Stellar Populations at Low-Metallicity via Nearby Star-Forming Galaxies

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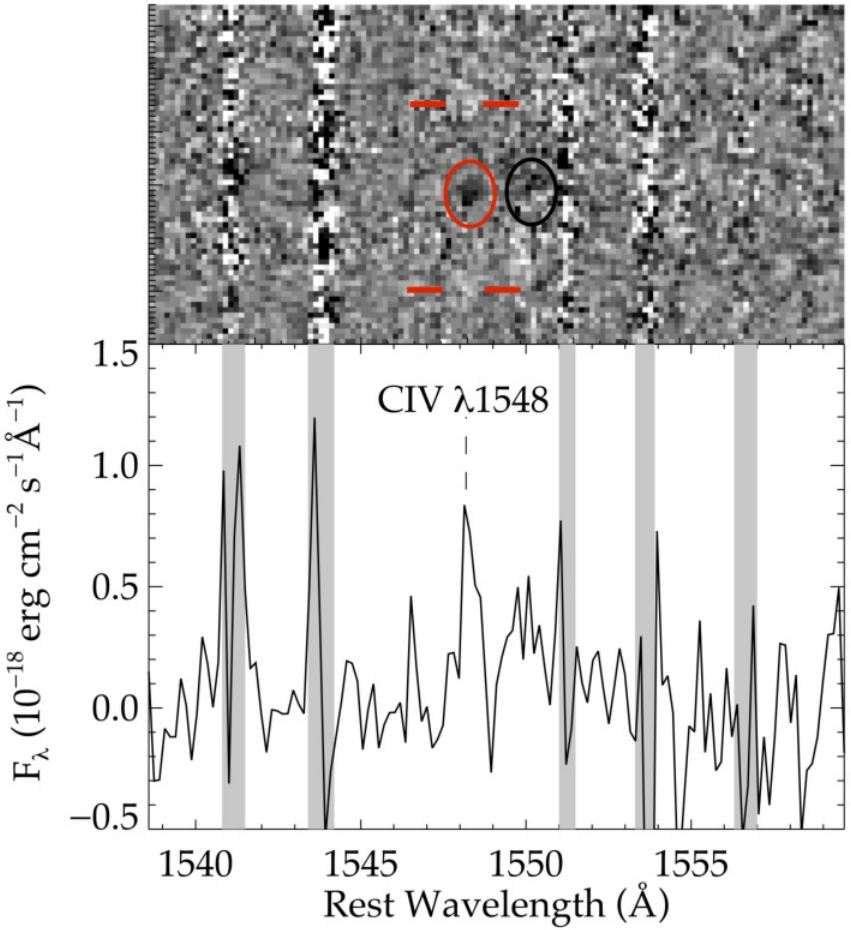
Dan Stark

March 2016
Reionization Epoch
Aspen Center for Physics

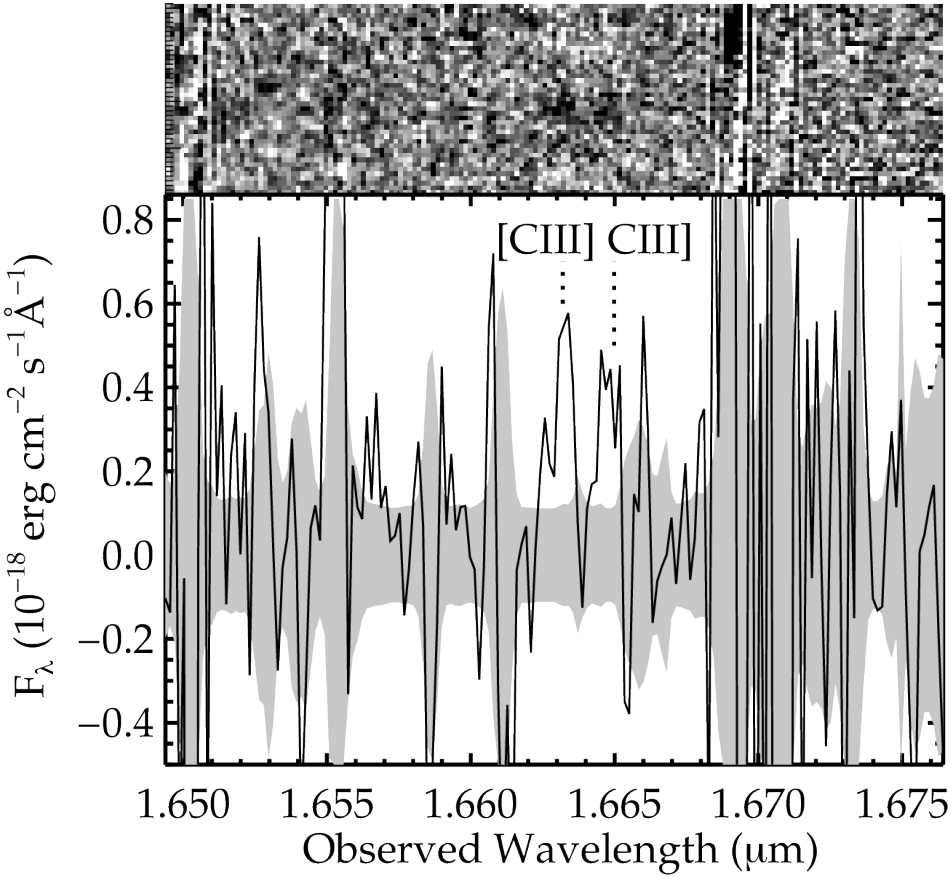
image: NASA, ESA, and A. Aloisi (STScI)

