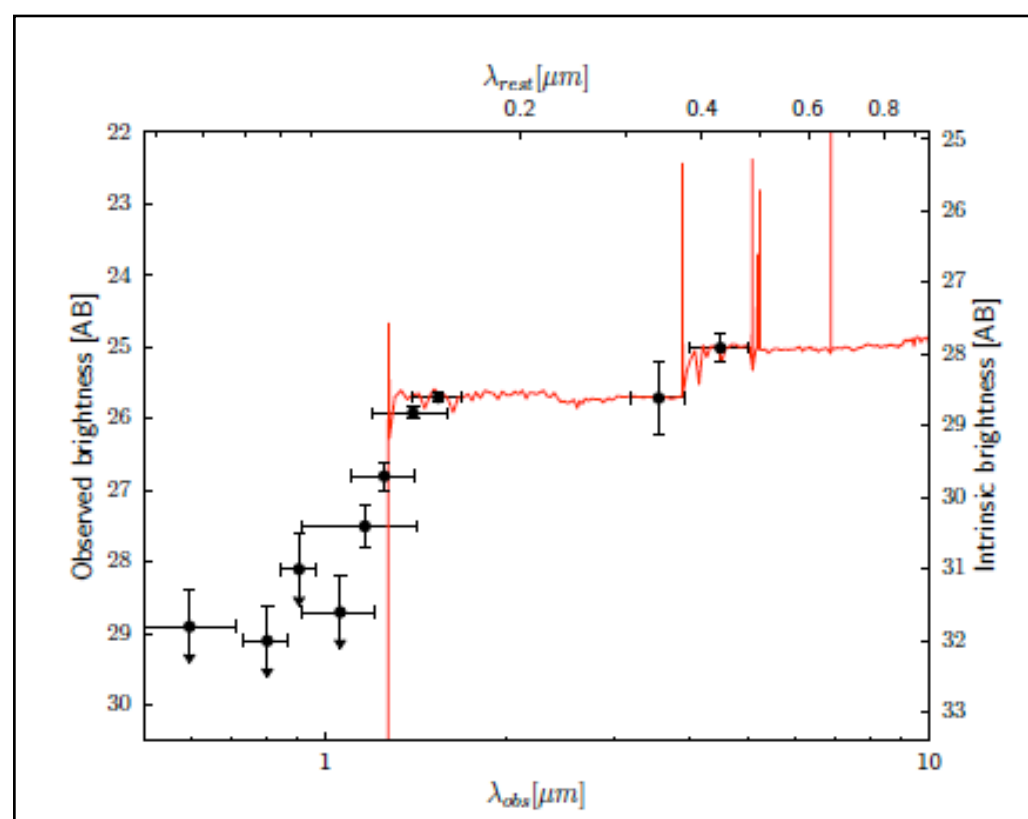


Reionization-Era Galaxies in Deep IRAC Images: Lessons from SURFS UP

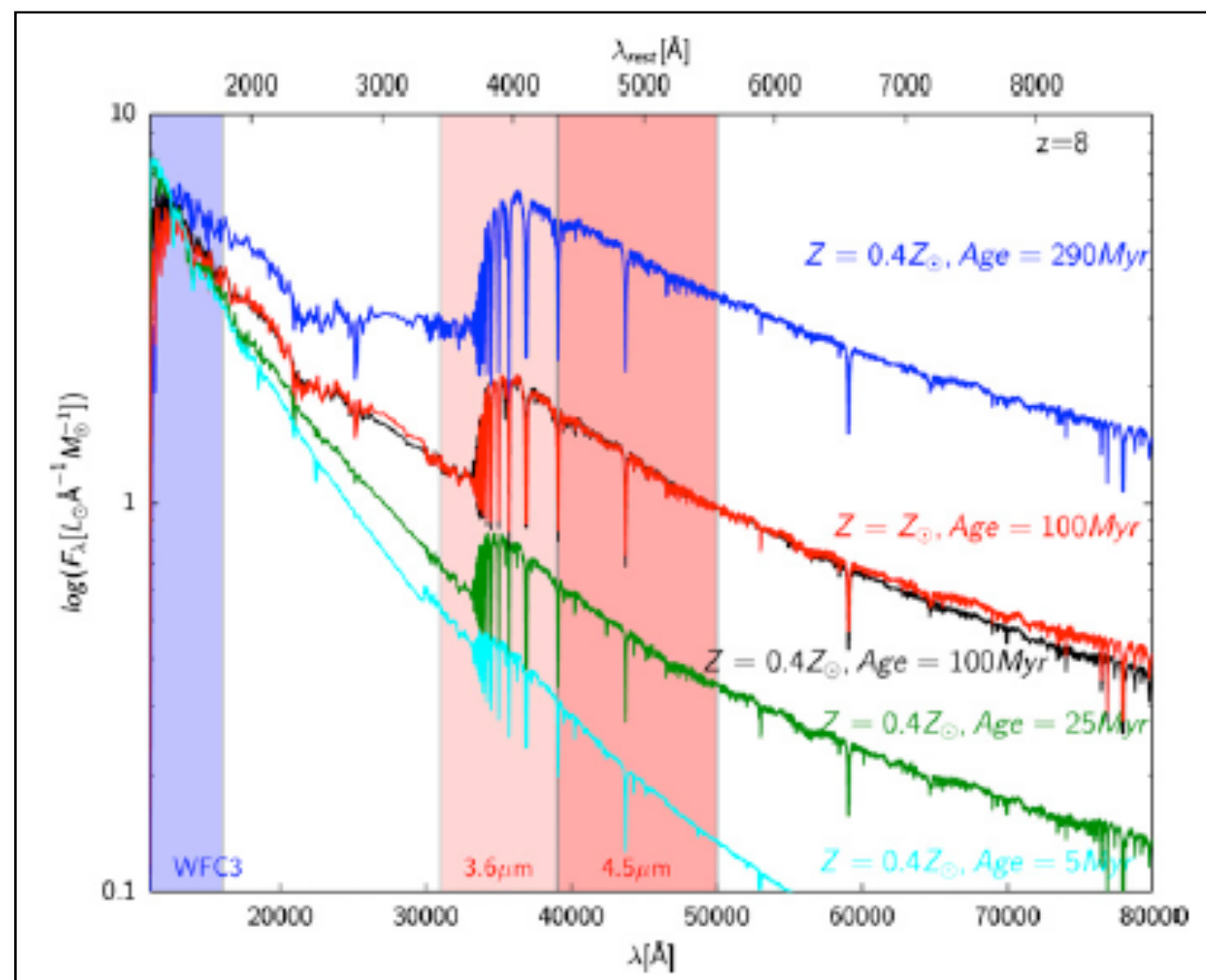
Kuang-Han Huang (UCD)
Maruša Bradač (UCD)
Russell Ryan (STScI)
SURFS UP Team
UCDAVIS

Why do we need IRAC?

MACS1149-JD

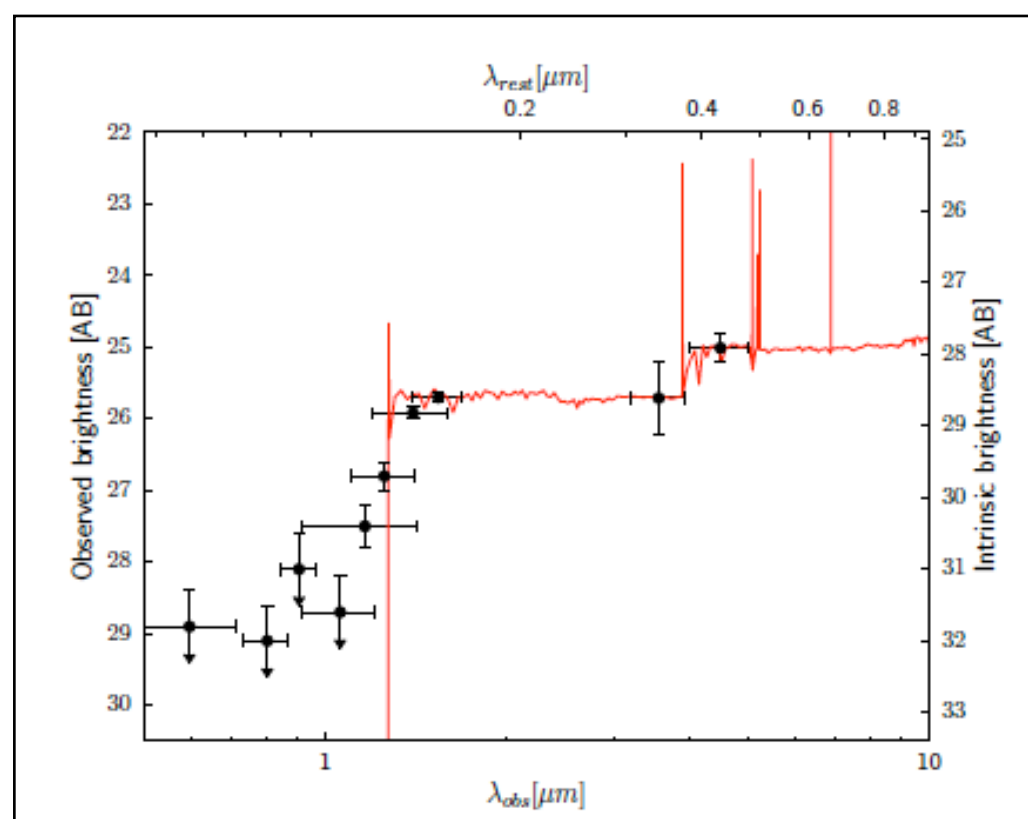


(Bradač et al. 2014)

