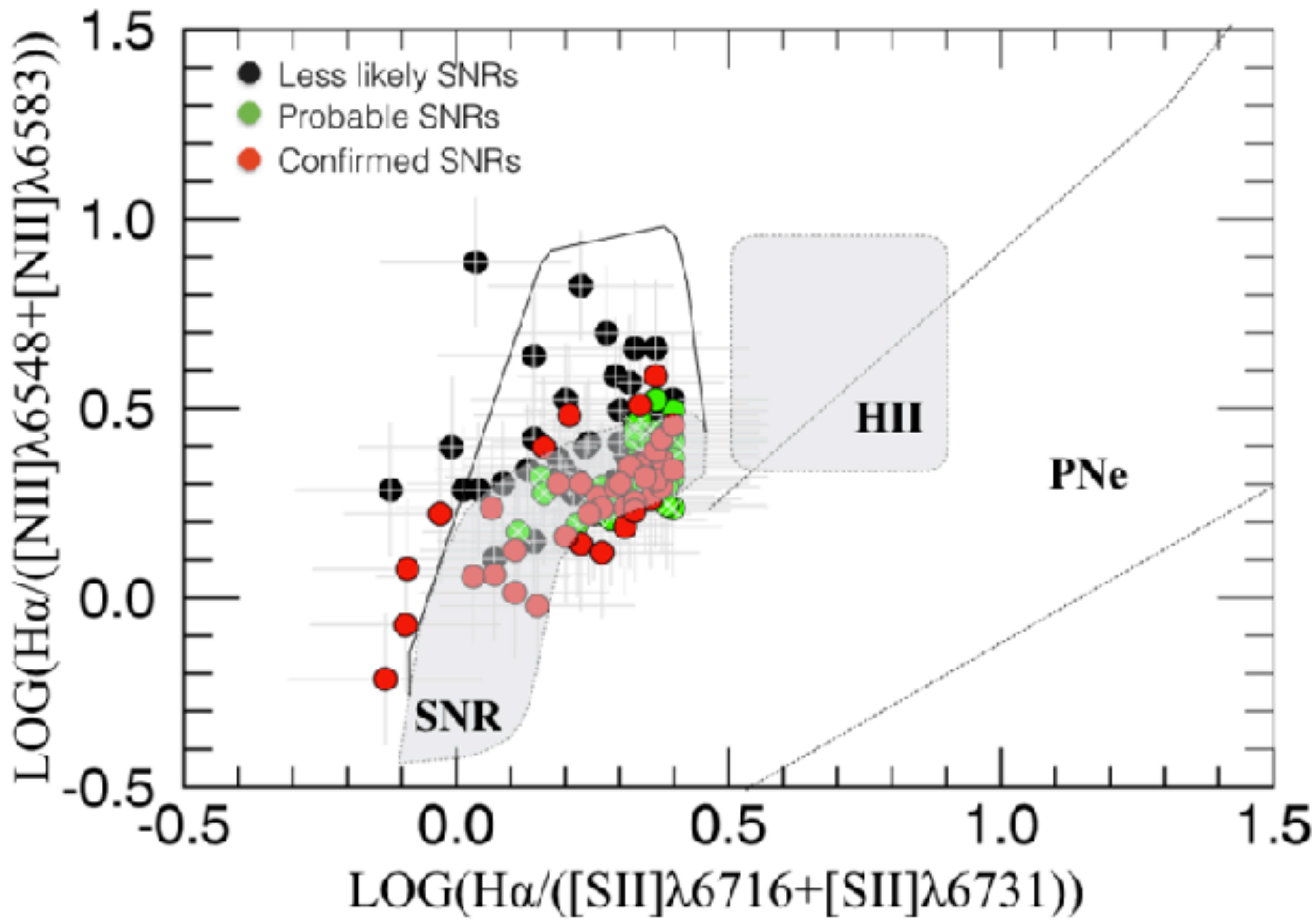
I. Moumen[1,2]*, C. Robert[1], D. Devost[2], R. P. Martin[3], L. Rousseau-Nepton[2,3], L. Drissen[1], and T. Martin[1]

[1] *Département de physique, de génie physique et d'optique, Université Laval, and Centre de Recherche en Astrophysique du Québec (CRAQ), Québec, QC, G1V 0A6, Canada*

[2] *Canada-France-Hawaii Telescope, Kamuela, HI, 96743, USA*

[3] *Department of Physics and Astronomy, University of Hawaii at Hilo, Hilo, HI, 96720, USA*





Searching for intergalactic star forming regions in Stephan's Quintet with SITELLE. I. Ionised gas structures and kinematics

S. Duarte Puertas[1], J. Iglesias-Páramo[1,2], J. M. Vílchez[1], L. Drissen[3,4], C. Kehrig[1], and T. Martin[3,4]

[1] Instituto de Astrofísica de Andalucía – CSIC, Glorieta de la Astronomía s.n., 18008 Granada, Spain
e-mail: salvini@iaa.es
[2] Estación Experimental de Zonas Áridas - CSIC, Ctra. de Sacramento s.n., La Cañada, Almería, Spain
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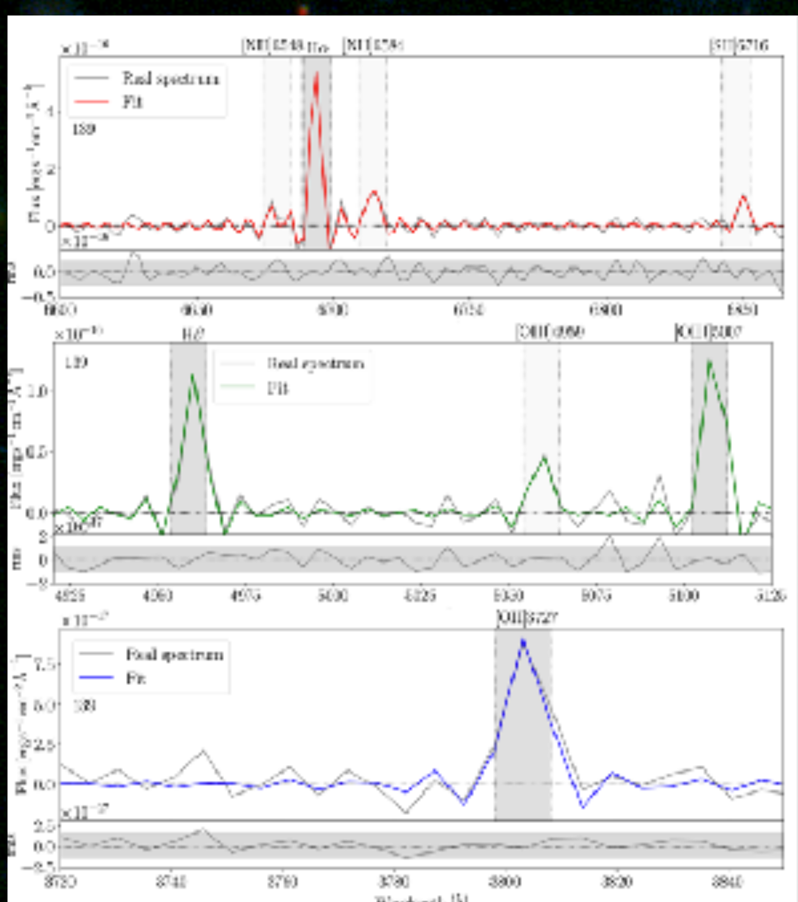
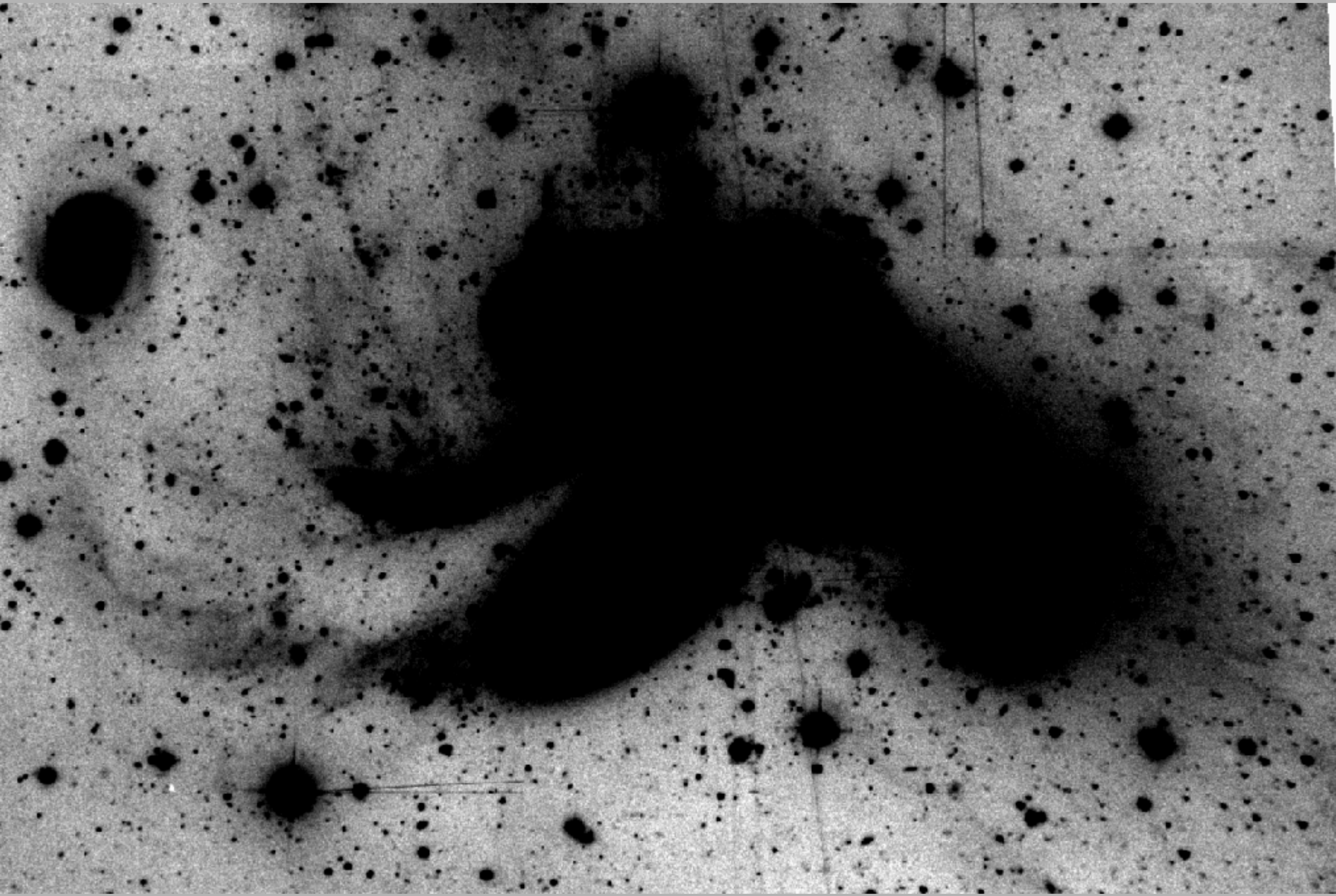
[4] Centre de recherche en astrophysique du Québec