z=7.045



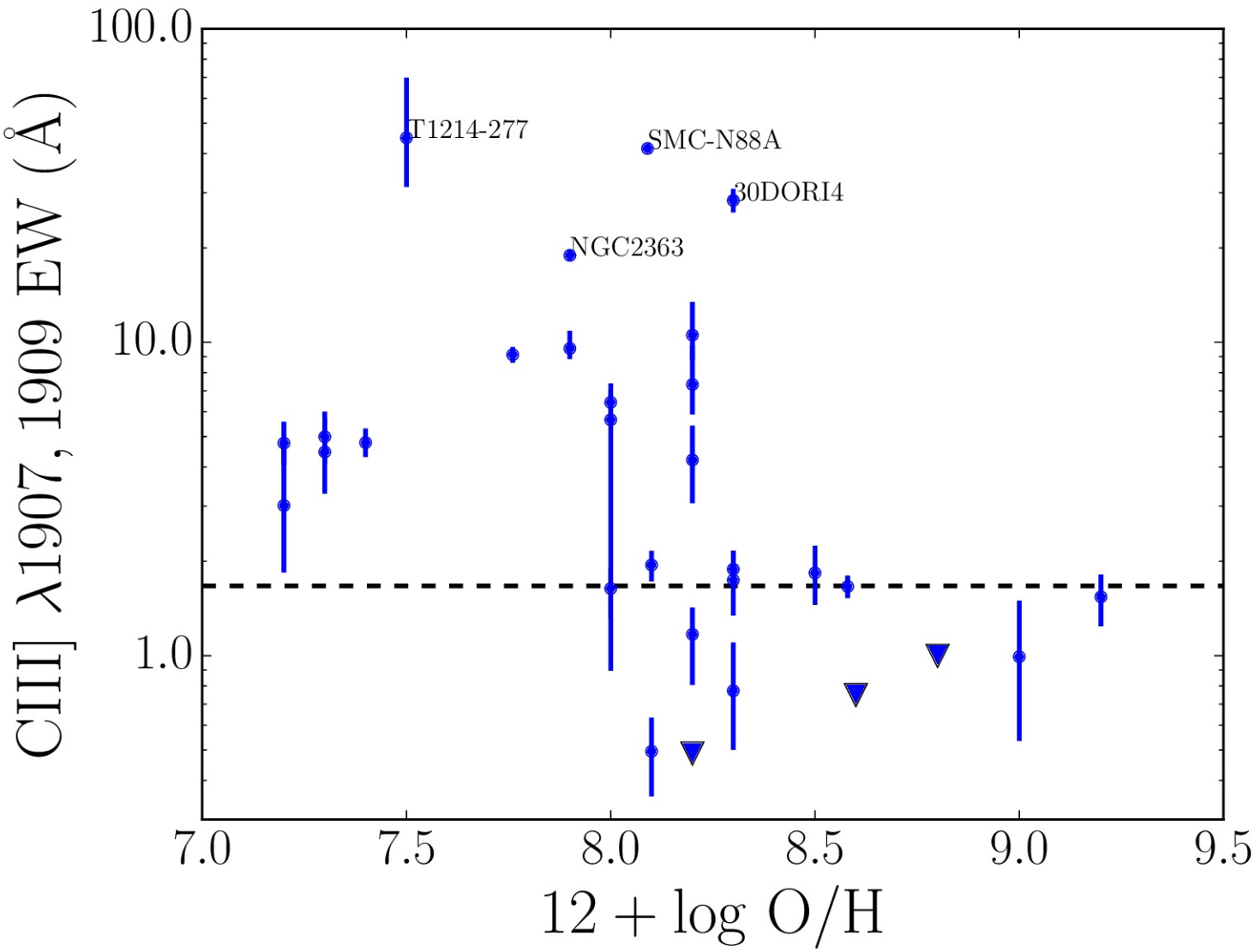
Stark+2015, MNRAS 454, 1393

z=7.73



Stark+2016 (in-prep)

CIII], CIV at z~6-7:
what is producing this ionizing flux?

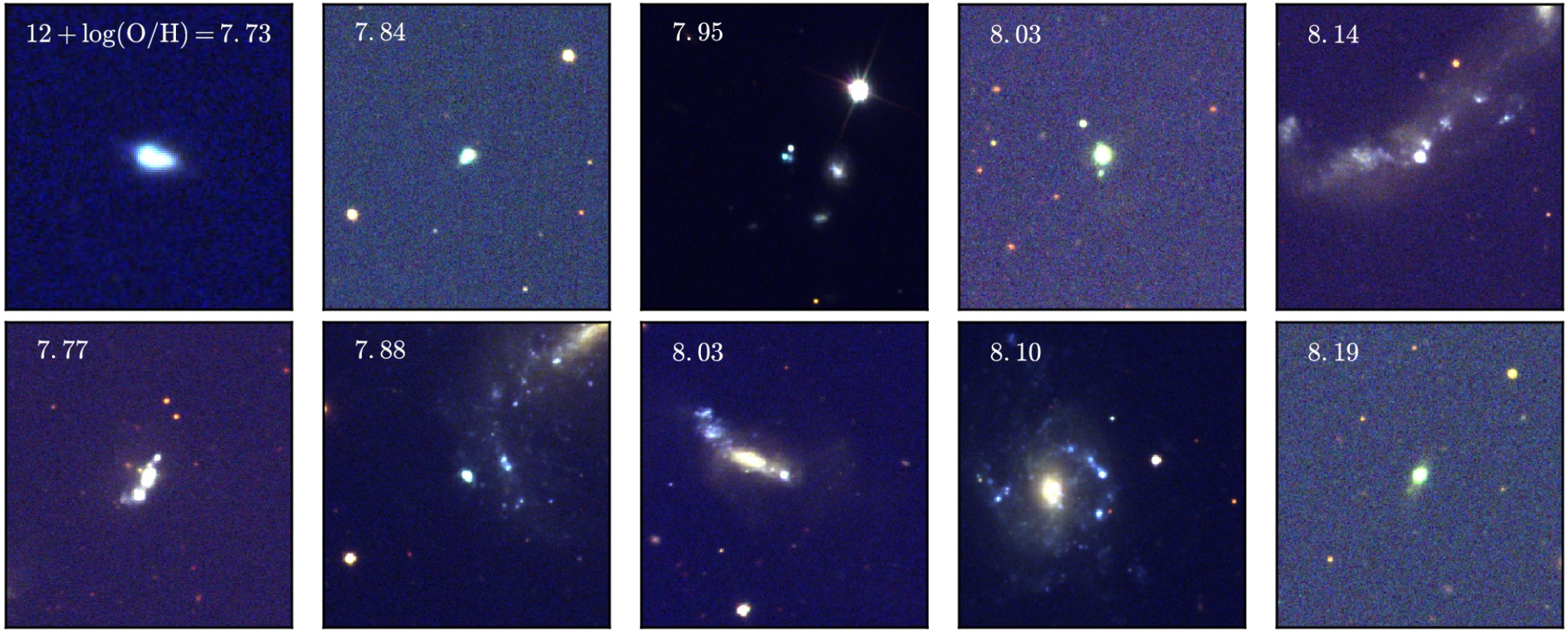


we need:

- more data at low metallicity

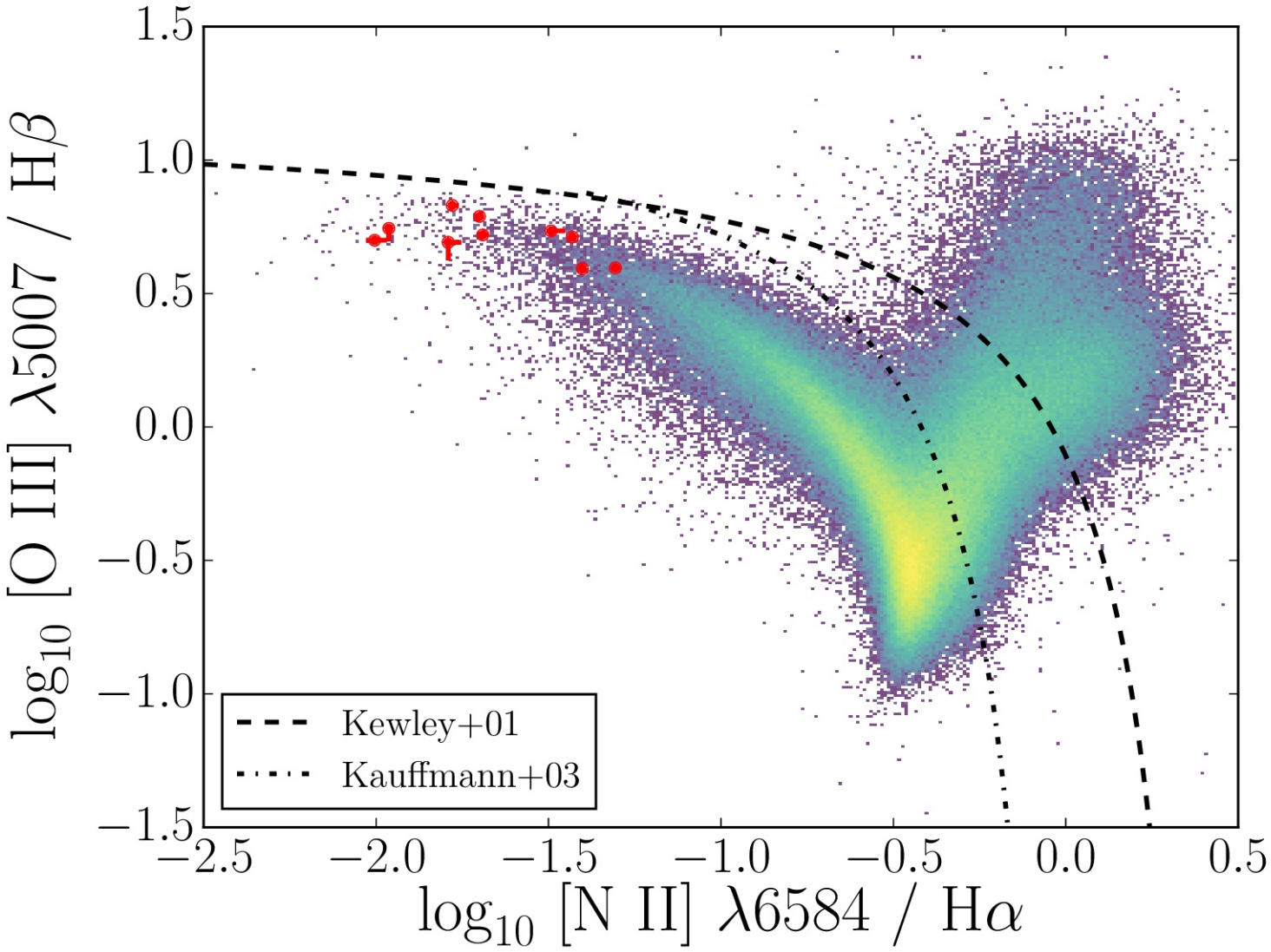
- constraints on HeII, CIV

Cycle 23 HST/COS program (PI: Stark)