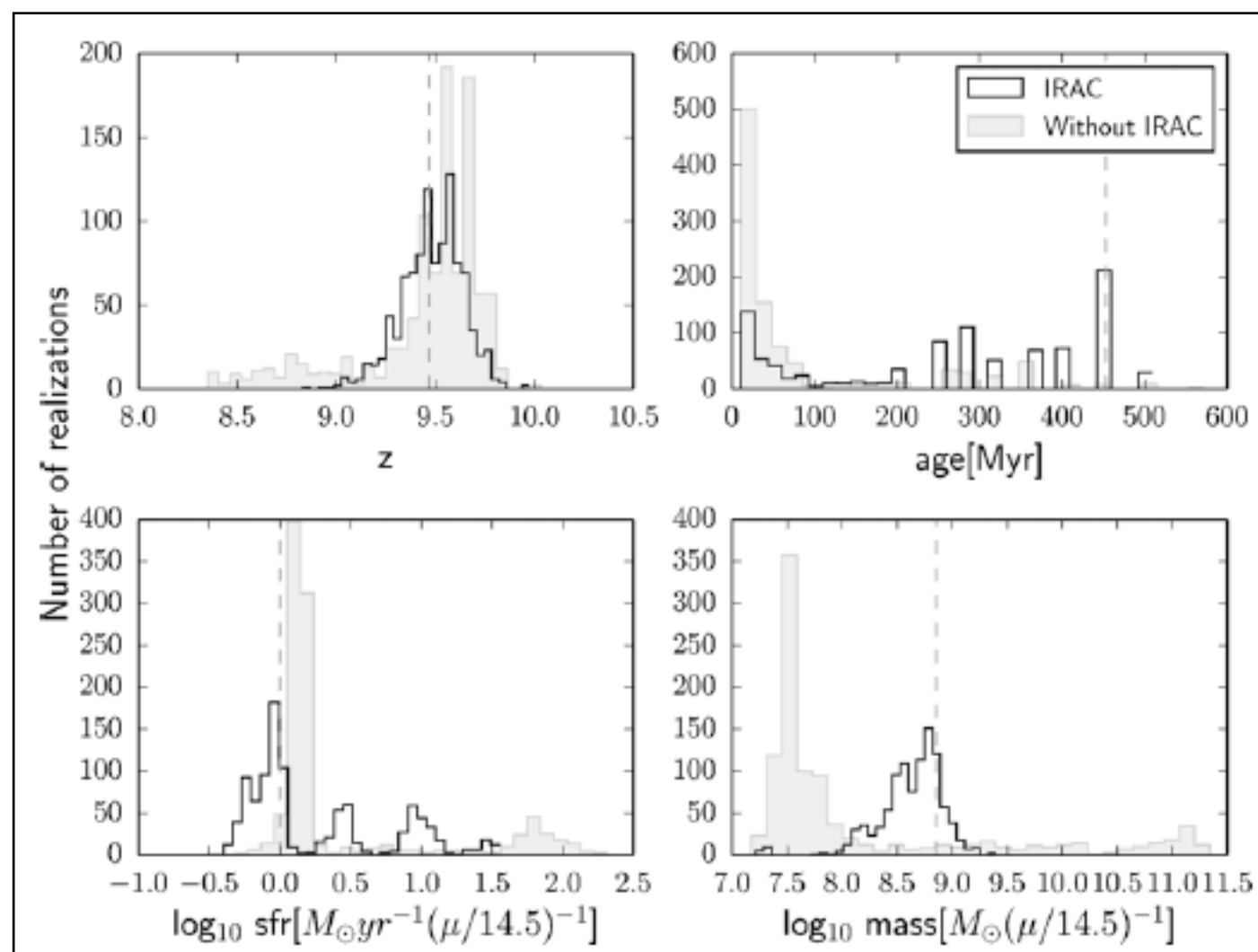


Why do we need IRAC?

MACS1149-JD



(Bradač et al. 2014)



SURFS UP (Spitzer Ultra-Faint Survey Program)

- 10 galaxy clusters; 550 hours total Spitzer time + archival data
- ~ 30 hours exposure time at 3.6 μm and 4.5 μm
- Bradač et al. 2014

Name	FF	CLASH	HST-GO	z
MACSJ0454.1-0300			YES	0.54
Bullet Cluster			YES	0.30
MACSJ0717.5+3745	YES	YES		0.55
MACSJ0744.8+3927		YES		0.70
MACSJ1149.5+2223	YES	YES		0.54
RXJ1347-1145		YES		0.59
MACSJ1423.8+2404		YES		0.54
MACSJ2129.4-0741		YES		0.59
MACSJ2214.9-1359			YES	0.50
RCS2-2327.4-0204			YES	0.70

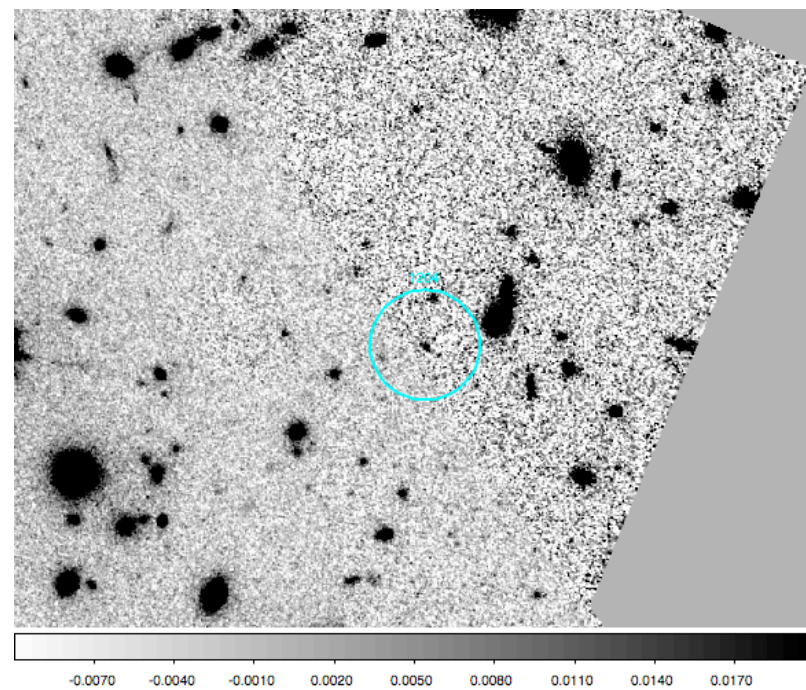
SURFS UP (Spitzer Ultra-Faint Survey Program)

- 10 galaxy clusters; 550 hours total Spitzer time + archival data
- ~ 30 hours exposure time at 3.6 μm and 4.5 μm
- Bradač et al. 2014

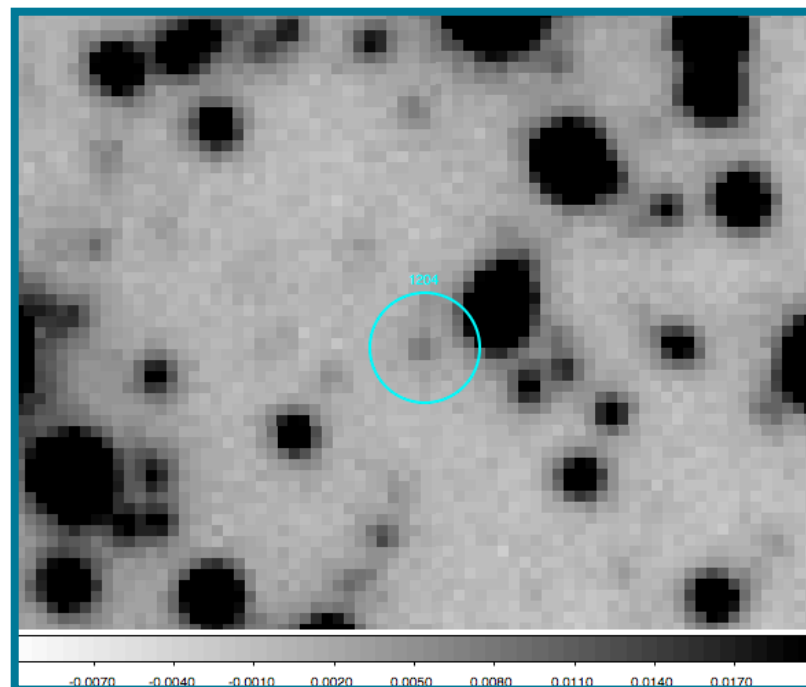
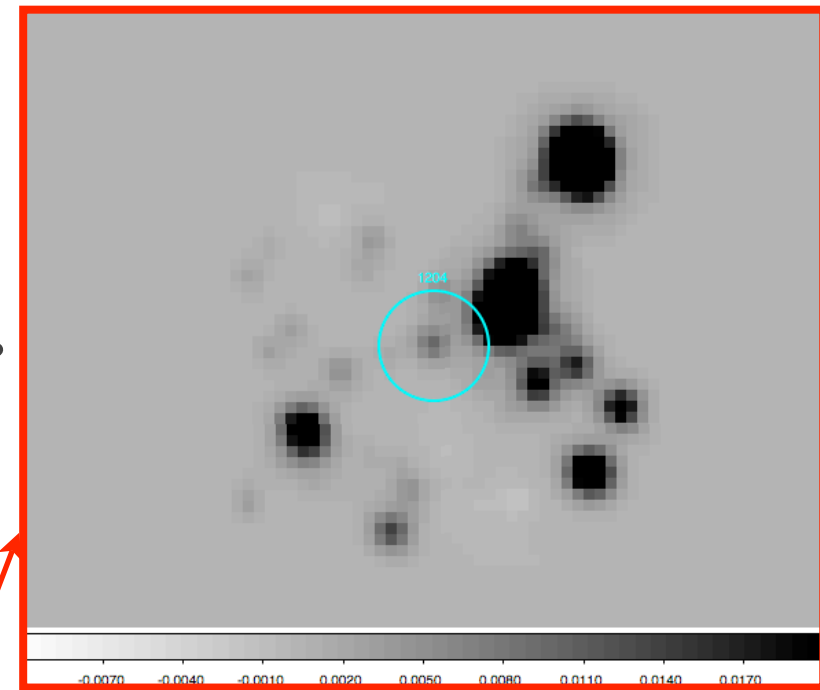
Look for IRAC detections!