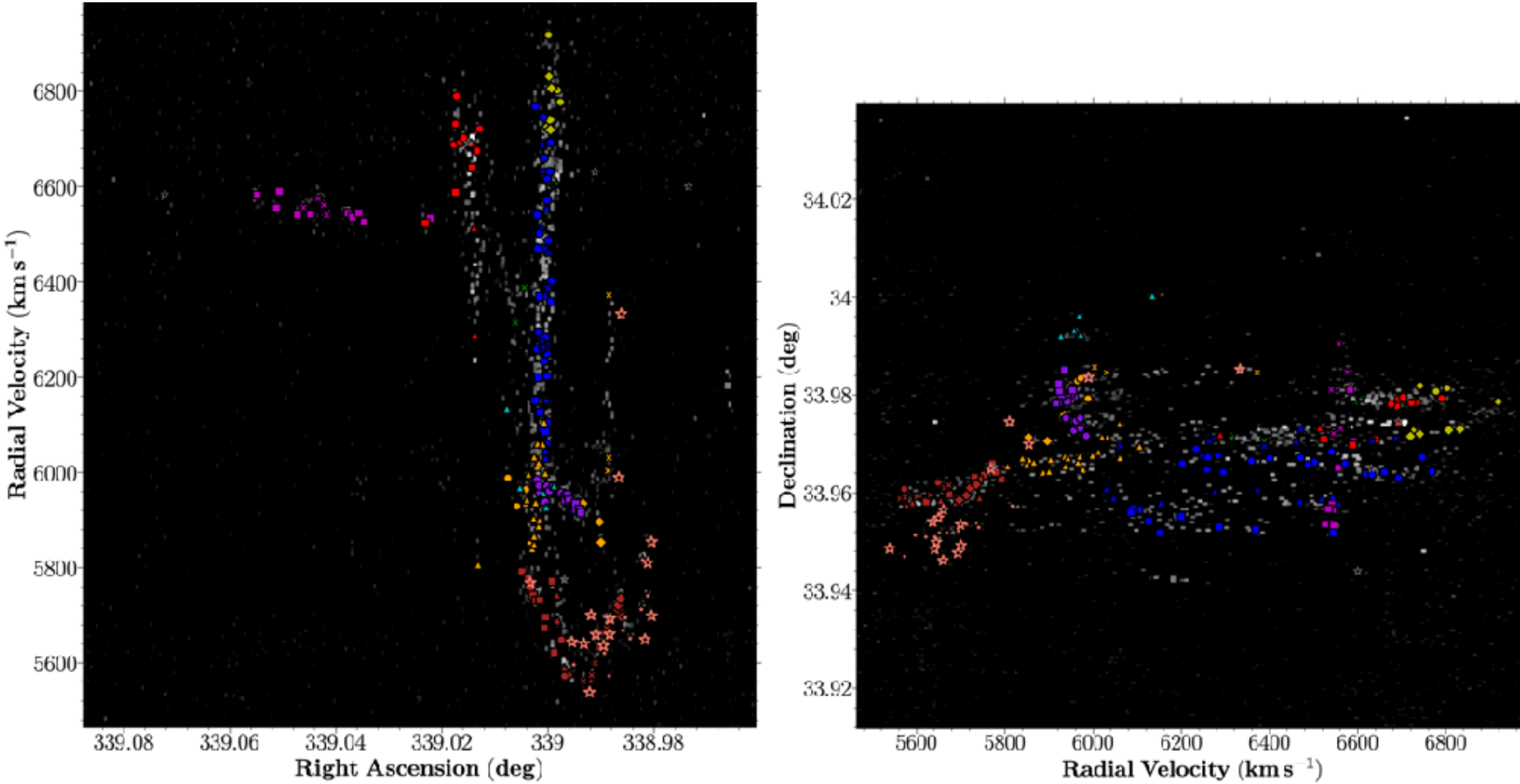
Received April 12, 2019; accepted April 12, 2019



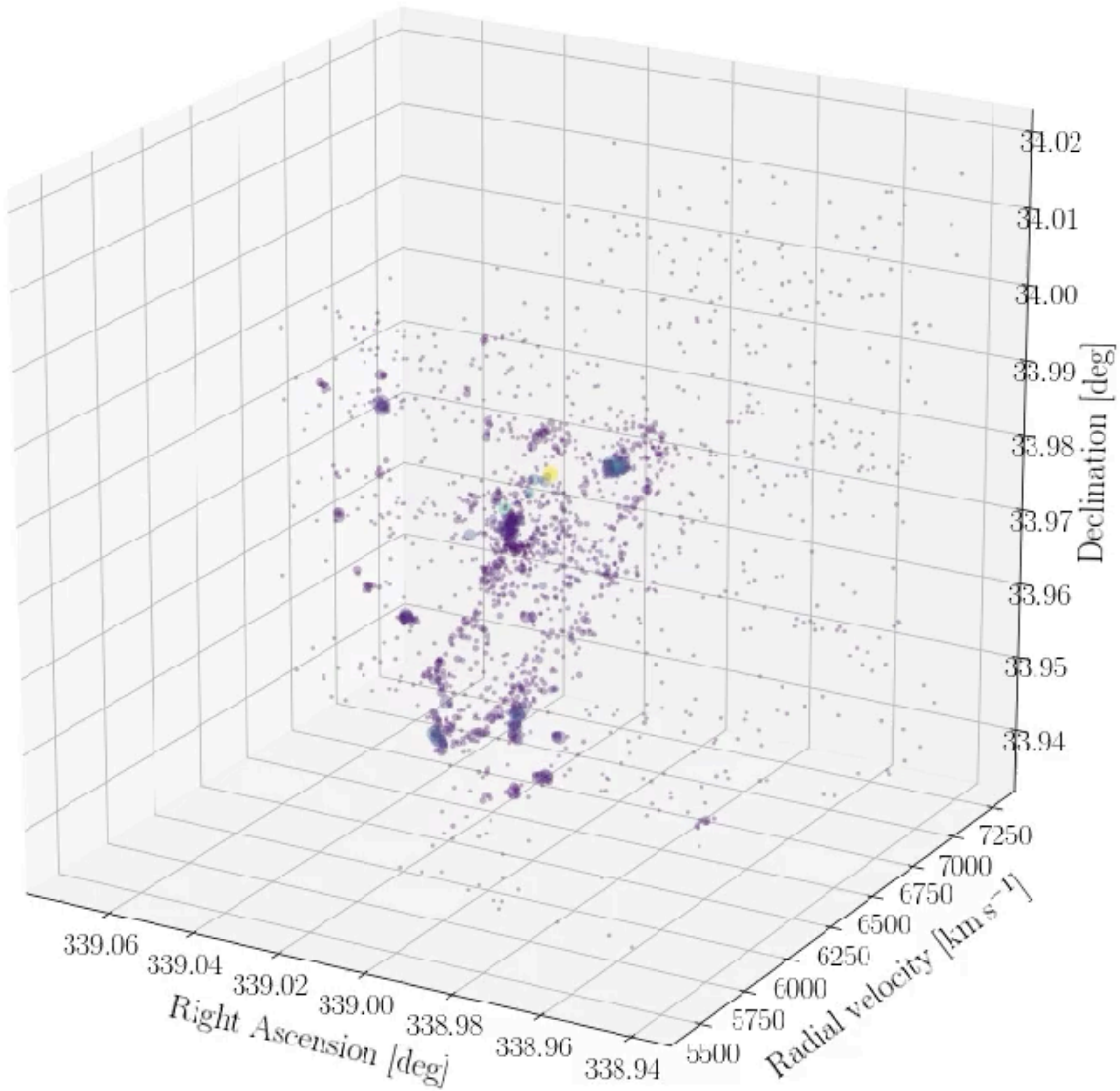
SITELLE Deep (SN1, SN2, SN3: 370 /490/660 nm)