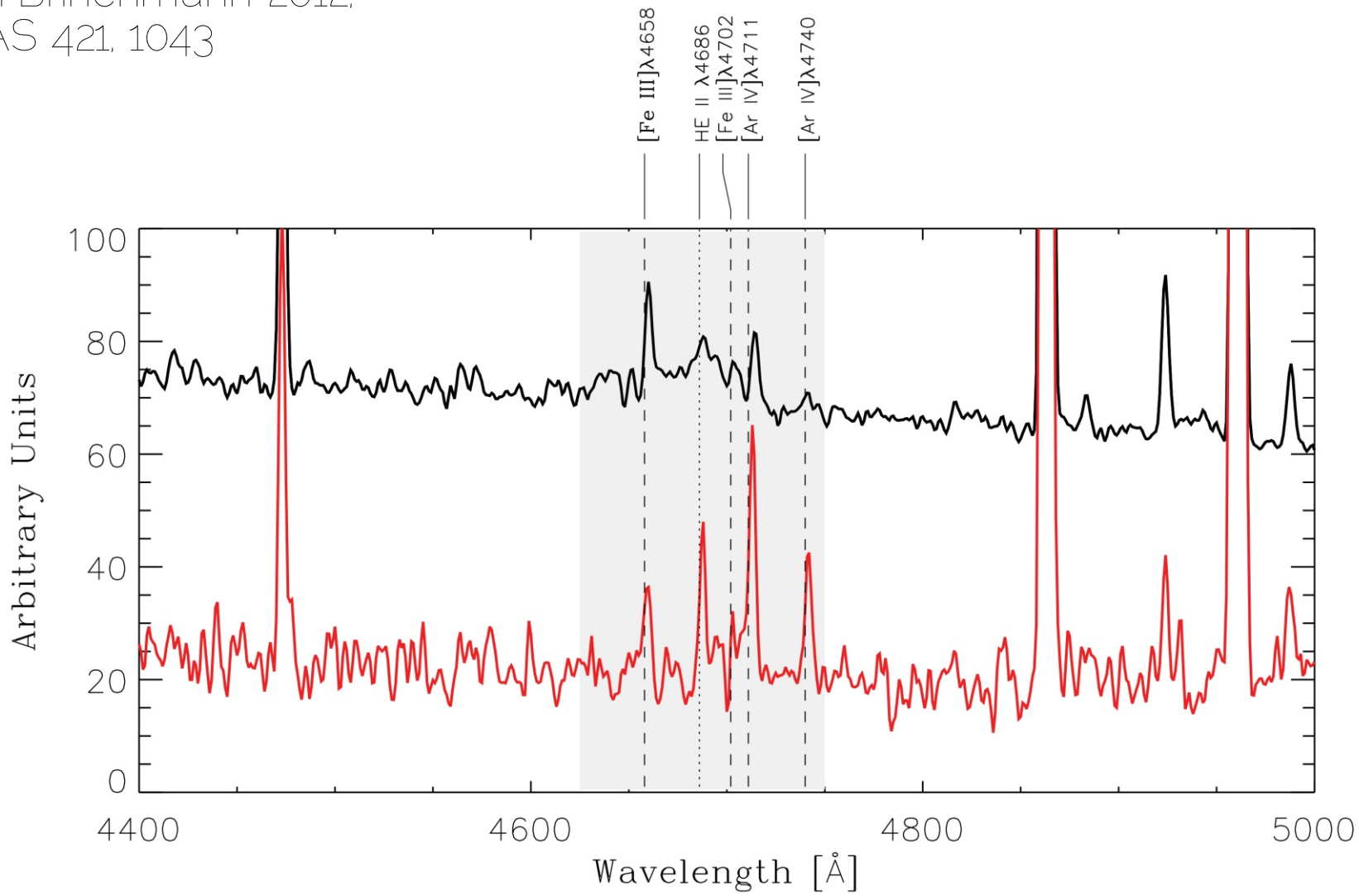
HeII emitters from
Shirazi+Brinchmann 2012

$5.5 < \log M^* < 8.5$
log (HeII/Hbeta) ~ -2
6 without WR bumps in SDSS



extreme tail of star-forming galaxies

Shirazi+Brinchmann 2012,
MNRAS 421, 1043



WR signatures often absent in the optical at low-metallicity

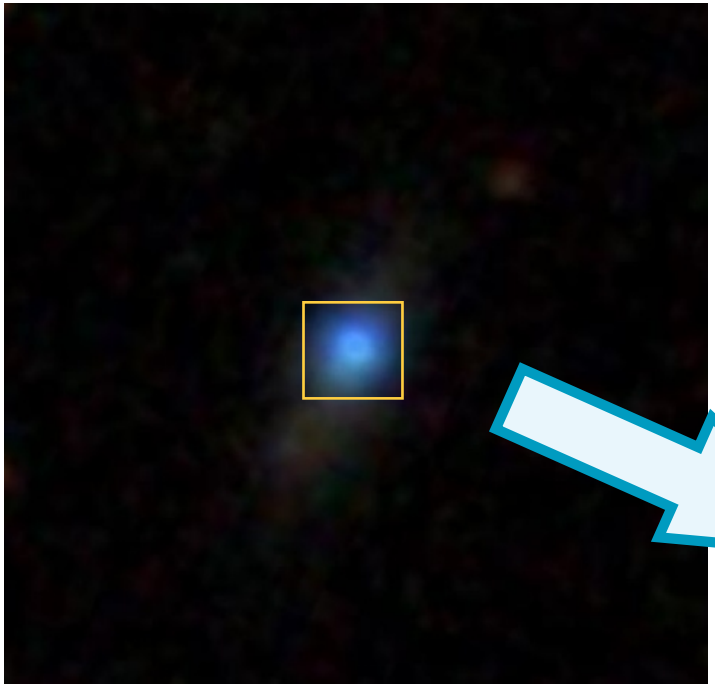
COS data provides:

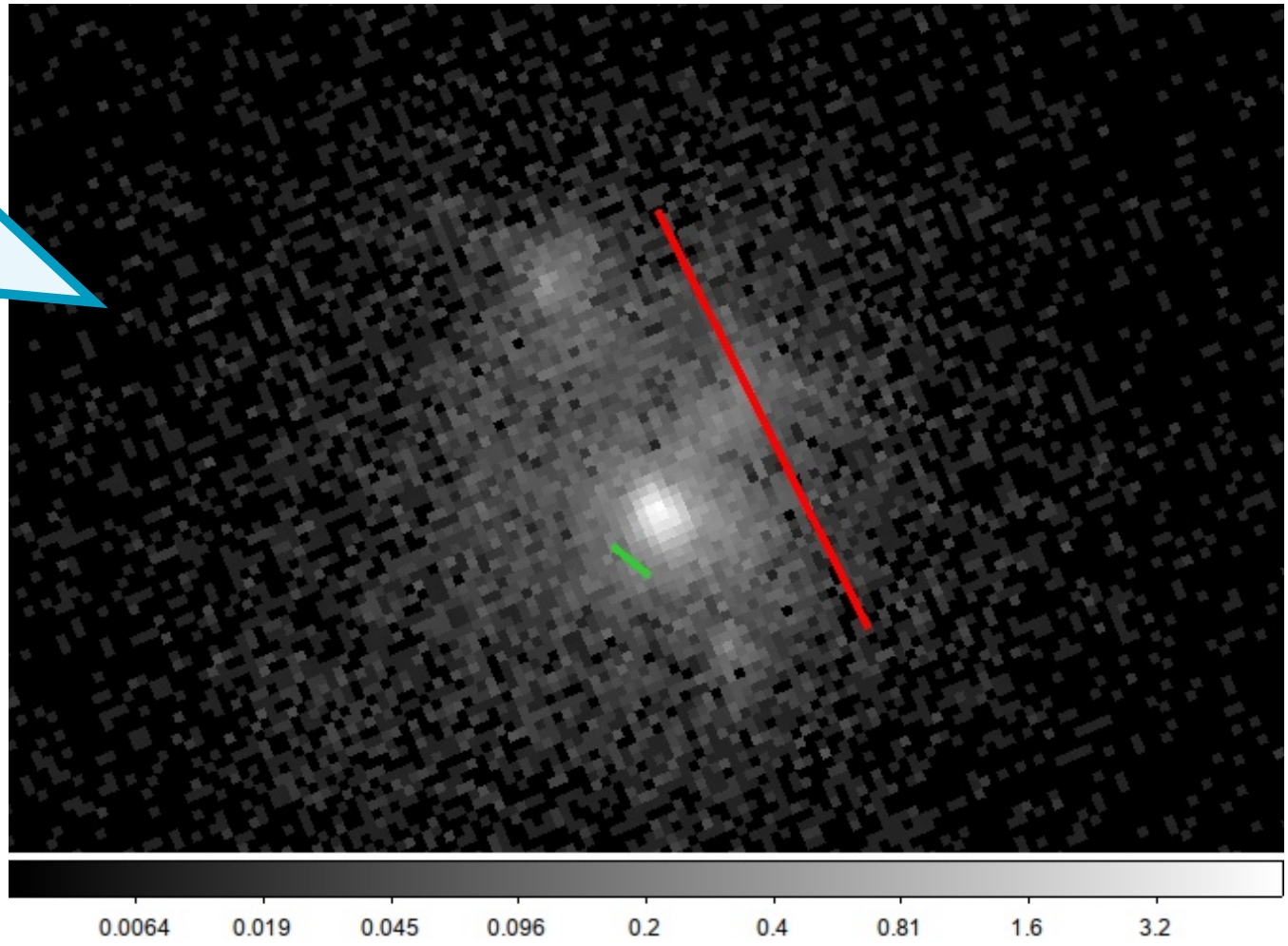
key nebular emission lines
- CIII], HeII, OIII], CIV

massive star features
- CIV P-Cygni (O stars), HeII (WRs)
- additional metallicity indicators (Rix+2004)

ISM/CGM absorption lines
- CIV, SiII

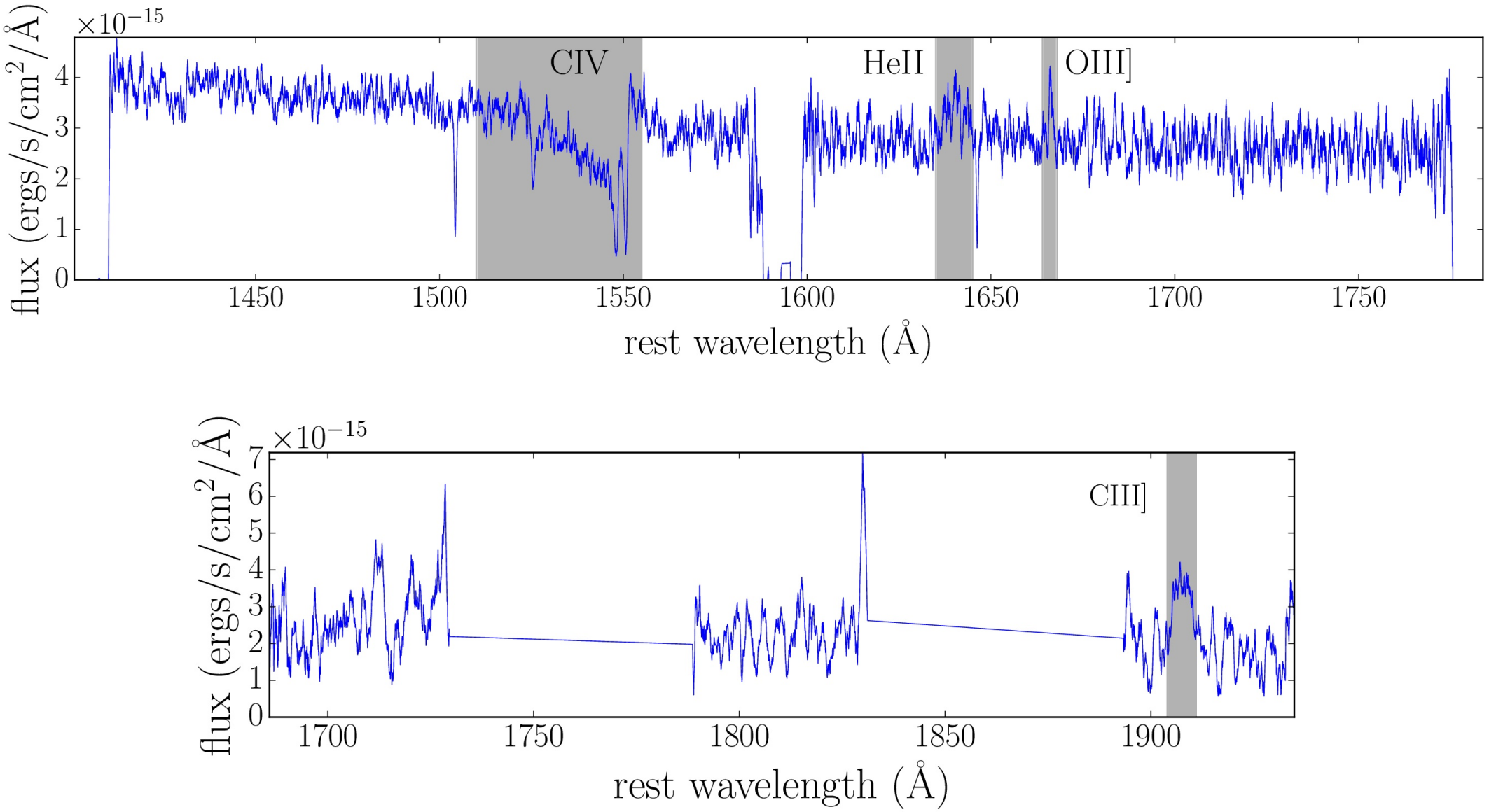
COS data!