Name	FF	CLASH	HST-GO	z
MACSJ0454.1-0300			YES	0.54
Bullet Cluster			YES	0.30
MACSJ0717.5+3745	YES	YES		0.55
MACSJ0744.8+3927		YES		0.70
MACSJ1149.5+2223	YES	YES		0.54
RXJ1347-1145		YES		0.59
MACSJ1423.8+2404		YES		0.54
MACSJ2129.4-0741		YES		0.59
MACSJ2214.9-1359			YES	0.50
RCS2-2327.4-0204			YES	0.70

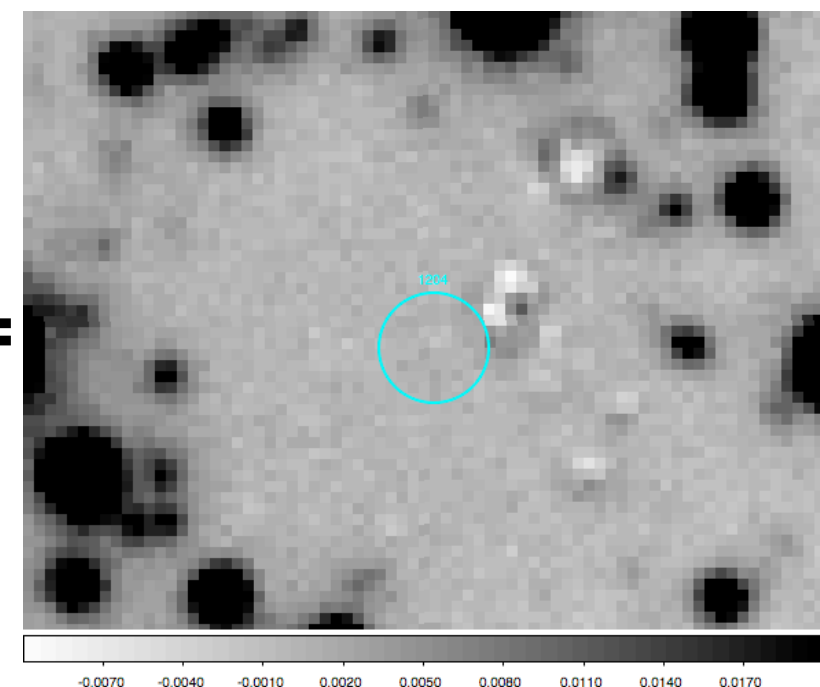
IRAC Photometry — TPHOT (TFIT)



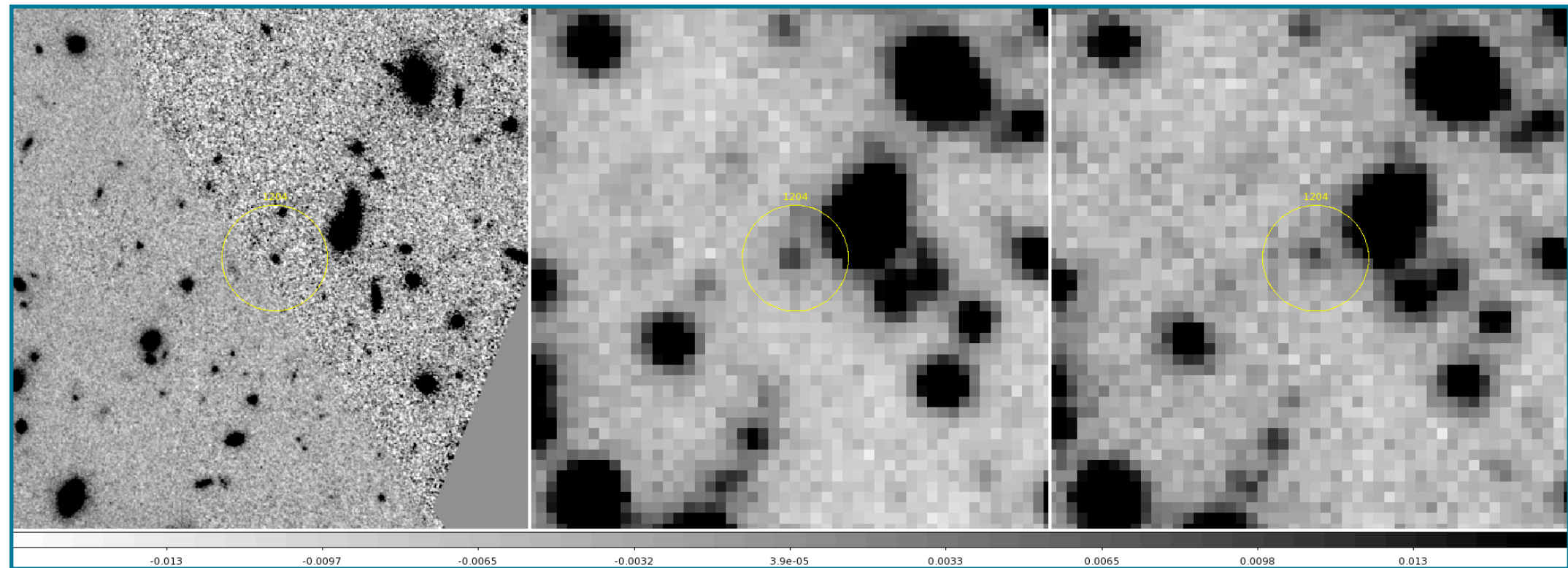
degrade
PSF



input - model =



MACS1149-1204 ($z_{\text{PHOT}}=6.0$; $\mu=2.2$)

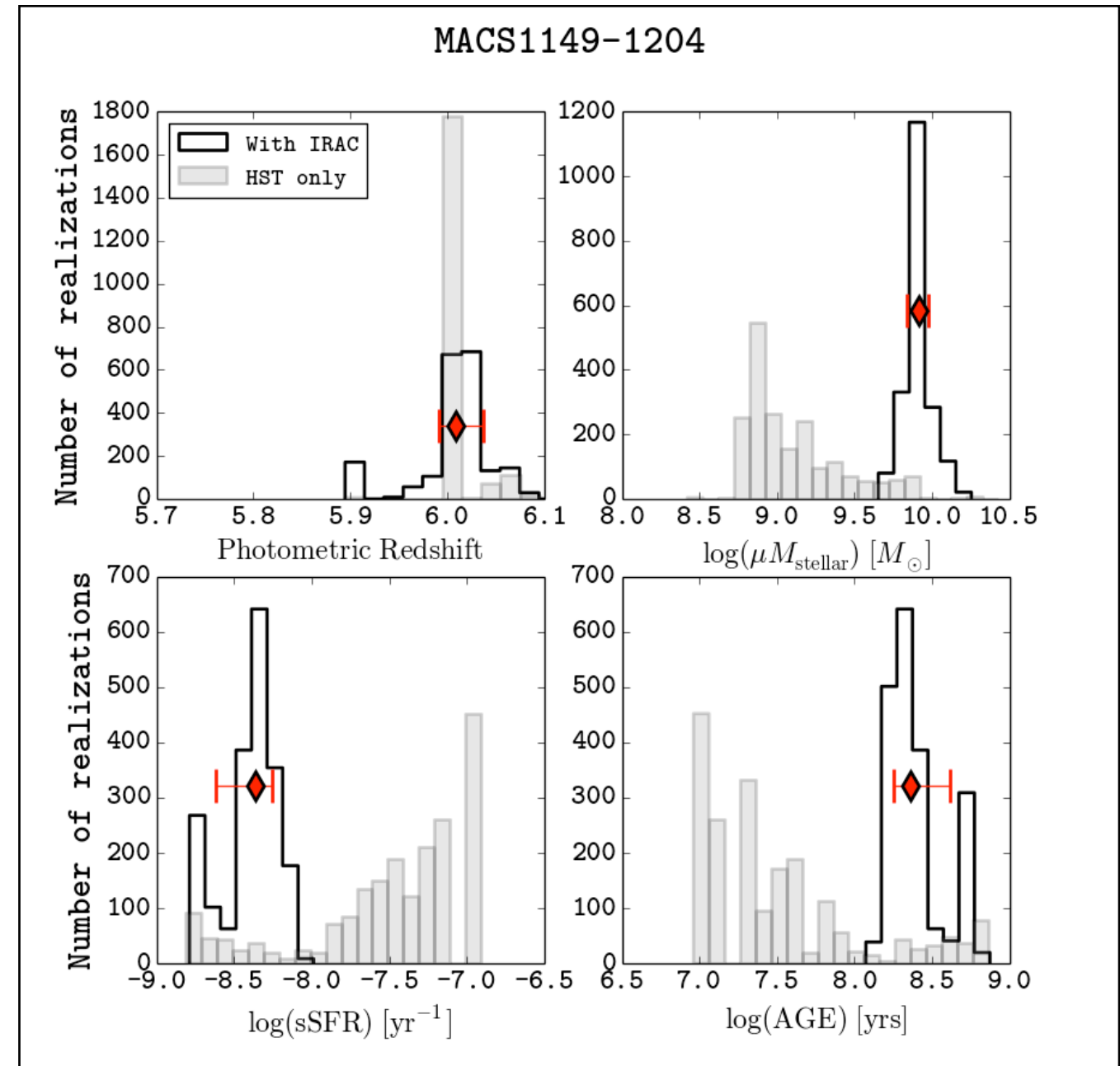
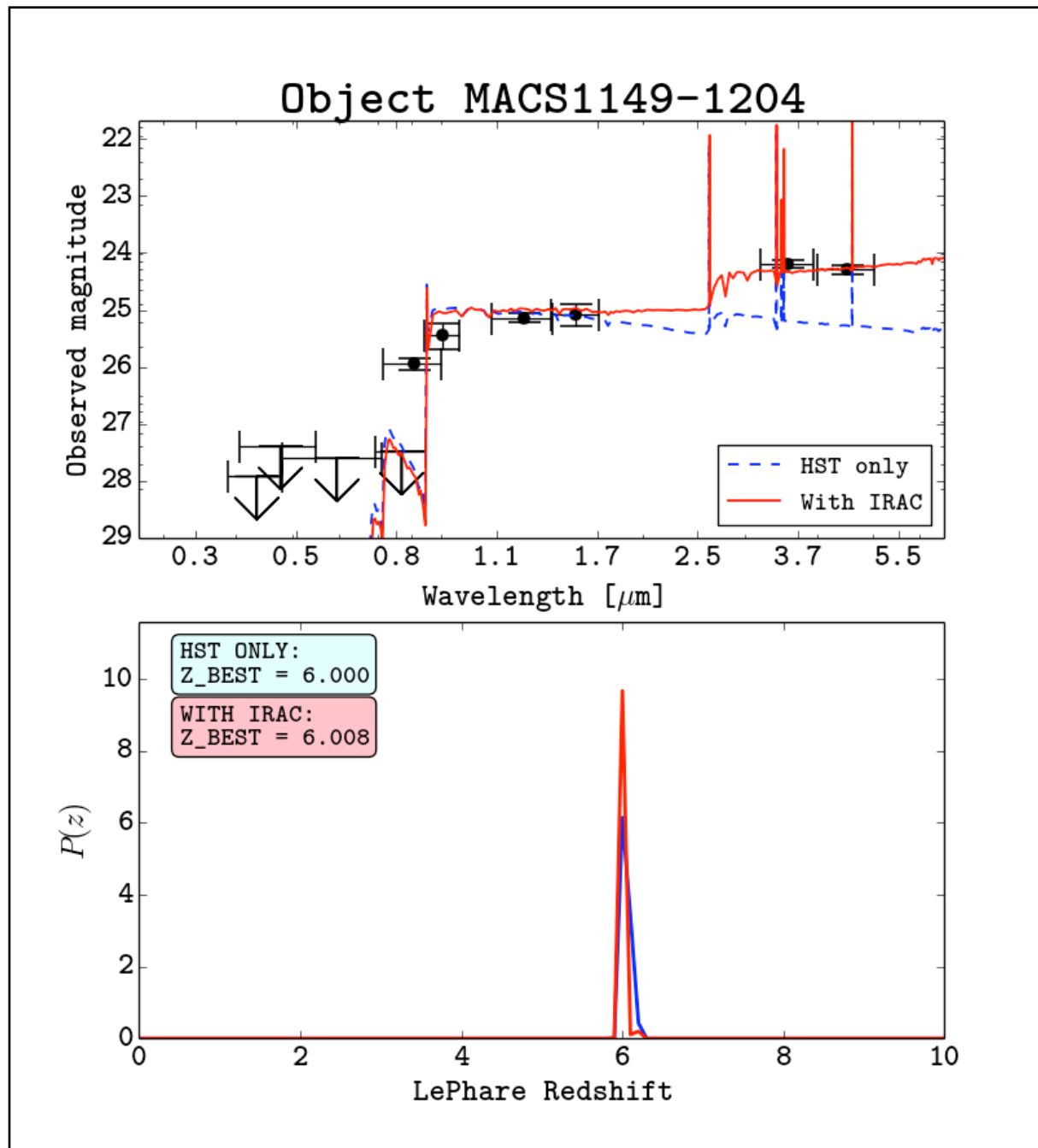


