



STScI | SPACE TELESCOPE
SCIENCE INSTITUTE

EXPANDING THE FRONTIERS OF SPACE ASTRONOMY

The Extragalactic Face of MAST

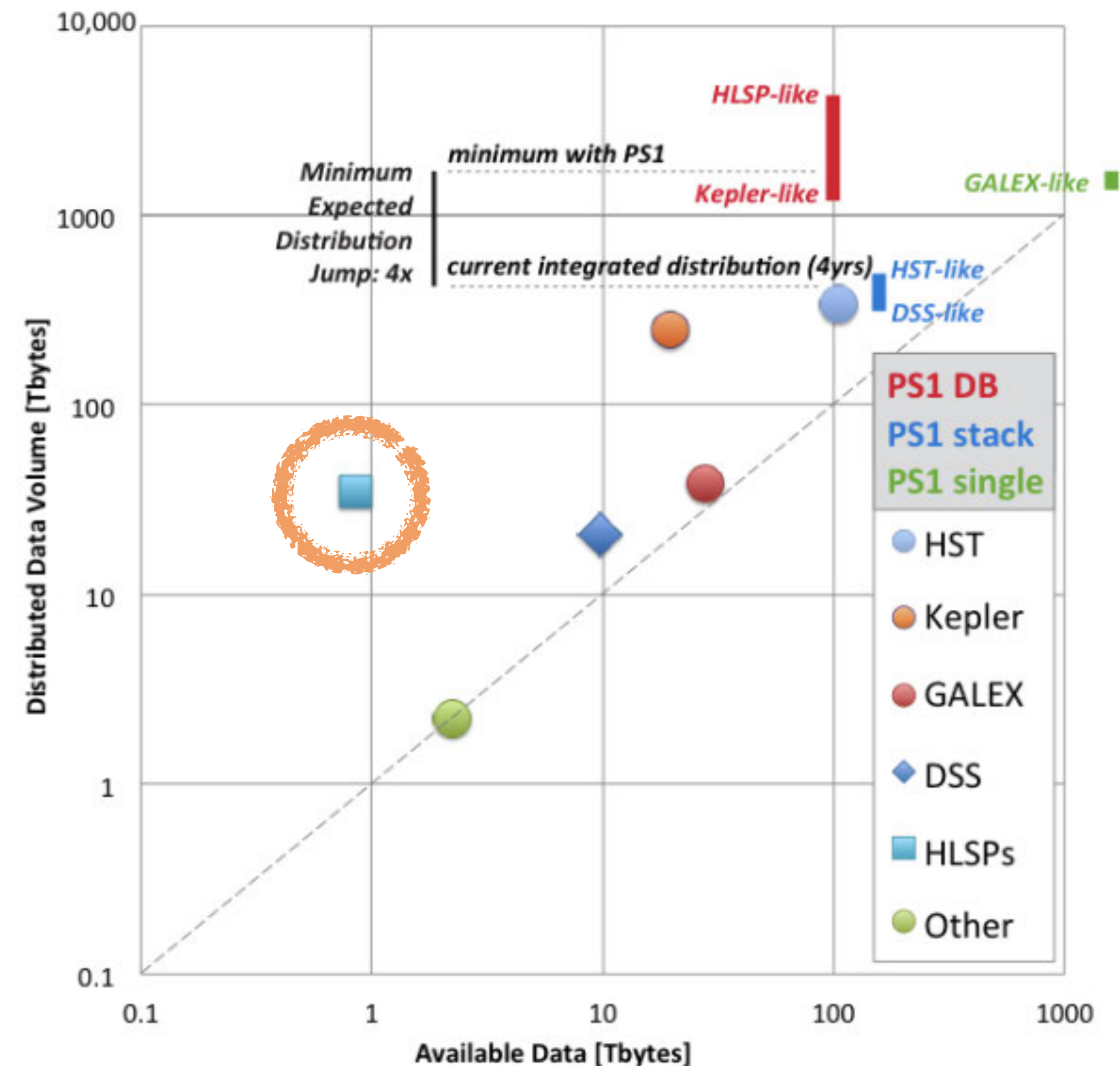
Iva Momcheva (DSMO)

Marc Rafelski, Jenn Kotler, Scott Fleming, Jeff Cahmblis,
Clara Brasseur and ASB Team



High Level Science Products (HLSPs)

- HLSPs are the most science-ready products we deliver
- High download rate
- Need to be tied to a paper but not in paper (not consistently available in NED, Simbad)
- HLSPs are also very heterogenous
- From the perspective of PIs, we primarily provide long-term hosting for datasets
- Website update notwithstanding, HLSPs have limited discoverability





GOODS-S & HUDF

Observations taken as part of the
GOODS and CANDELS surveys



GOODS-S & HUDF

Observations taken as part of the
GOODS and CANDELS surveys

GOODS-S & HUDF

~2000 orbits of HST observations

HST mosaics in >10 different bands

Matched ground-based mosaics in
 >30 different bands (U-IR)

Several different catalogs with
matched photometry, photometric
redshifts, stellar masses, star
formation rates, etc.

Grism spectra, grism redshifts,
emission line fluxes, etc.



Looking ahead: JWST



First Light & Reionization

Webb will be a powerful time machine with infrared vision that will peer back over 13.5 billion years to see the first stars and galaxies forming out of the darkness of the early universe.

[Read More](#) ►



Assembly of Galaxies

Webb's unprecedented infrared sensitivity will help astronomers to compare the faintest, earliest galaxies to today's grand spirals and ellipticals, helping us to understand how galaxies assemble over billions of years.