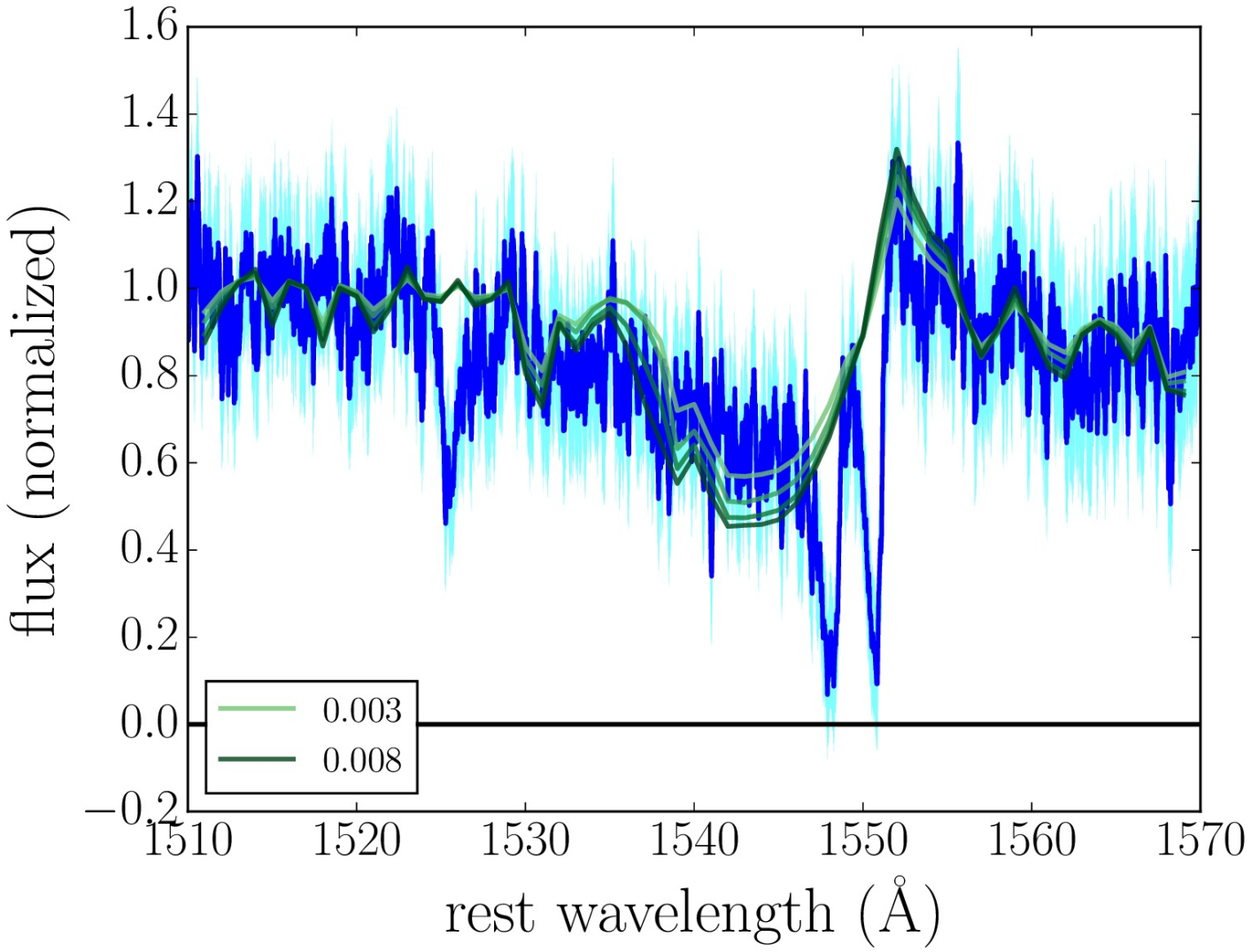
400 pc

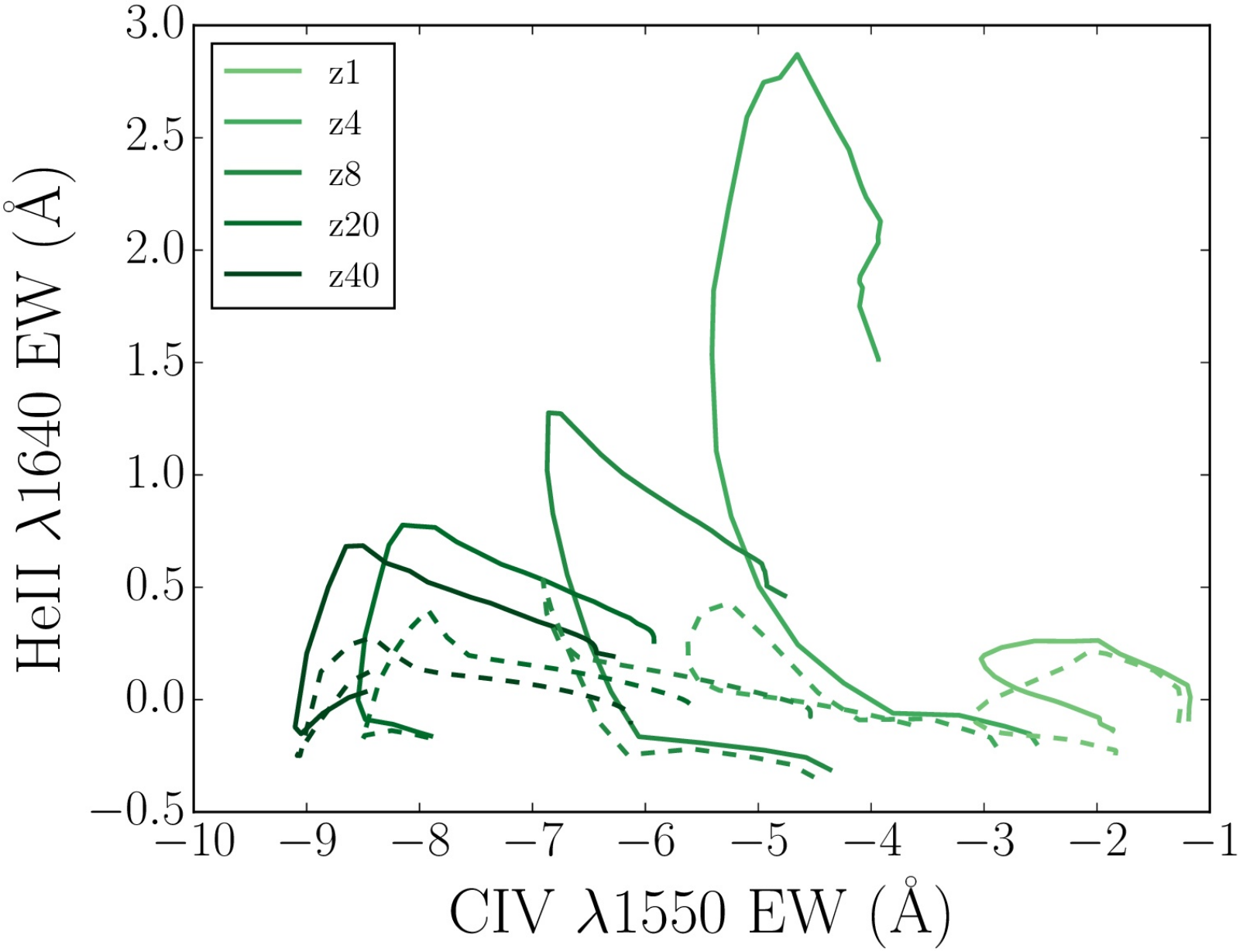
40 pc!


×10^−15
flux (ergs/s/cm^2/Å)
CIV
HeII
OIII]
CIII]
rest wavelength (Å)
0
1
2
3
4
5
6
7
1450
1500
1550
1600
1650
1700
1750
1800
1850
1900