$$H_{160}=25.07\pm0.14$$

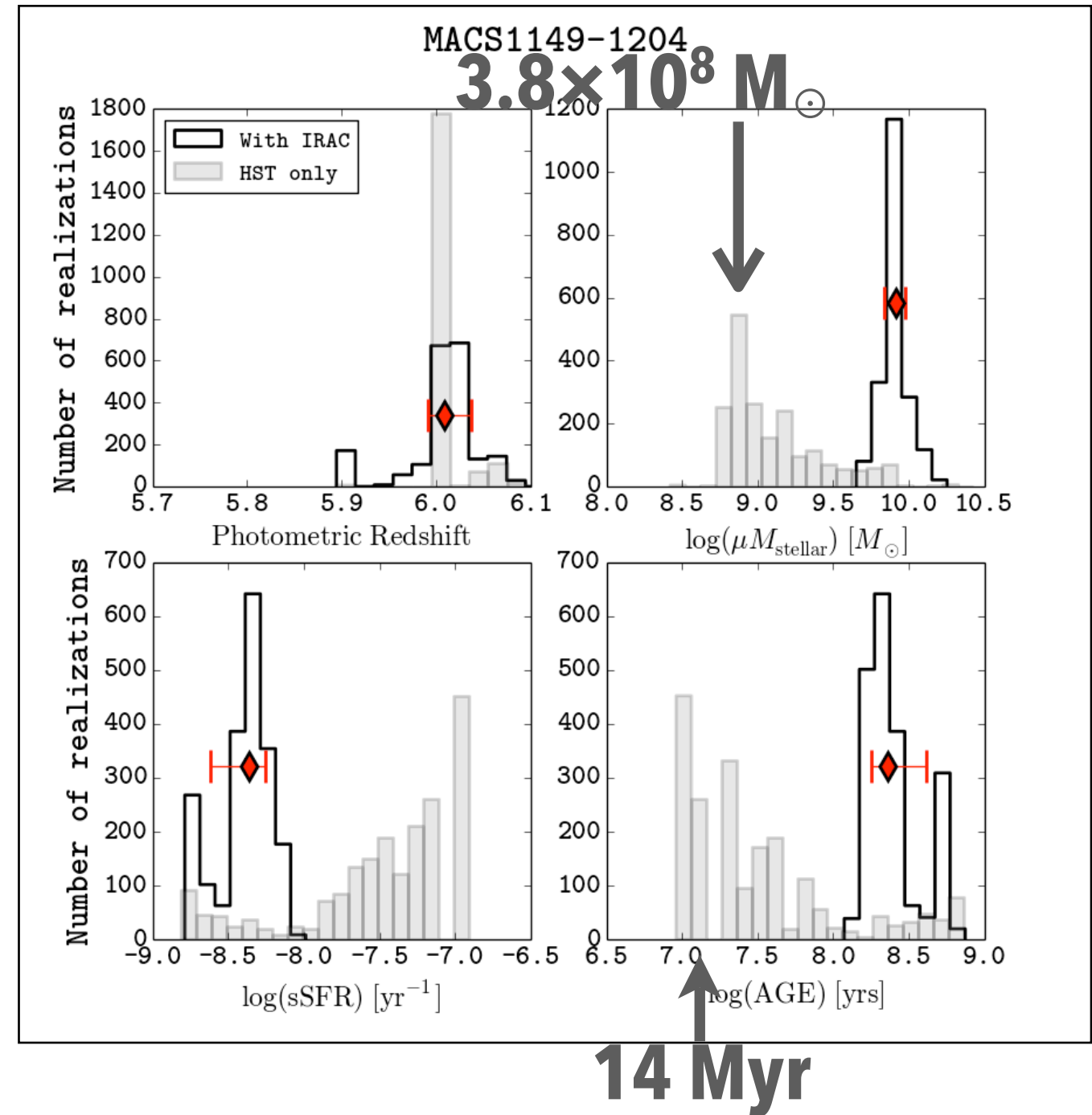
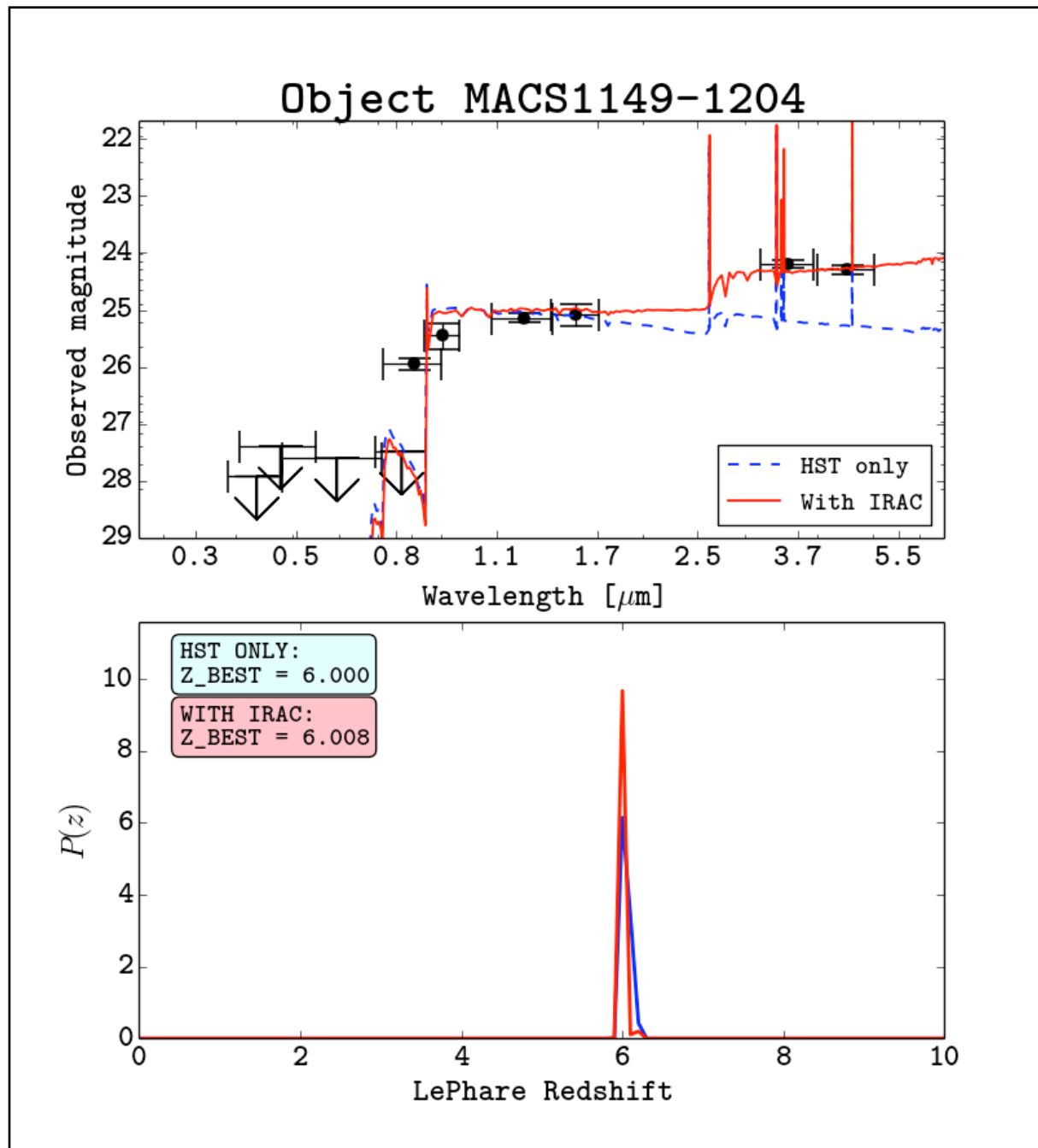
$$[3.6]=24.18\pm0.07$$