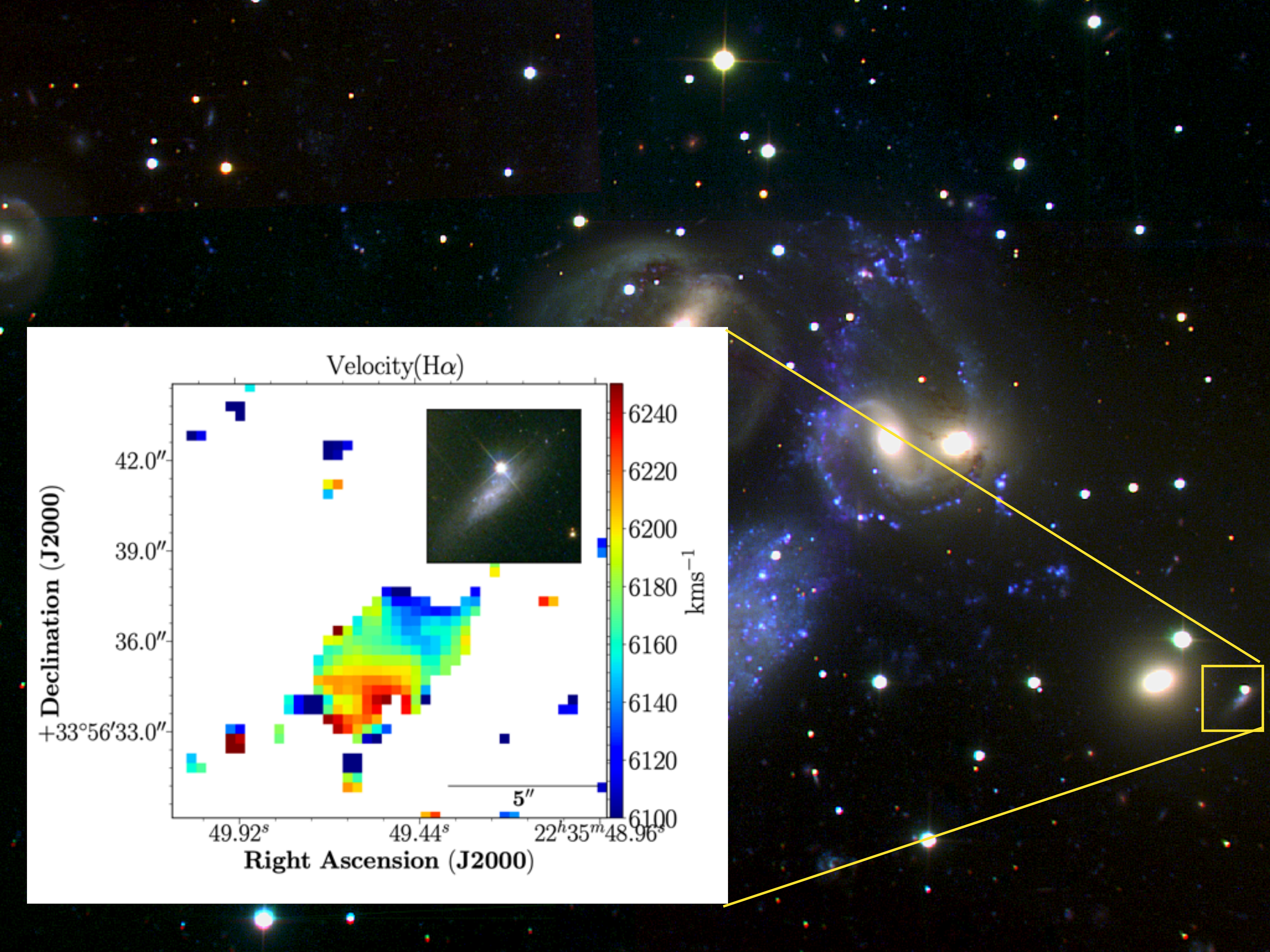
Deep image (Sum of all interferograms), SN2 filter (480 m)



Radial Velocity (km s^{-1})
6800
6600
6400
6200
6000
5800
5600
339.08
339.06
339.04
339.02
339
338.98
Right Ascension (deg)
Declination (deg)
34.02
34
33.98
33.96
33.94
33.92
5600
5800
6000
6200
6400
6600
6800
Radial Velocity (km s^{-1})

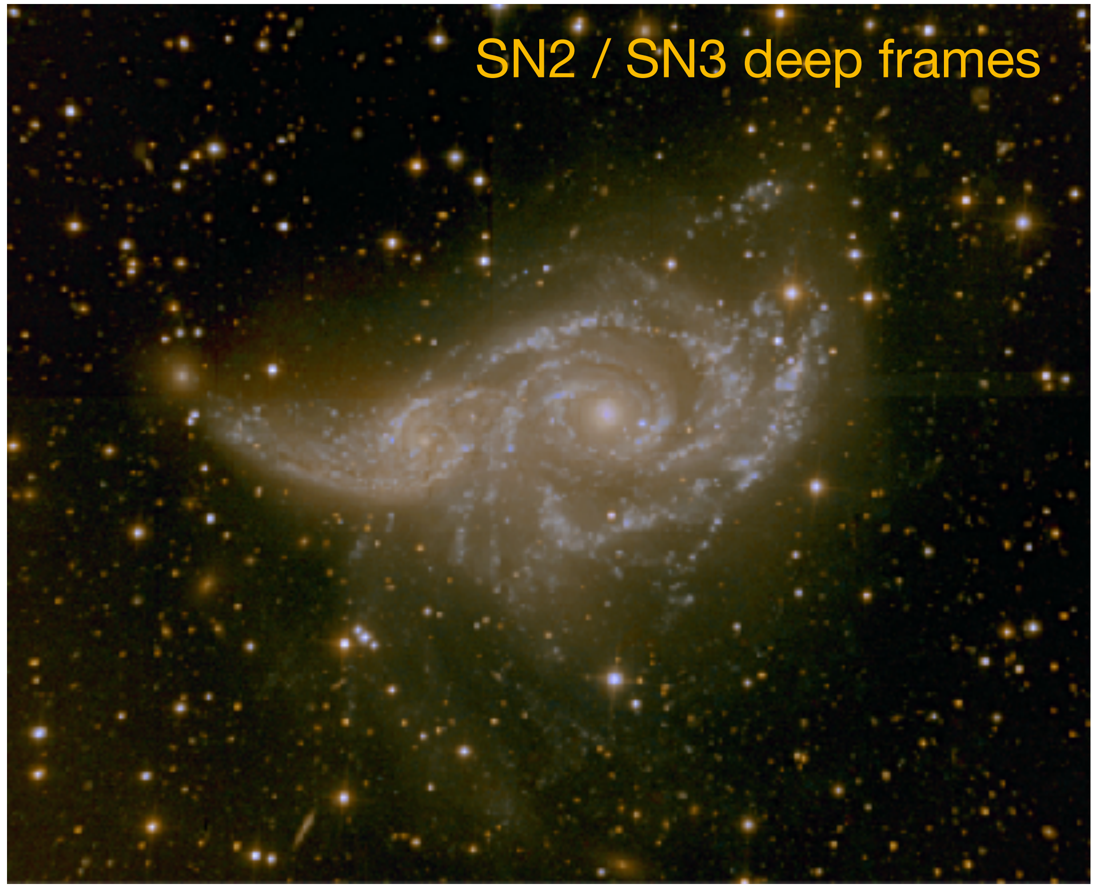


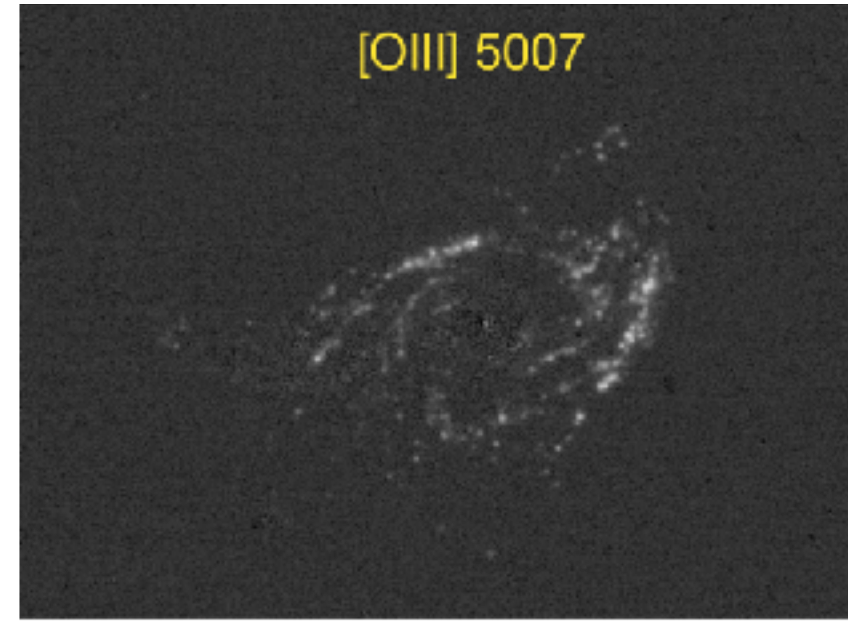
34.02
34.01
34.00
33.99
33.98
33.97
33.96
33.95
33.94
Declination [deg]
339.06
339.04
339.02
339.00
338.98
338.96
338.94
Right Ascension [deg]
7250
7000
6750
6500
6250
6000
5750
5500
Radial velocity [km s^{-1}]