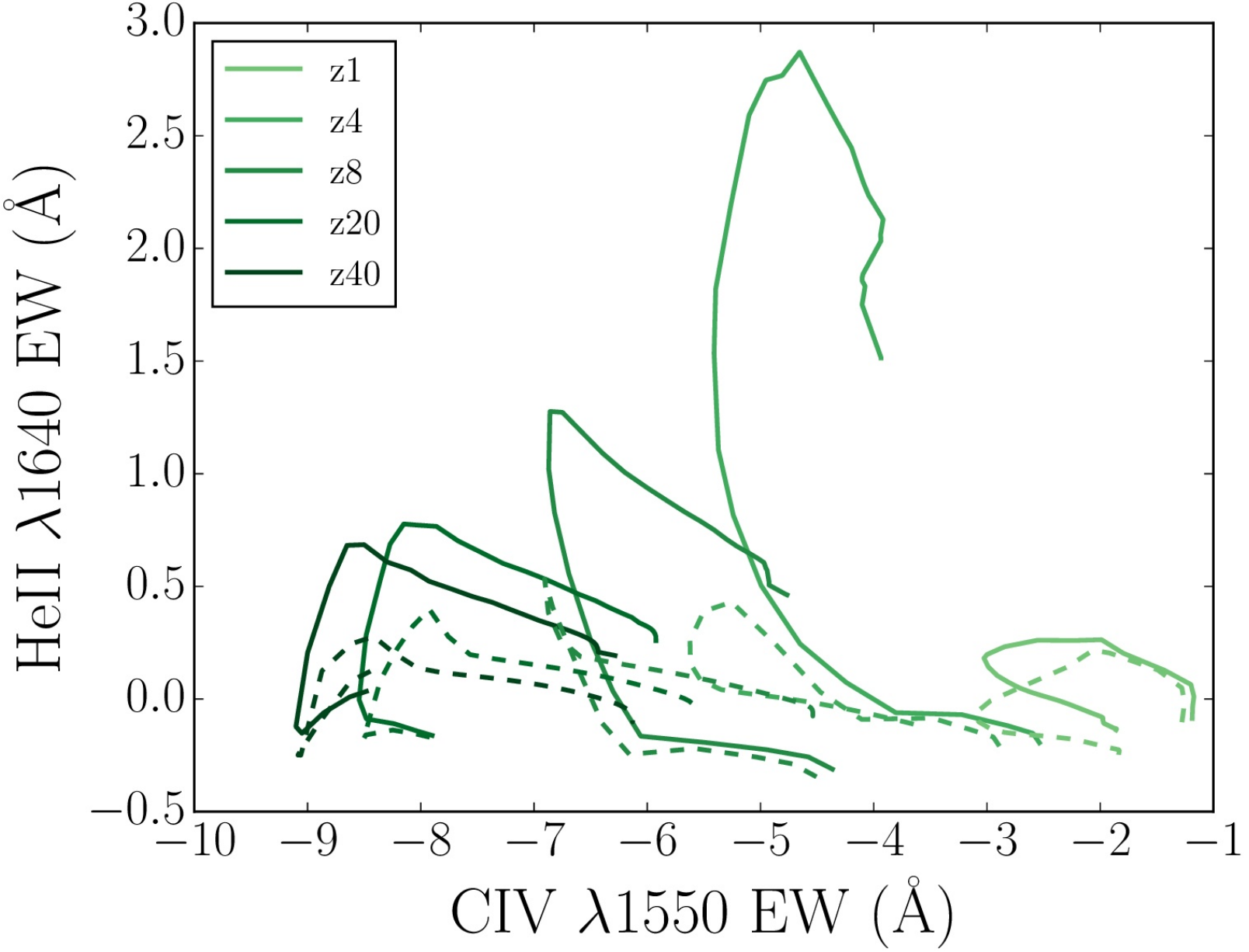
stellar metallicity constraints

Z=0.003-0.008; nebular: Z=0.005 (~Zsun/3)



