The organizers asked me to summarize and contextualize the last day of talks.
And highlight some of my own new work.

Please apply for JWST postdoc fellowships,
through the NASA Postdoctoral Program (NPP).

Deadline: Nov 1
Ad on AAS job register in Aug.
If interested, please contact me:

Jane Rigby
JWST Deputy Project Scientist for Operations
NASA Goddard Space Flight Center
Jane.Rigby@nasa.gov

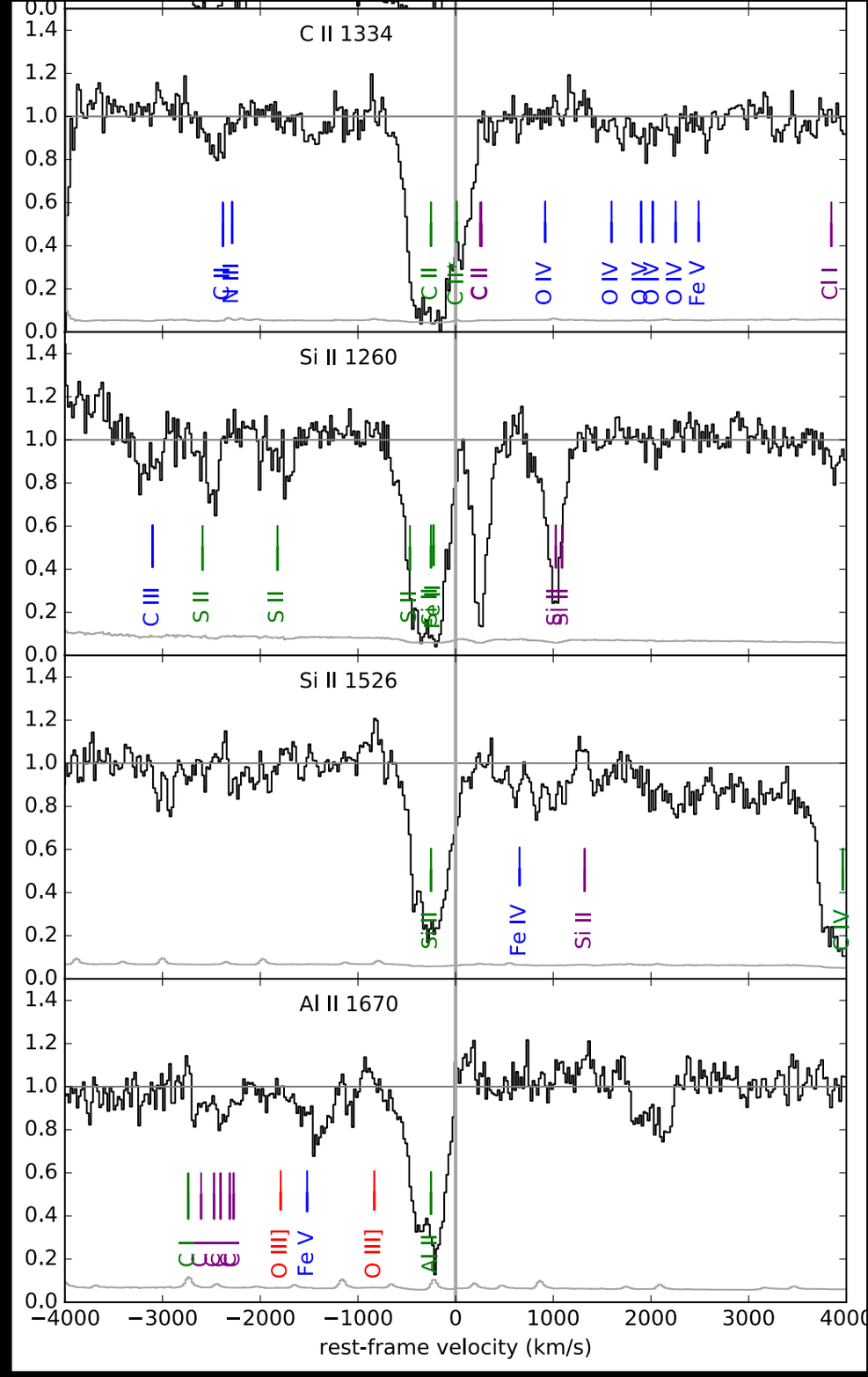
MEGaSaURA:

The Magellan Evolution of Galaxies Spectroscopic and Ultraviolet Reference Atlas

(Rigby et al. in prep. a, b)

High-quality rest-frame UV spectra for 14 lensed galaxies at 1.6<z<4

Diagnostics of outflows, hot stars, & nebulae



Rigby-Galpath

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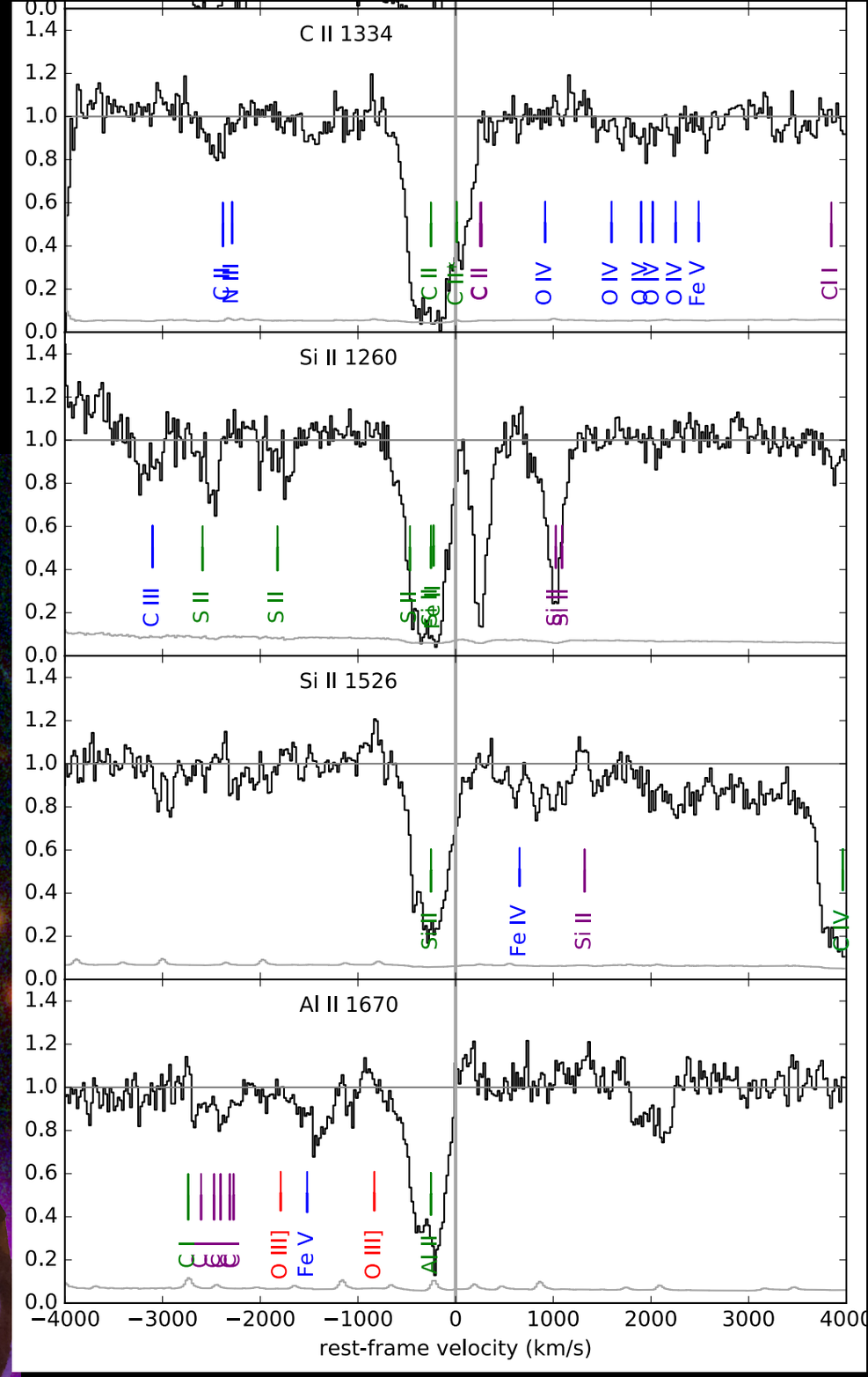
logo by Ella Koester (age 7)



