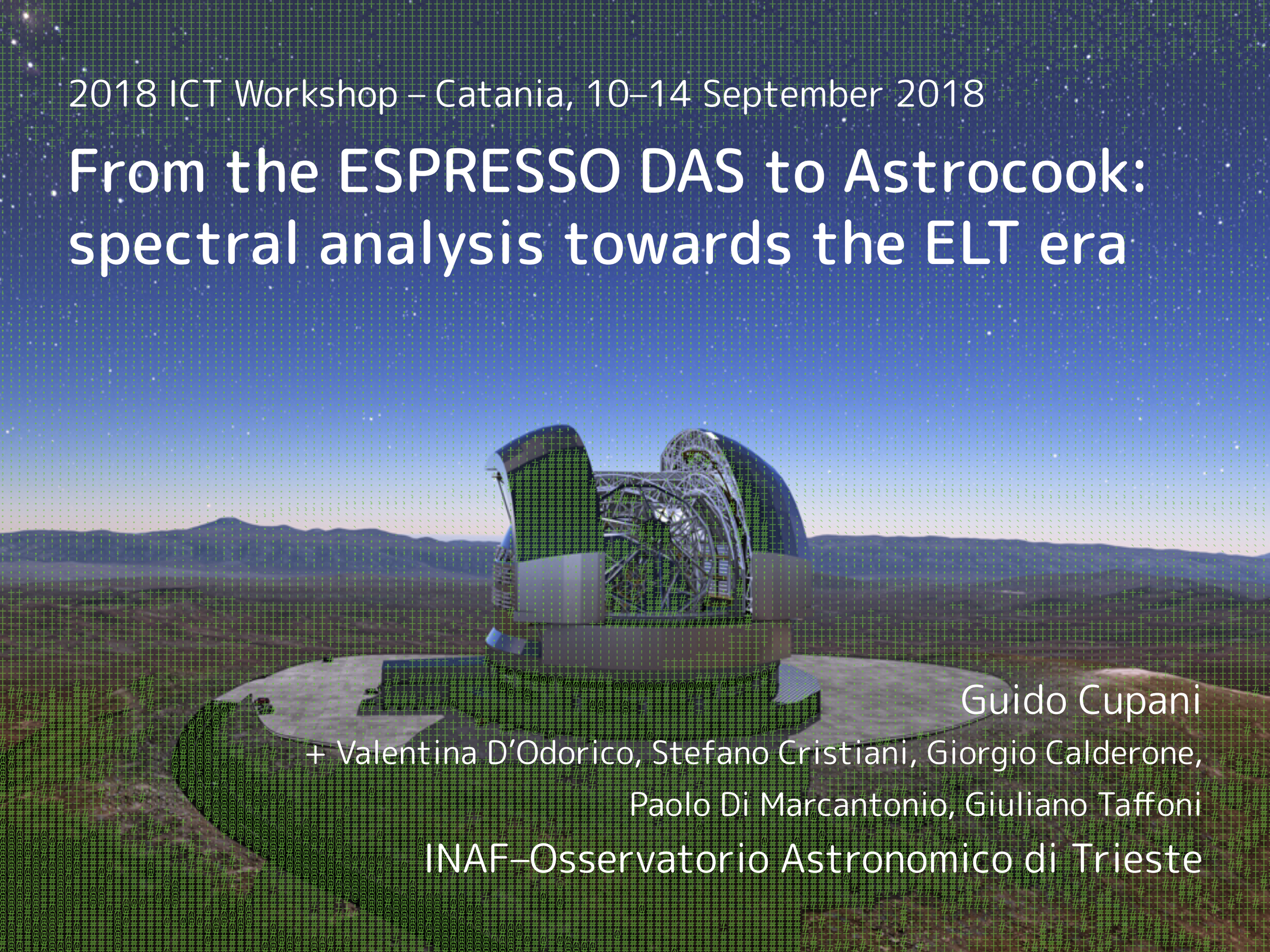
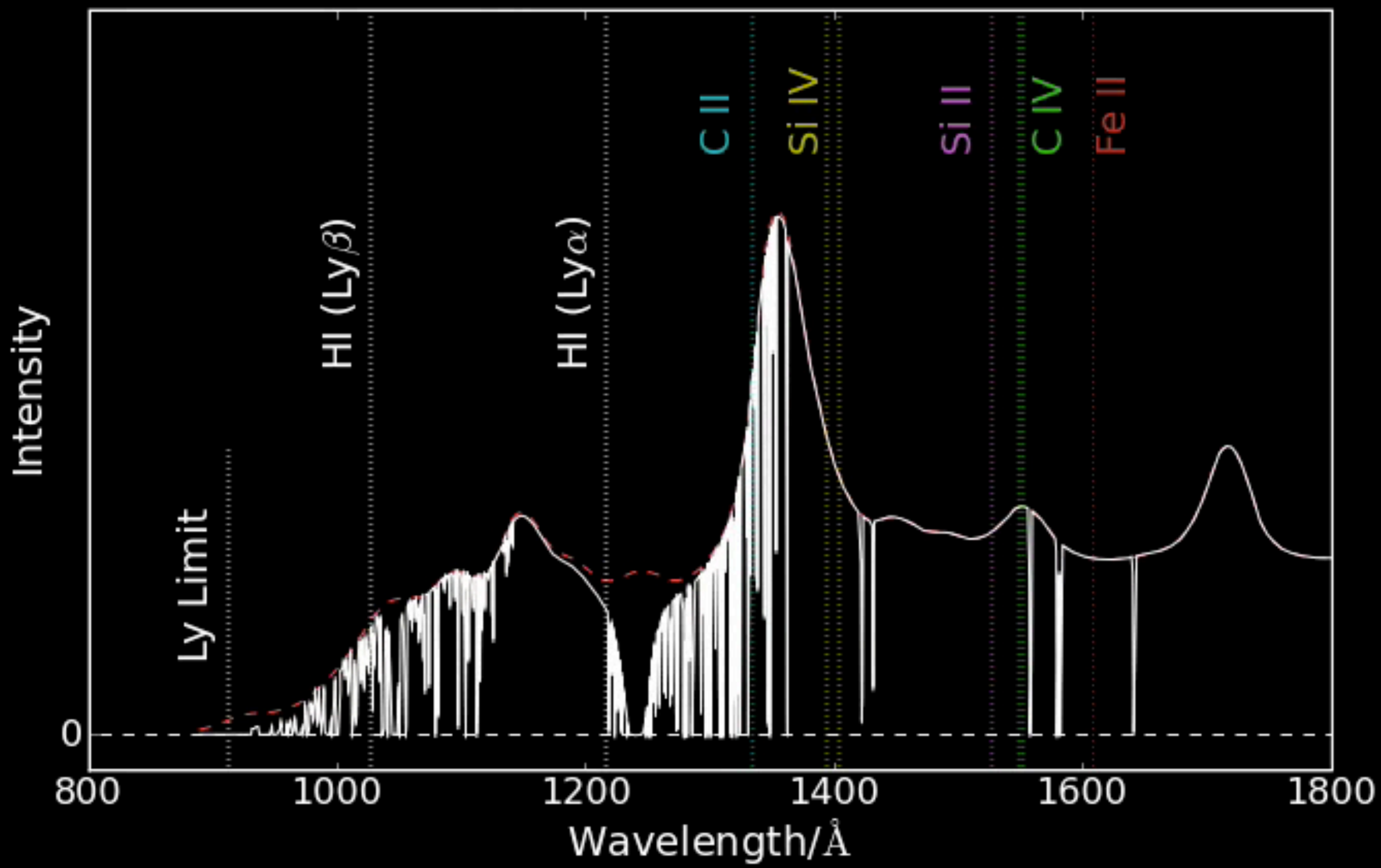
2018 ICT Workshop – Catania, 10–14 September 2018