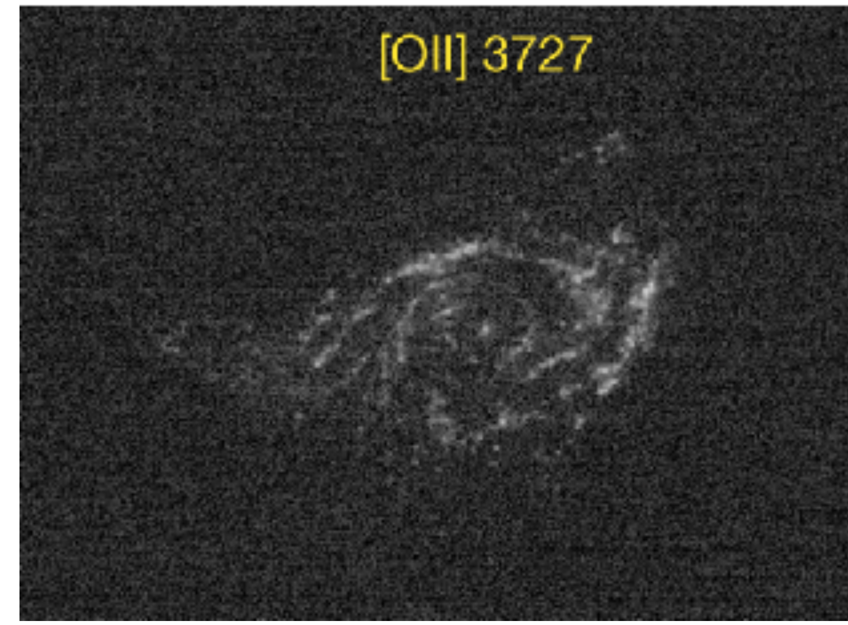


Velocity(Hα)
42.0″
39.0″
36.0″
+33°56′33.0″
Declination (J2000)
49.92^s
49.44^s
22^{h}35^{m}48.96^s
Right Ascension (J2000)
5″
6240
6220
6200
6180
6160
6140
6120
6100
kms^{-1}