Rigby-Galpath

MEGaSaU

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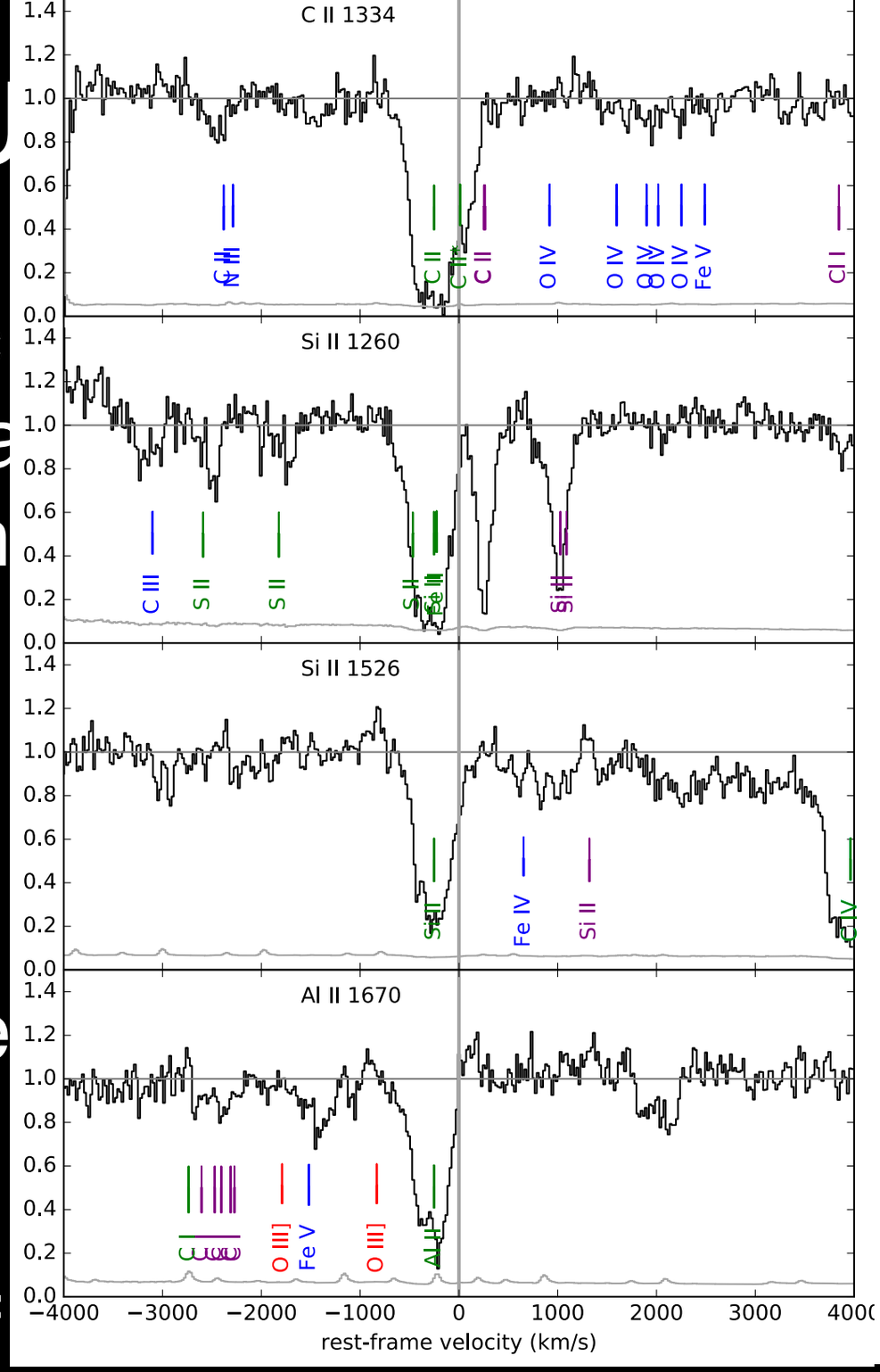
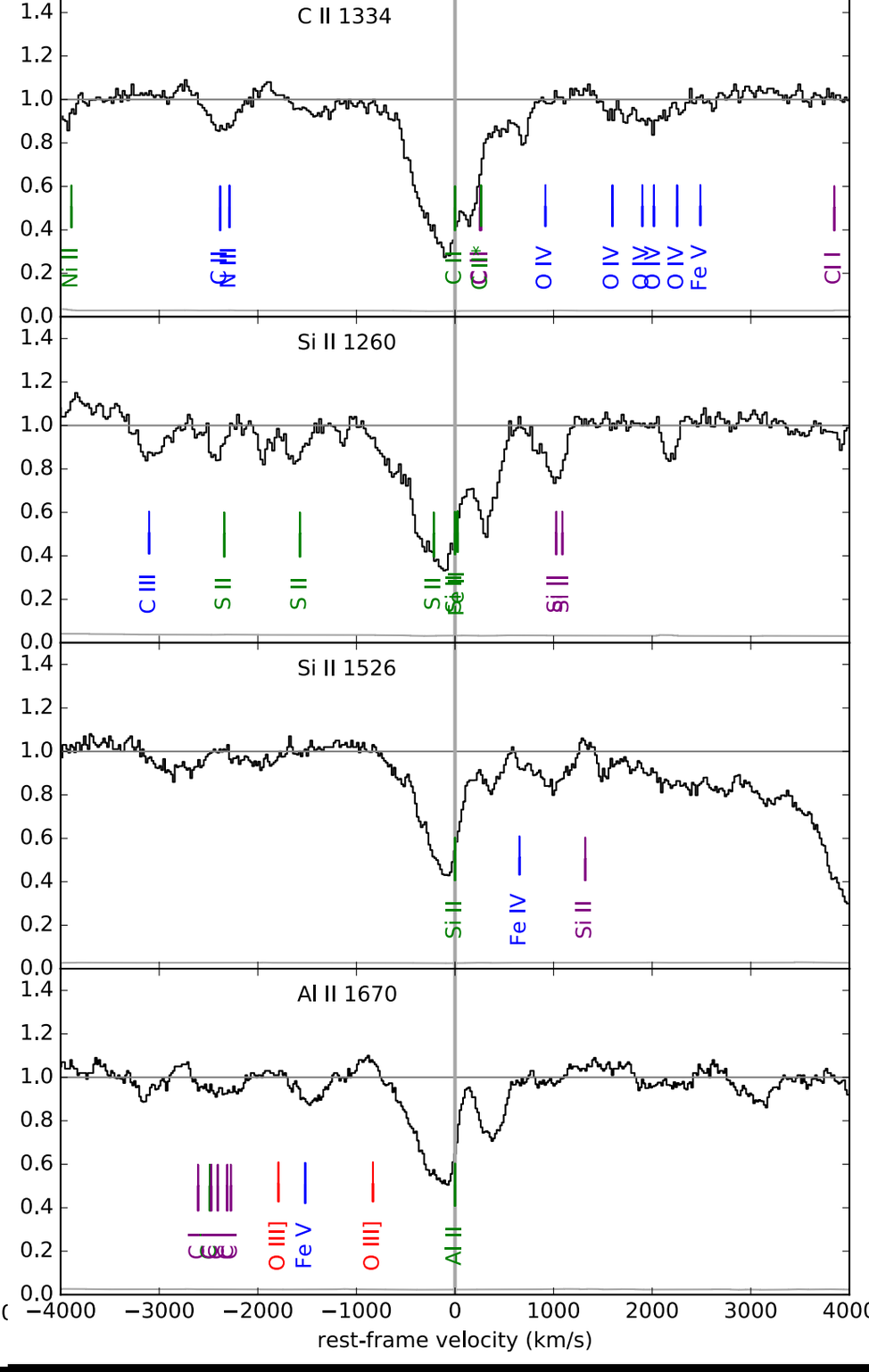


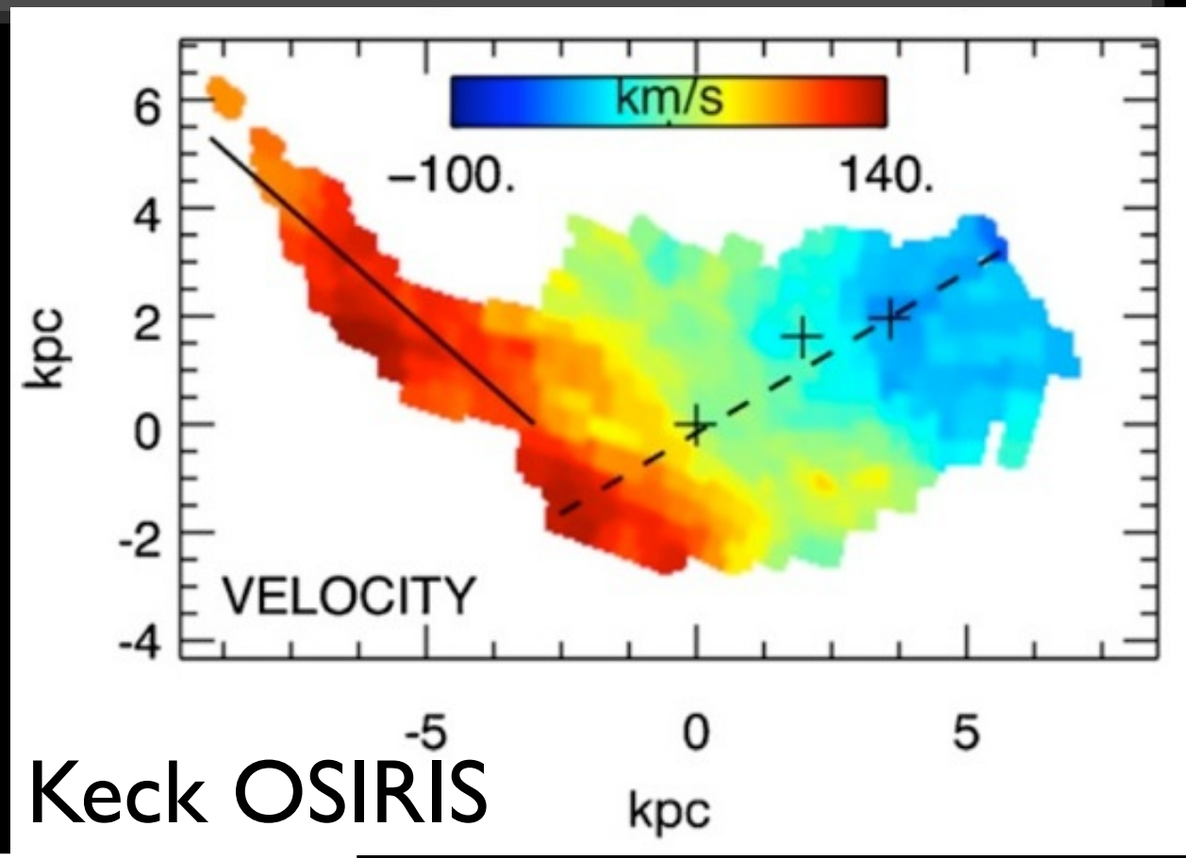
Individual spectrum



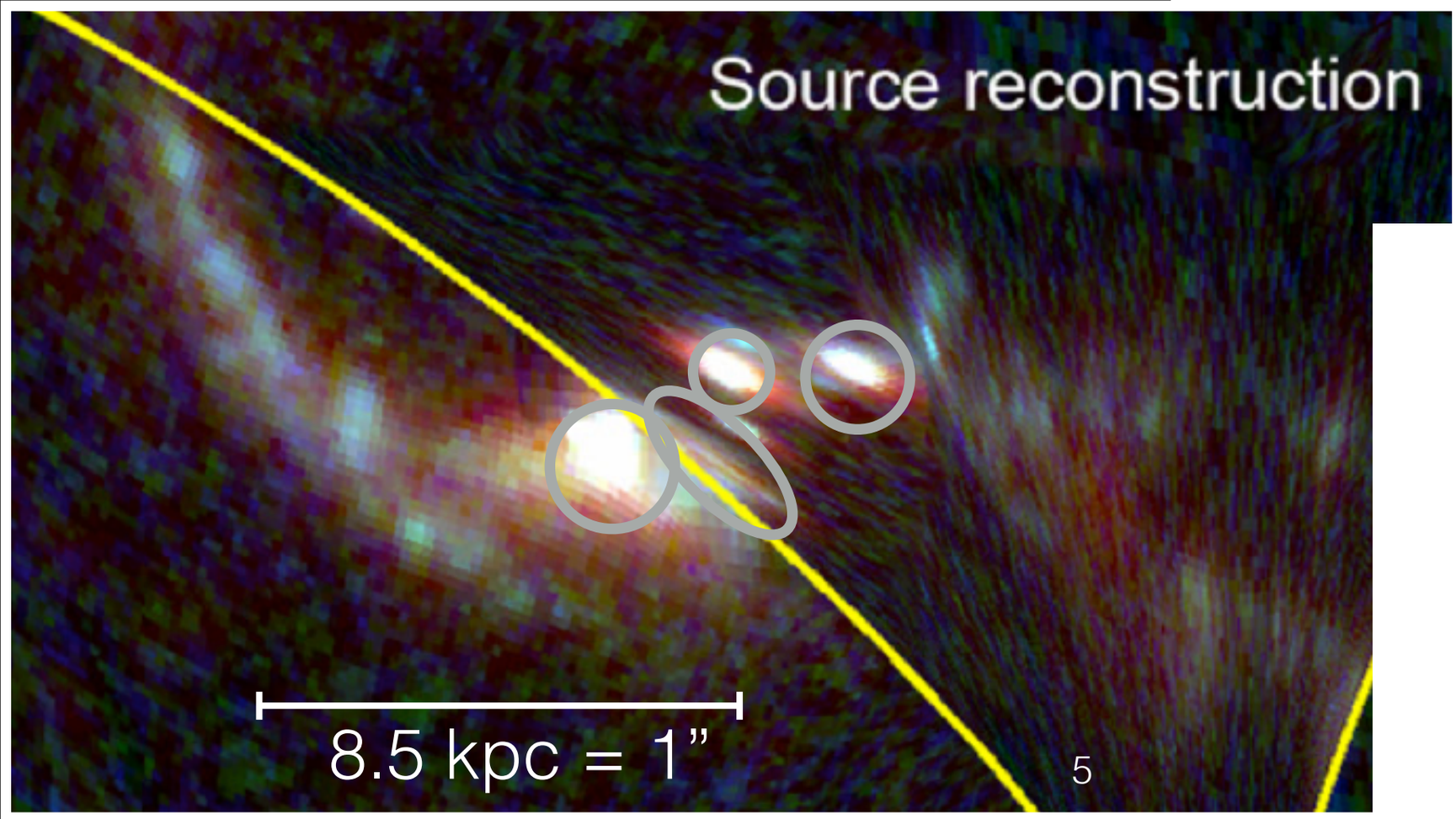
Stacked spectrum: S/N=100 per 100 km/s

Rigby-Galpath

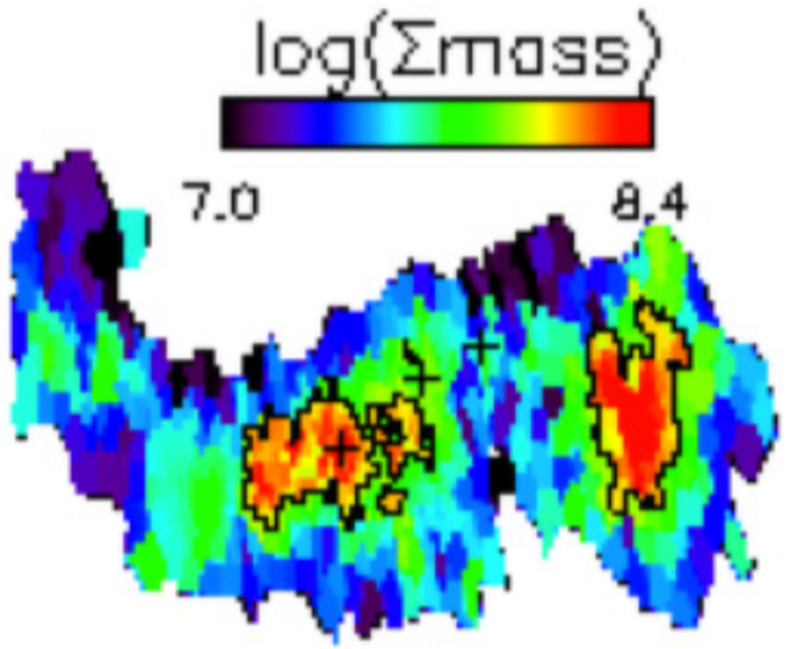
In a z=1.7 lensed galaxy, outflow "locally sourced" on kpc scales.