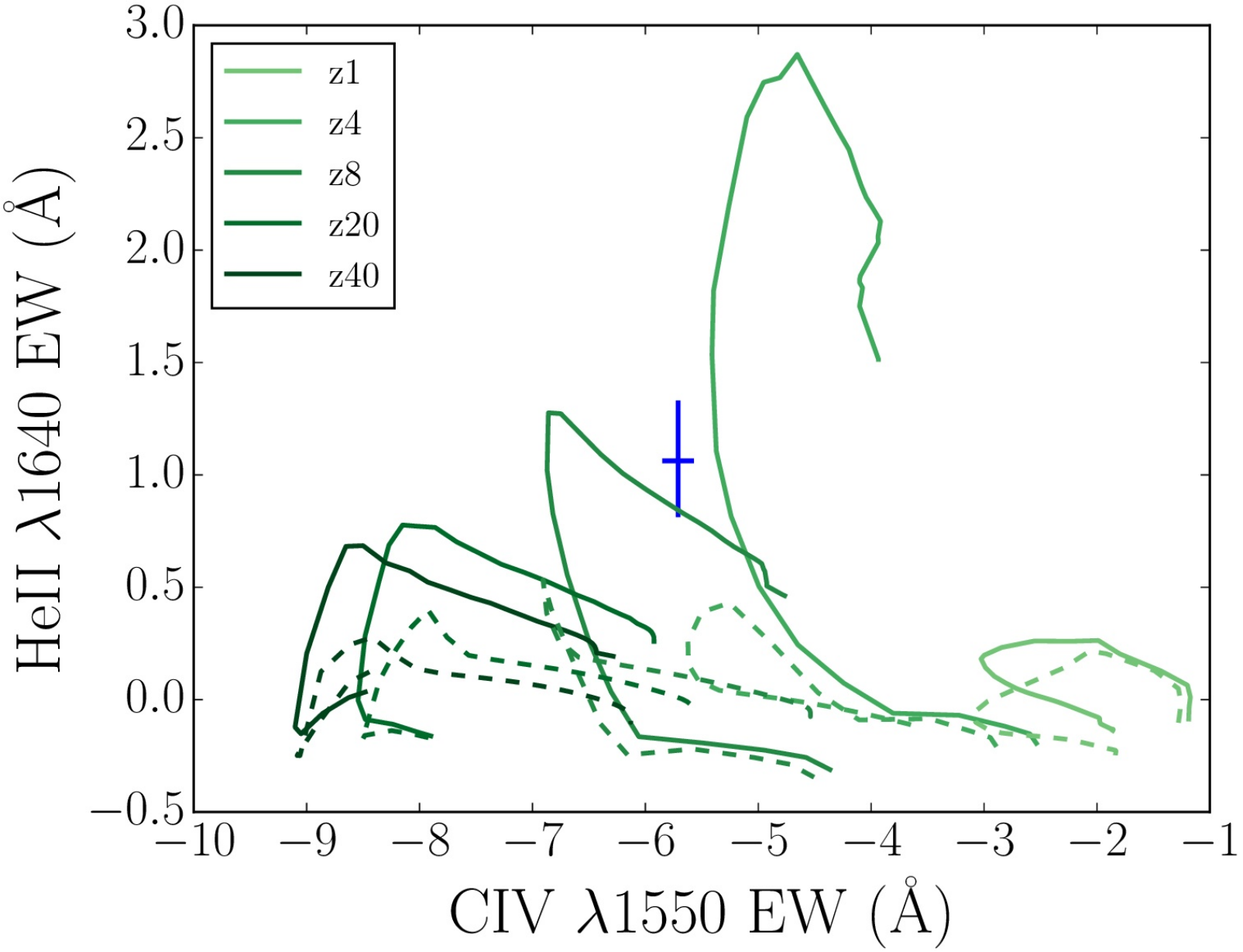


population synthesis models are uncertain;
esp. in ionizing flux predictions



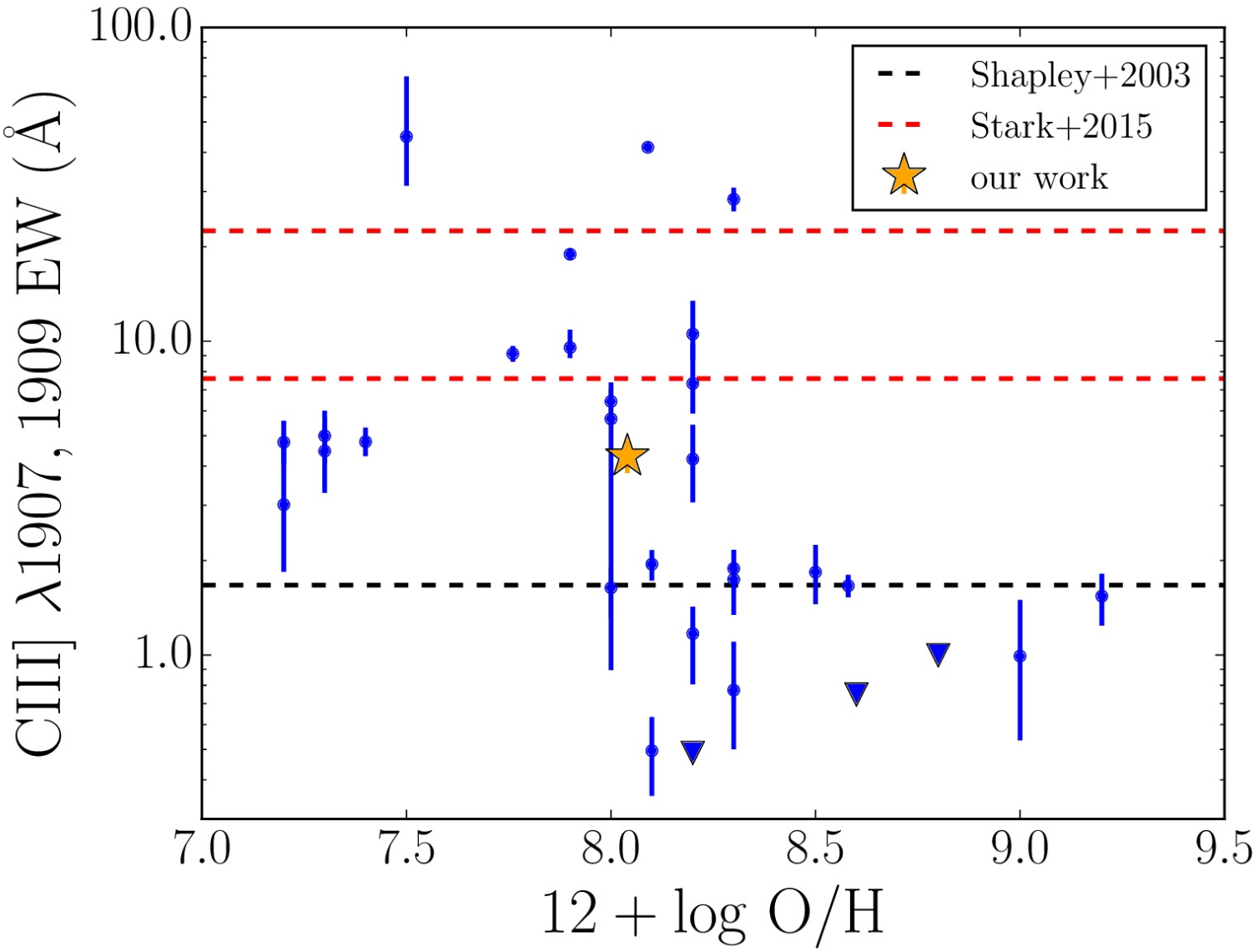
more 'WR-like' stars

decreasing metallicity



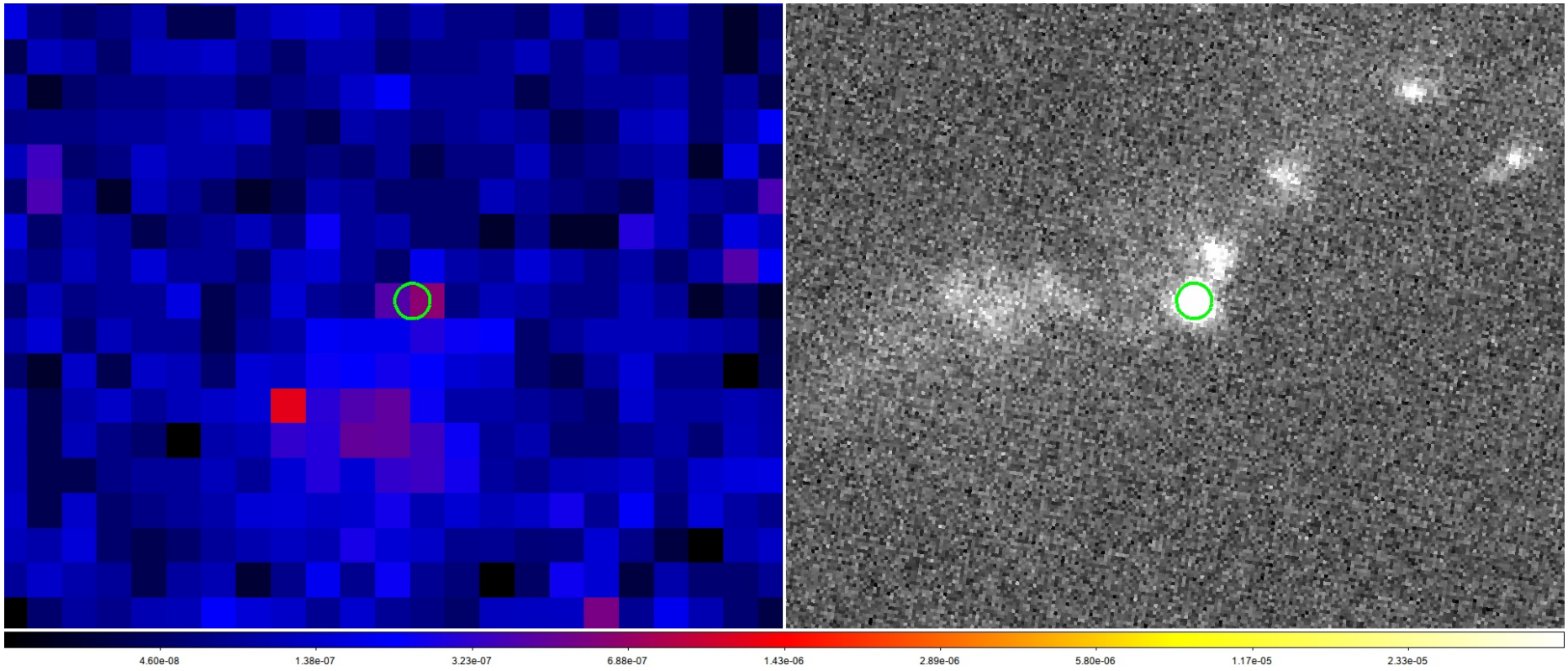
we can anchor these models locally

multiwavelength data (COS, Chandra, MMT)