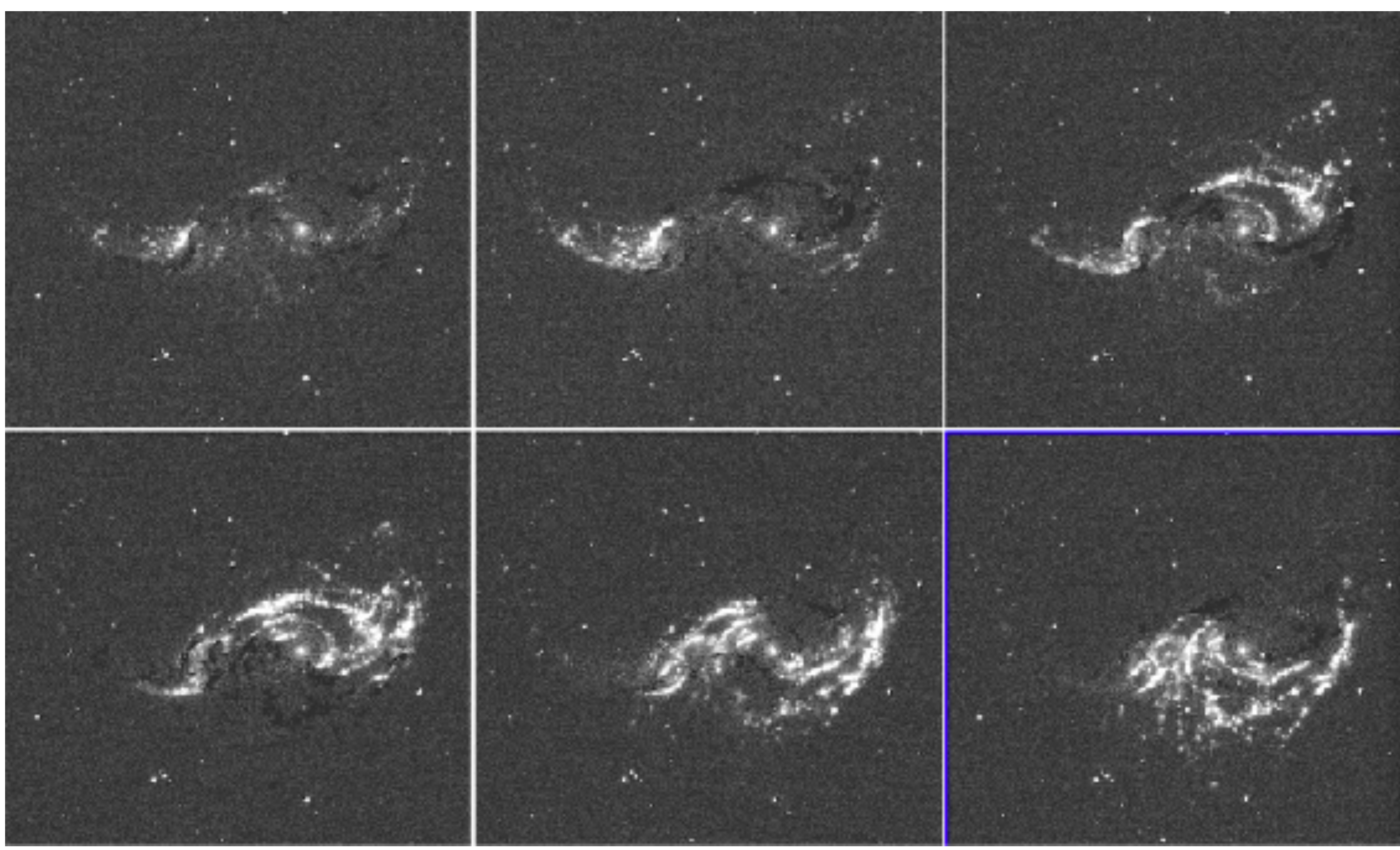
University of Hawaiʻi
Hilo

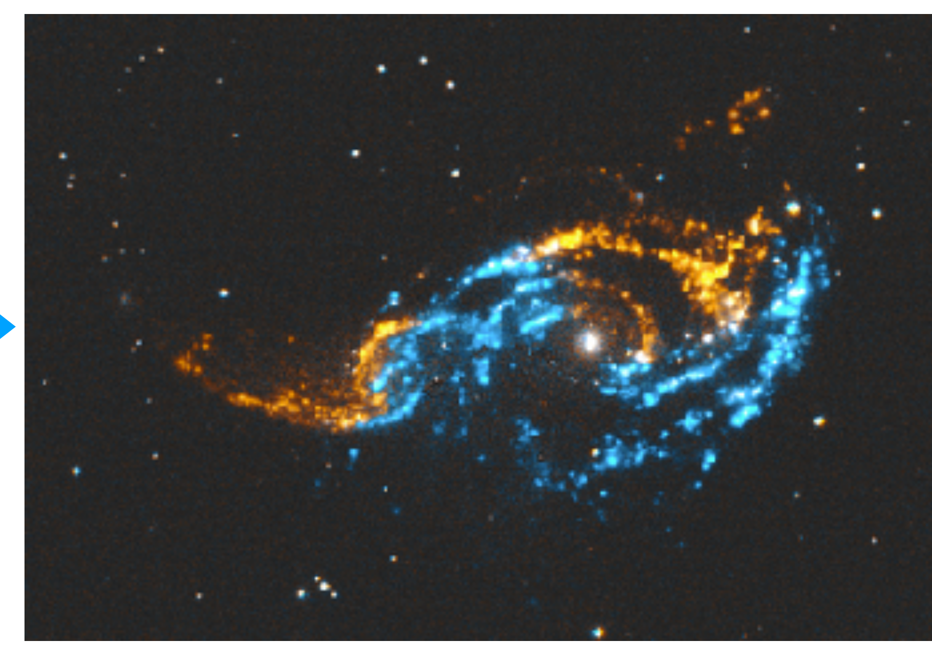






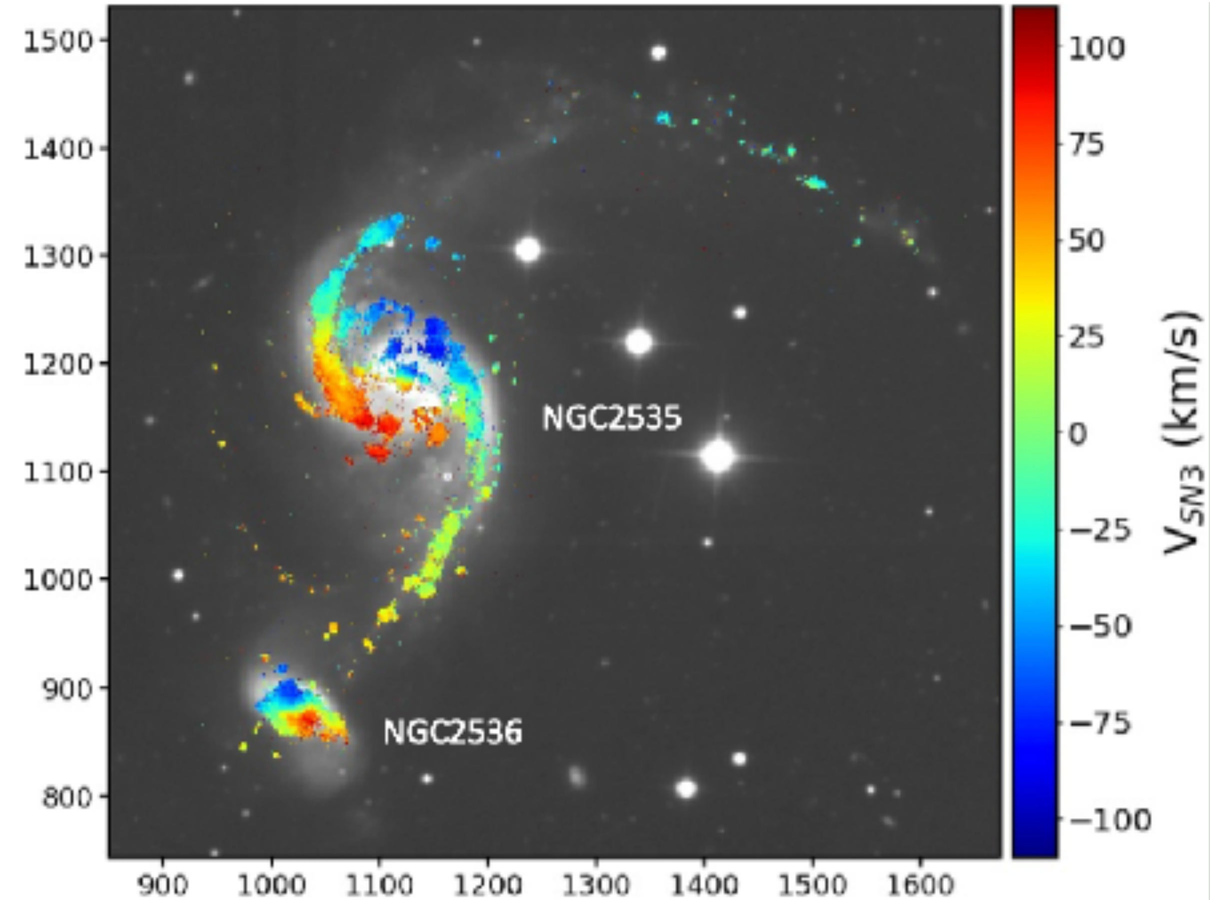
NGC 2207 / IC 2163

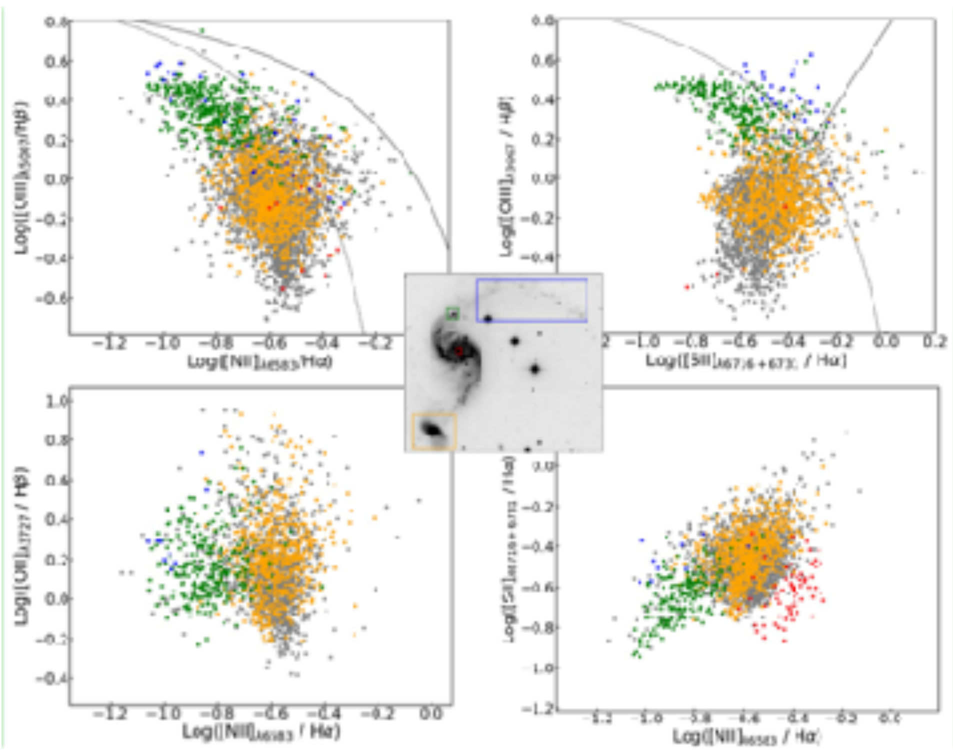


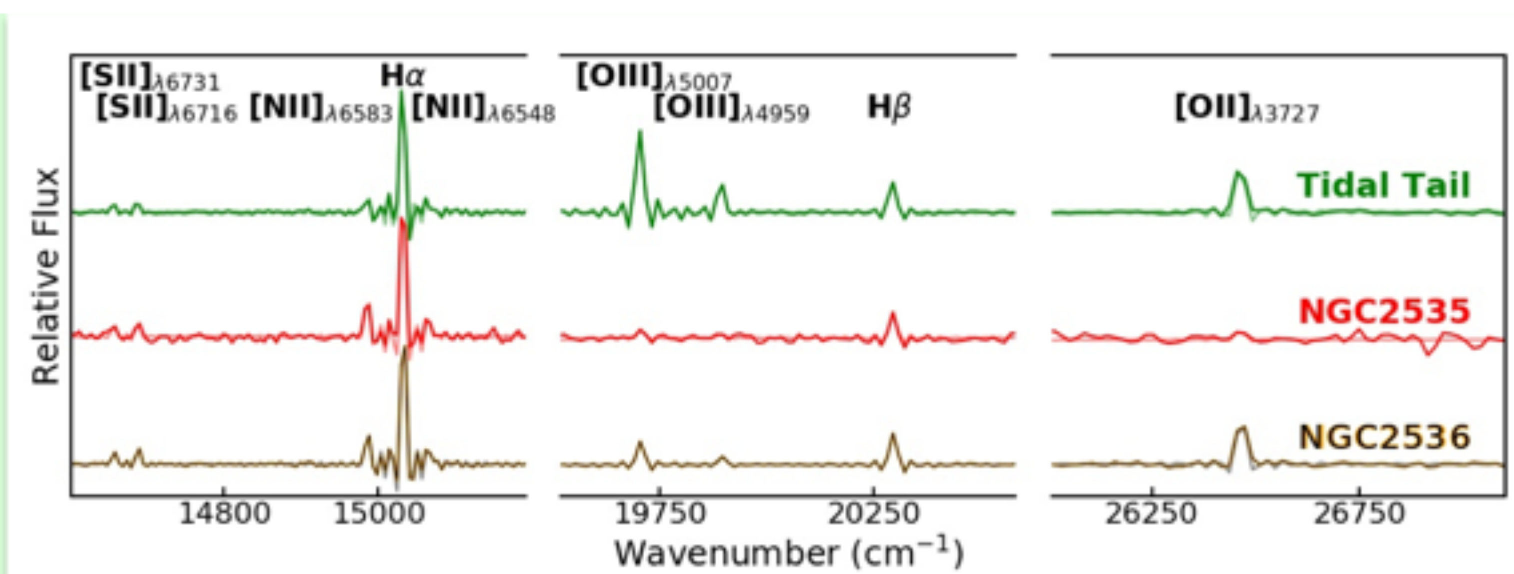


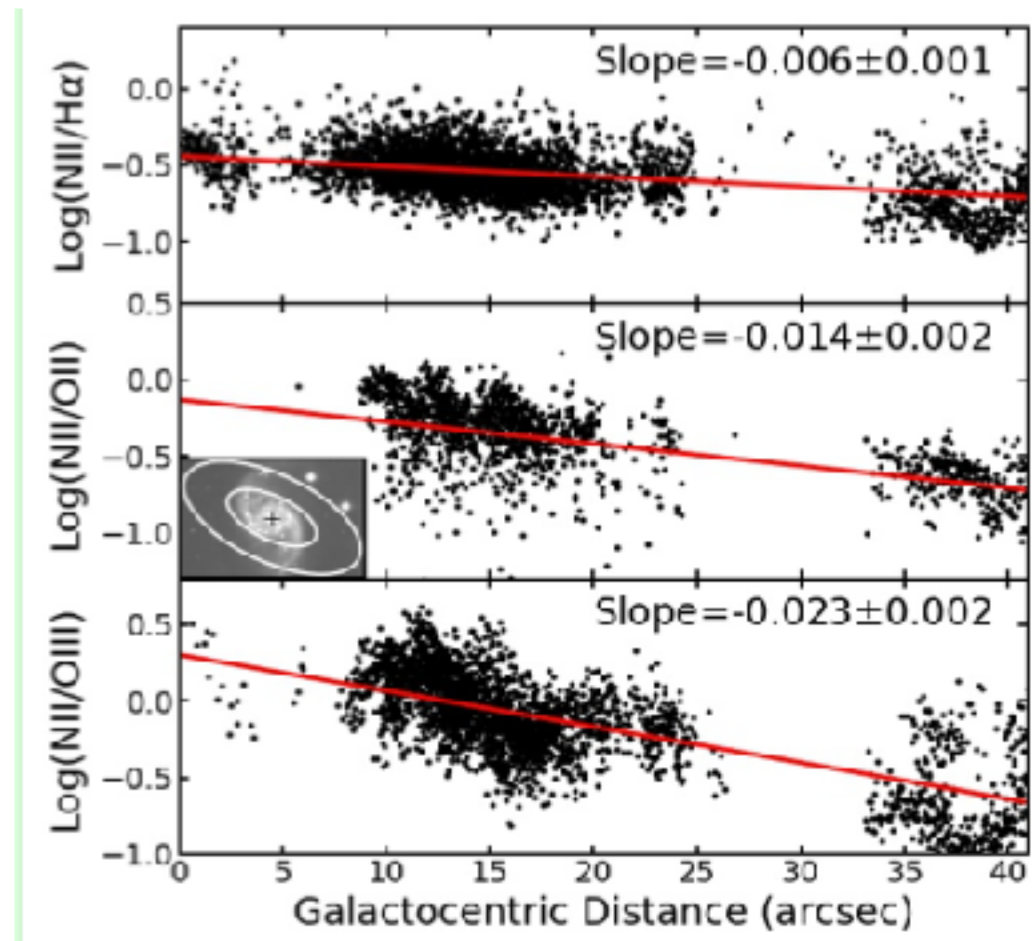
Prime Karera
(U. Laval)