[Read More](#) ►



Birth of Stars & Protoplanetary Systems

Webb will be able to see right through and into massive clouds of dust that are opaque to visible-light observatories like Hubble, where stars and planetary systems are being born.

[Read More](#) ►



Planets & Origins of Life

Webb will tell us more about the atmospheres of extrasolar planets, and perhaps even find the building blocks of life elsewhere in the universe. In addition to other planetary systems, Webb will also study objects within our own Solar System.

[Read More](#) ►

EXOMAST

SEARCH

Search by planet, object of interest or TESS TCE

Metadata provided by

NExSci (WASP-12_b)

Star

Rs [R_⊙] 1.66 ^{+0.05/-0.05}

Ms [M_⊙] 1.43 ^{+0.11/-0.11}

[Fe/H] 0.21 ^{+0.04/-0.04}

log₁₀(g) [cgs] 4.16 ^{+0.01/-0.01}

Teff [K] 6360 ^{+140/-140}

Constellation Auriga

V mag 11.7

K mag 10.2

RA [h:m:s] 06:30:32.794

Dec [h:m:s] +29:40:20.25

Distance [pc] 432.48 ^{+6.09/-6.09}

Planet

R_p [R_J] 1.937 ^{+0.06/-0.06}

M_p [M_J] 1.465 ^{+0.08/-0.08}

T_{eq} [K] 2594.18 ^{+57/-57}

log₁₀(g) [cgs] 2.9858

System

Period [day] 1.09142 ^{+1e-7/-1e-7}

Transit Epoch [MJD] 56176.1683 ^{+7.8e-5/-7.8e-5}

Transit Duration [hour] 3.0408 ^{+0.0022/-0.012}

Impact Parameter null

ω [°] null

a [AU] 0.023 ^{+0.001/-0.001}

Inclination [°] null

Depth [%] 1.4379

Eccentricity 0.04 ^{+0/-0}

a/Rs 3.005

WASP-12b Sing2016 (Transmission)

DOWNLOAD DATA

VIEW ABSTRACT

Download icon

WASP-12b icon

Q Mission - Instrument	Q Waveband	Q Product	Q Filters	Q Exposure (sec)	Q Target	Q RA	Q Dec	Q Start Time	Q Project	Q Observation ID
HLA - WFC3/IR	INFRARED	image	F132N	8	WASP-12	06:30:32.081	+29:40:08.86	2011-04-12 00:45:06	HLA	hst_12230_01_wfc3_ir_f132n
HLA - WFC3/IR	INFRARED	image	G141	8	WASP-12	06:30:32.150	+29:40:08.89	2011-04-12 00:55:07	HLA	hst_12230_01_wfc3_ir_g141_01
HLA - WFC3/IR	INFRARED	image	G141	8	WASP-12	06:30:32.150	+29:40:08.89	2011-04-12 01:20:13	HLA	hst_12230_01_wfc3_ir_g141_02
HLA - WFC3/IR	INFRARED	image	G141	8	WASP-12	06:30:32.150	+29:40:08.89	2011-04-12 02:39:34	HLA	hst_12230_01_wfc3_ir_g141_03
HLA - WFC3/IR	INFRARED	image	G141	8	WASP-12	06:30:32.150	+29:40:08.89	2011-04-12 02:30:16	HLA	hst_12230_01_wfc3_ir_g141_04
HLA - WFC3/IR	INFRARED	image	G141	8	WASP-12	06:30:32.150	+29:40:08.89	2011-04-12 04:21:27	HLA	hst_12230_01_wfc3_ir_g141_05
HLA - WFC3/IR	INFRARED	image	G141	8	WASP-12	06:30:32.150	+29:40:08.89	2011-04-12 02:18:35	HLA	hst_12230_01_wfc3_ir_g141_06

Q Kepler-11 b

DATA COVERAGE

KEPLER LIGHT CURVE

RELATED LINKS

JWST VISIBILITY

Metadata provided by **NExSci** (Kepler-11_b) ▼

Star

Rs [R_⊙] 1.06 ^{+0.02}/_{-0.02} V mag 14.2

V mag 14.2

Ms [M_⊙] 0.96 $^{+0.03}_{-0.03}$ **K mag 12.2**

K mag 12.2

[Fe/H] -0.041 $\pm 0.04/-0.04$ **RA [h:m:s]** 19:48:27.630

RA [h:m:s] 19:48:27.630

log₁₀(g) [cgs] 4.37 ^{+0.01}/_{-0.02} **Dec [h:m:s]** +41:54:32.90

Dec [h:m:s] +41:54:32.90

Teff [K] 5663 $^{+55}_{-66}$ Distance [pc] 658.59 $^{+6.57}_{-6.57}$ Distance [pc]
658.59_{+6.57/-6.57}

Constellation Cygnus

Planet

R_p [R _J]	0.161 ^{+0/-0}	T_{eq} [K]	931.99
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T_{eq} [K] 931.99