Keck OSIRIS



Wuyts, Rigby, Gladders, & Sharon 2014



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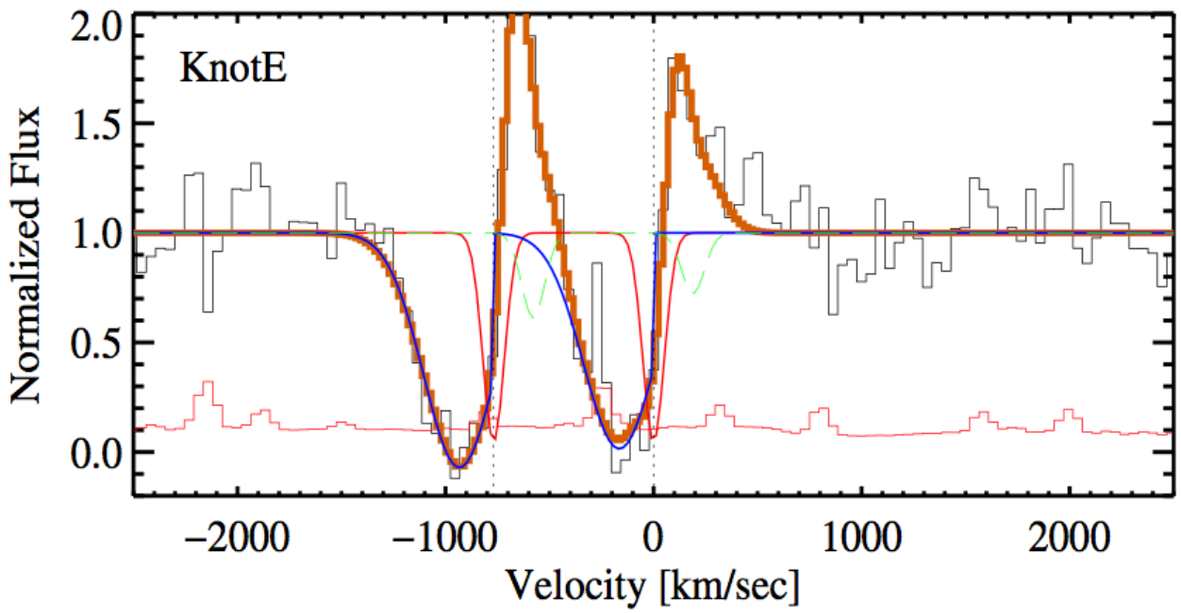

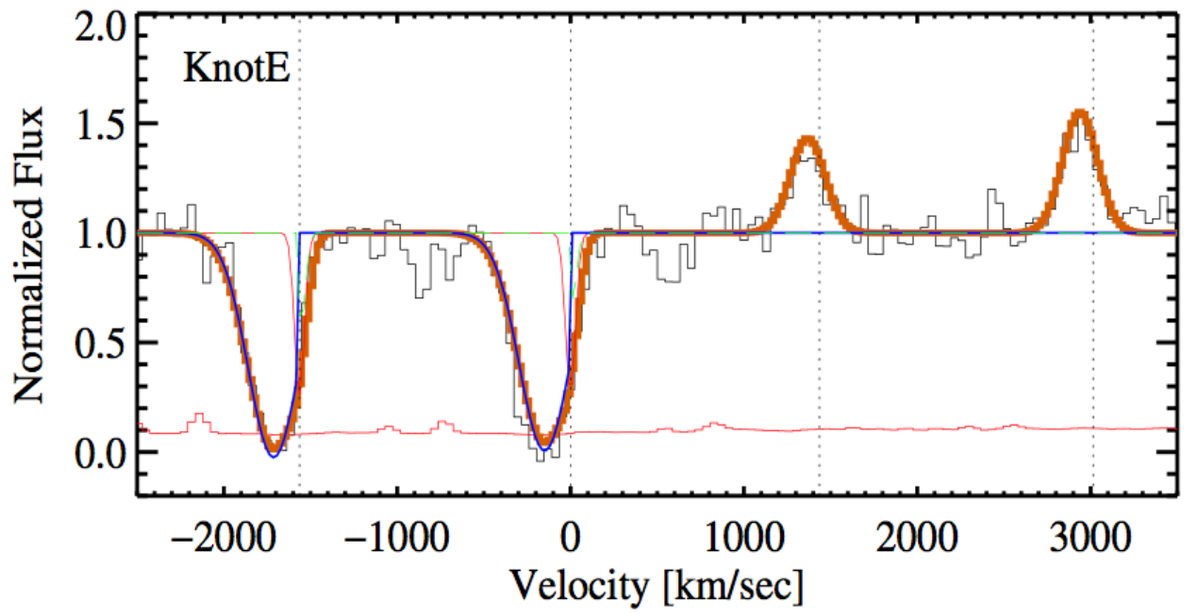

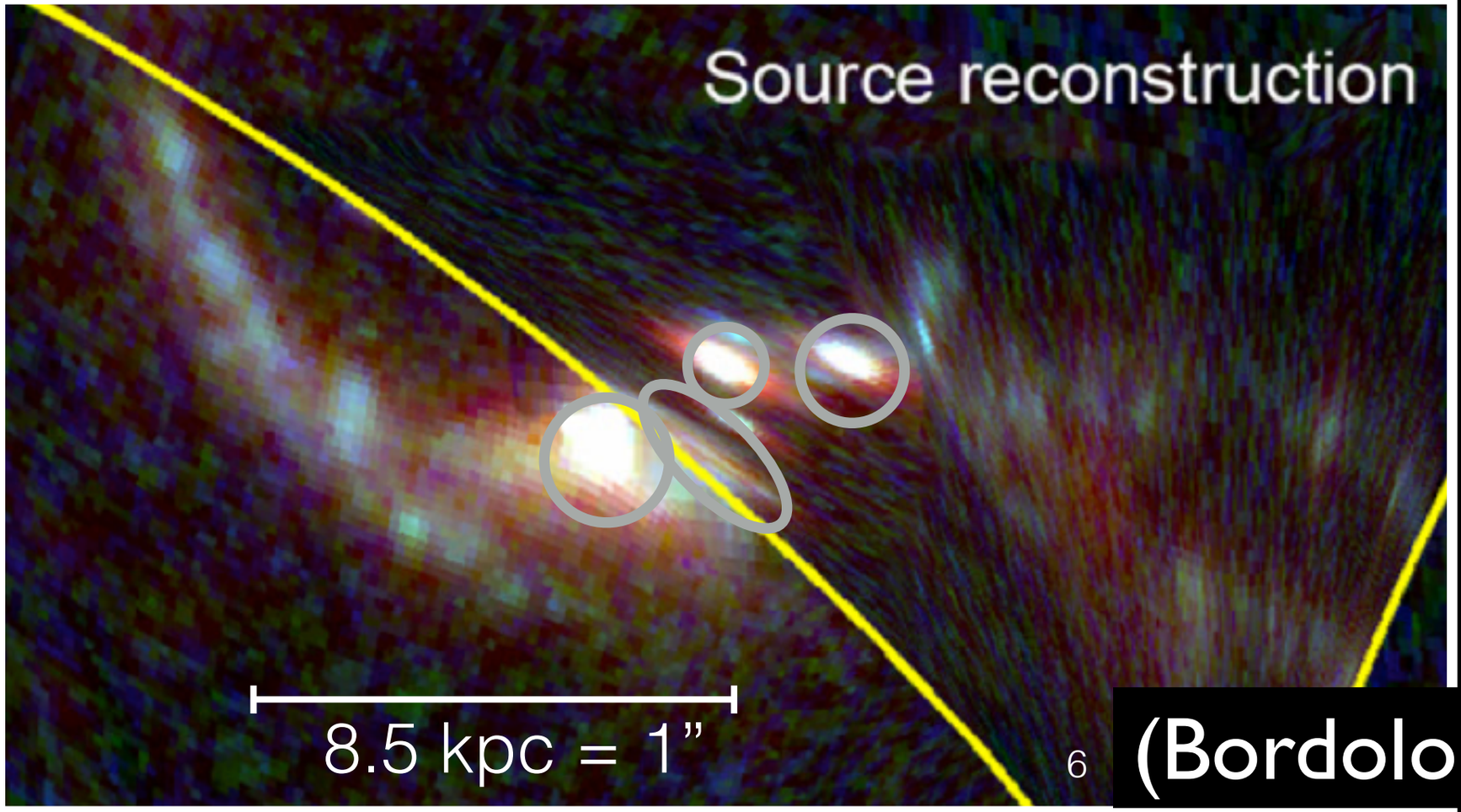

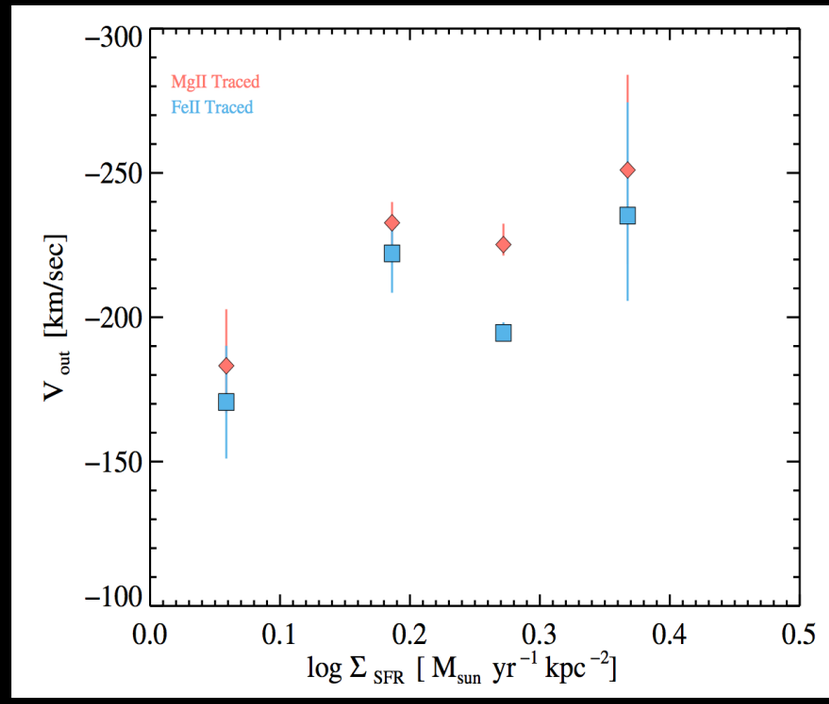

(Bordoloi, Rigby et al. 2016)