Interacting galaxies - Arp 82



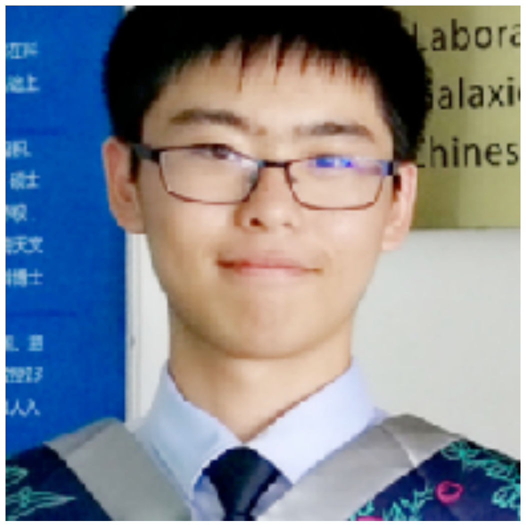


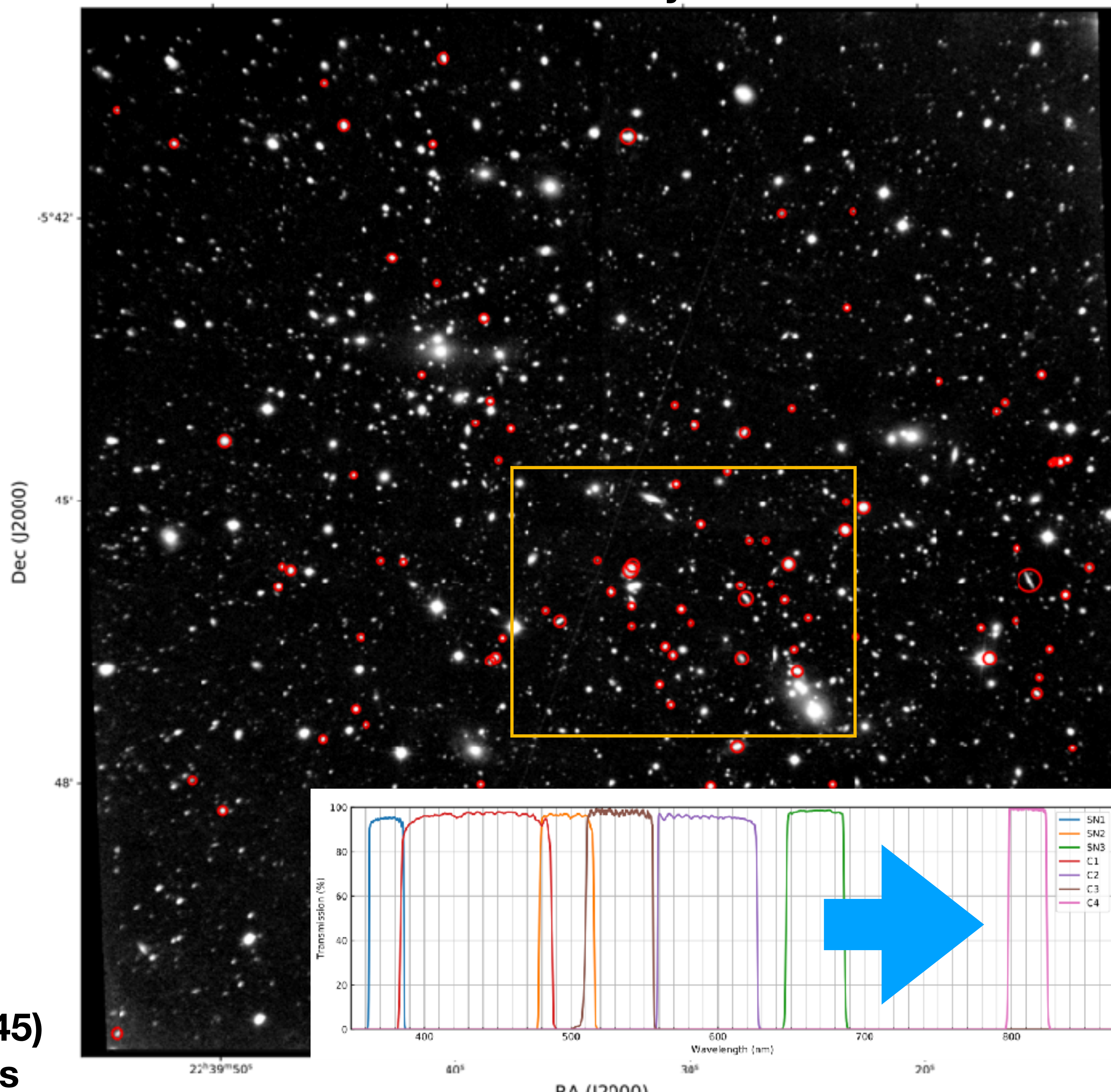




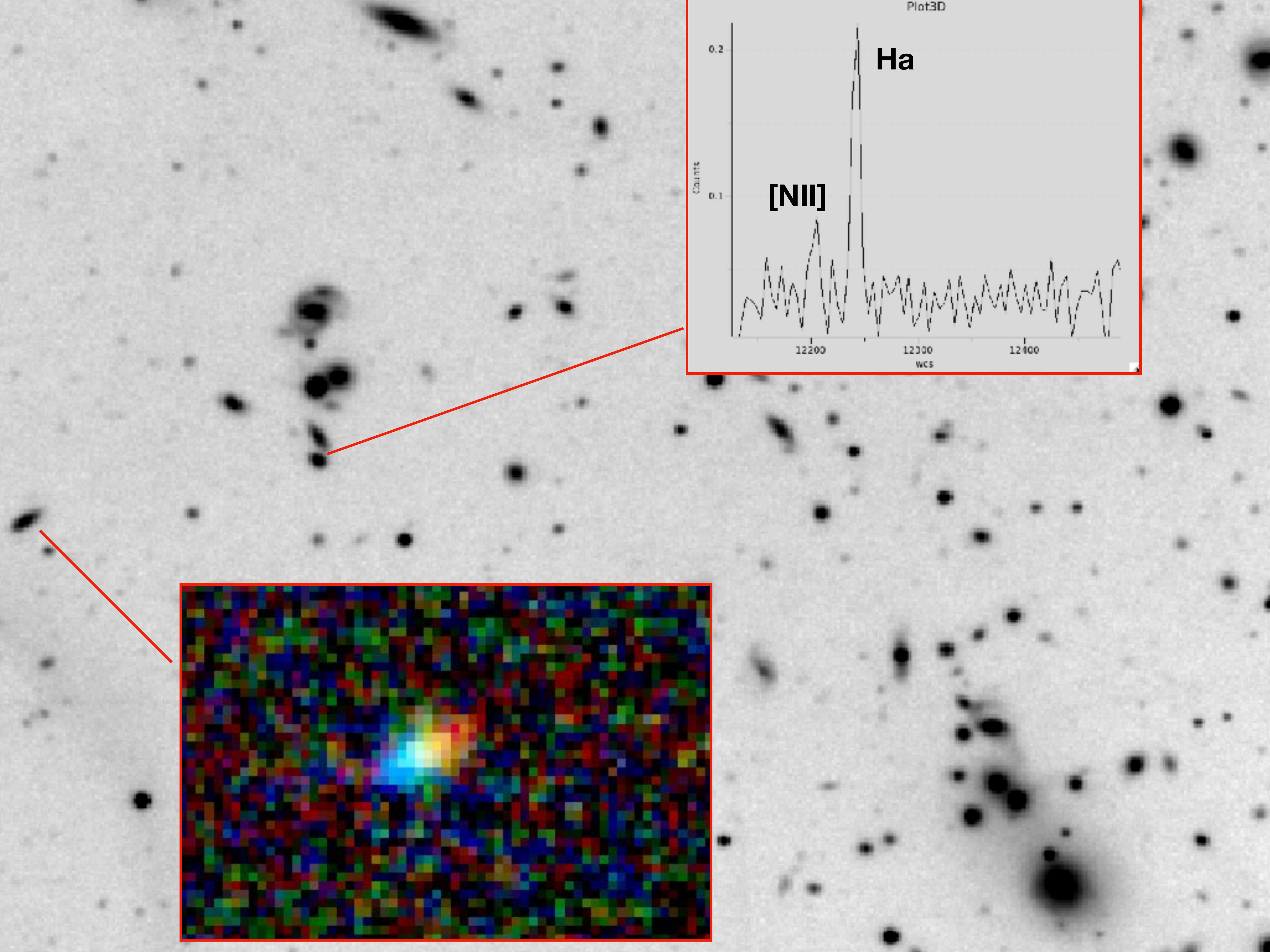
Qing Liu, Howard Yee, et al.
(U. of Toronto)