$M_p [M_J]$ 0.006 $^{+0.0}_{-0}$ $\log_{10}(g)$ [cgs] 2.7587

log₁₀(g) [cgs] 2.7587

System

Period [day] 10.3039 $+6e-4/-1e-3$ **a [AU]** 0.091 $+0.001/-0.001$

a [AU] 0.091 $+0.001/-0.001$

Transit Epoch [MJD]	Inclination [°] null
55127.2222	

Inclination [°] null

55187.3839 $+2.8e-4/-2.8e-4$ Inclination [°] null
Transit Duration [min] null

Inclination [°] hull

Transit Duration [hour] 4.2139 ± 0.0002 ± 0.0002 Depth [%] 0.0244

Depth [%] 0.0244

4.2139 +0.039/-0.039

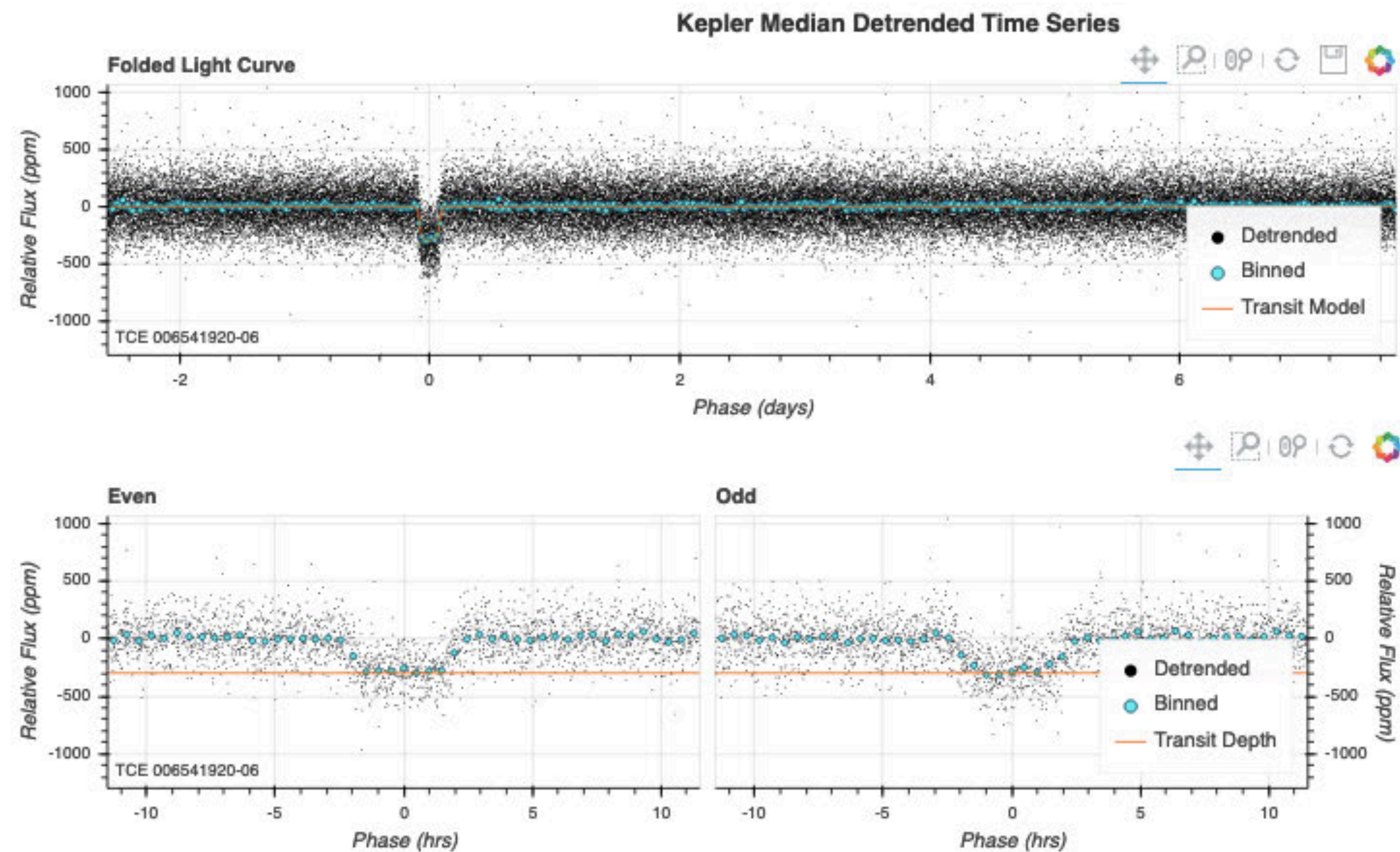
Depth [%] 0.0244

Impact Parameter null **Eccentricity** 0.05 $+0.07/-0.04$

Eccentricity 0.05 $+0.07/-0.04$

 ω [°] null a/R_s 18.46

a/Bs 18.46



Q Mission - Instrument	Q Waveband	Q Product	Q Filters	Q Exposure (sec)	Q Target	Q RA	Q Dec	Q Start Time	Q Project	Q Observation ID
GALEX - GALEX	UV	image	NUV	116	MISKEP_08618_0015	19:46:19.344	+41:47:13.24	2011-07-01 03:24:27	MIS	3729053196933398528
GALEX - GALEX	UV	image	NUV	171	AIS_14_1_15	19:46:40.111	+41:46:17.17	2011-06-11 07:10:14	AIS	6371408352802504704
HLA - WFC3/IR	INFRARED	image	F132N	15	KEPLER-11	19:48:27.510	+41:54:18.19	2013-11-18 04:35:09	HLA	hst_12955_01_wfc3_ir_f132n
HLA - WFC3/IR	INFRARED	image	G141	45	KEPLER-11	19:48:27.575	+41:54:18.73	2013-11-18 05:03:18	HLA	hst_12955_01_wfc3_ir_g141_01
HLA - WFC3/IR	INFRARED	image	G141	45	KEPLER-11	19:48:27.575	+41:54:18.73	2013-11-18 05:16:56	HLA	hst_12955_01_wfc3_ir_g141_02

The background of the slide is a deep space image featuring a dense field of stars and several large, complex galaxy structures. The galaxies show intricate patterns of dust and gas, with some appearing as bright, irregular clouds and others as more defined spiral or elliptical shapes. The stars are numerous, appearing as small, bright points of light against the dark cosmic backdrop.