From the ESPRESSO DAS to Astrocook: spectral analysis towards the ELT era

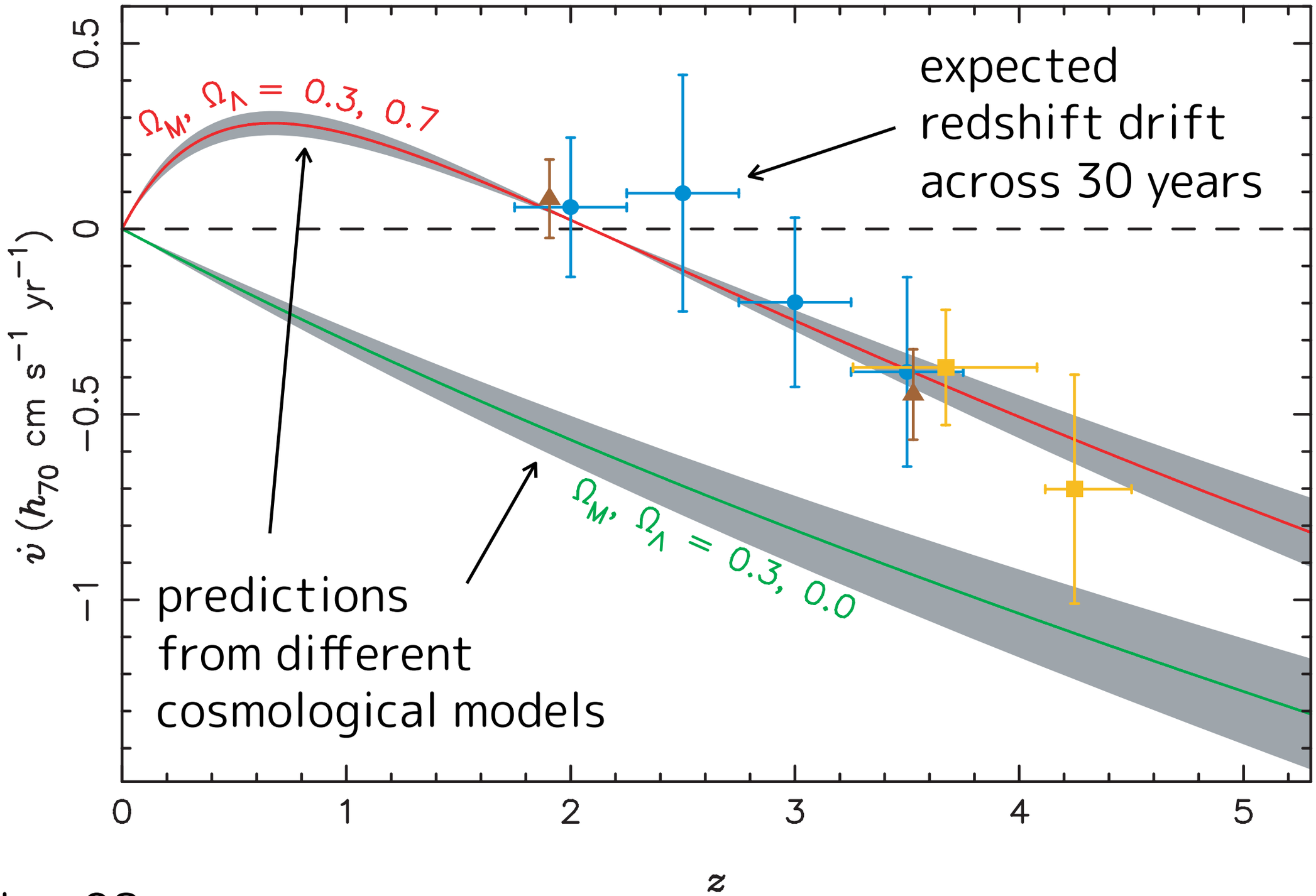


Guido Cupani
+ Valentina D'Odorico, Stefano Cristiani, Giorgio Calderone,
Paolo Di Marcantonio, Giuliano Taffoni
INAF–Osservatorio Astronomico di Trieste