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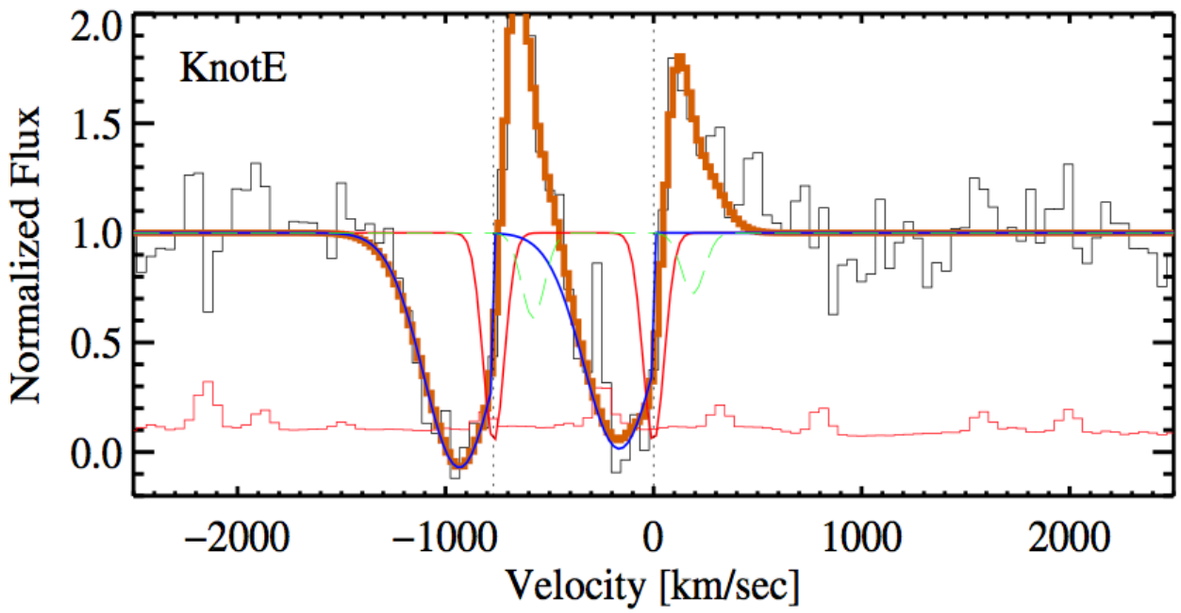
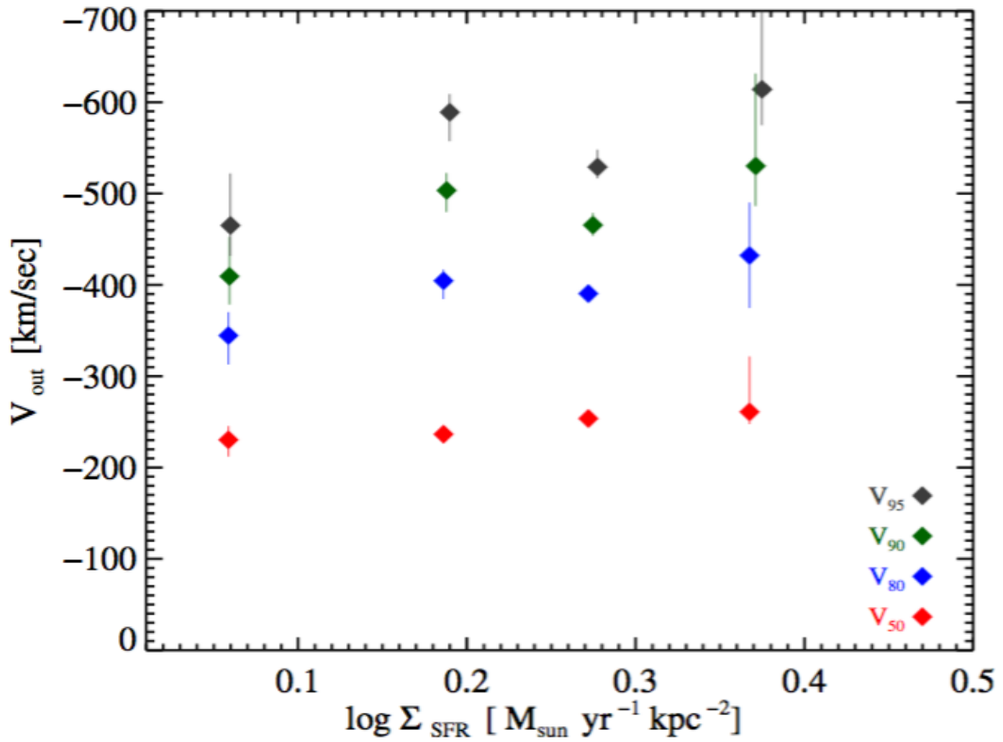
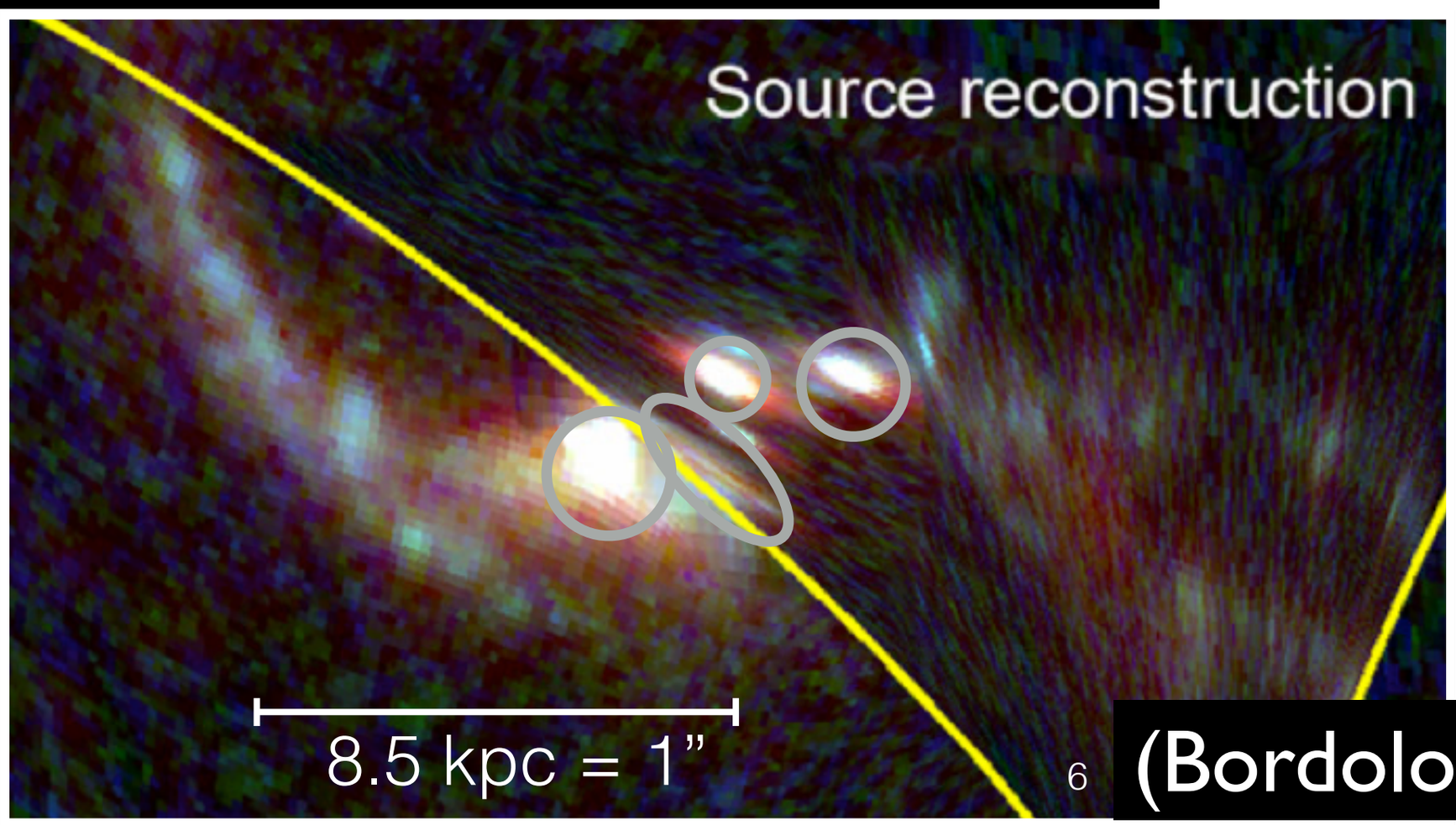
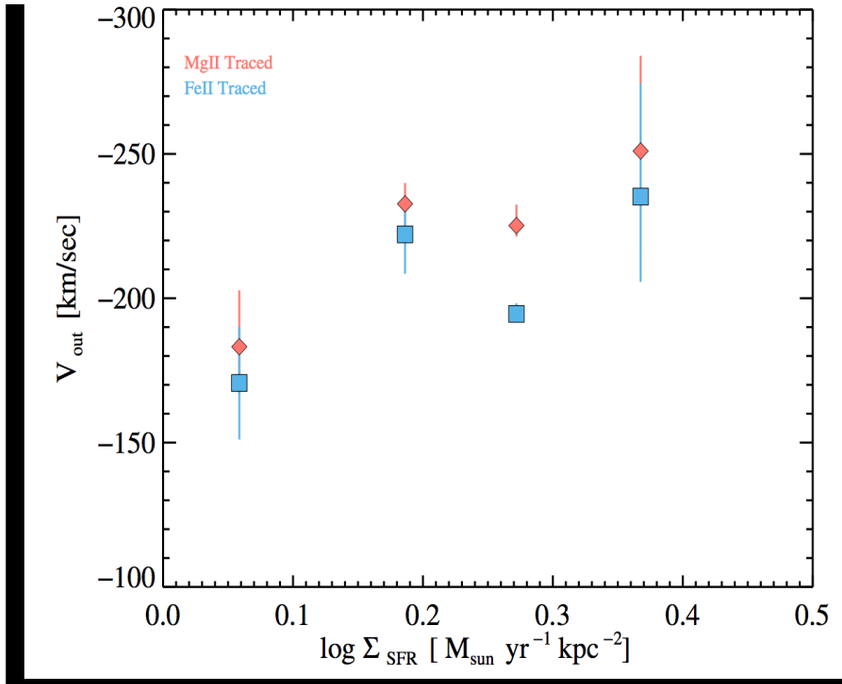