NO STARS?
Extragalactic

“High-z MAST”

The background of the image is a deep space scene featuring a dense field of stars of various colors (blue, white, yellow) and intricate nebulae in shades of blue, purple, and brown. The text 'zMAST' is centered horizontally and partially overlaid by a thin orange line.

zMAST



Guiding Principle and Goals

Mission statement:

“To enhance access, increase discoverability, and enable visualization of datasets related to galaxy evolution from the MAST missions and aid in HST and JWST observation planning.”

Goals:

1. Enable exploration through catalog faceting
2. Enable image access for individual sources
3. Aid in JWST observation planning and data discovery
4. Show interesting/relevant visualizations of data



Trade study and staff interviews

“Trade study”:

- identified a list of existing interfaces
- tested interfaces, assessed usability, identifies common design patterns
- sketched out possible development goals

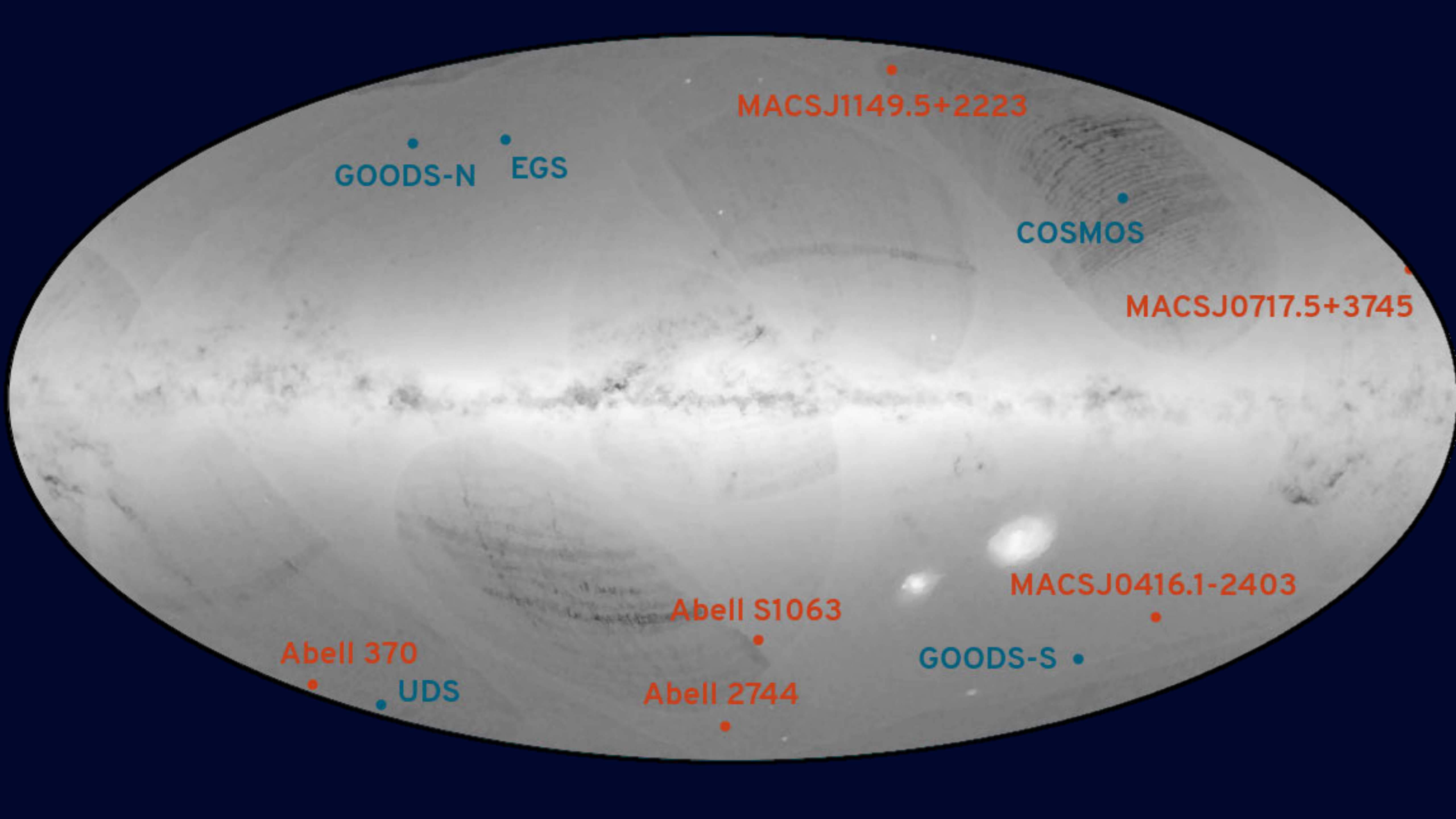
Staff interviews:

- Free-form interviews with ~10 ST staff members who work on galaxy evolution about workflows, datasets value, hopes and dreams, possible features:
 - yes to API and notebooks
 - HELL YES! to cutouts
 - catalog search and single object interface interesting
 - no to “browsable map”



Target Datasets

Images	Images & Catalogs	Images, Catalogs, Spectra
BORG	CANDELS	3D-HST
COSMOS	CLASH	CLEAR
HUDF09, HUDF12	FRONTIER	GLASS
HIPPIES	GOODS	GRAPES
HLF	HDF, HDF-South	GRIZLI
UDF, UDF05 —>	HDFV	PEARS
UDFUV	RELICS	WISP
XDF	UVUDF	
	ILLUSTRIS?	