$$[4.5]=24.28\pm0.07$$

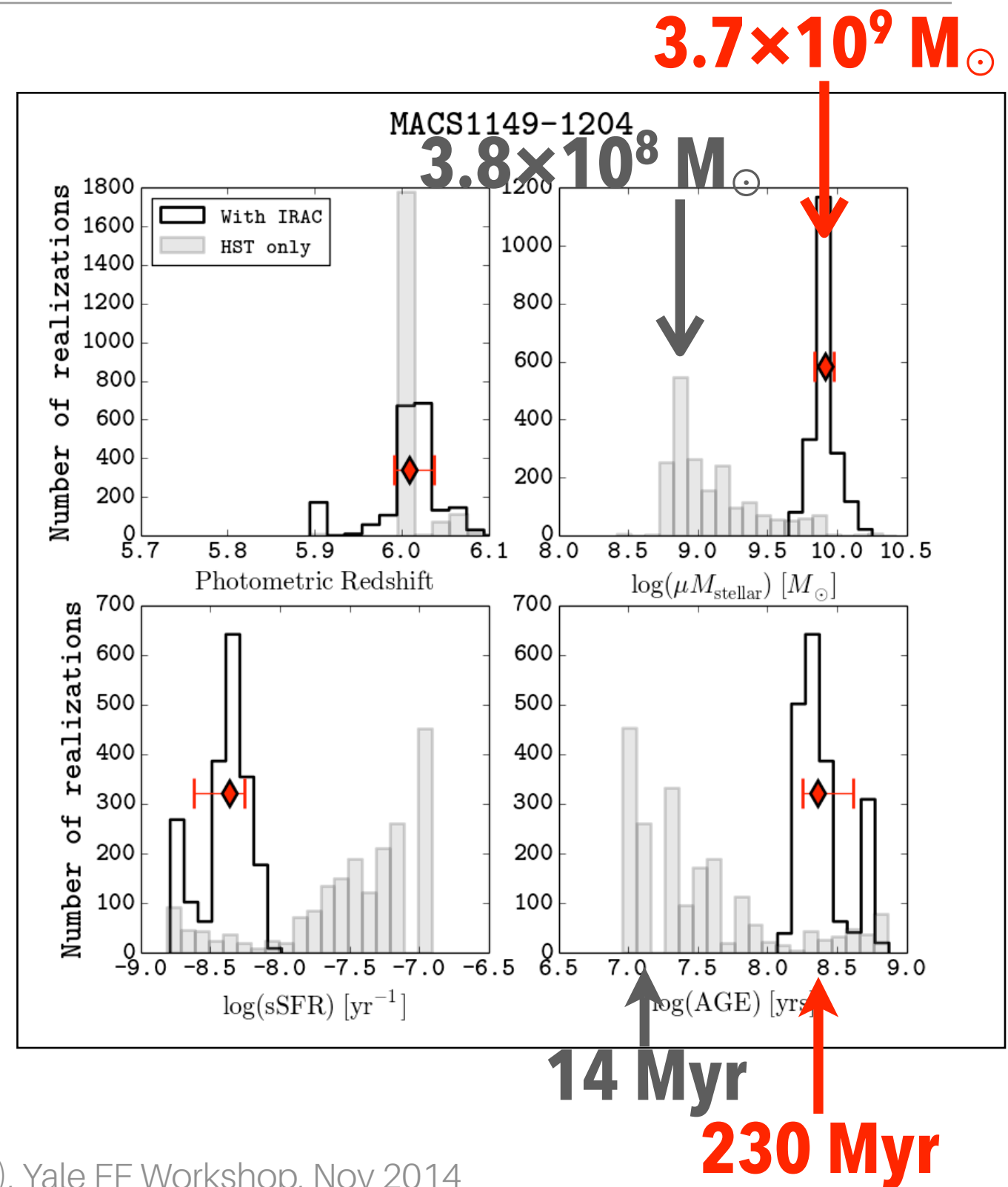
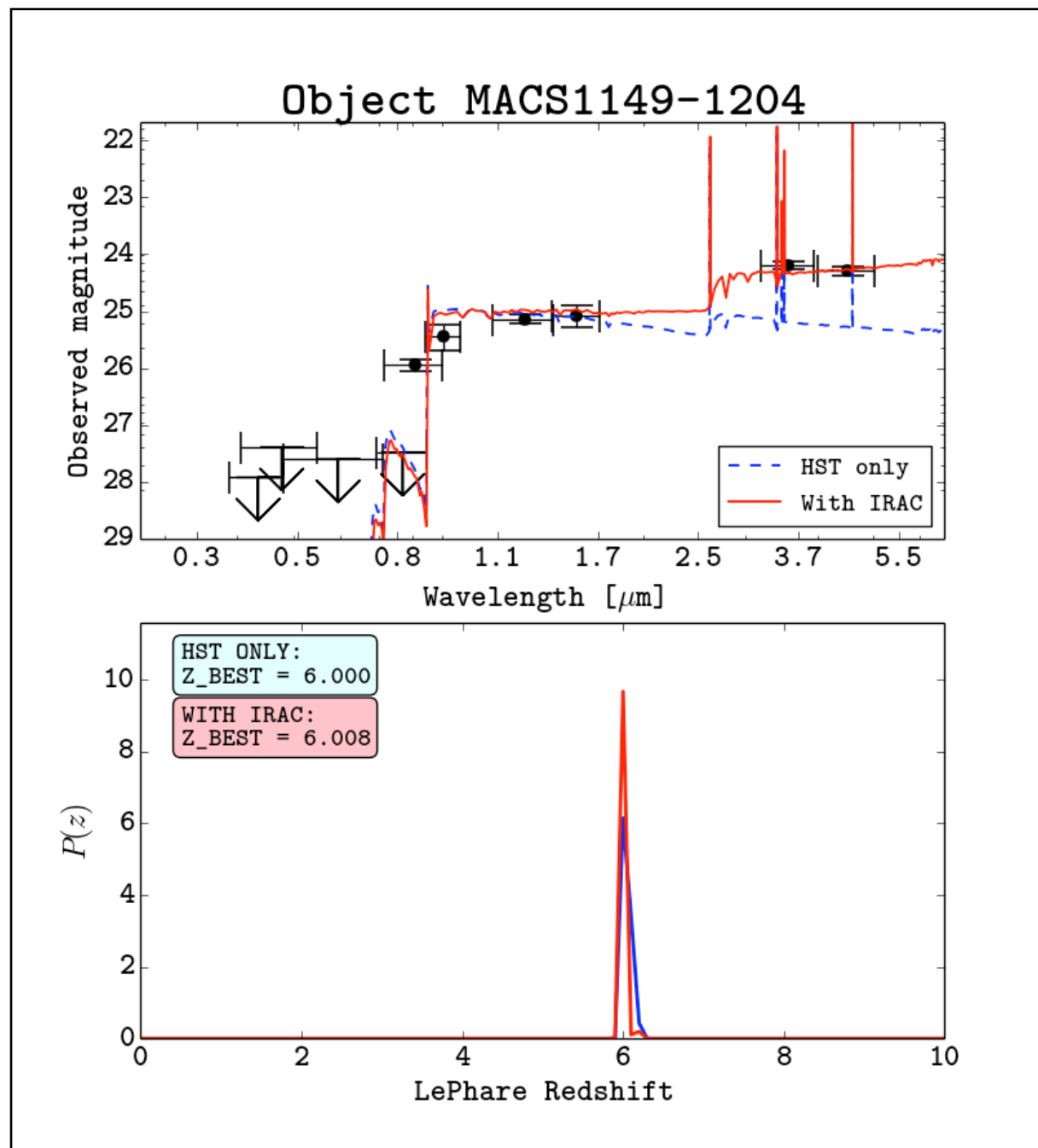
MACS1149-1204 ($z_{\text{PHOT}}=6.0$; $\mu=2.2$)