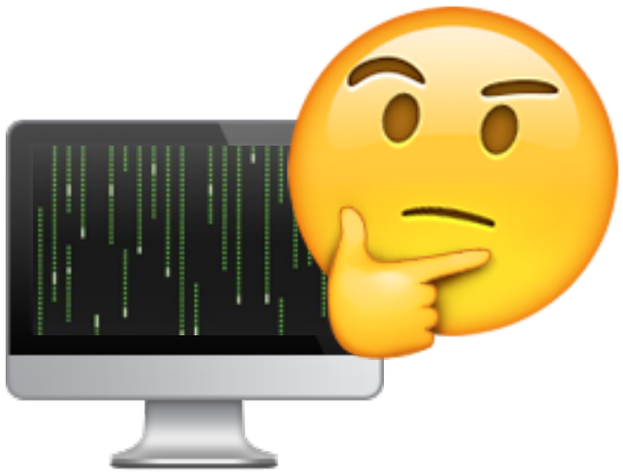
Credits: Andrew Pontzen



Sandage Test

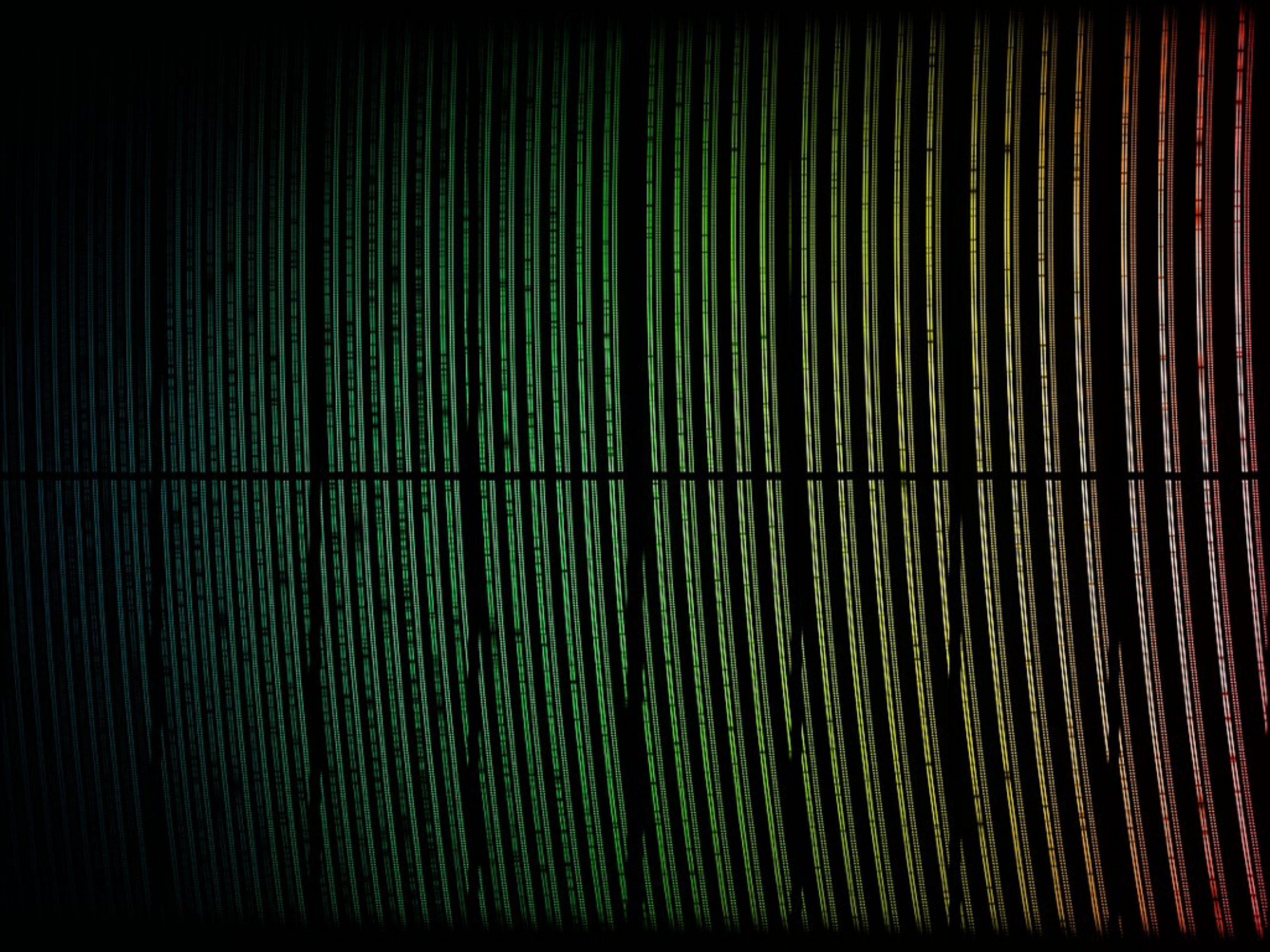


Liske+08

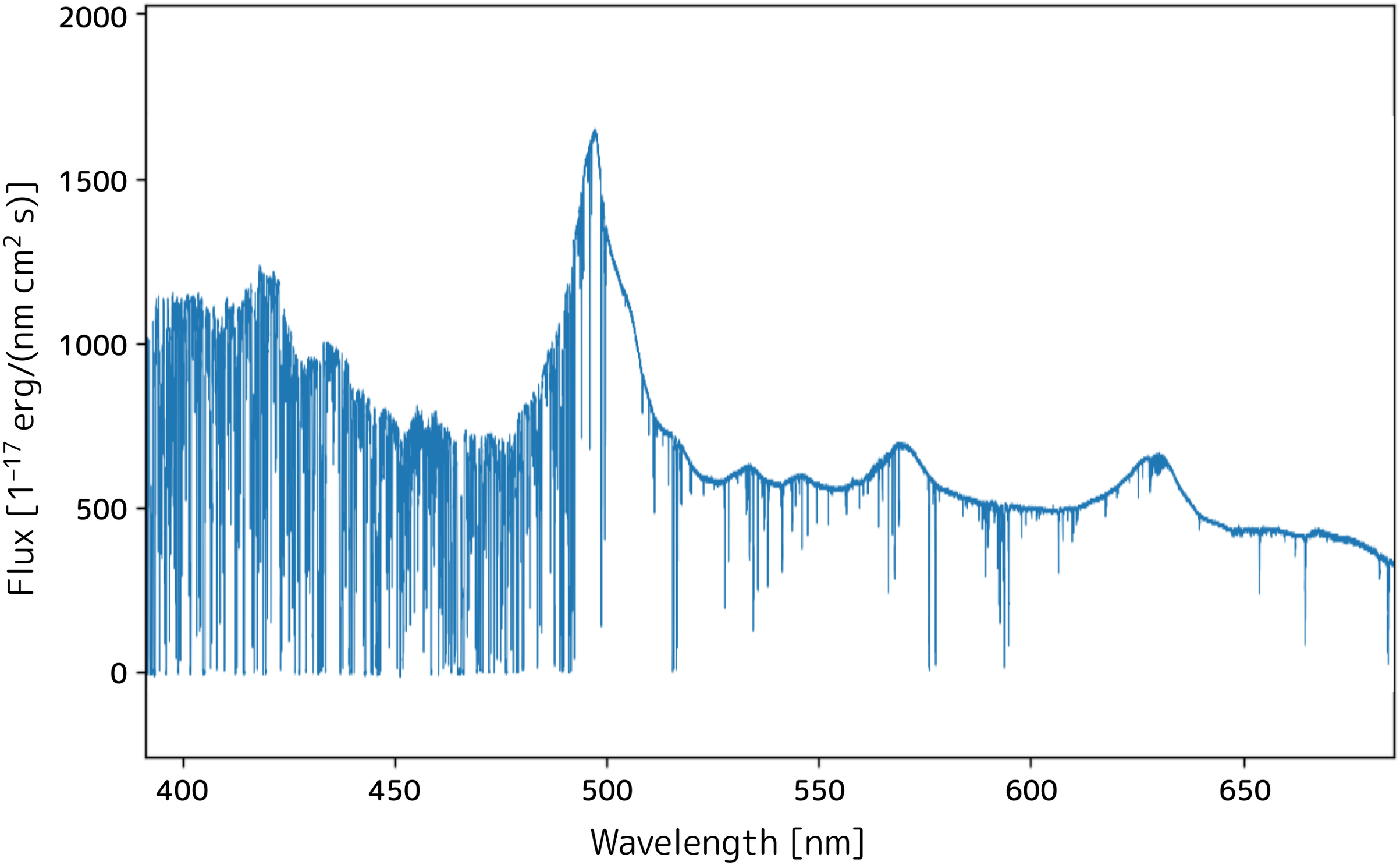


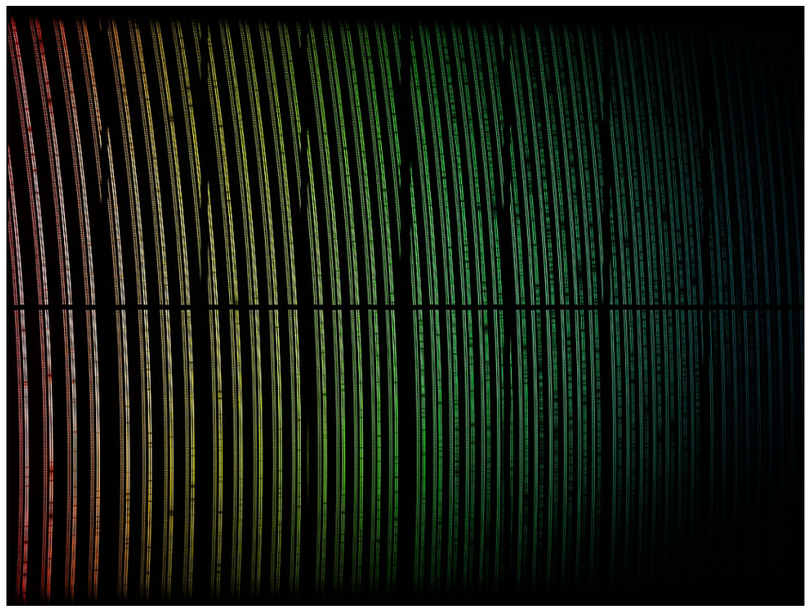
- Efficiency
  - Resolution
  - Stability
  - Flexibility
  - …
- Reliability
  - Repeatability
  - Scalability
  - Flexibility
  - …

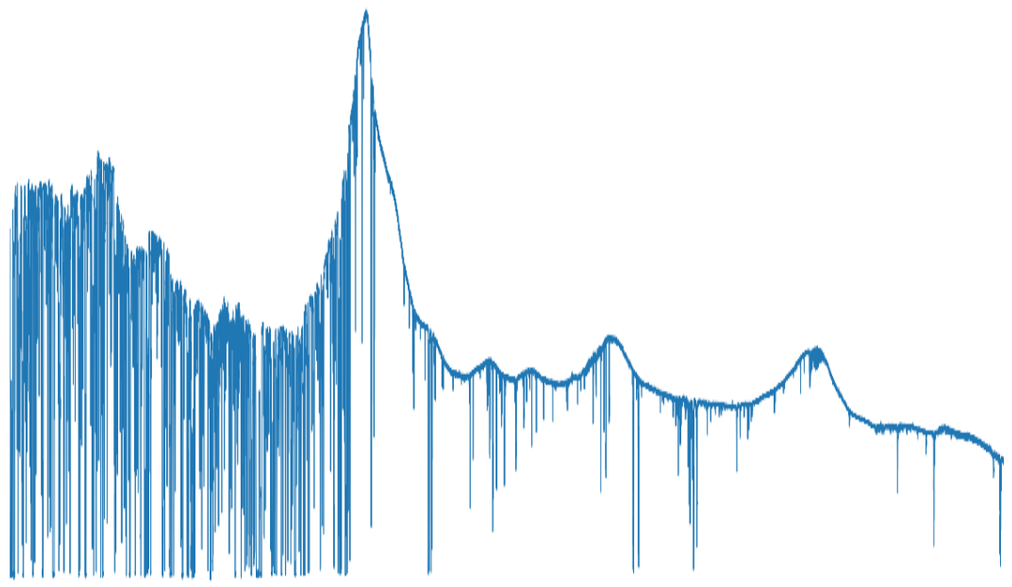
VLT ESPRESSO



HE 0940-1050


2000
1500
1000
500
0
Flux [1^{-17} erg/(nm cm^2 s)]
400
450
500
550
600
650
Wavelength [nm]