MACSJ1149.5+2223

GOODS-N

EGS

COSMOS

MACSJ0717.5+3745

MACSJ0416.1-2403

Abell S1063

Abell 370

UDS

Abell 2744

GOODS-S



Underlying Services

- Database
- API
- AstroCut ++ (API)
- (Link to other archives to consolidate data access)
- (Ties to the spectroscopic initiative)



What does this interface look like?



Barbara A.

MIKULSKI ARCHIVE OF SPACE TELESCOPES

A Part of



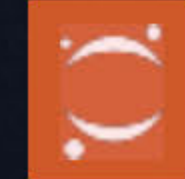
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High-Z ▼

target="3DHST-GOODS-S_43114"

SEARCH



target= 3DHST-GOODS-S_43114

radius=

ra=

dec=

catalog= All | CANDELS | CLASH | FRONTIER | 3D-HST | COSMOS | WISPS | ...

observation=

spectrum

image

+ ADD CONDITION

photometric_redshift ▼

between ▼

2.0

3.0

- Remove

All Search Terms ▼

ID	RA	DEC	MAG_H160W	ZBEST_SIQR	ZSPECFLAG	MSTAR 10 ₉ M*	SFR (M./yr)
1153	3.583475	-30.583475	99.0	0.035	0	1.944	0.54210001230123987
1154	3.583475	-30.583475	25.6322	0.035	0	1.25	0.54210001230123987
1155	3.583475	-30.583475	-28.547	0.035	0	0.0	0.0
1156	3.583475	-30.583475	99.0	0.035	0	0.019462	0.54210001230123987
1157	3.583475	-30.583475	-30.89009	0.035	0	9.0873	0.54210001230123987
1158	3.583475	-30.583475	-29.89549	0.035	0	780.192	0.0
1159	3.583475	-30.583475	25.234	0.035	0	6.226	0.54210001230123987
1160	3.583475	-30.583475	24.358	0.035	0	0.019462	1.5456387212
1161	3.583475	-30.583475	24.358	0.035	0	9.0873	0.54210001230123987
1162	3.583475	-30.583475	25.358	0.035	0	6.226	8.543435456456547
1163	3.583475	-30.583475	27.358	0.035	0	93.000	2.0454210001230123987
1164	3.583475	-30.583475	29.358	0.035	0	1.000	0.54210001230123987
1165	3.583475	-30.583475	23.358	0.035	0	0.019462	1.5456387212
1166	3.583475	-30.583475	23.358	0.035	0	9.0873	0.0001230123987
1167	3.583475	-30.583475	23.358	0.035	0	85.024	0.54210001230123987
1168	3.583475	-30.583475	29.358	0.035	0	80.032	0.54210001230123987
1169	3.583475	-30.583475	29.358	0.035	0	0.019462	0.54210001230123987
1170	3.583475	-30.583475	25.234	0.035	0	9.0873	1.5456387212

ID field 43114. GOODS-S
RA 03h32m 14.9771s
DEC -27d42m 24.8936s
z_spec None
z_peak 1.9135
Imass 11.64