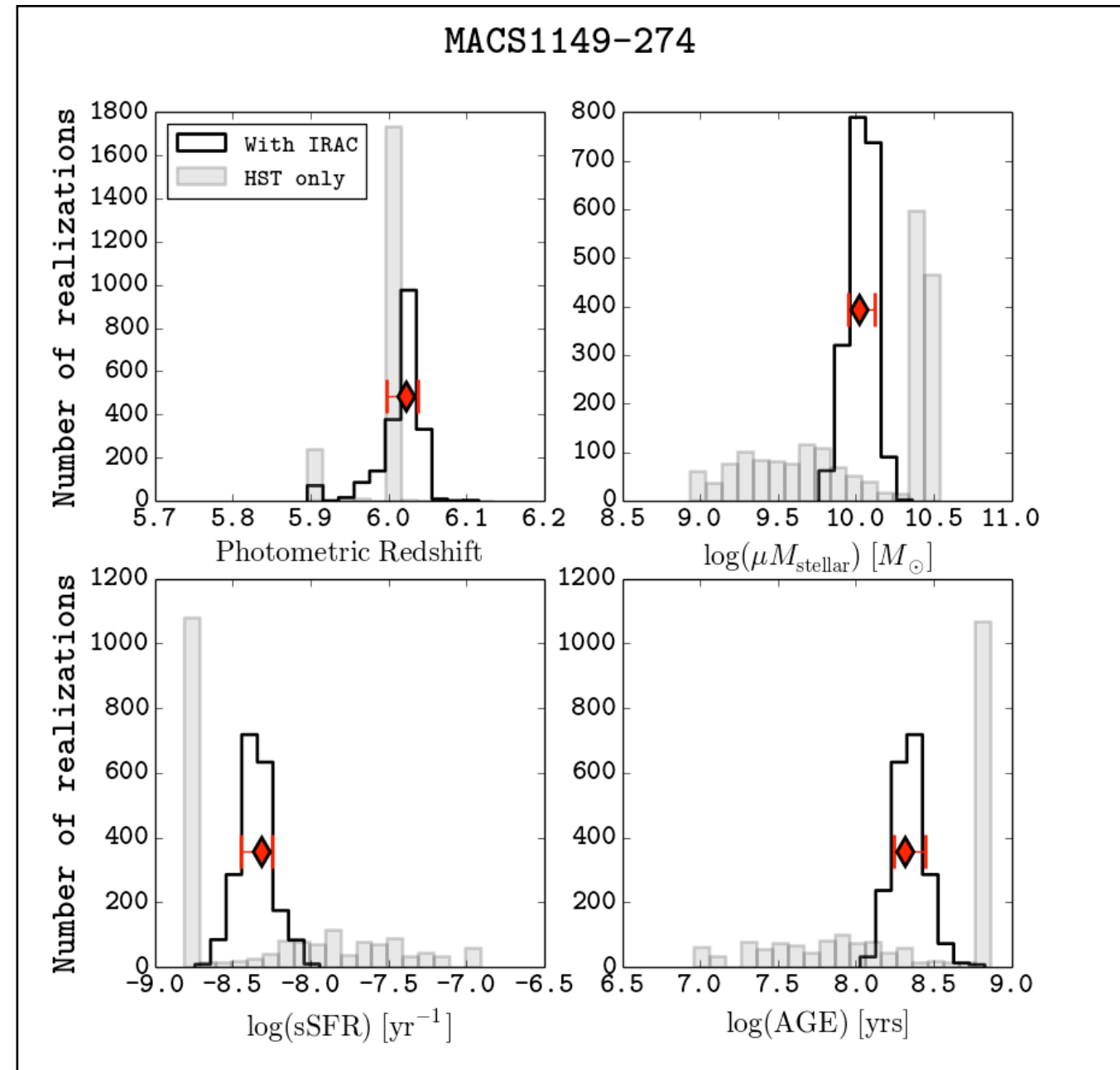
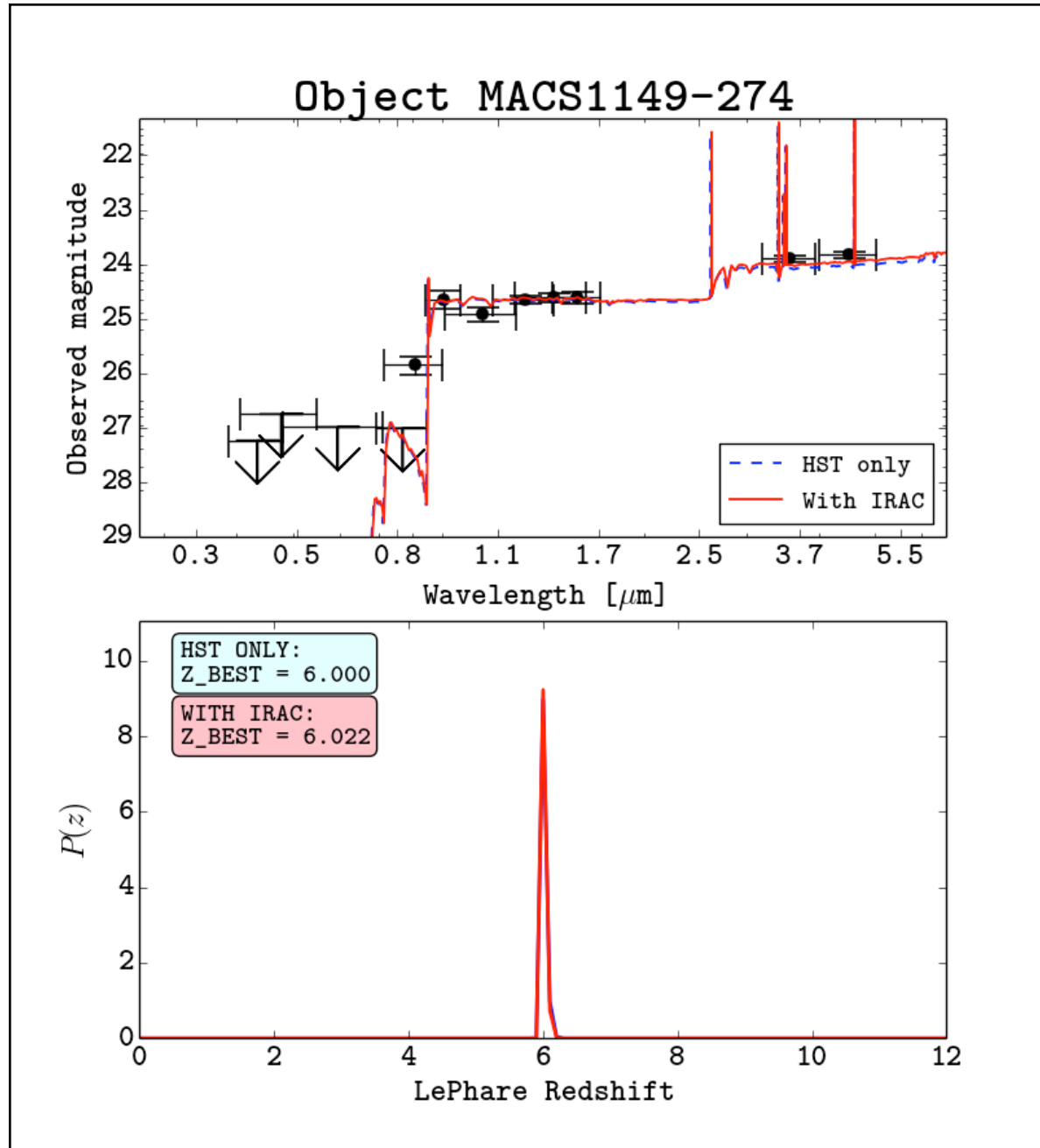
MACS1149-1204 ($z_{\text{PHOT}}=6.0$; $\mu=2.2$)