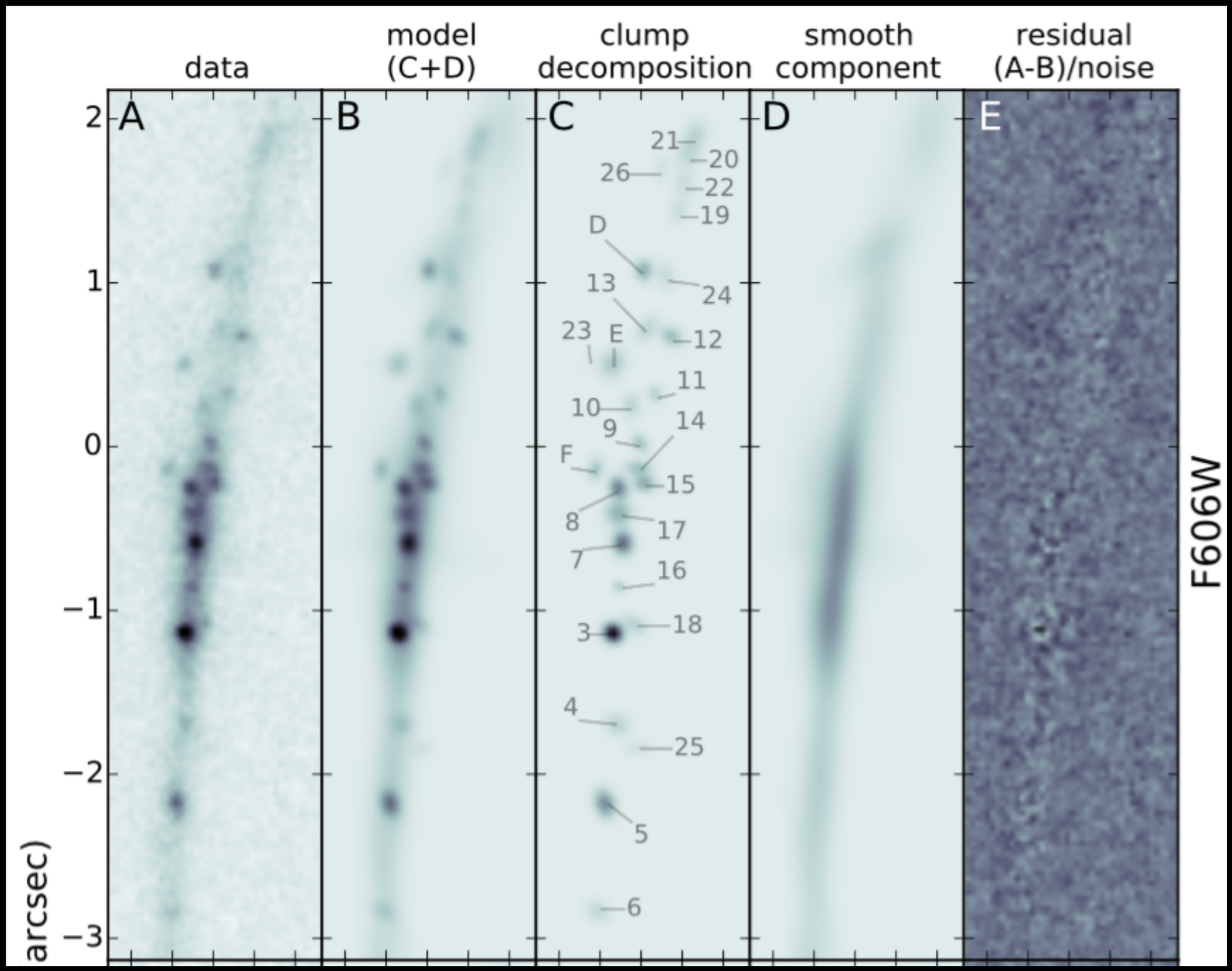






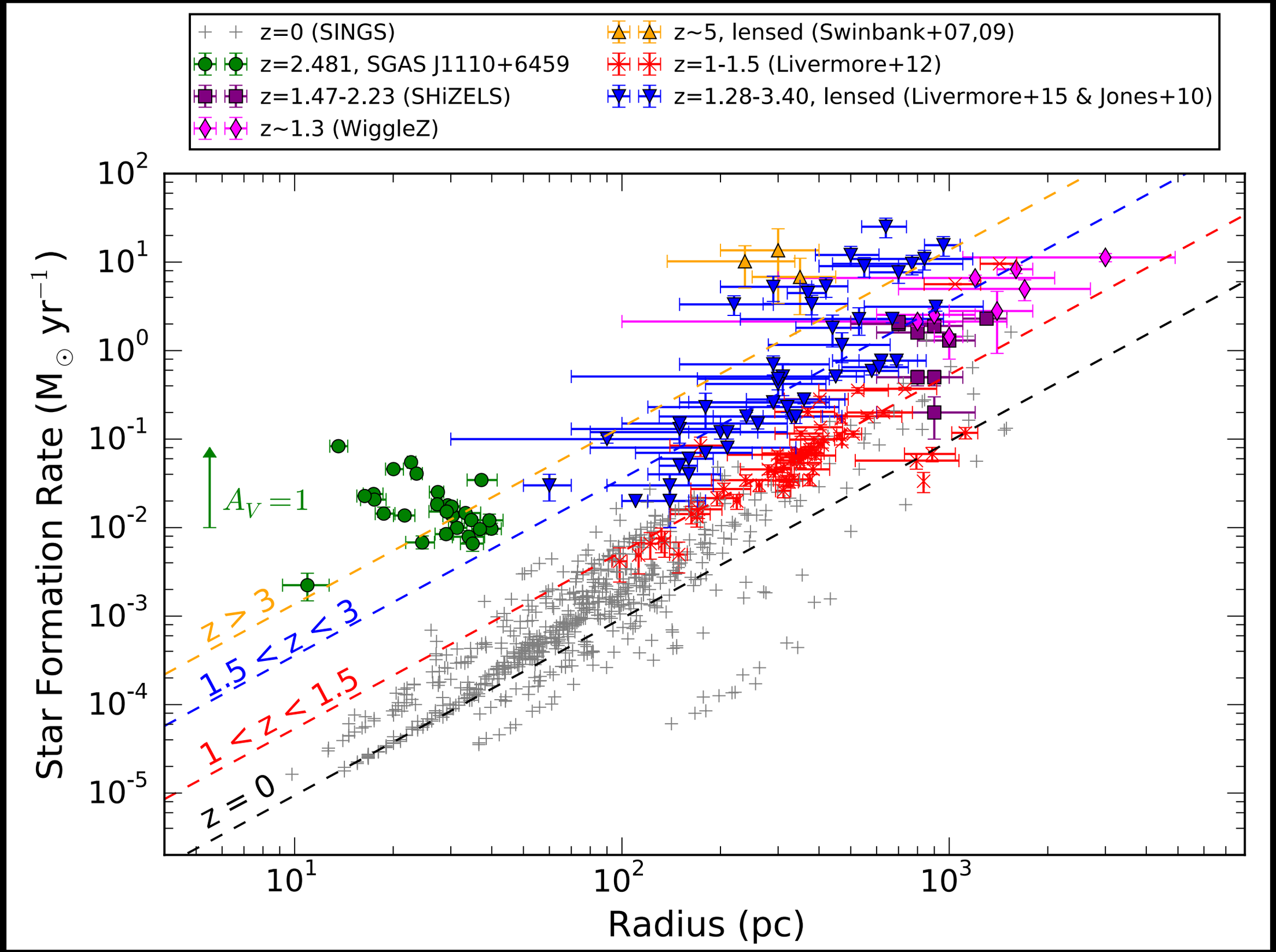
(Bordoloi, Rigby et al. 2016)

Lensed galaxy SDSS J1110+6459 at z=2.481

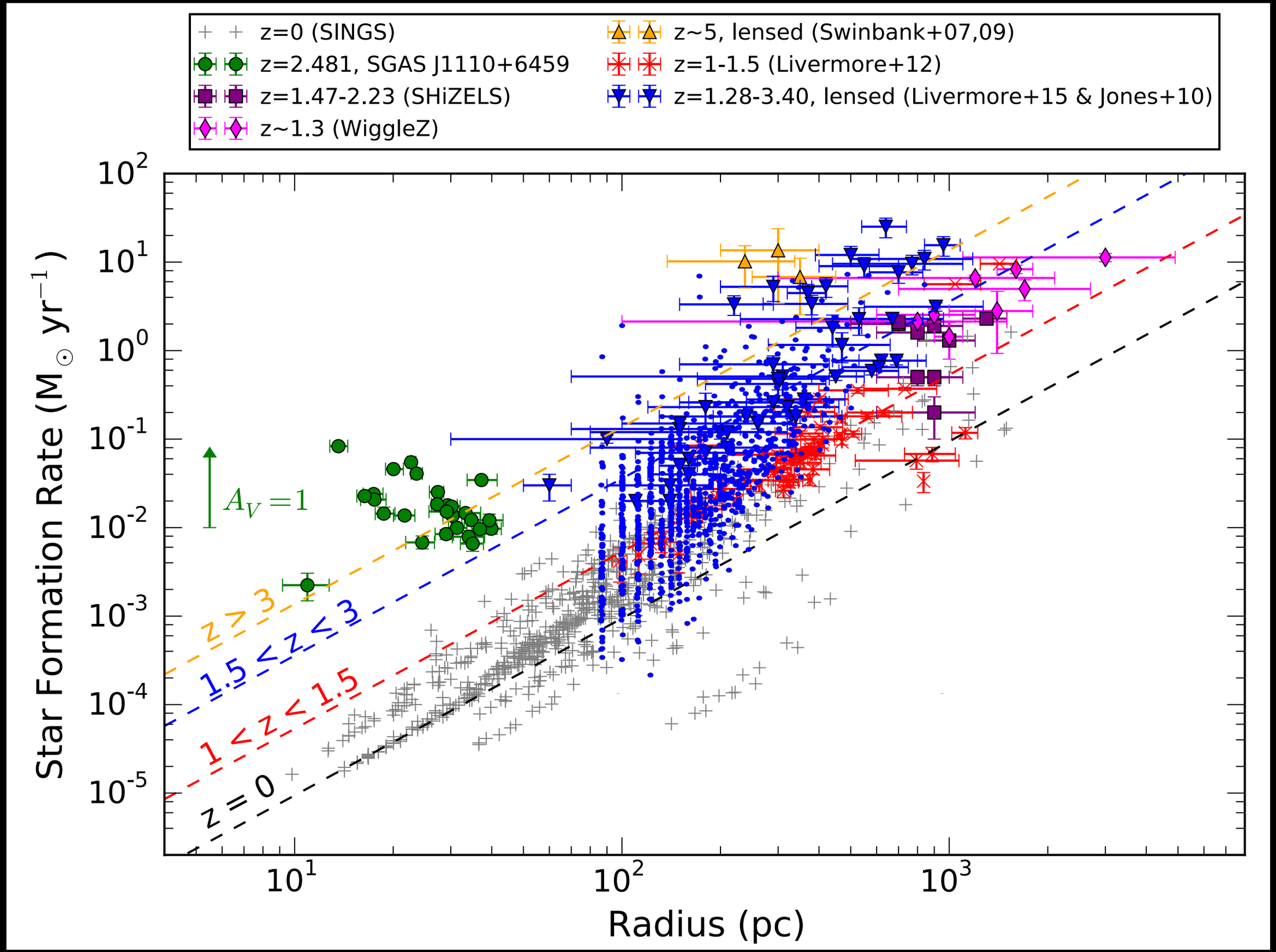


(T. Johnson et al. in prep. a.)