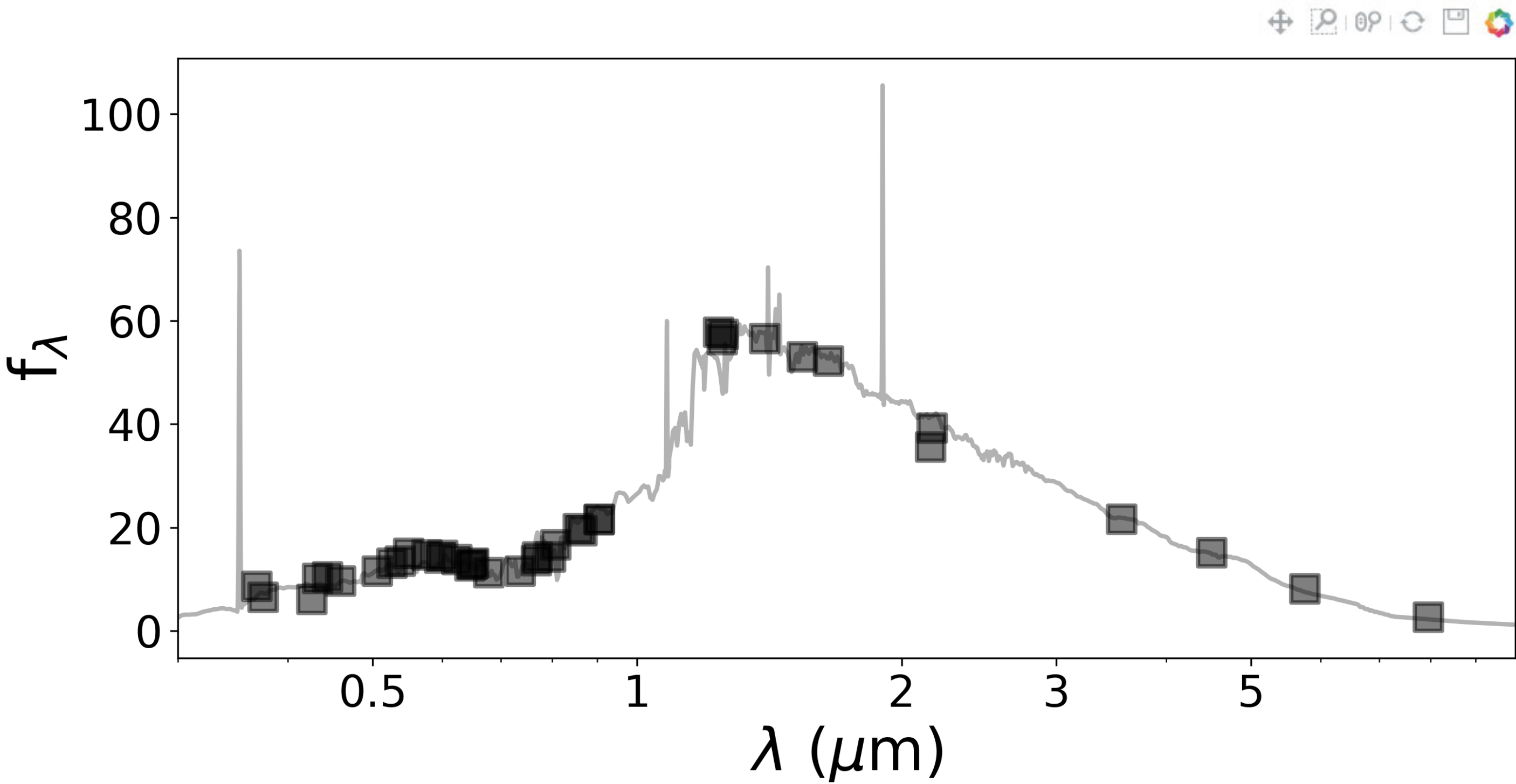


Photometry

faper_F140W (aper) 20.871	f_F125W 20.231 ±0.002
faper_F160W (aper) 20.7195	f_F140W 19.997 ±0.002
f_F606W 23.347 ±0.008	f_F160W 19.843 ±0.003
f_F814W 22.505 ±0.004	tot_cor 1.1557

Morphology

kron_radius 2.78 ^{+0.00} _{-0.01}	fwhm_image 8.7950
a_image 1.00	f140w_flag 6.79
b_image 3.50	star_flag 6.7400
flux_radius 11.92	



RA	DEC	Observation Type	Mission	Instrument	Project	Filters	Waveband	Target Name	Target Classification	Observation ID	Proposal ID
3:32:14.169	-27:42:21.10	science	HST	WFC3/IR	HST	F125W	Infared	WFC#-ERSII-IR04	Unidentified, Blank	ib6o04020	11359
3:32:14.169	-27:42:21.10	science	HST	WFC3/IR	HST	F16W	Infared	WFC#-ERSII-IR04	Unidentified, Blank	ib6o04030	11359
3:32:14.169	-27:42:21.10	science	HST	WFC3/IR	HST	F098M	Infared	WFC#-ERSII-IR04	Unidentified, Blank	ib6o04030	11359

ID field 43114. GOODS-S
RA 03h32m 14.9771s
DEC -27d42m 24.8936s
z_spec None
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Imass 11.64