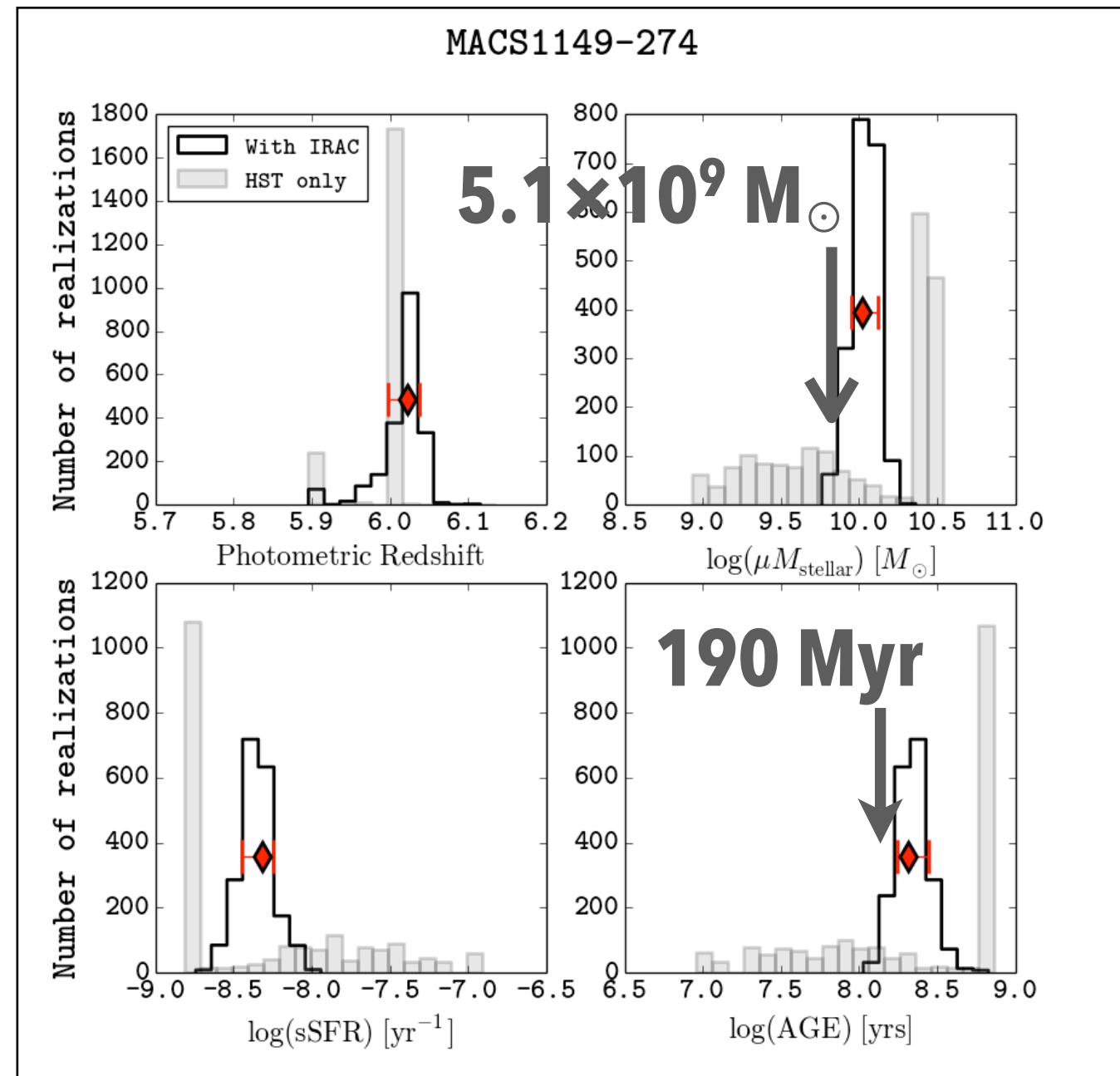
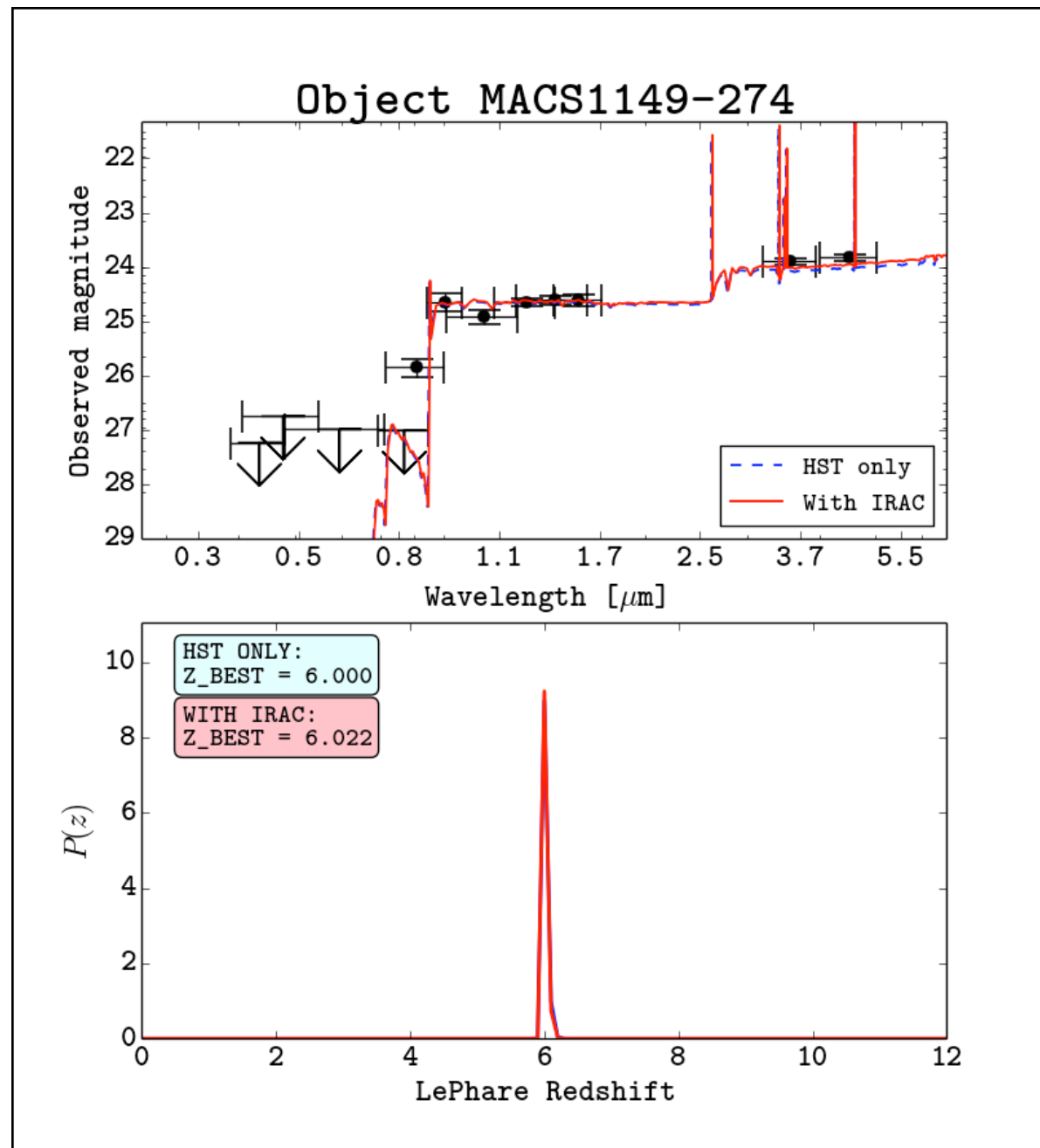
MACS1149-1204 ($z_{\text{PHOT}}=6.0$; $\mu=2.2$)



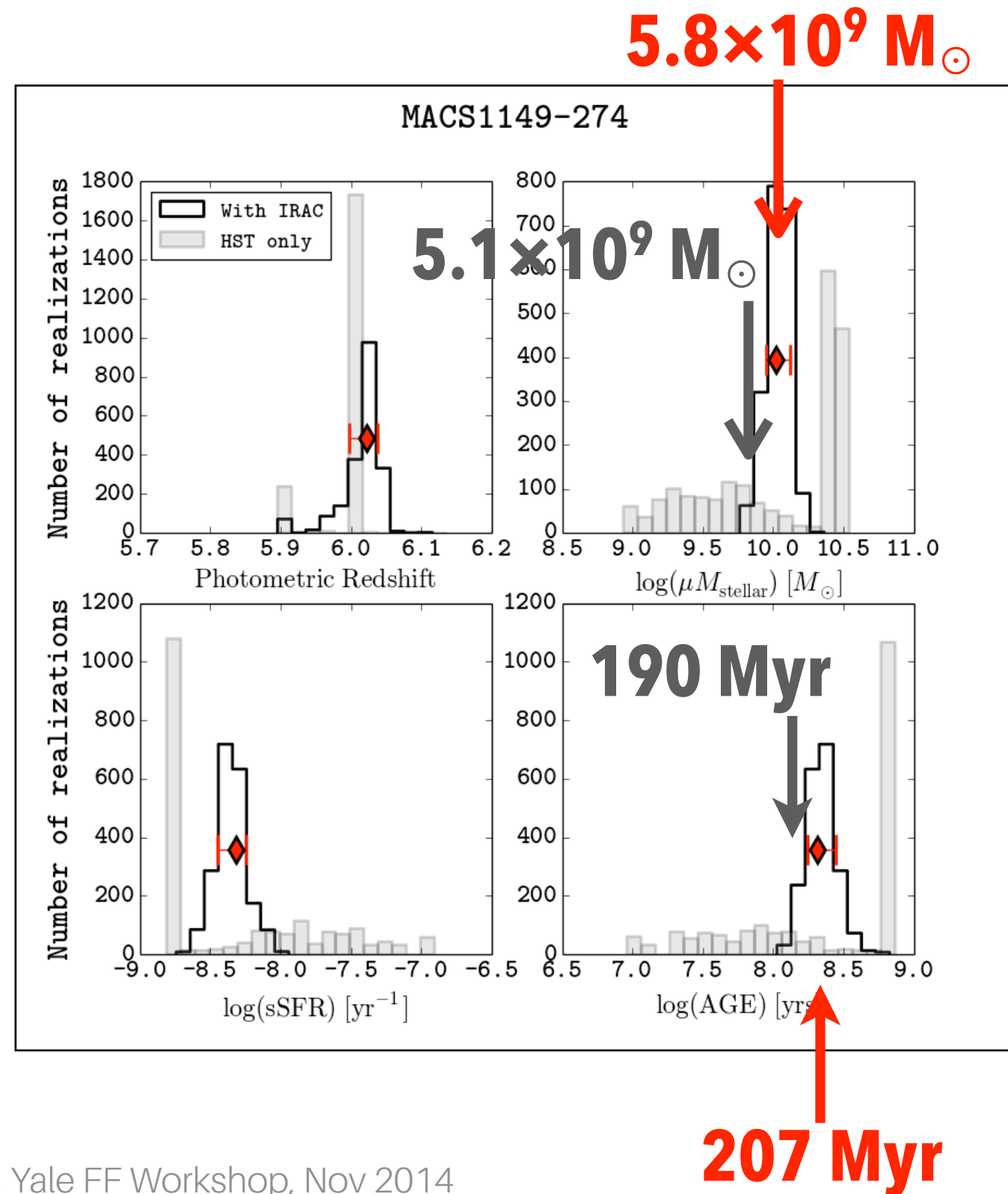
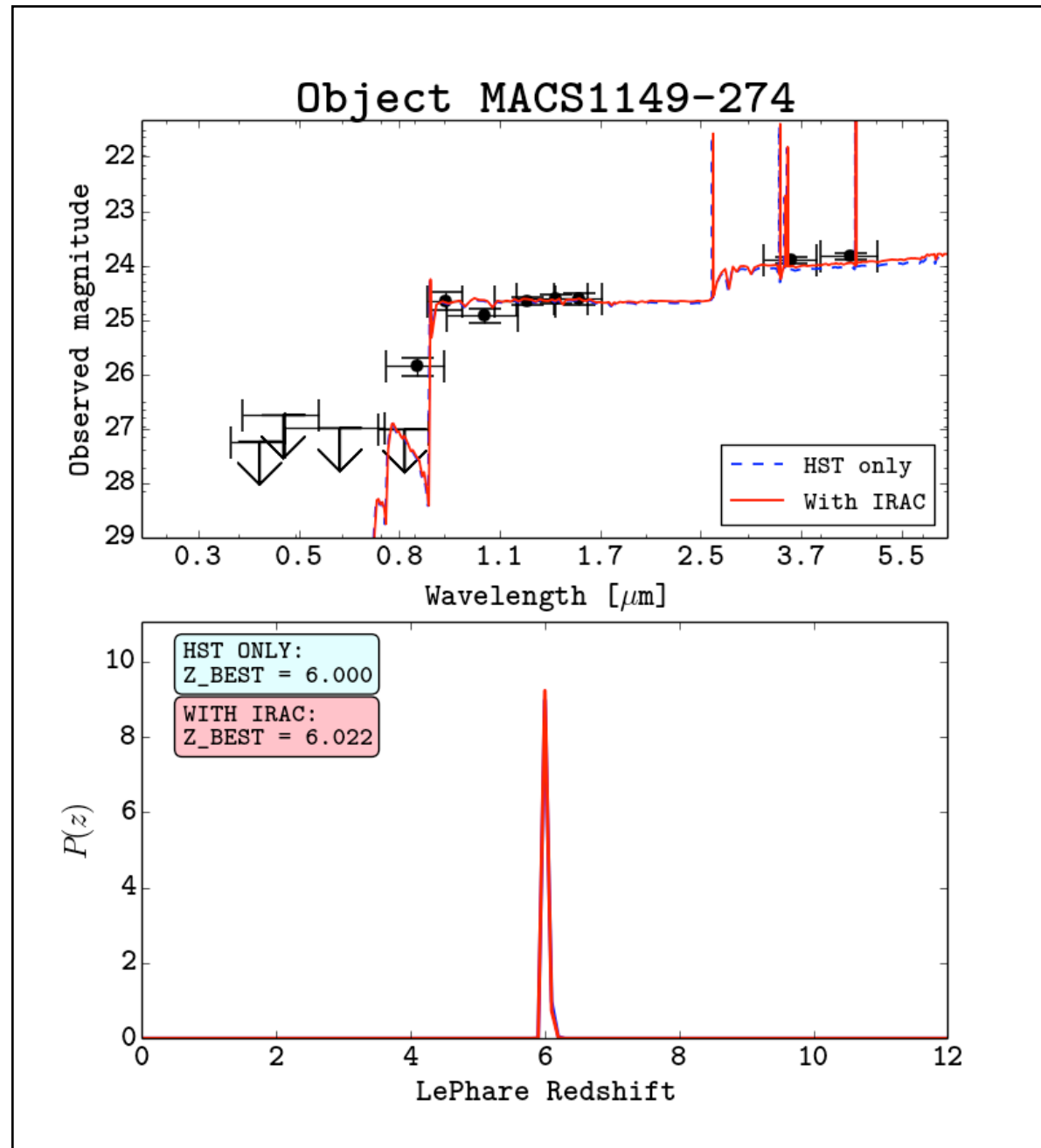
MACS1149-274 ($z_{\text{PHOT}}=6.0$; $\mu=1.8$)