Rigby-Galpath



Livermore+ 2015, + lensed galaxy at z=2.5 (T. Johnson et al. in prep. b.), + **Larson in prep. GOALS** Rigby-Galpath



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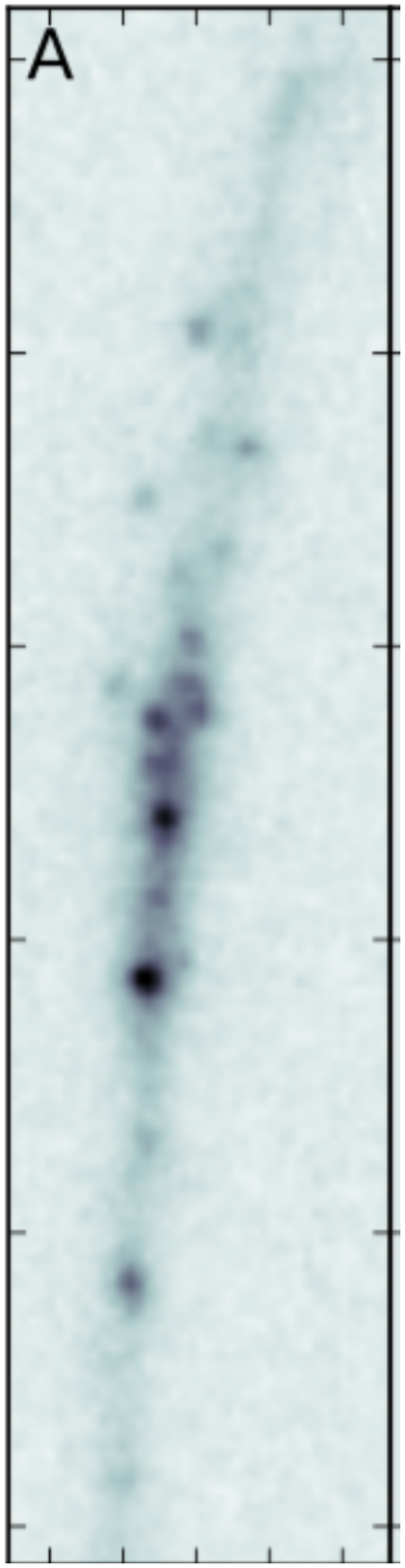
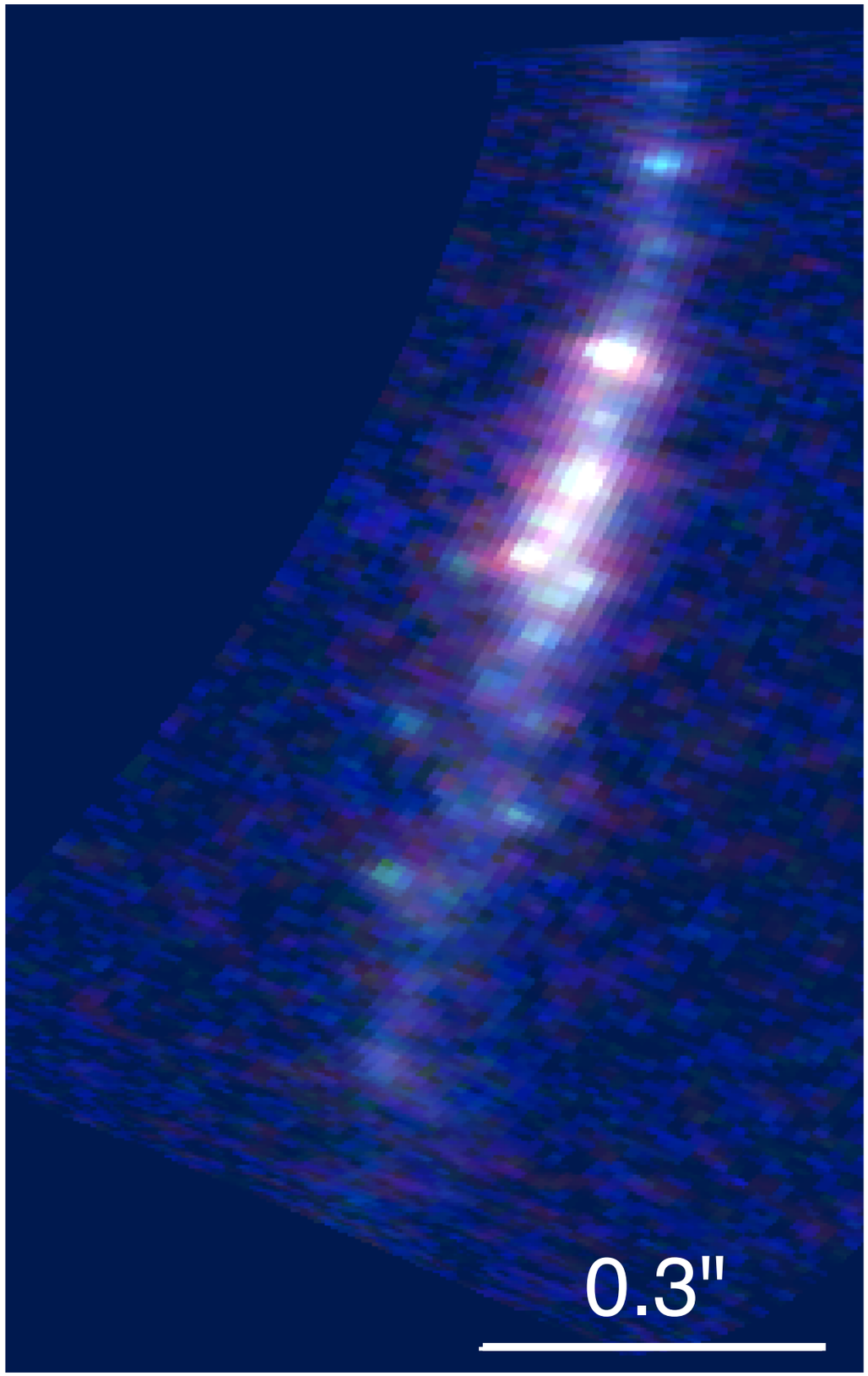
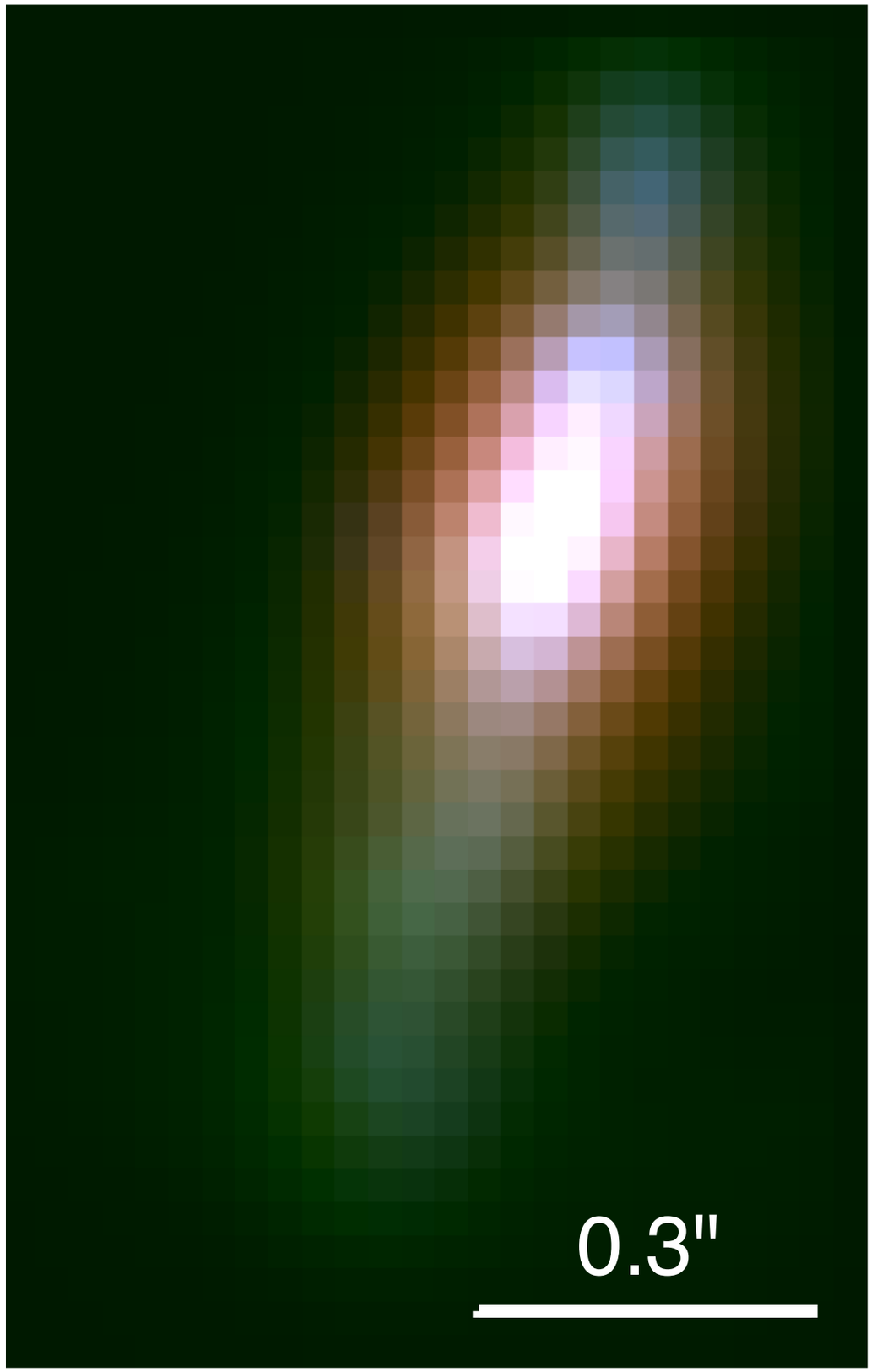
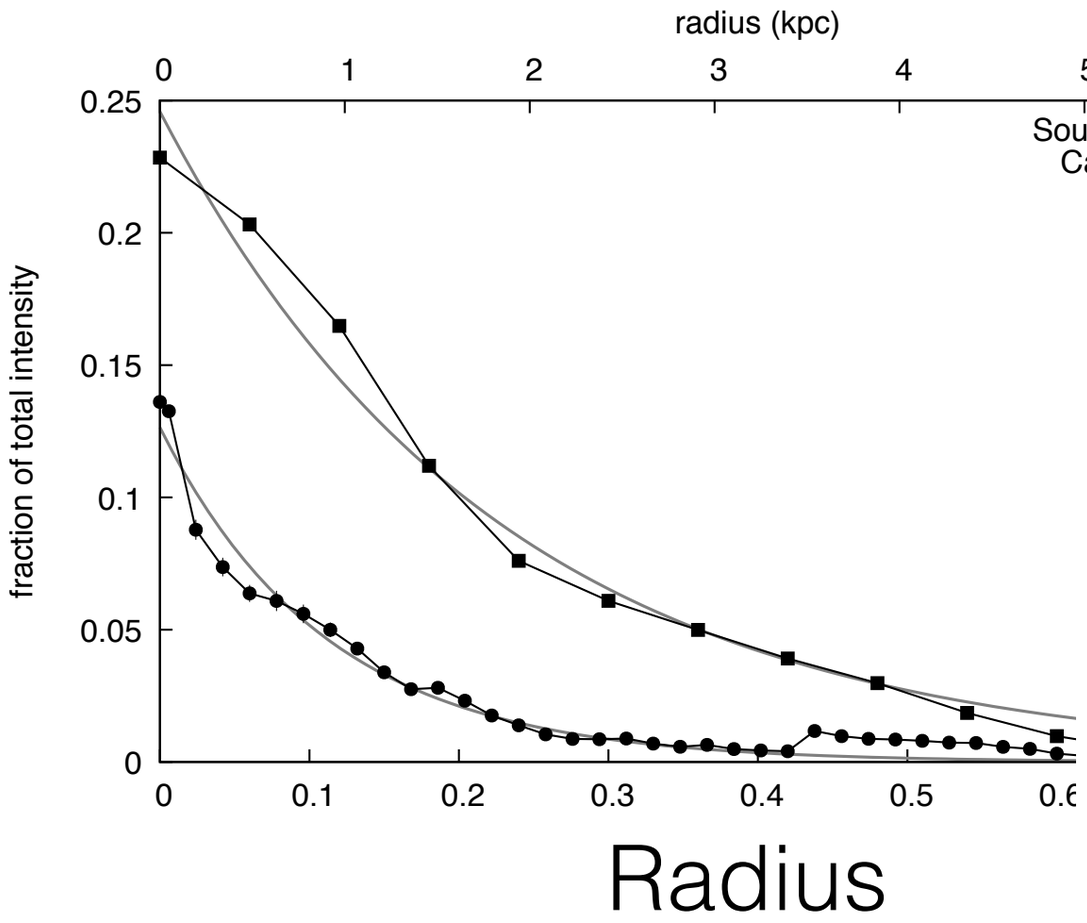