The Emission-line Galaxy Population in Rich Galaxy Clusters

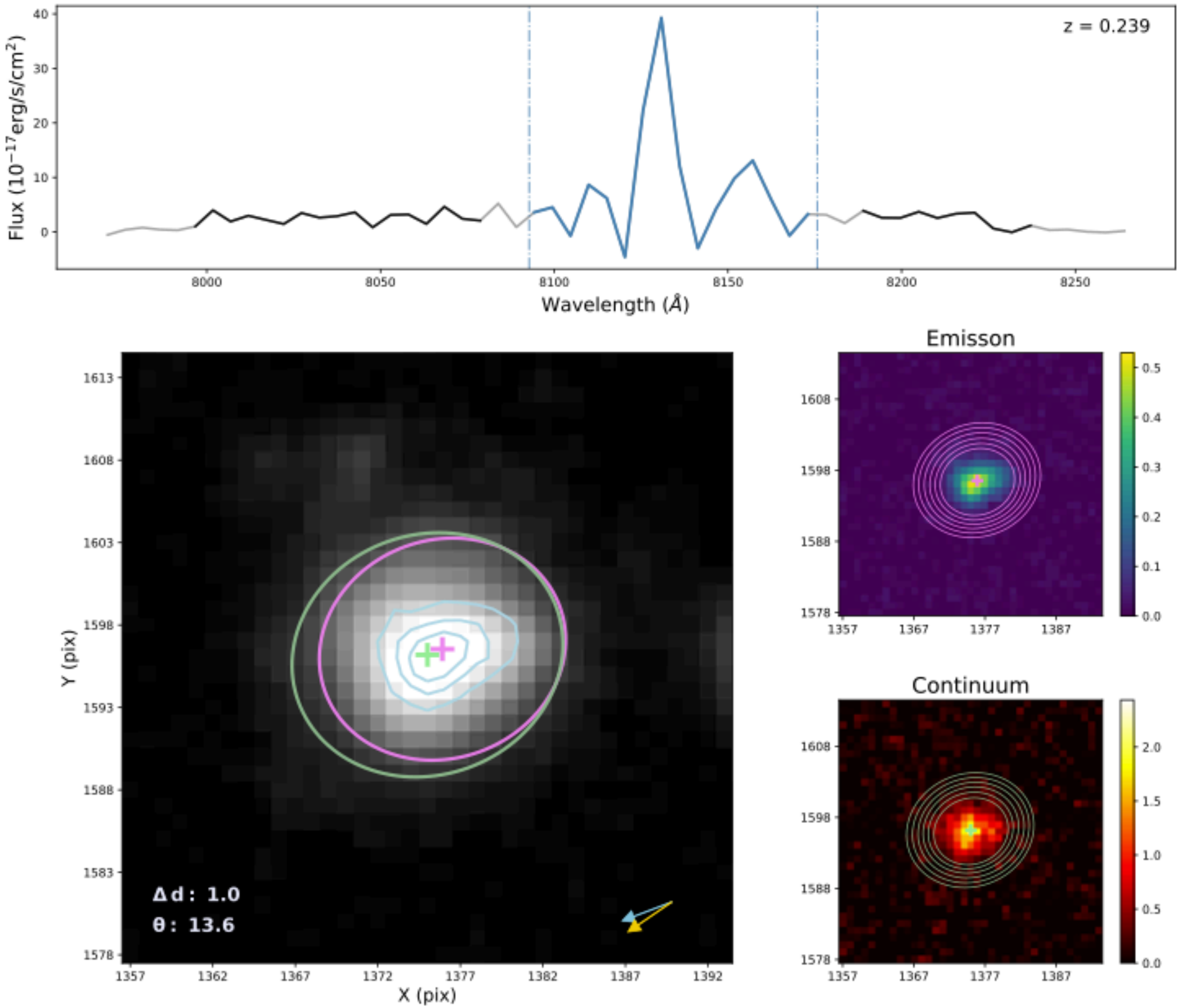




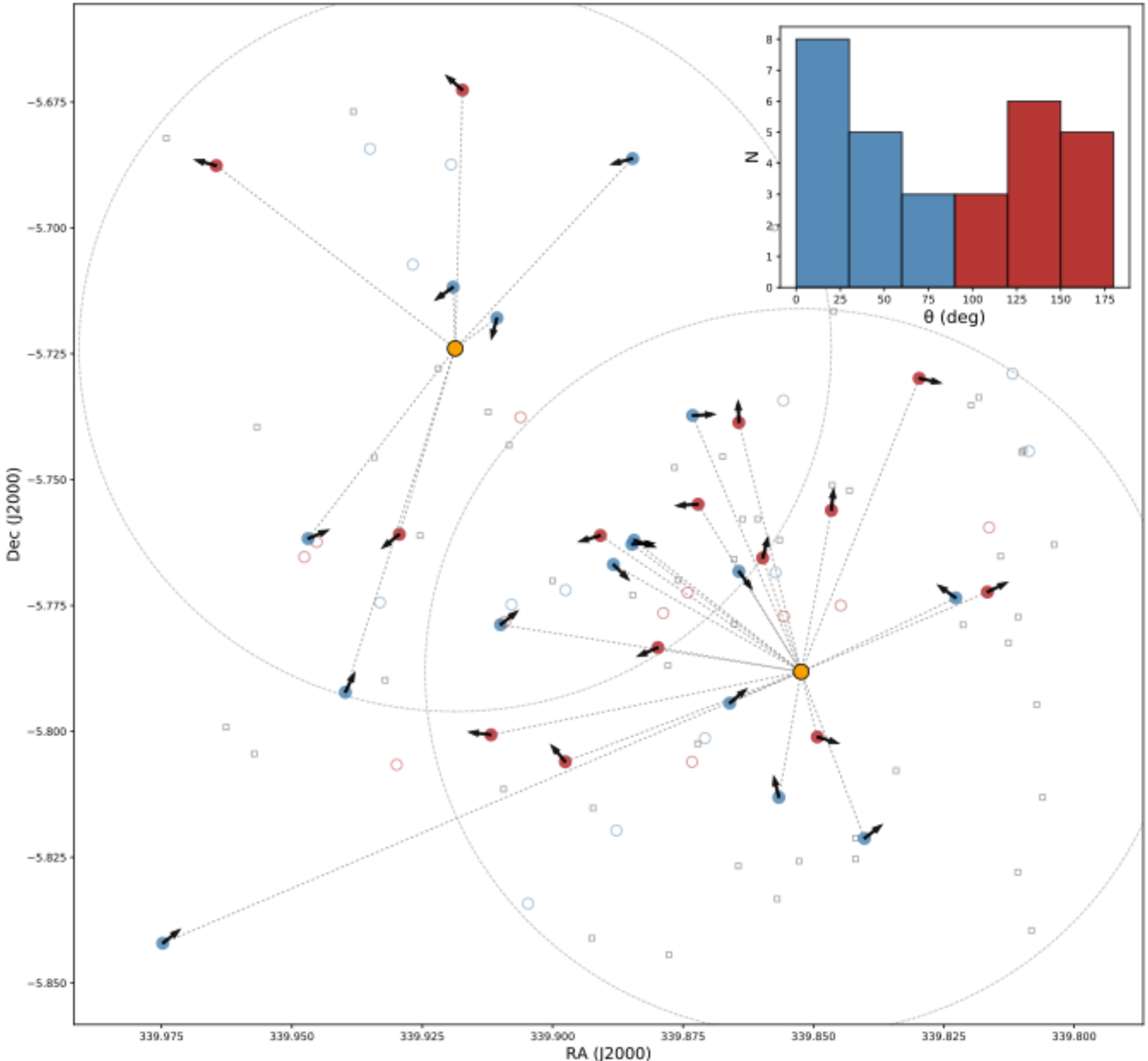
Abell 2465 (z=0.245)
colliding clusters


Plot3D
0.2
0.1
Counts
Ha
[NII]
12200
12300
12400
wcs

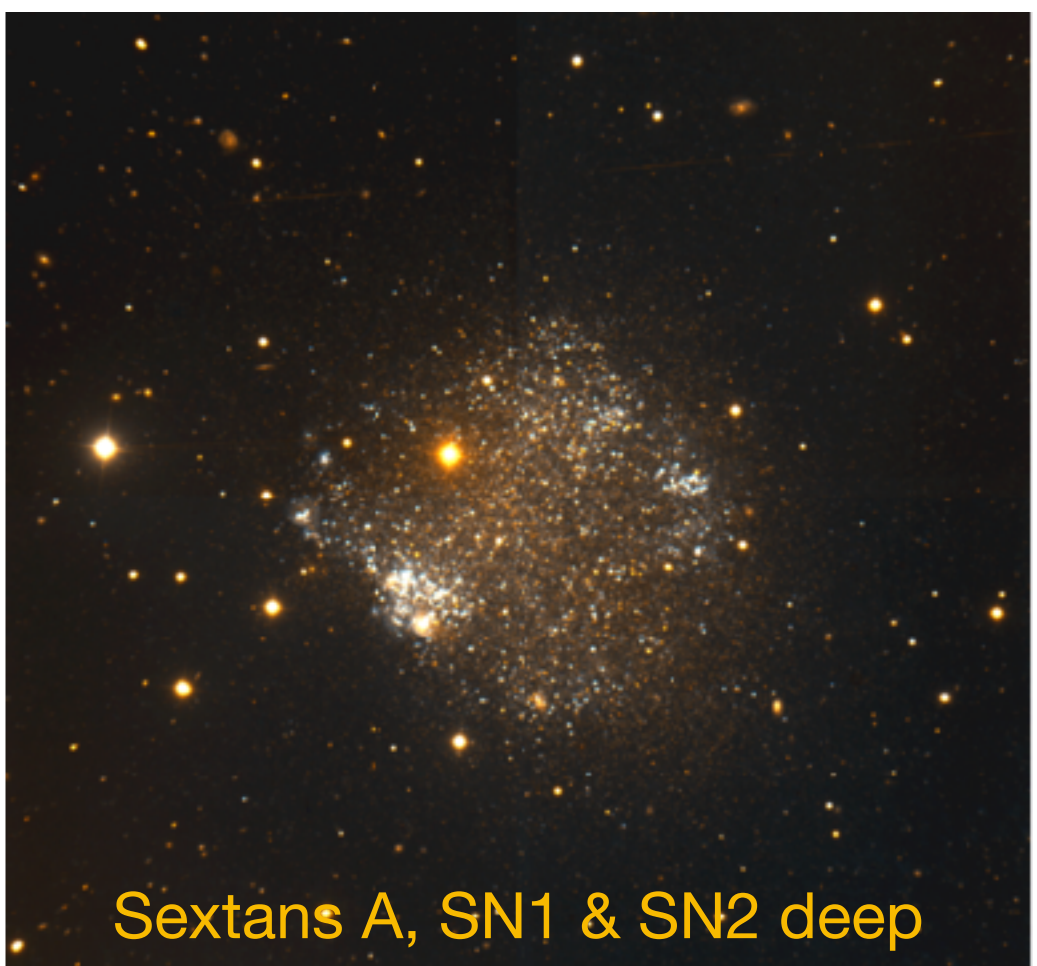
A2465 - Offsets (emission vs continuum)