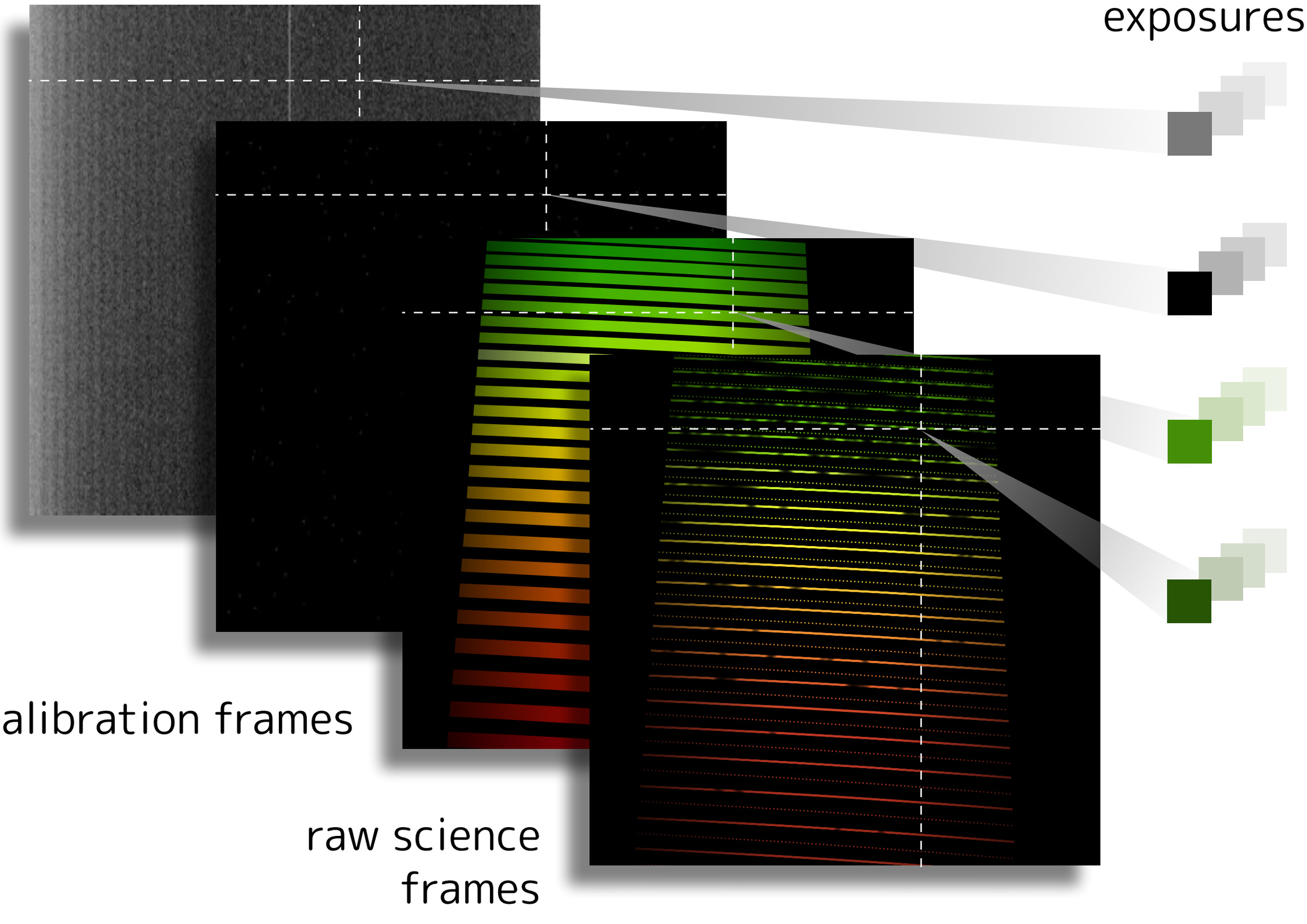




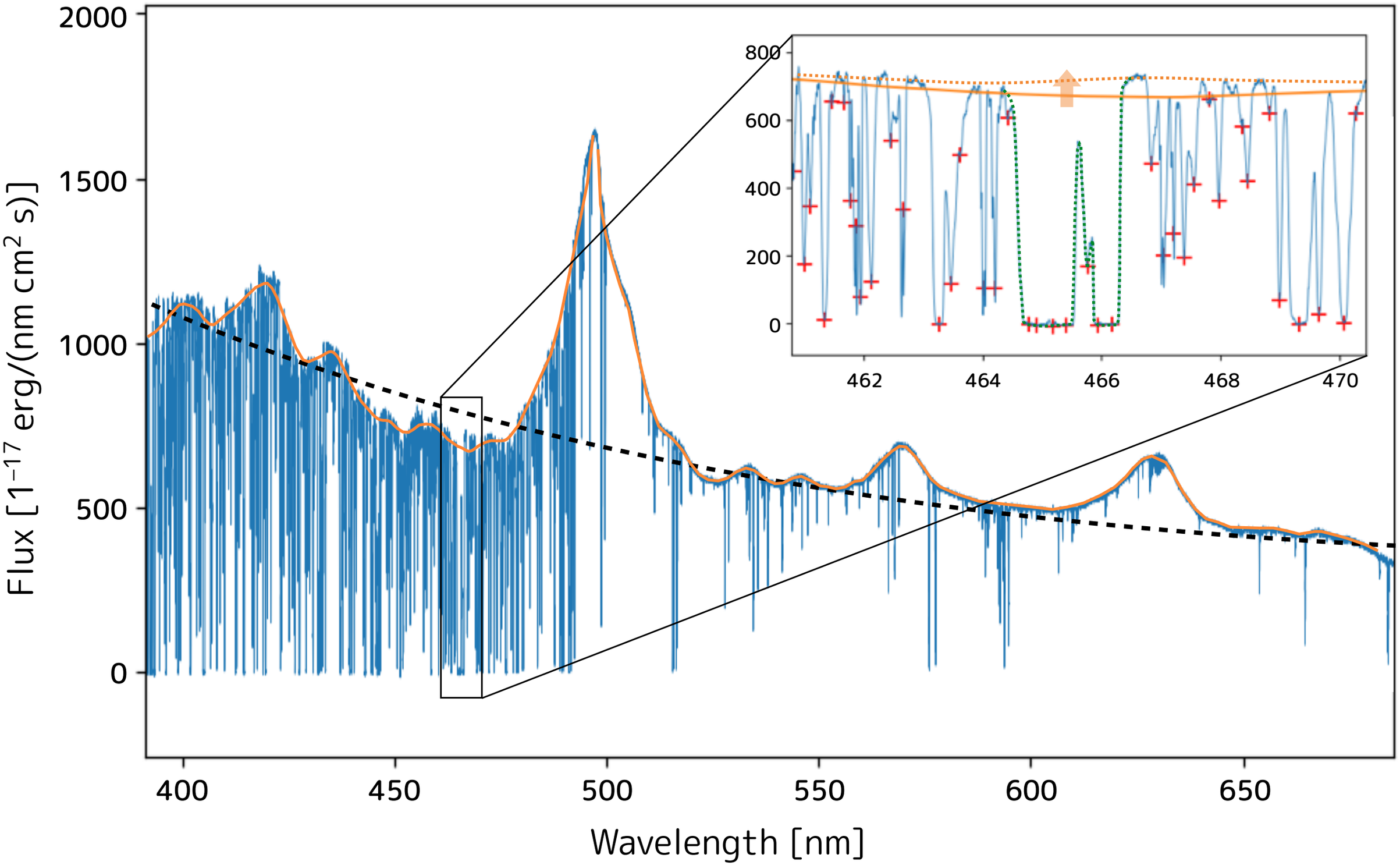
- Remove bias
- Remove cosmics
- Remove background
- Perform flat-fielding
- Convert to physical units

- Co-add exposures
- Detect absorption lines
- Fit emission continuum
- Fit absorption systems
- …

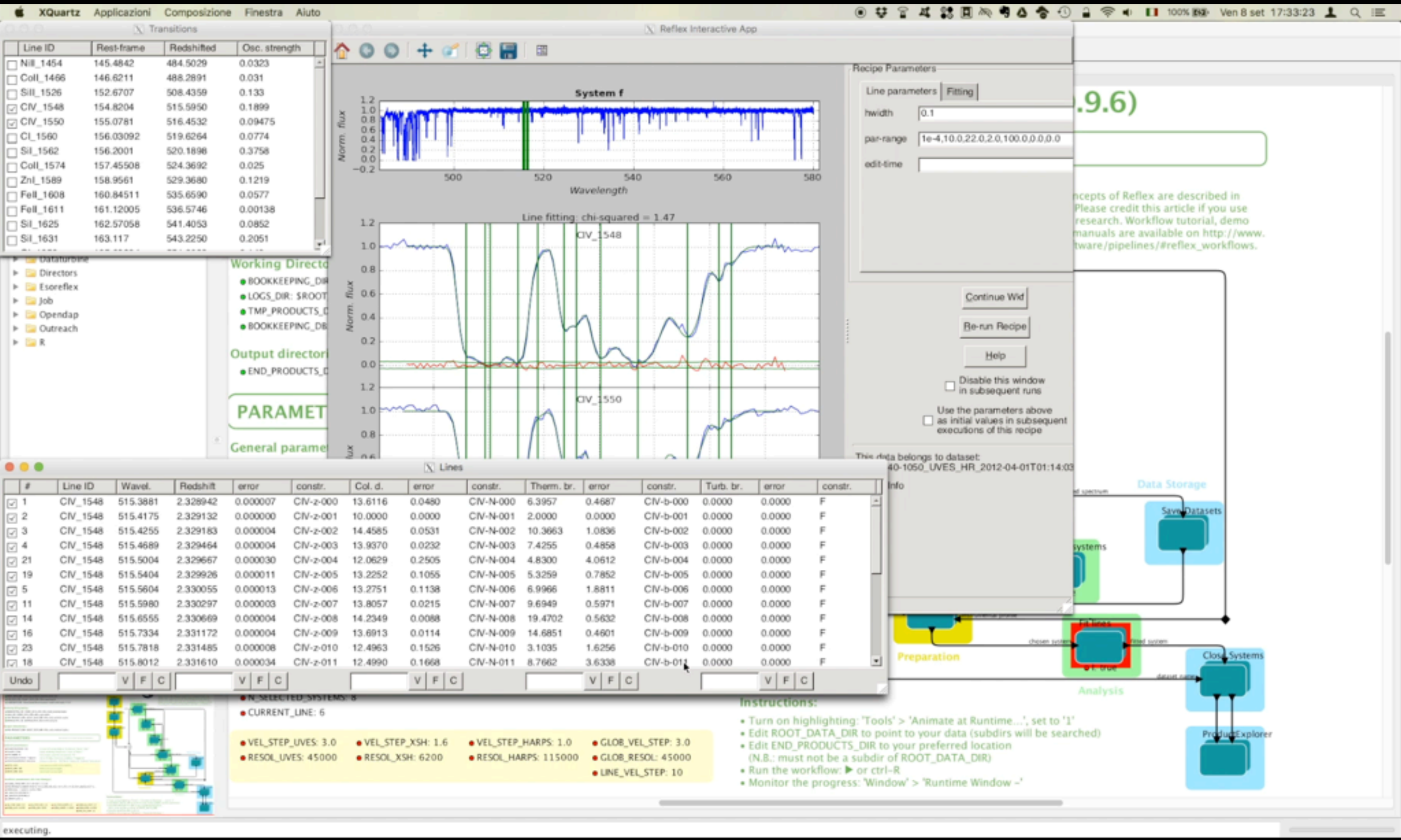
Pixel conservation



HE 0940-1050


2000
1500
1000
500
0
Flux [1^{-17} erg/(nm cm^2 s)]
400
450
500
550
600
650
Wavelength [nm]
800
600
400
200
0
462
464
466
468
470

ESPRESSO Data Analysis Software



GC+15,16

DAS

Coaddition

Line detection

Continuum fit

Line identification

Voigt fit

DAS

Coaddition

Line detection

Continuum fit

Line identification

Voigt fit

Astrocook

https://github.com/DAS-OATs/astrocook

Coaddition

Redshift match

Doublet detection

Power-law fit

Continuum guess

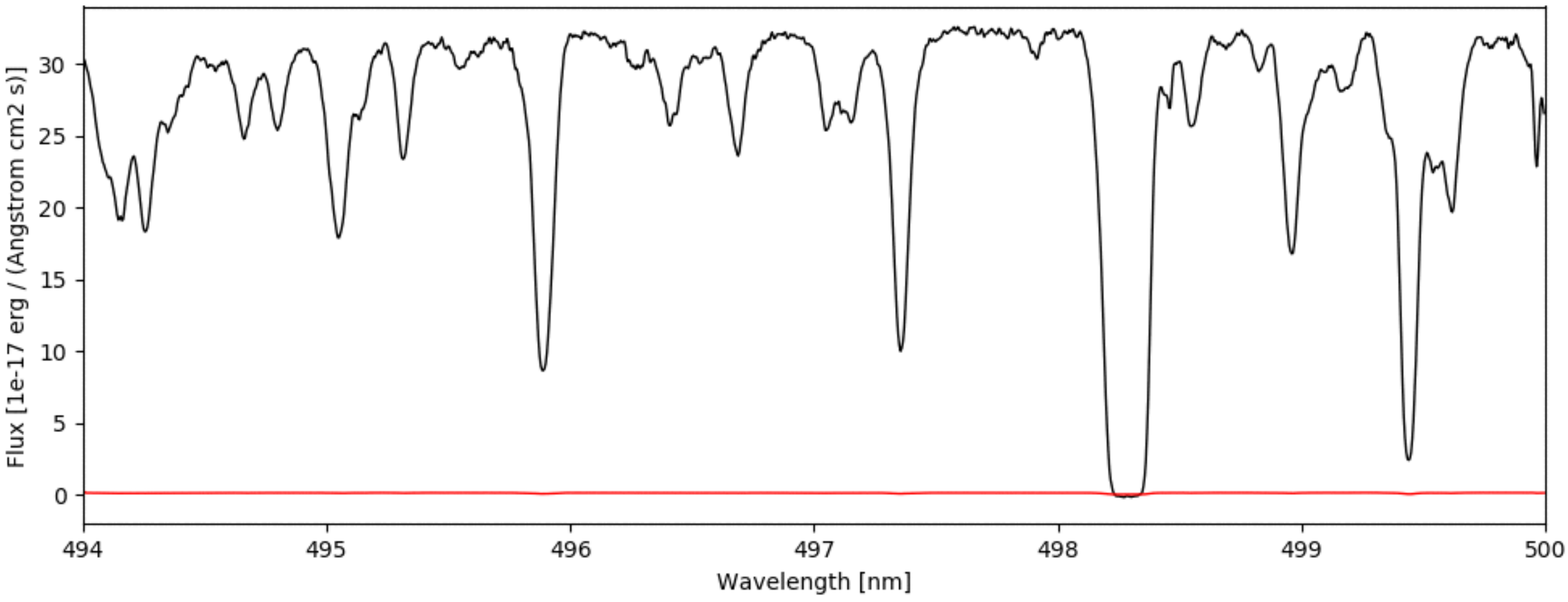
Line+ continuum fit

Incremental Voigt fit

...