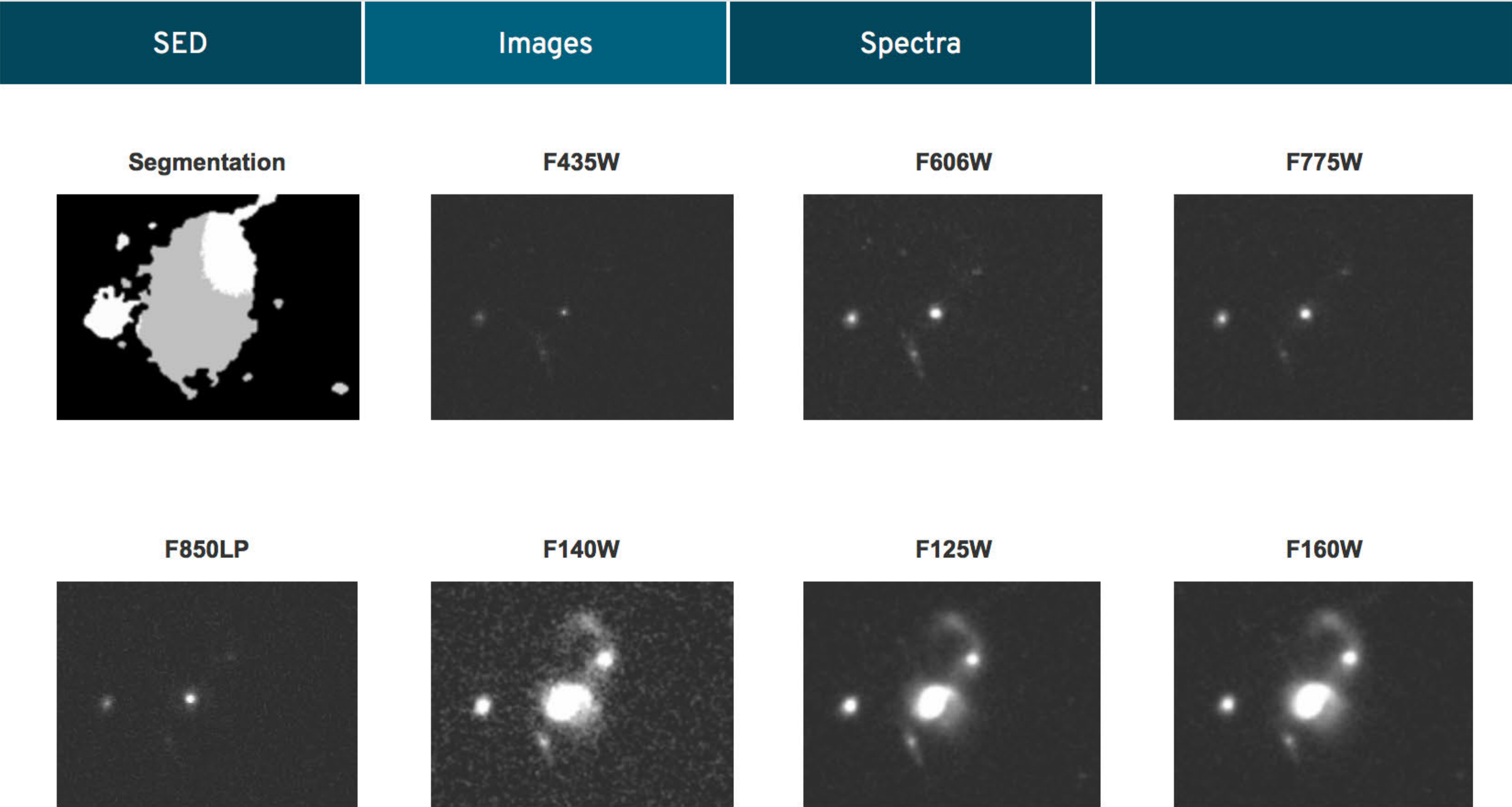


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3:32:14.169	-27:42:21.10	science	HST	WFC3/IR	HST	F098M	Infared	WFC#-ERSII-IR04	Unidentified, Blank	ib6o04030	11359