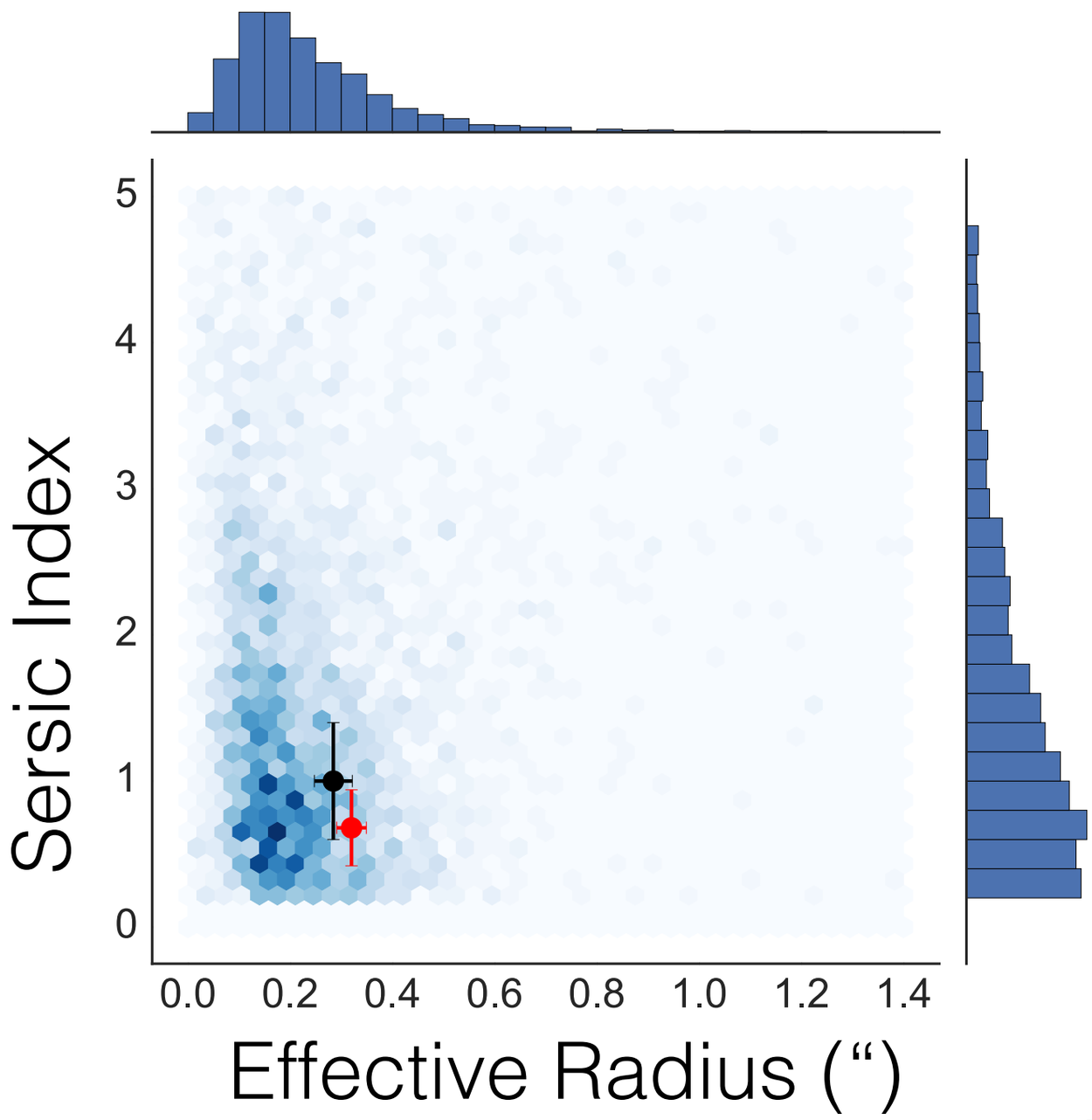


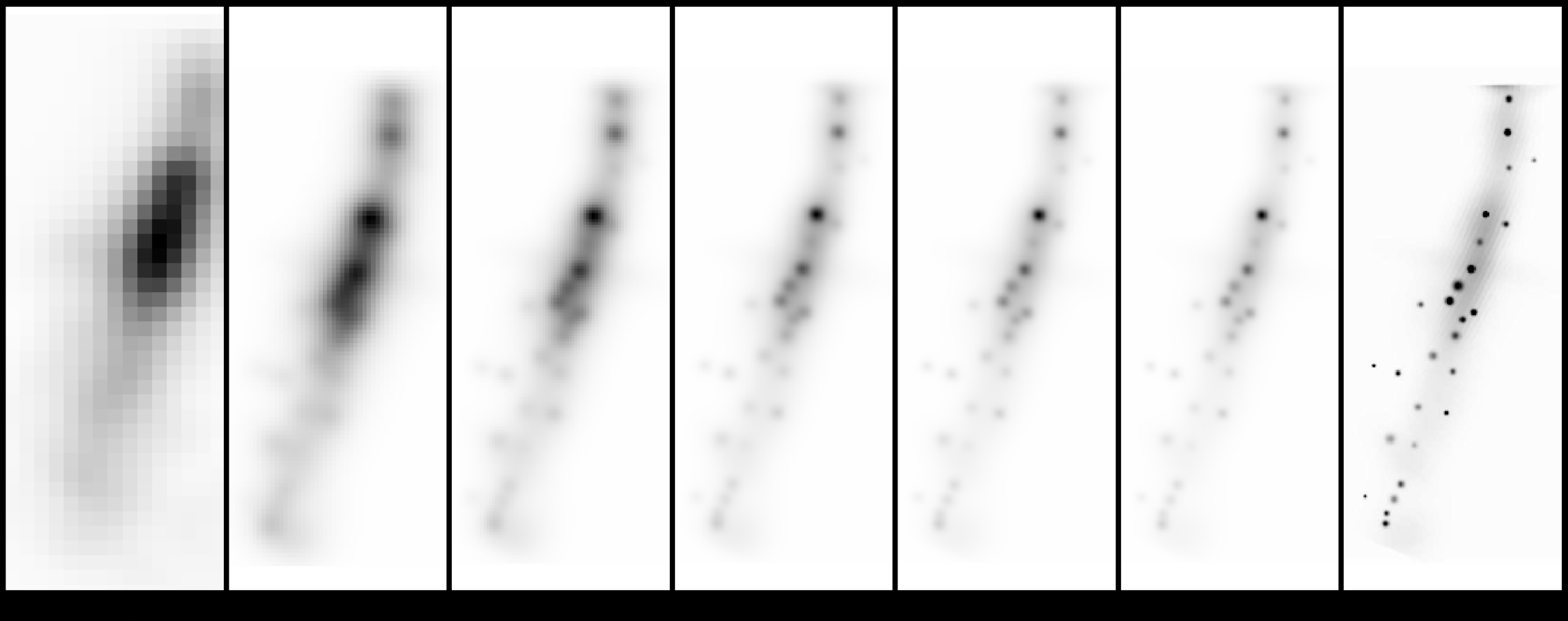


A lensed galaxy at z=2.5, as seen by HST (T. Johnson et al. in prep.a), and at CANDELS resolution (Rigby et al. in prep.)



Galfit and ellipse fitting say this is a smooth exponential disk of typical size for z, M*. (Rigby+ in prep.)





Our-best-fit model of the z=2 lensed galaxy, as seen by a large UV/Optical/IR telescope (LUVOIR), noiseless, F390W. (Rigby et al. in prep.)

“Tracing Galaxy Evolution into the High Redshift Universe”

Mariska Kriek: Formation of massive z~2 compact quiescent galaxies. Fe/H of high-z galaxy.
Kate Rowlands: Only <10% of red sequence galaxies had a post-starburst phase. Decline of SF in most galaxies is gradual.
Andreas Faisst: Quenching mechanisms in massive galaxies in COSMOS. Needs fast quenching.
Robert Feldmann: Halo accretion rate helps determine which galaxies stop forming stars. JWST simulations
Elizabeth McGrath: In CANDELS, ~30% of quiescent galaxies are **disk**-dominated.
Gergerly Popping: Predictions of gas content of high-z galaxies. Predictions for ALMA.
Omar Almaini: Post-starbursts in UKIDSS are compact spheroids.
Anna Sajina: Simulations of dusty galaxies.
Pablo Pérez-González: How fast can the Universe make a massive quiescent galaxy?
Alison Coil: AGN-driven outflows & galactic conformity at z~1-2
Wiphu Rujopakarn: JVLA+ALMA of UDF shows galaxy-wide SF, R~2kpc, driving outflows
David Wilman: KMOS, Halpha, Halpha traces stellar light distribution —> global disk-wide SF.

Synthesis Questions, p.1 of 3

What path do massive galaxies take through M*, SFR, size plots?

- Kriek: Post-starburst z~1 galaxies are very compact. Core SF can make gals more compact.
- Feldmann: halo mass and d(halo mass)/dt may determine the path
- McGrath: Massive quiescent disks are common at high redshift. They're compact.
- Perez-Gonzalez: "The fast-track": shrink, then quench, then grow. (Barro+13)

How fast do galaxies quench?

- Kriek: very quickly, at high z (from [Fe/H])
- Faisst: <500 Myr, probably by a merger + starburst, and maybe an AGN too.
- Rowlands: At z~0, a slow 4Gyr hike through the green valley.
- Pérez-González: very fast. Live in the MS for ~0.5Gyr, then dead
- Wilmer: slowly (Gyrs), for satellites.

Synthesis Questions, p.2 of 3

<u>Does morphological transformation happen before, after, or during quenching?</u>

-Almaini: post-starburst galaxies are very compact, high Sersic indices. Therefore, morphological transformation occurs **before** quenching.

- Pérez-González: Before, on the "fast track"

- Rujopakarn: more compact population at SFR>300 (above the z~2 MS).

<u>What the heck causes the quenching?</u>

- Coil: Role of AGN: Same host properties for AGN, non-active gals. But, 10x more outflows in the AGN. Regulation, not quenching?

- Coil: galaxy conformity at Rproj <2 Mpc. Environment doesn't lower sSFR of central stars during SF era, until it halts it.