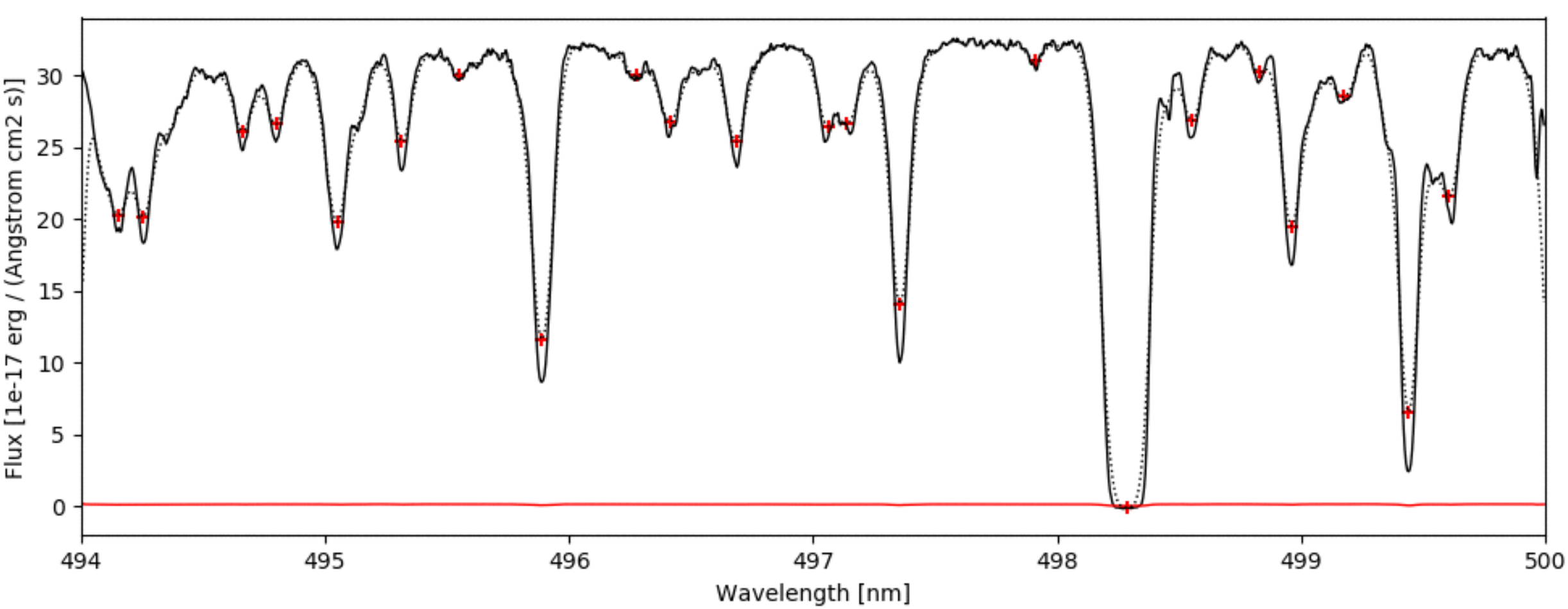
```
spec = Spec1DReader().uves(filename)
```

```
spec.plot()
```



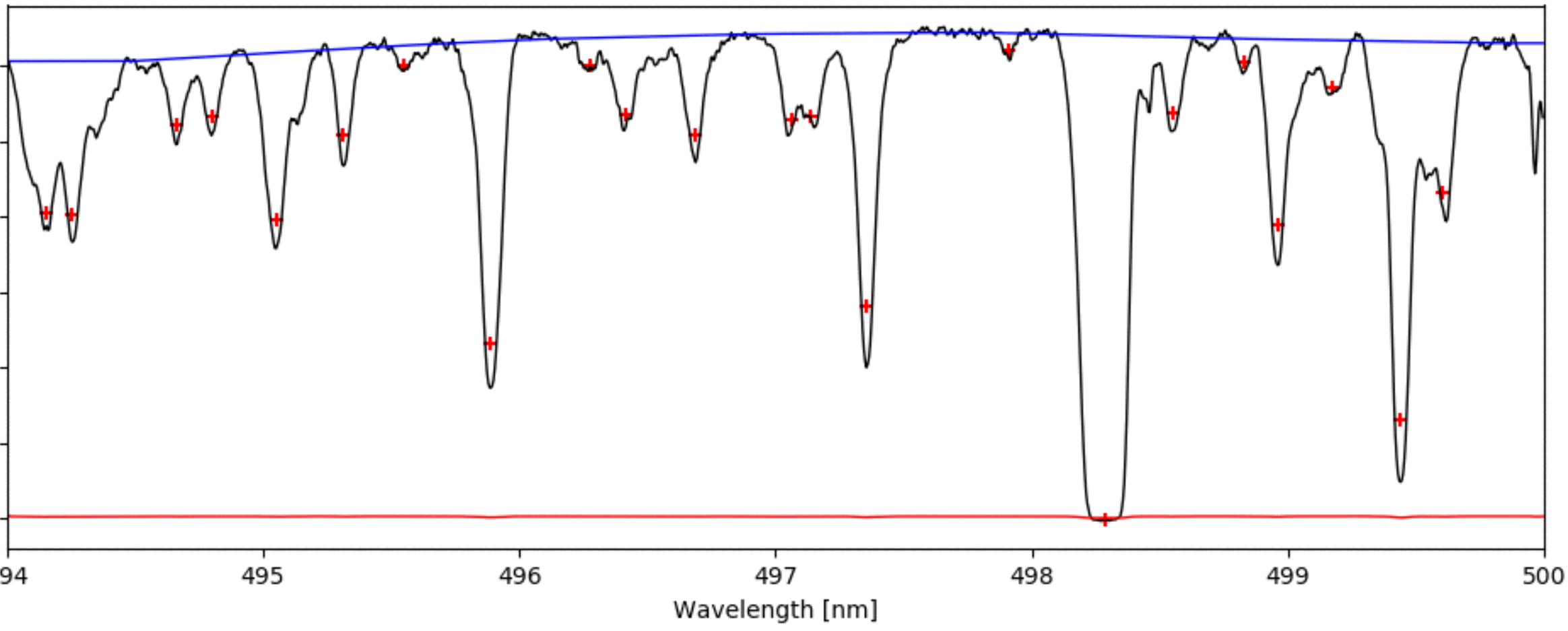
```
spec = Spec1DReader().uves(filename)
line = Line(spec)
line.find()
```

```
line.plot()
```



```
spec = Spec1DReader().uves(filename)
line = Line(spec)
line.find()
line.cont()
```

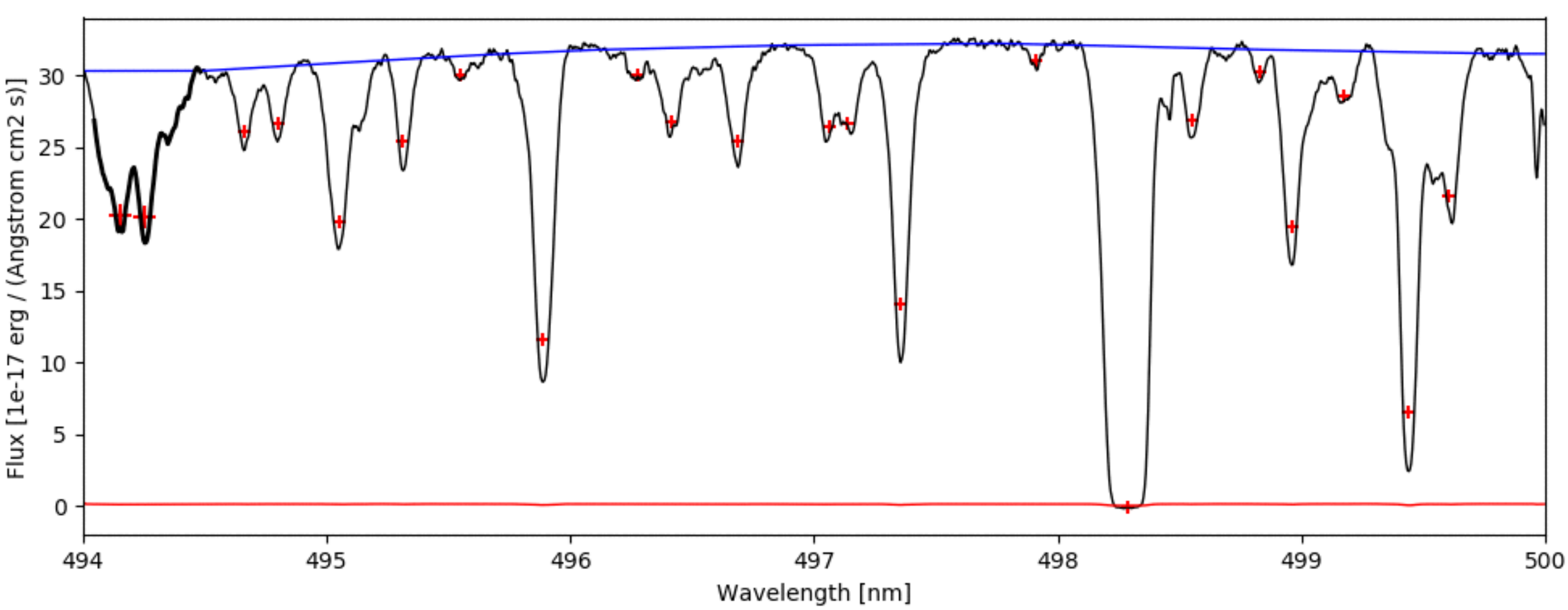
```
line.plot()
```



```
spec = Spec1DReader().uves(filename)
line = Line(spec)
line.find()
line.cont()
for l in line:
    group = line.group(l)

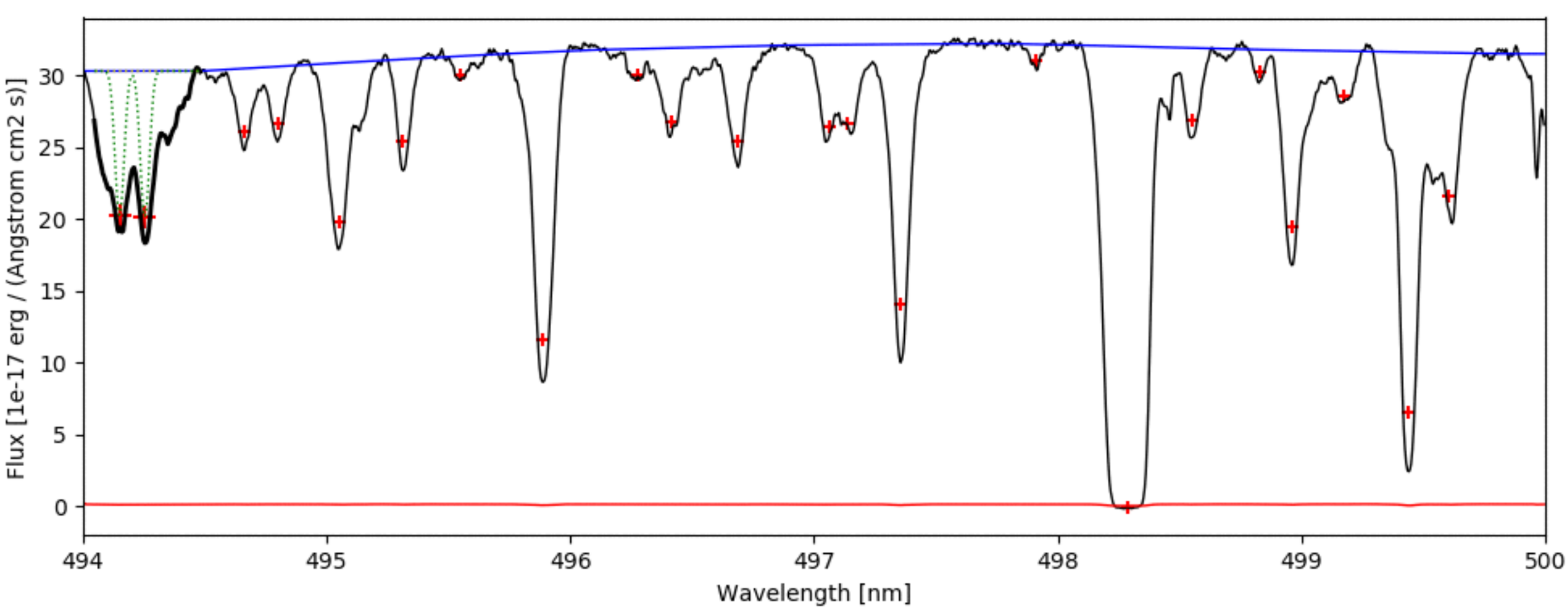


    line.plot(group)
```