ID field

43114. GOODS-S

RA

03h32m 14.9771s

DEC

-27d42m 24.8936s

z_spec

None

z_peak

1.9135

Imass

11.64



Photometry

faper_F140W

(aper) 20.871

f_F125W

20.231 ±0.002

faper_F160W

(aper) 20.7195

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f_F606W

23.347 ±0.008

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tot_cor

1.1557

Morphology

kron_radius

2.78^{+0.00}_{-0.01}

fwhm_image

8.7950

a_image

1.00

f140w_flag

6.79

b_image

3.50

star_flag

6.7400

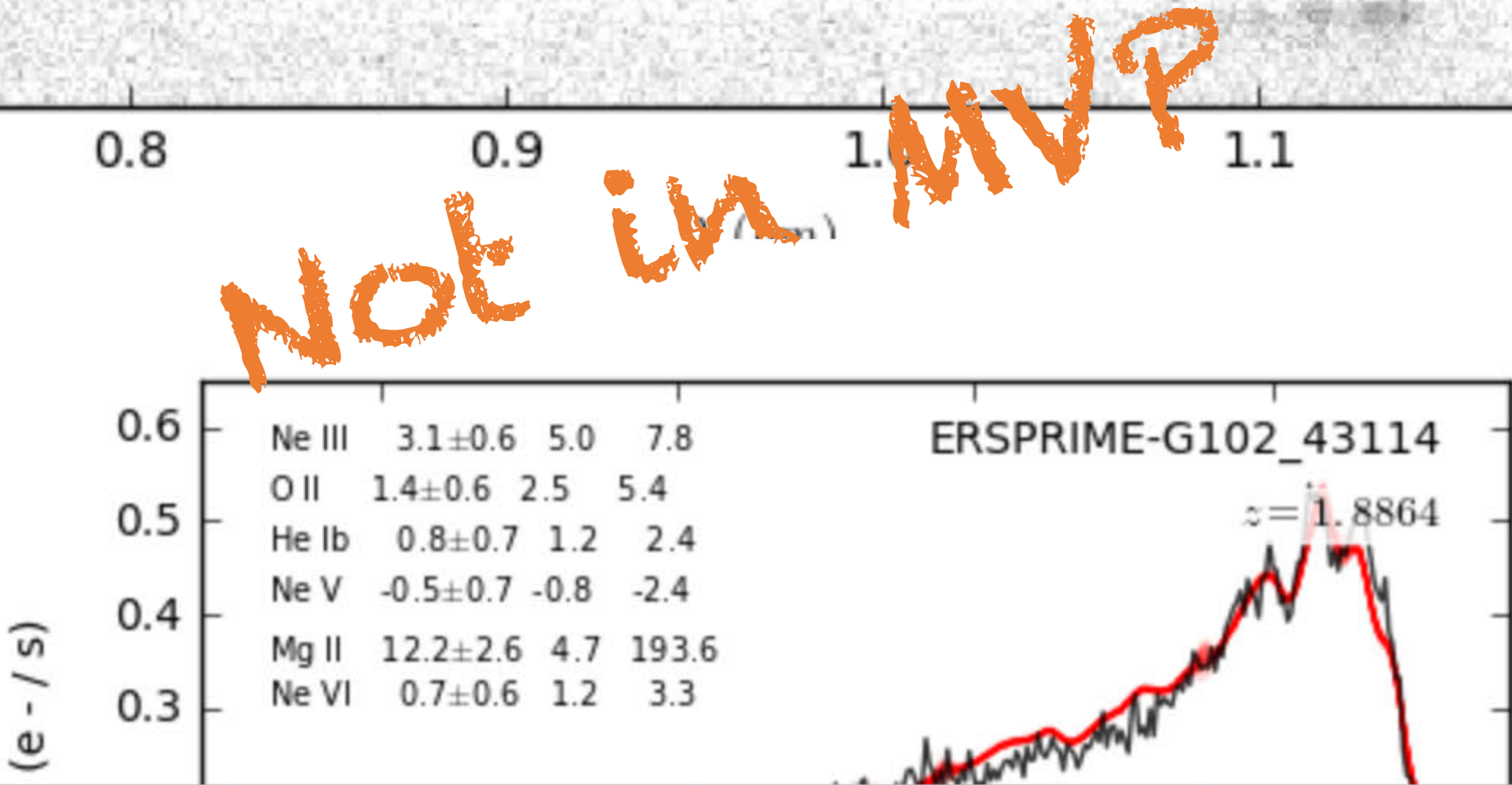
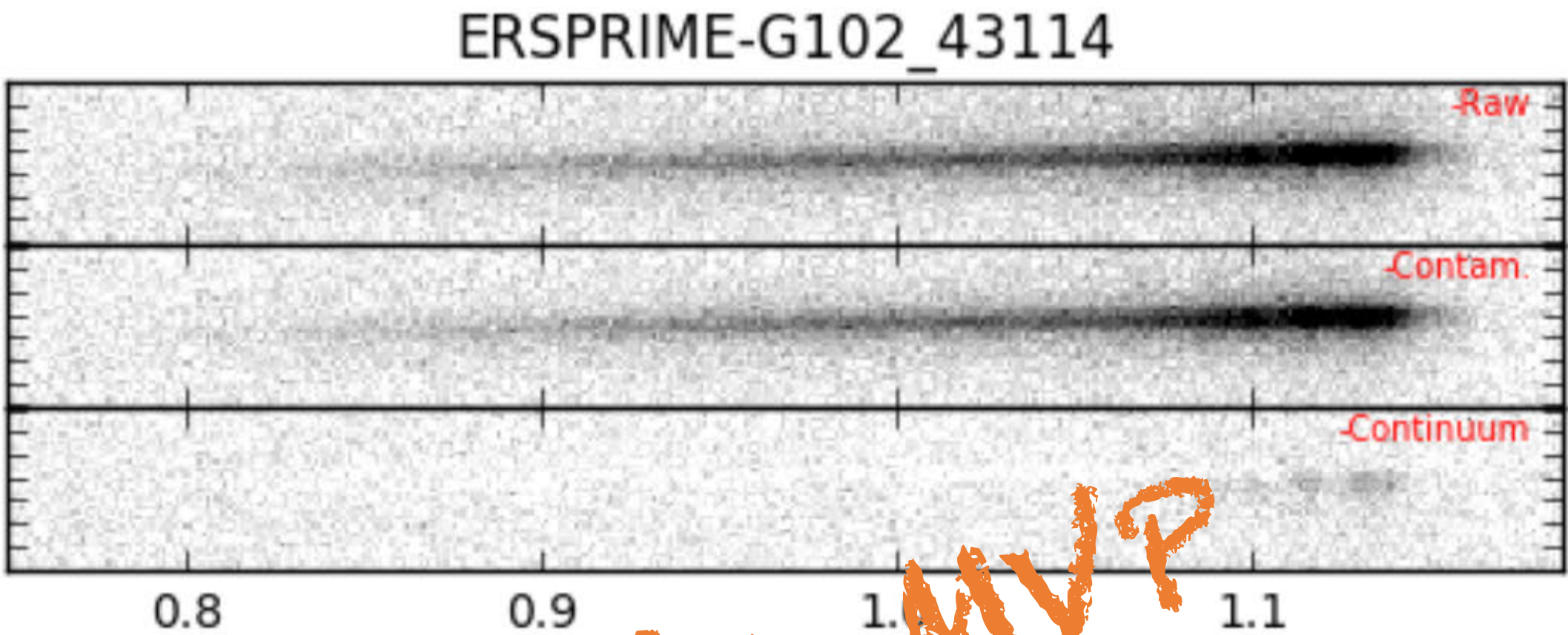
flux_radius

11.92

SED

Images

Spectra



RA	DEC	Observation Type	Mission	Instrument	Project	Filters	Waveband	Target Name	Target Classification	Observation ID	Proposal ID
3:32:14.169	-27:42:21.10	science	HST	WFC3/IR	HST	F125W	Infared	WFC#-ERSII-IR04	Unidentified, Blank	ib6o04020	11359
3:32:14.169	-27:42:21.10	science	HST	WFC3/IR	HST	F16W	Infared	WFC#-ERSII-IR04	Unidentified, Blank	ib6o04030	11359
3:32:14.169	-27:42:21.10	science	HST	WFC3/IR	HST	F098M	Infared	WFC#-ERSII-IR04	Unidentified, Blank	ib6o04030	11359



Current Status and Next Steps

- Major item of work in FY2020 Q1
 - Work on minimum viable product (MVP) proceeding successfully
 - Most search functionality and SED plots implemented
 - Image cutouts are the main outstanding item of work
 - UI test by science staff imminent
-
- On track to have MVP for January 2020 AAS Tentative to make it available for Cycle 1 planning (funding through launch delay)