Synthesis Questions, p.2 of 3

.Other questions:

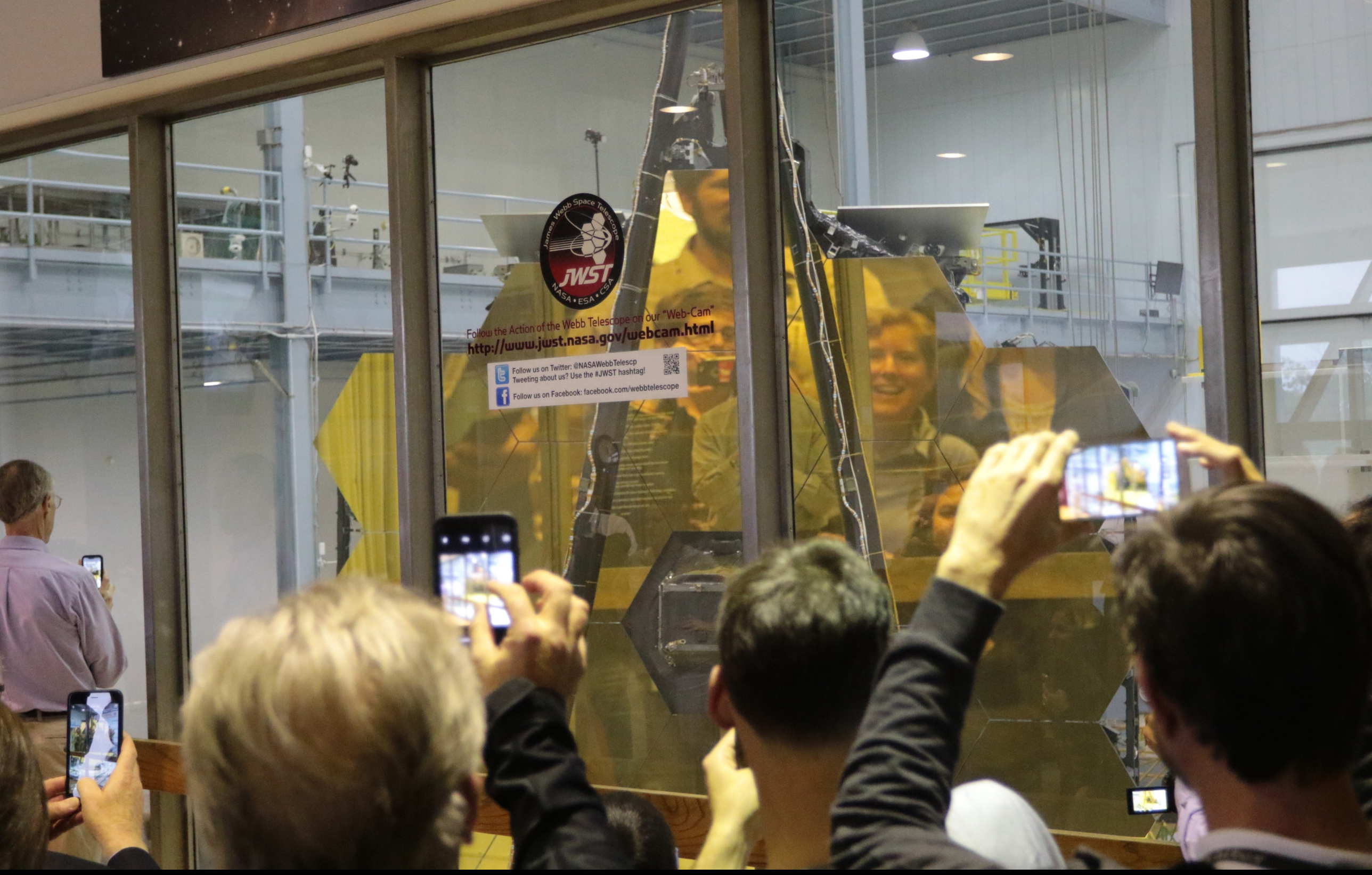
- How important is Resurrection?

Where do the stars form?

- Rujopakarn: Galaxy-wide, intense star formation in massive galaxies on MS seen by ALMA+VLA. Prob driving outflows.
- Wilman: galaxy-wide starburst, from KMOS.
- Kriek: (Barro) SF in cores makes more compact
- P-G: "There is already a core". Compact-ification SF event wasn't the first SB event?

What better diagnostics should we use?

- Kriek: Pioneering Fe/H metallicity from stellar absorption in old galaxies at z~2
My math for JWST: t=1E4s, SNR=10, R=2700 to mAB=22.5, R=1000 to mAB=24
-Popping: models predict little evoln for HI w z, strong evoln in H2, in SF efficiency. ALMA surveys, though not a surveyor
- Rujopakarn: Ditto ALMA,+VLA, for SFR. Robust to extinction, high ang resoln
- Sajina: Much better mid-IR SED libraries that incorporate strong evoln w z



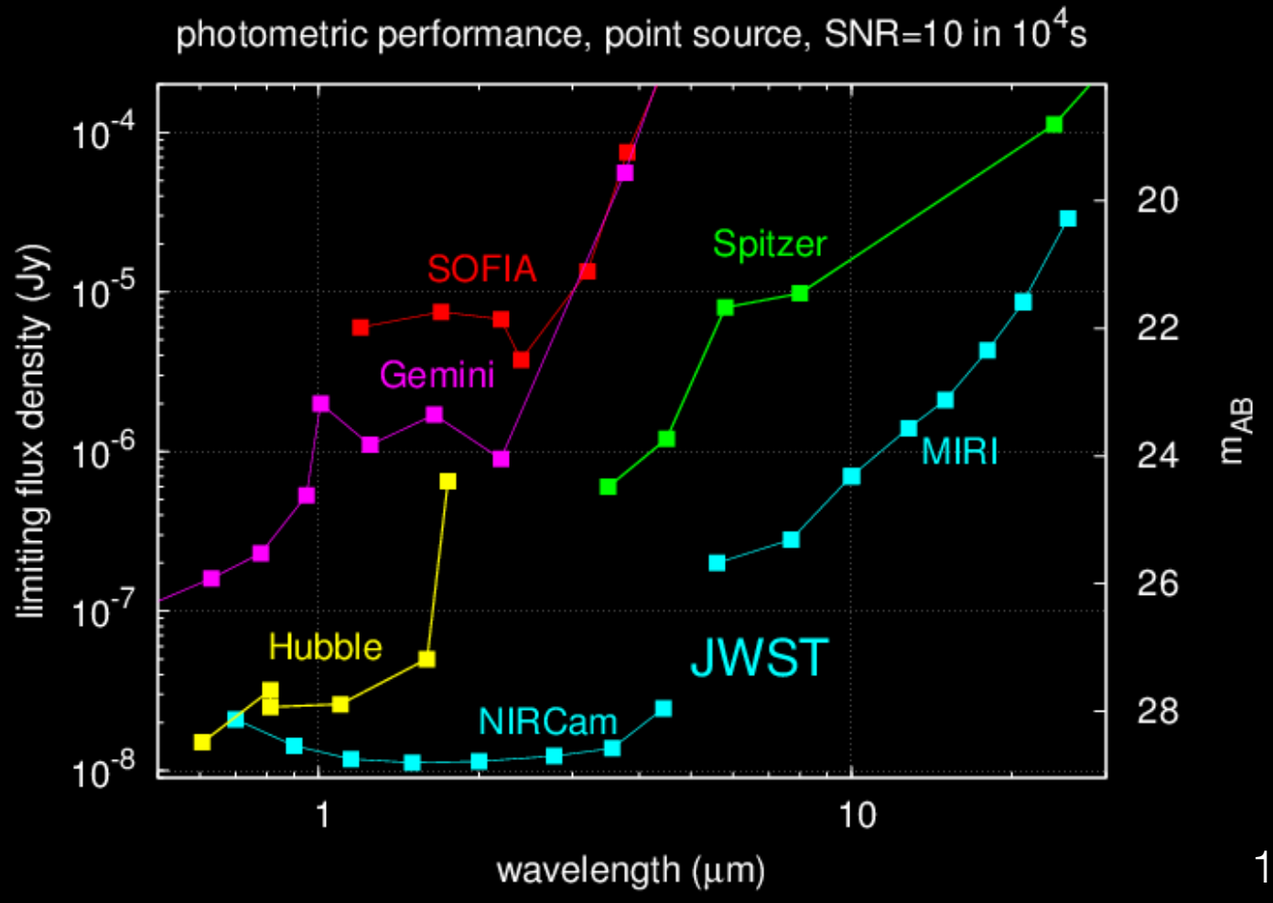
May 2016: mirror assembly complete
(pic courtesy @OmegaSpaces)

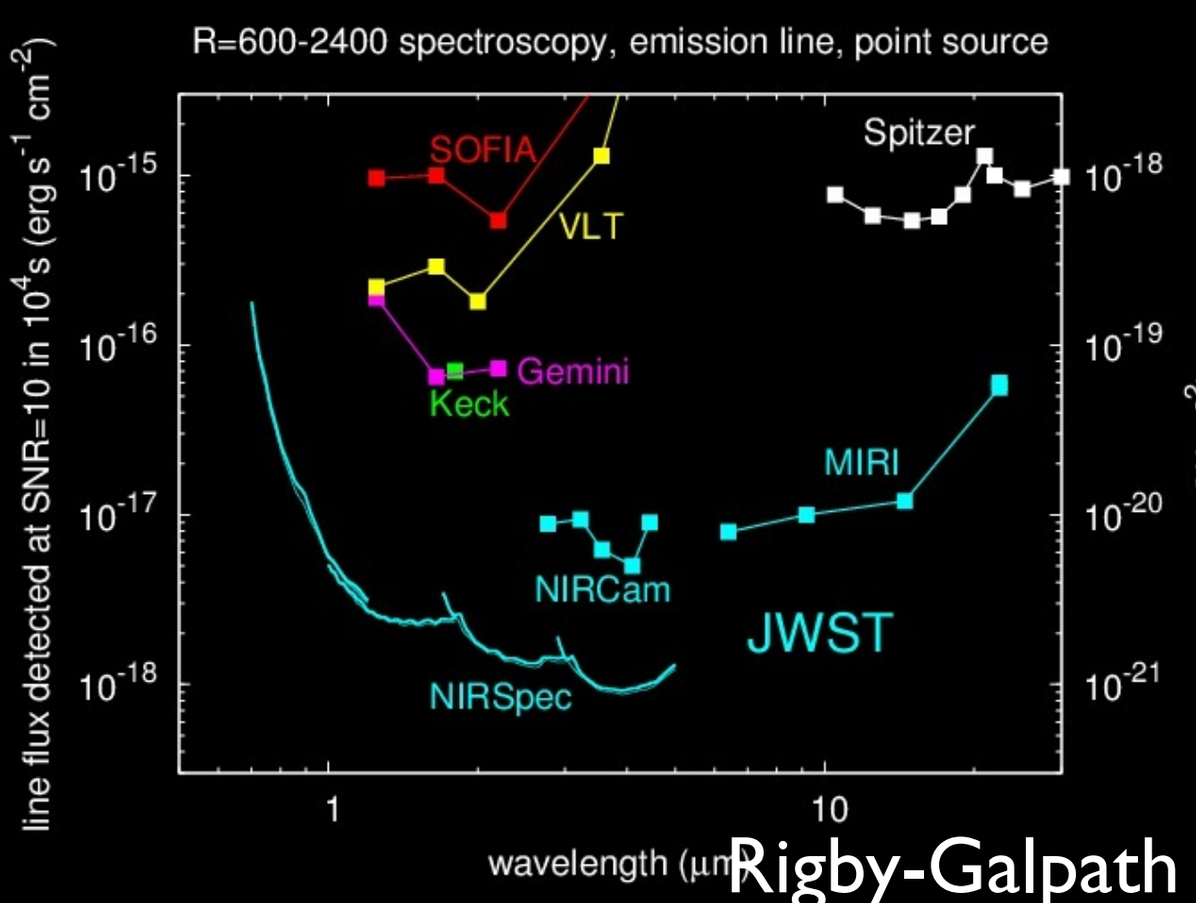
Rigby-Galpath

JWST Countdown to science

8/2017	Deadline, Early Release Science (ERS) proposals
2/2018	Deadline, Cycle 1 guest observer proposals
10/2018	LAUNCH
5/2019	Cycle 1 begins

(google: “JWST sensitivity overview”)





Rigby-Galpath

Spatial Resolution

- At 2 um, JWST resolves 0.06”. (Like HST at 0.7um.)
- At 4um: 0.13”
- At 10-20 um: 0.3-0.6”. (Like Magellan opt.)

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IRAC/Spitzer, 3;4,8um

Rigby-Galpath

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- At 4um: 0.13”
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GOODS, HST, BVI, 75”

Rigby-Galpath

GIVEN THAT:

- JWST deadlines are 12 & 19 months away,
- JWST will get HST-like spatial resolution at IRAC wavelengths,
- JWST will have unprecedented spectroscopic capabilities at 0.6—24um

THEN:

- What questions from this conference can we agree are solved?
- What questions do we think can be solved with JWST?
- How should those questions drive design of JWST surveys?
- What questions require something other than JWST? Input to decadal (LUVOIR, HABEX, FIR Surveyor, X-ray Surveyor, others.)