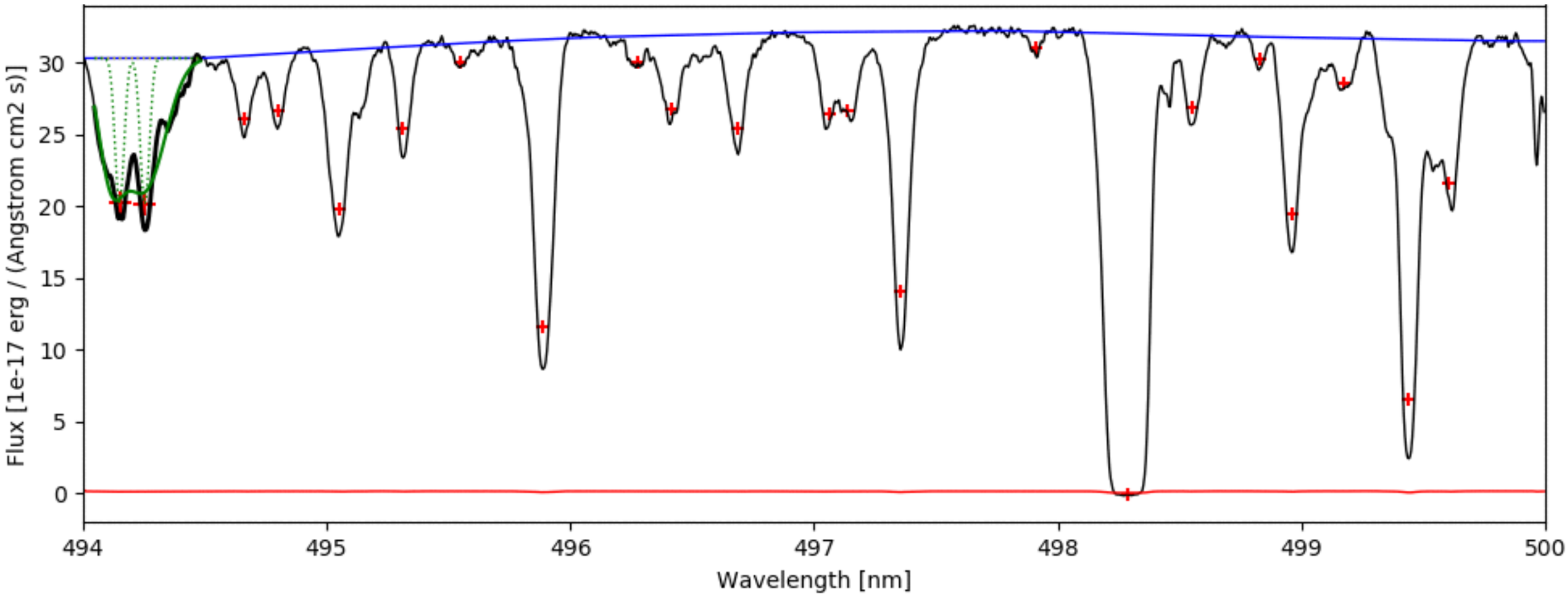


```
spec = Spec1DReader().uves(filename)
line = Line(spec)
line.find()
line.cont()
for l in line:
    group = line.group(l)
    norm_guess = line.norm(group)
    voigt_guess = line.voigt(group)
    psf = line.psf(group)

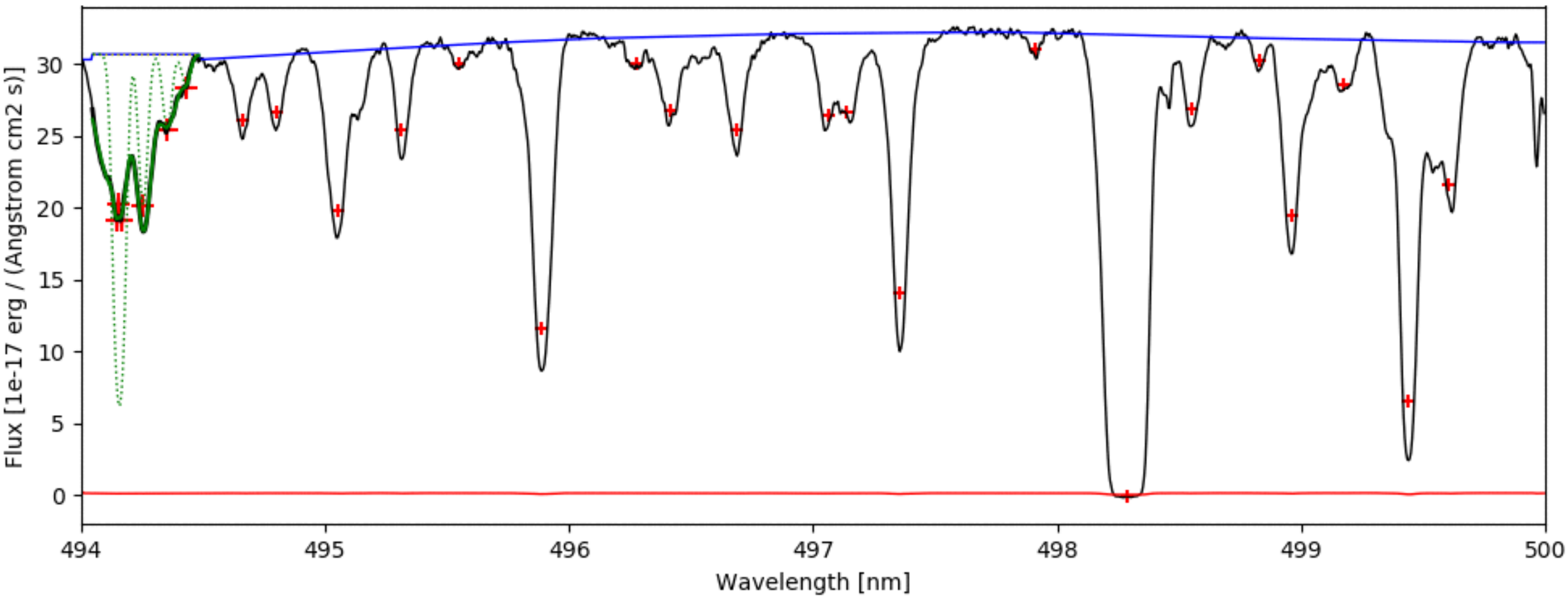
    line.plot(group)
```