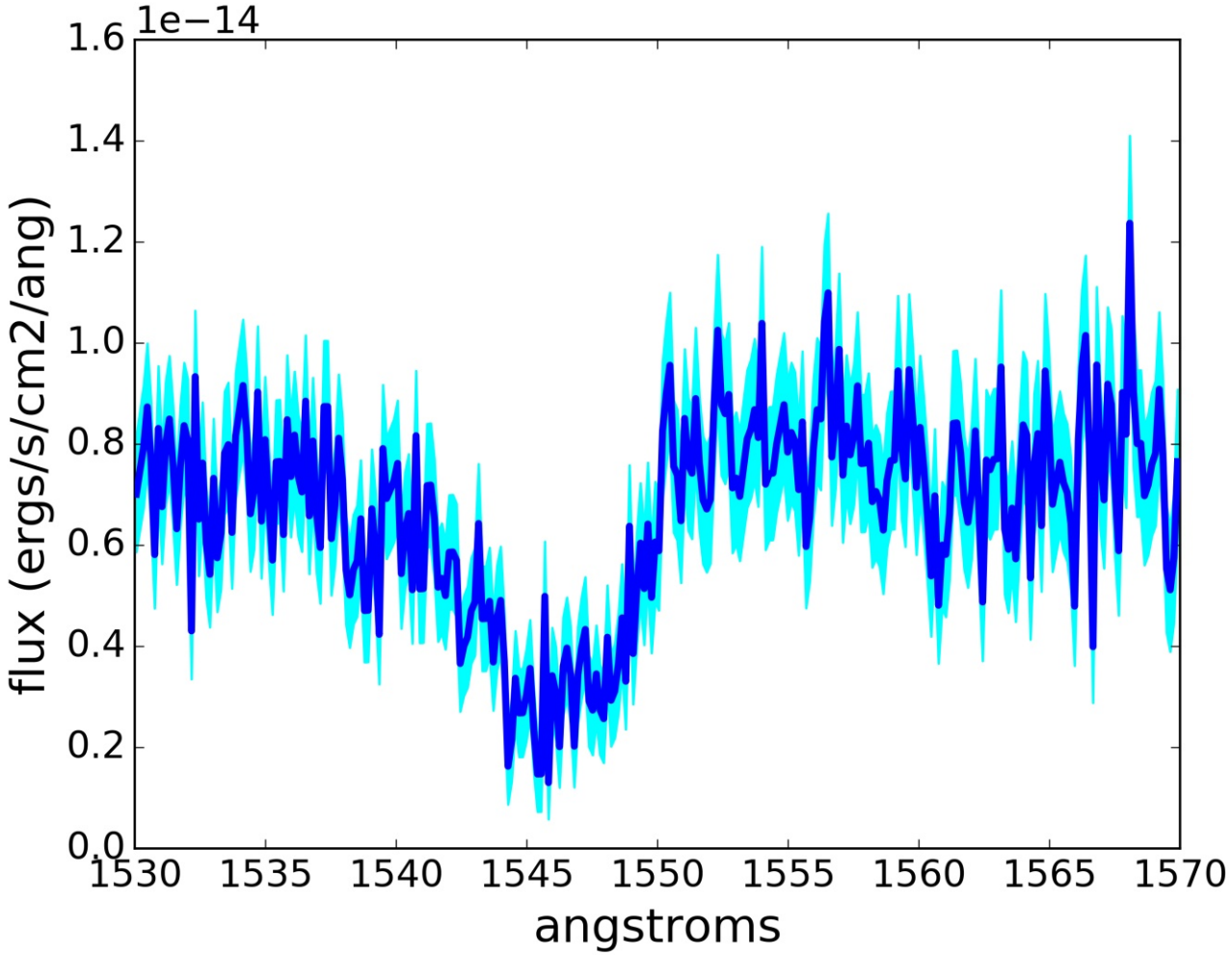


empirical templates for JWST

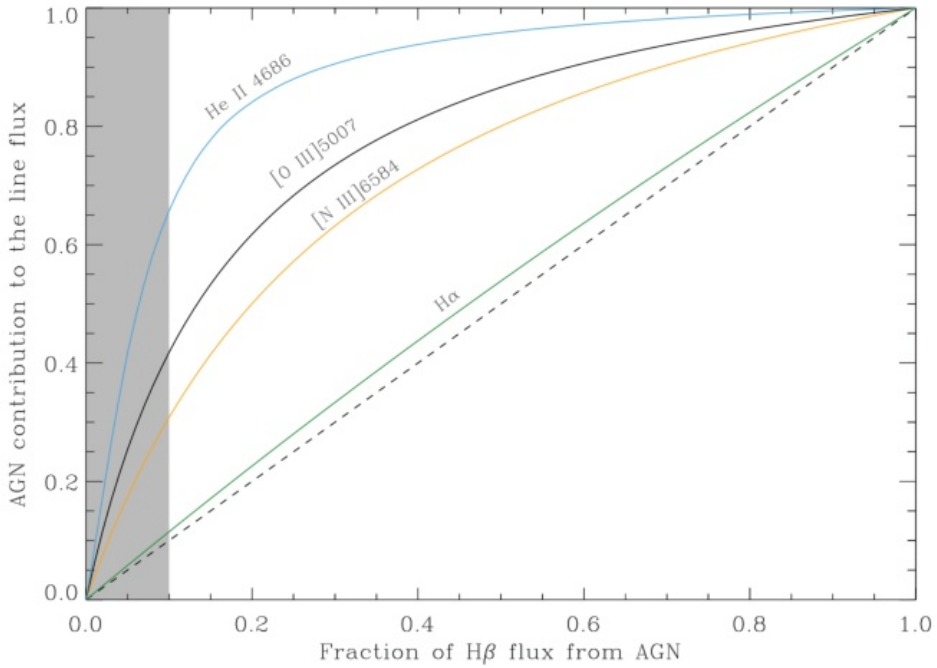
questions?

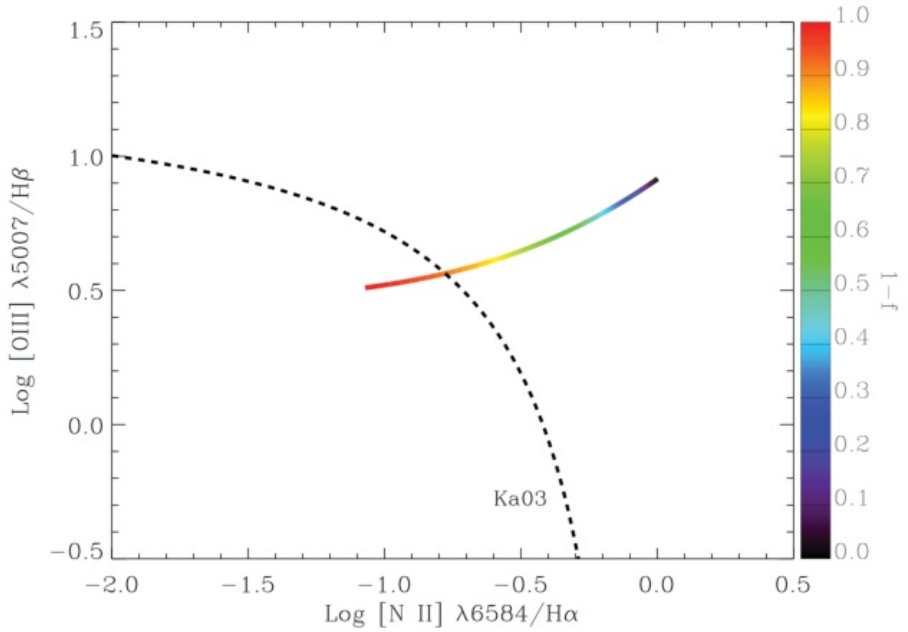


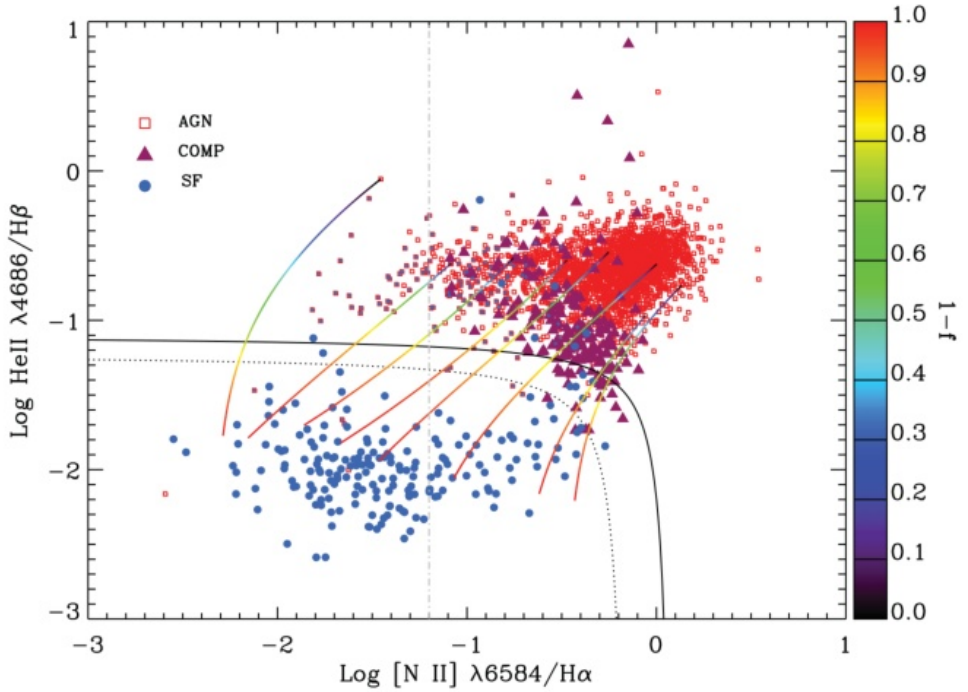
170 ks of Chandra archival data



typical FOS CIV profile







Shirazi & Brinchmann 2012, MNRAS 421, 1043