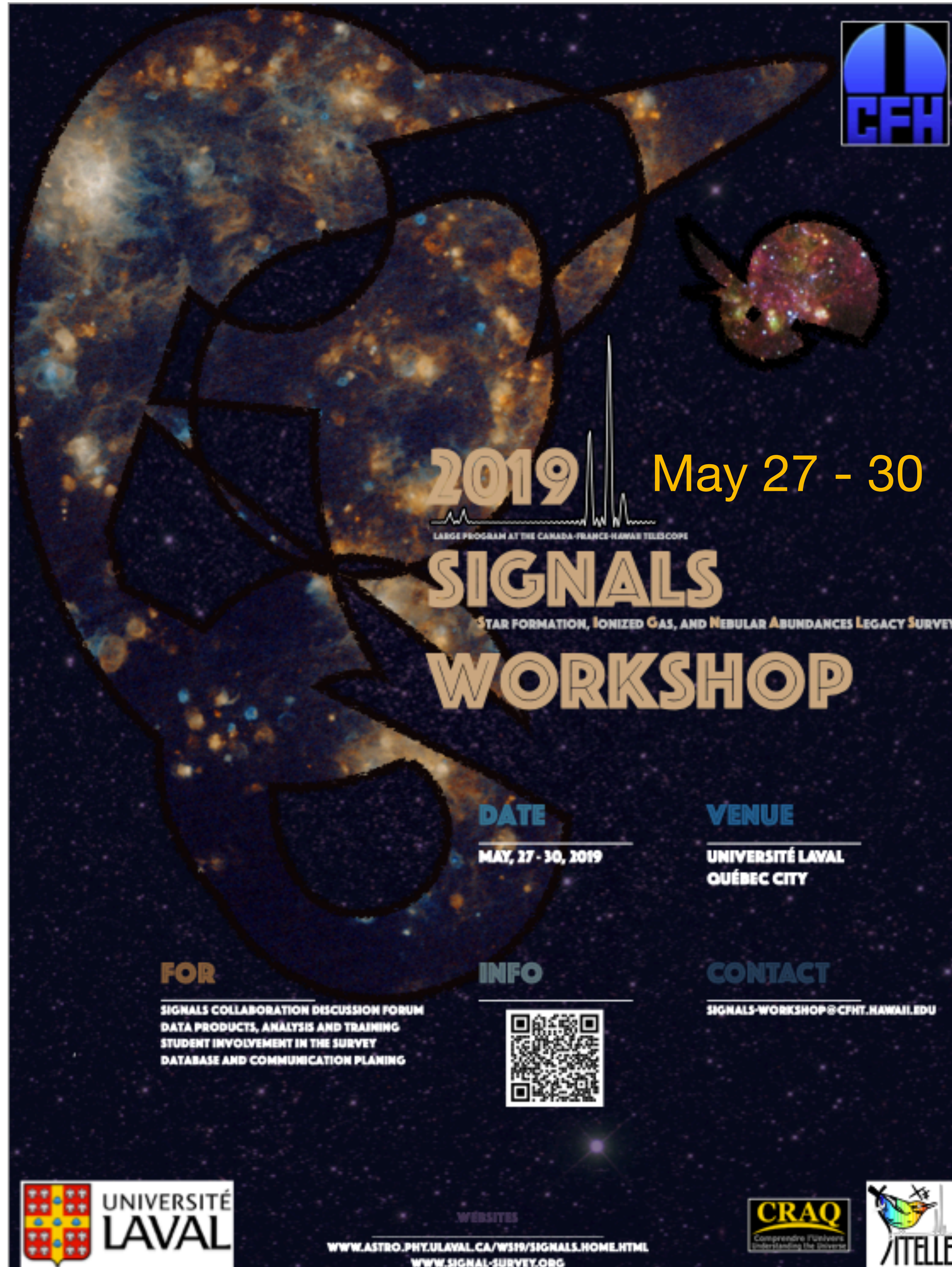


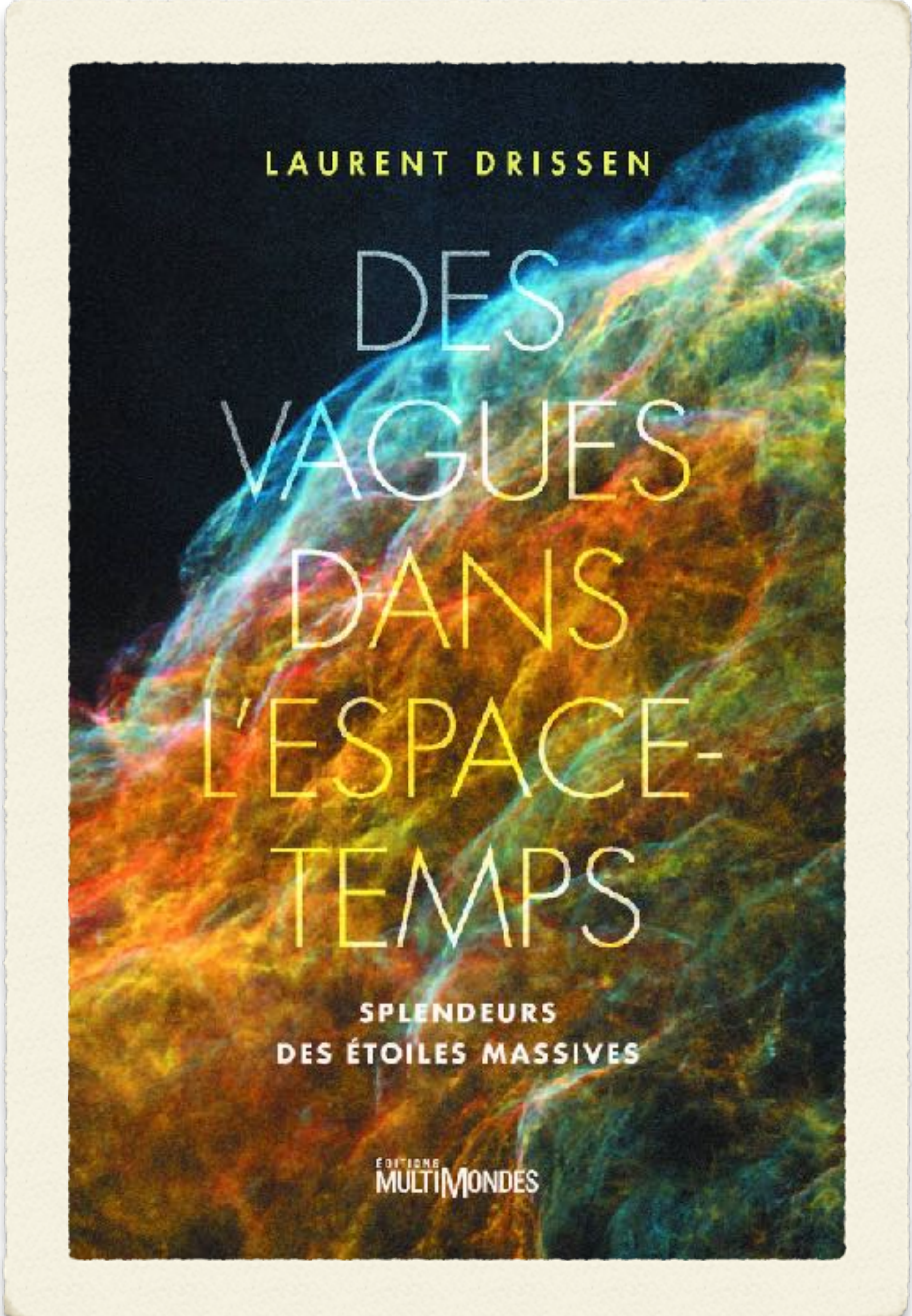
A2465 - Offsets (emission vs continuum)



SIGNALS PI:
Laurie Rousseau-Nepton







En librairie le 13 juin!

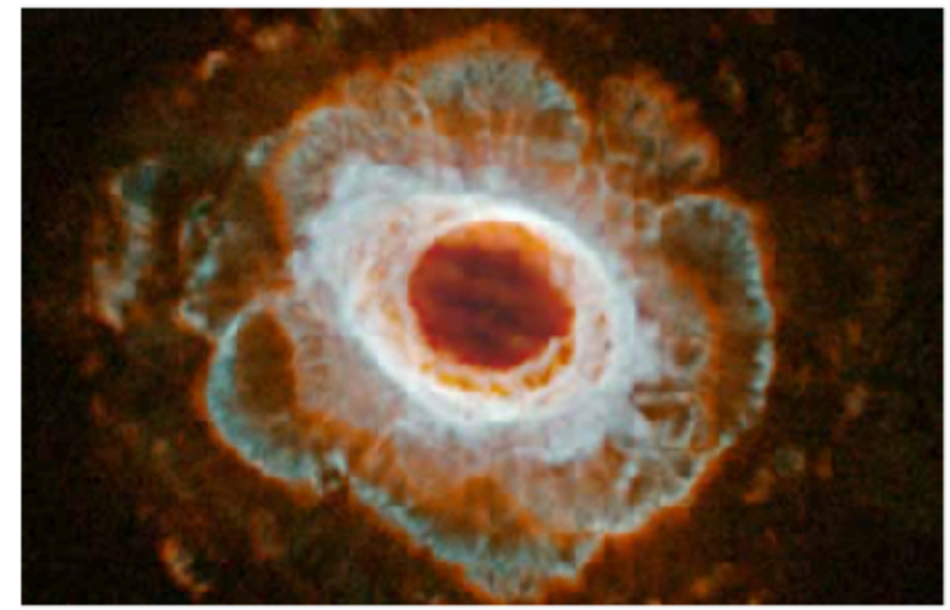


Figure 0.1 - Deux nébuleuses observées lors de la mise en service de SITELLE au télescope Canada-France-Hawaii. En haut, la nébuleuse de la Lyre, une nébuleuse planétaire résultant de l'éjection à faible vitesse des couches externes d'une étoile à peine plus massive que le Soleil. En bas, une petite région de IC 443 (la nébuleuse de la méduse), un reste de supernova issu de l'explosion rapide d'une étoile massive, il y a environ 15 000 ans. Les couleurs reflètent la proportion relative d'hydrogène, d'azote, d'oxygène et de soufre dans le spectre des nébuleuses.

Crédits: Laurent Drissen/Wei-Hao Wang/Alexandre Alarie/Télescope Canada-France-Hawaii