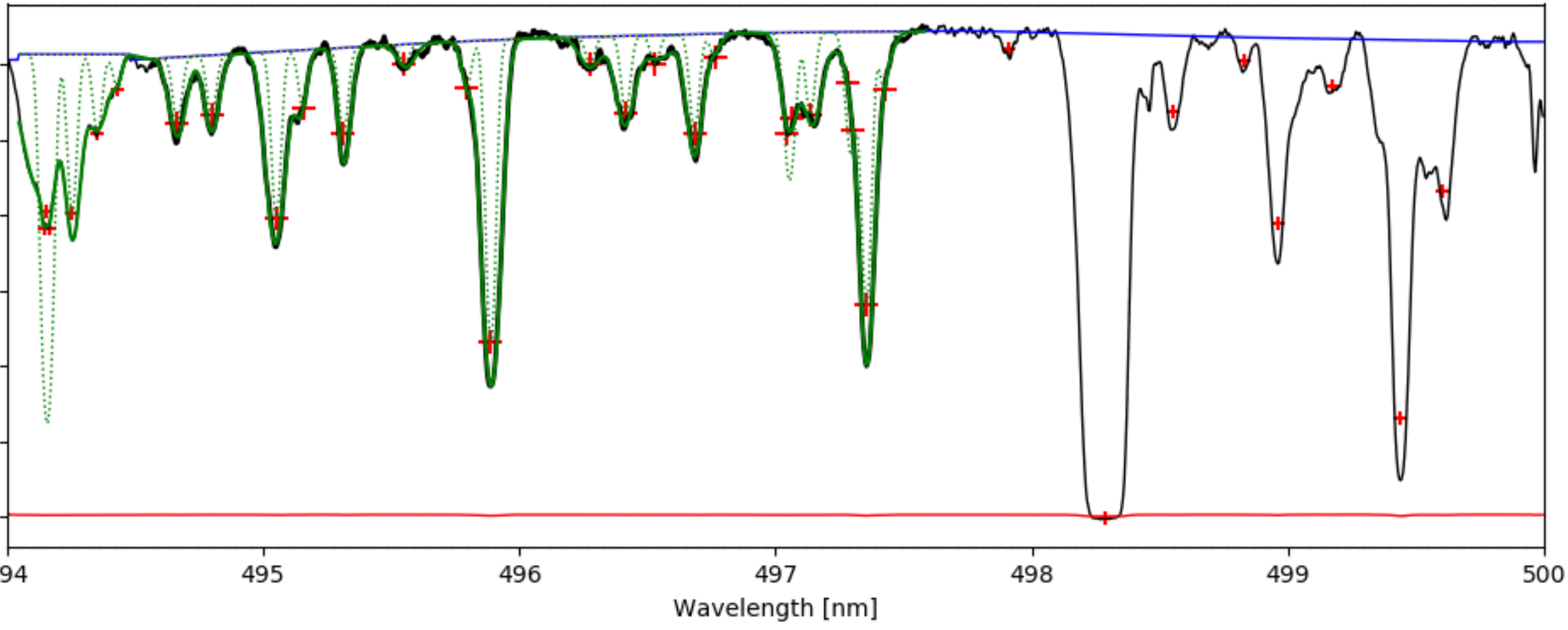
```
spec = Spec1DReader().uves(filename)
line = Line(spec)
line.find()
line.cont()
for l in line:
    group = line.group(l)
    norm_guess = line.norm(group)
    voigt_guess = line.voigt(group)
    psf = line.psf(group)
    fit = line.fit(group, norm_guess, voigt_guess, psf)
    line.plot(group)
```



```
spec = Spec1DReader().uves(filename)
line = Line(spec)
line.find()
line.cont()
for l in line:
    group = line.auto(l)
    line.plot(group)
```

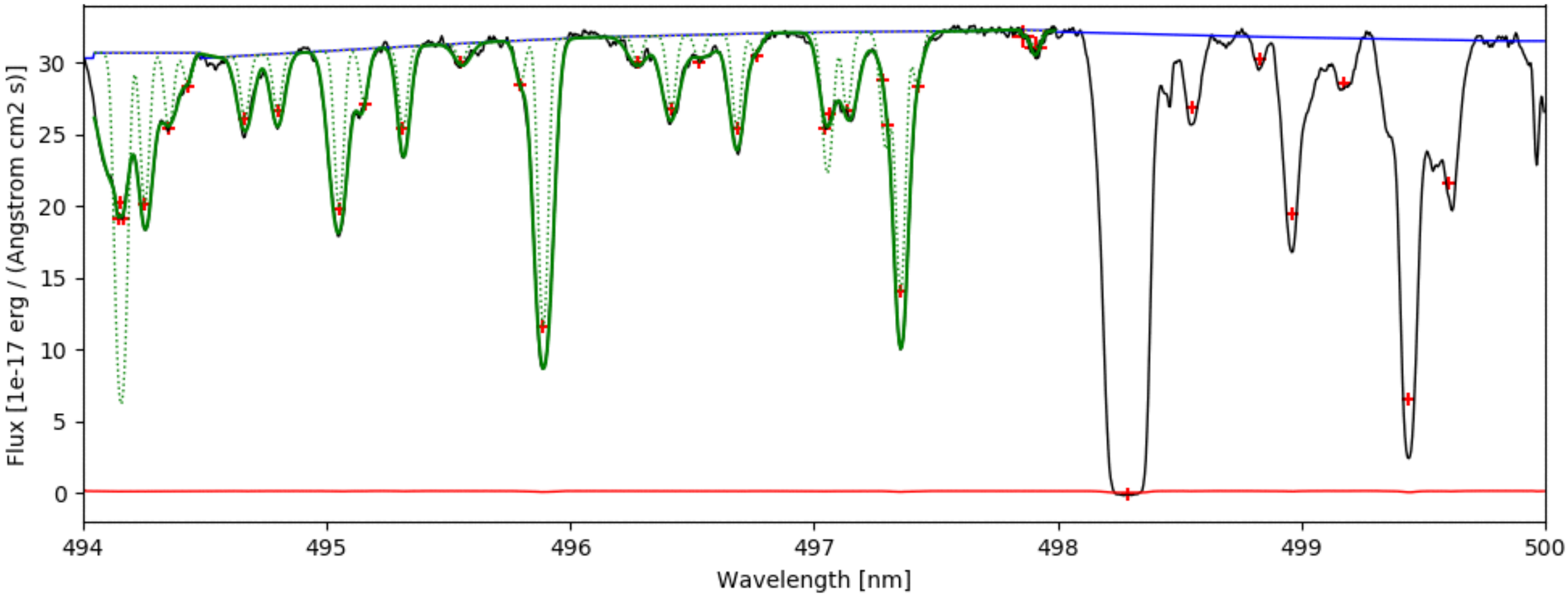


```
spec = Spec1DReader().uves(filename)
line = Line(spec)
line.find()
line.cont()
for l in line:
    group = line.auto(l)
    line.plot(group)
```



```
spec = Spec1DReader().uves(filename)
line = Line(spec)
line.find()
line.cont()
for l in line:
    group = line.auto(l)
    line.plot(group)
```

group 3, $\chi^2 = 0.94$



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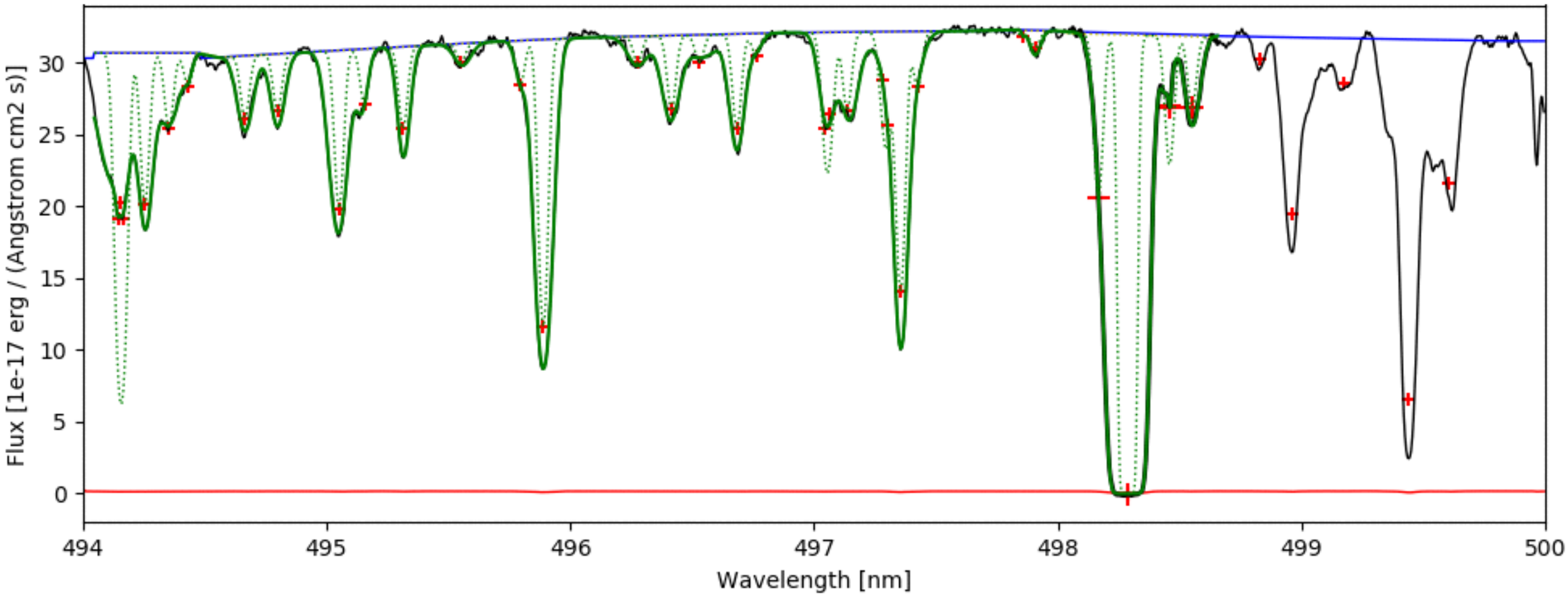
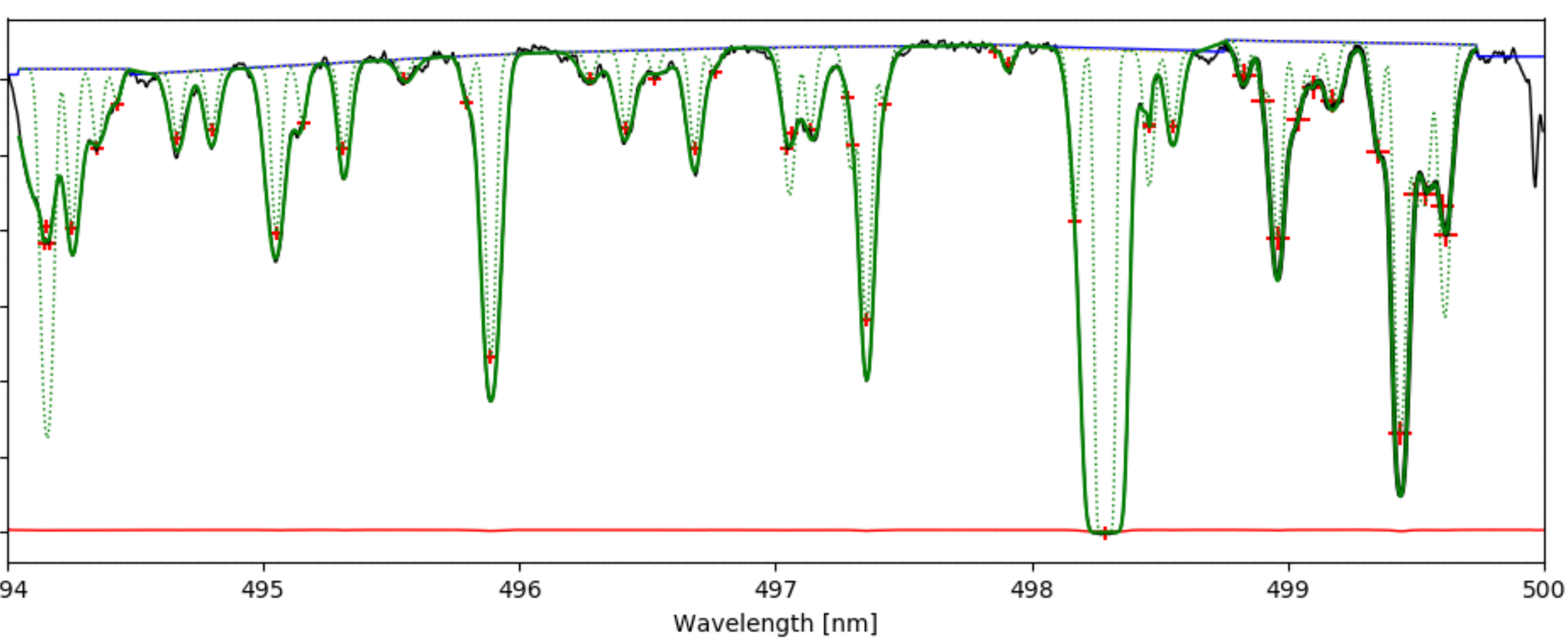
spec = Spec1DReader().uves(filename)
line = Line(spec)
line.find()
line.cont()
for l in line:
    group = line.auto(l)
    line.plot(group)
```



```
spec = Spec1DReader().uves(filename)
line = Line(spec)
line.find()
line.cont()
for l in line:
    group = line.auto(l)
    line.plot(group)
```

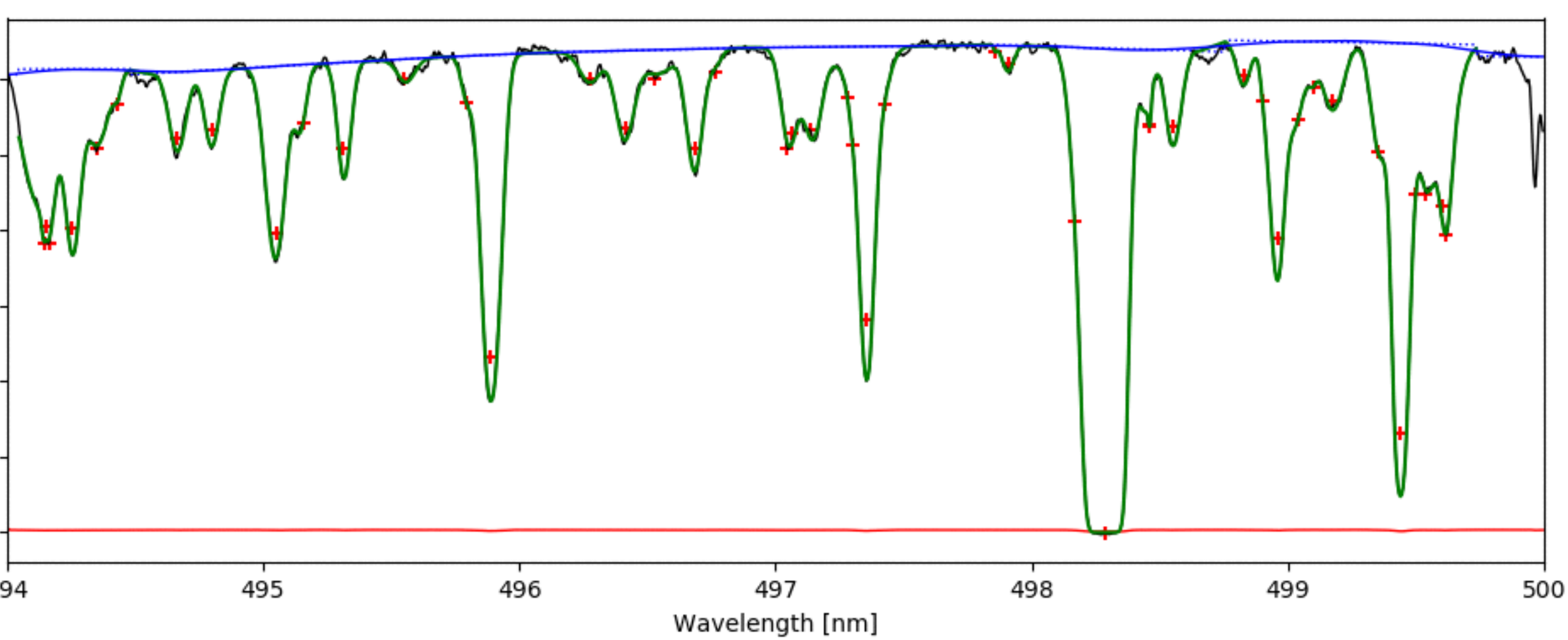
group 5, $\chi^2 = 0.97$



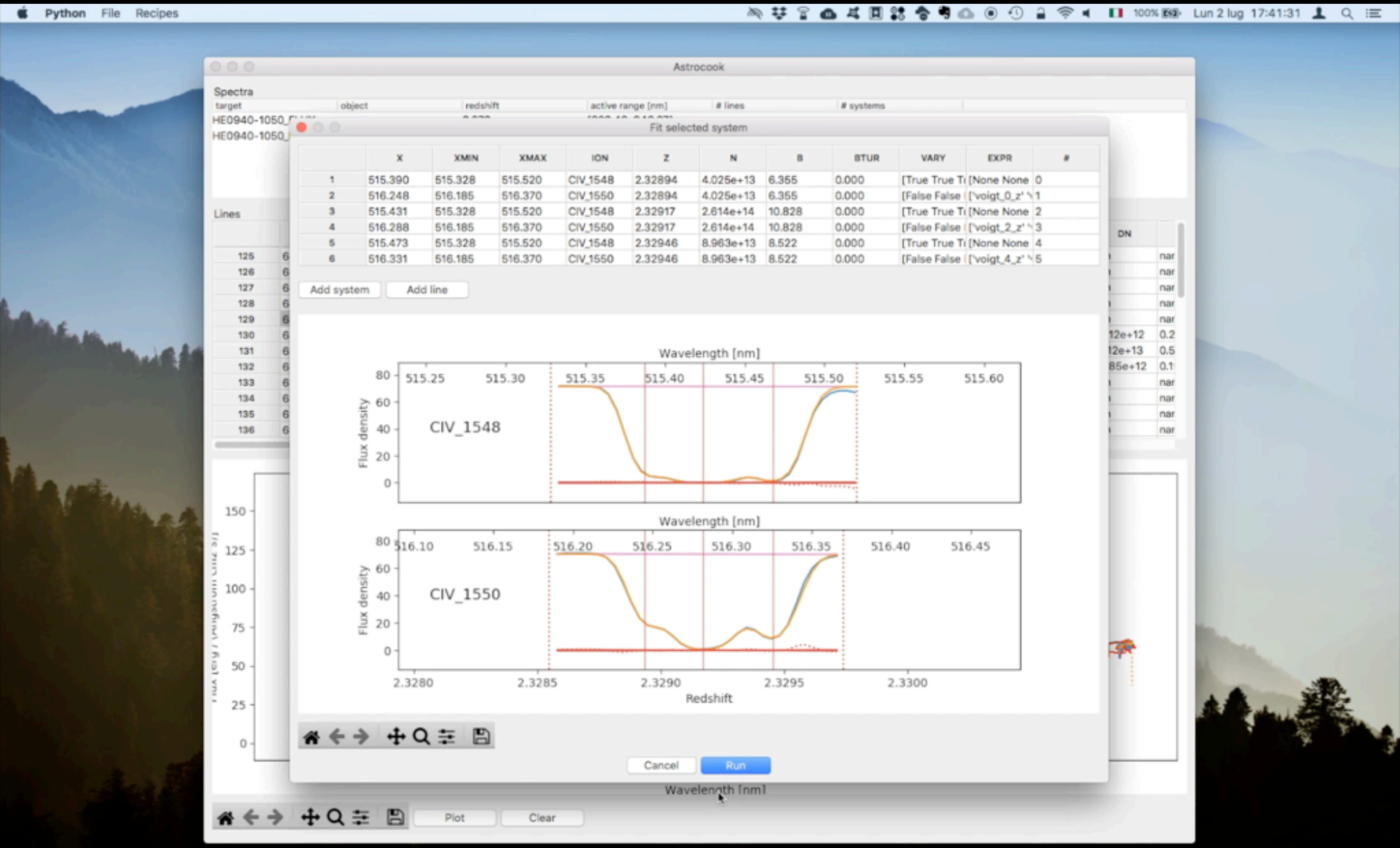
```
spec = Spec1DReader().uves(filename)
line = Line(spec)
line.find()
line.cont()
for l in line:
    group = line.auto(l)
    line.plot(group)



line.plot()
```



Astrocook



GC+17,18