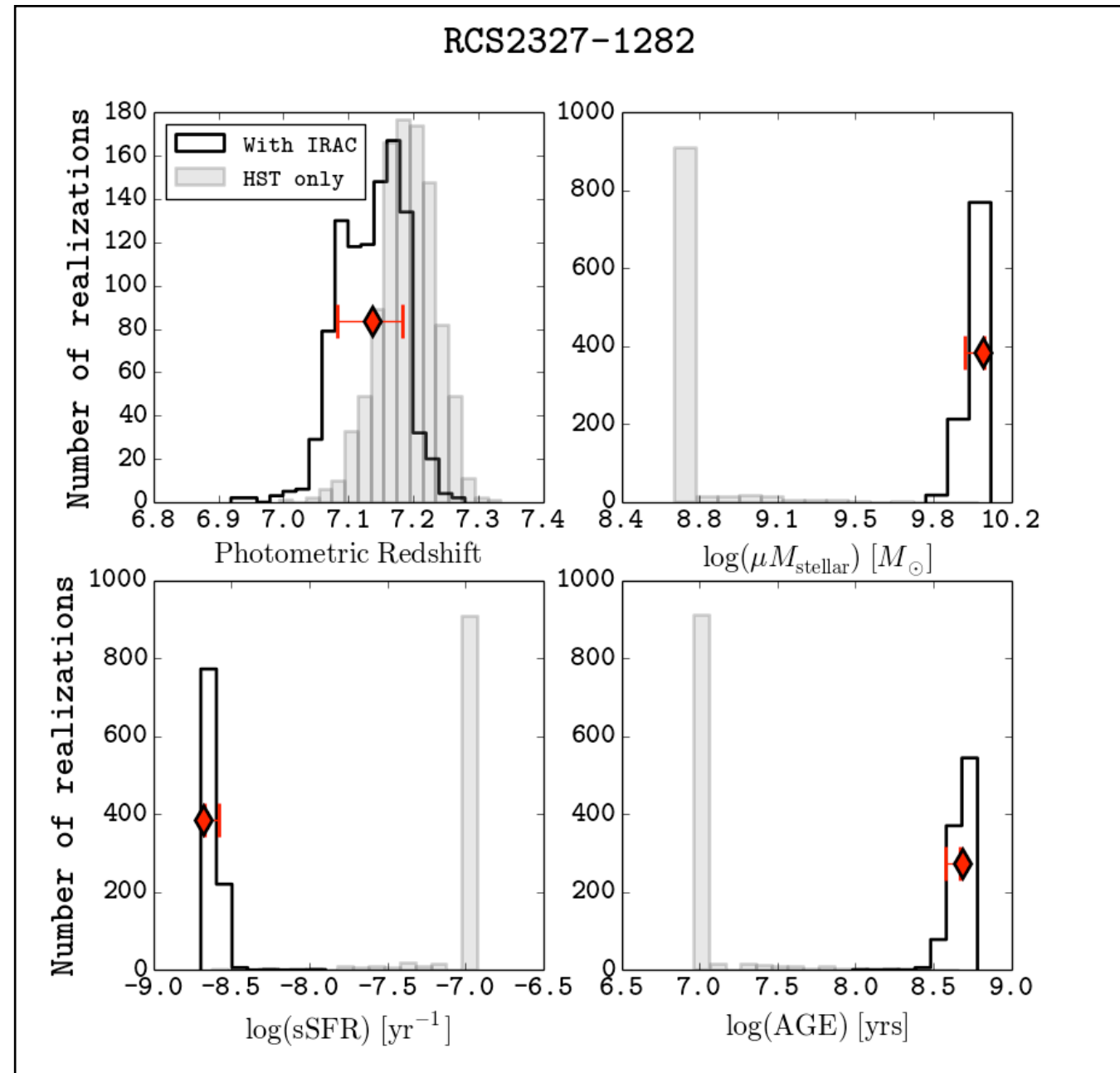
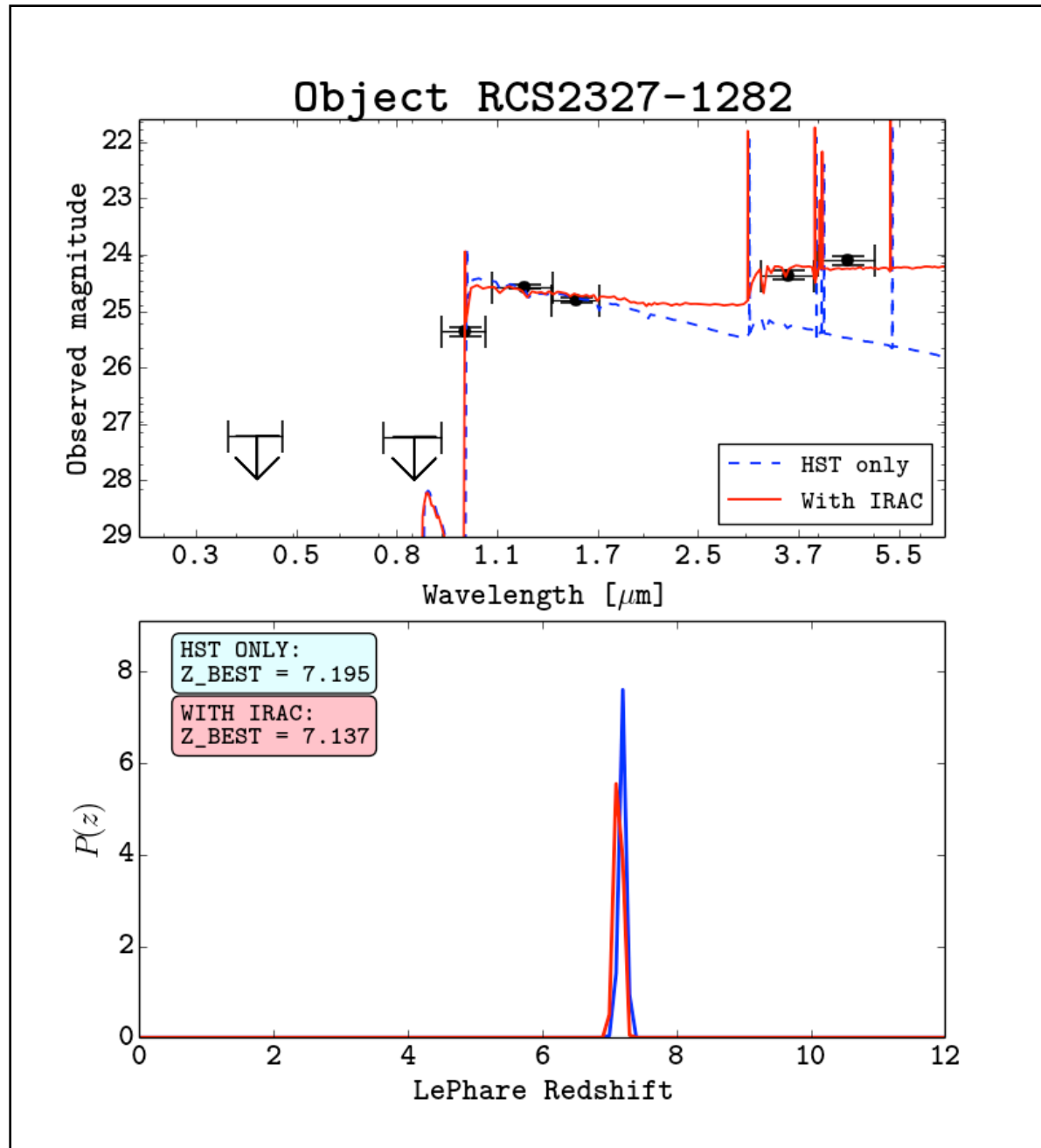
MACS1149-274 ($z_{\text{PHOT}}=6.0$; $\mu=1.8$)



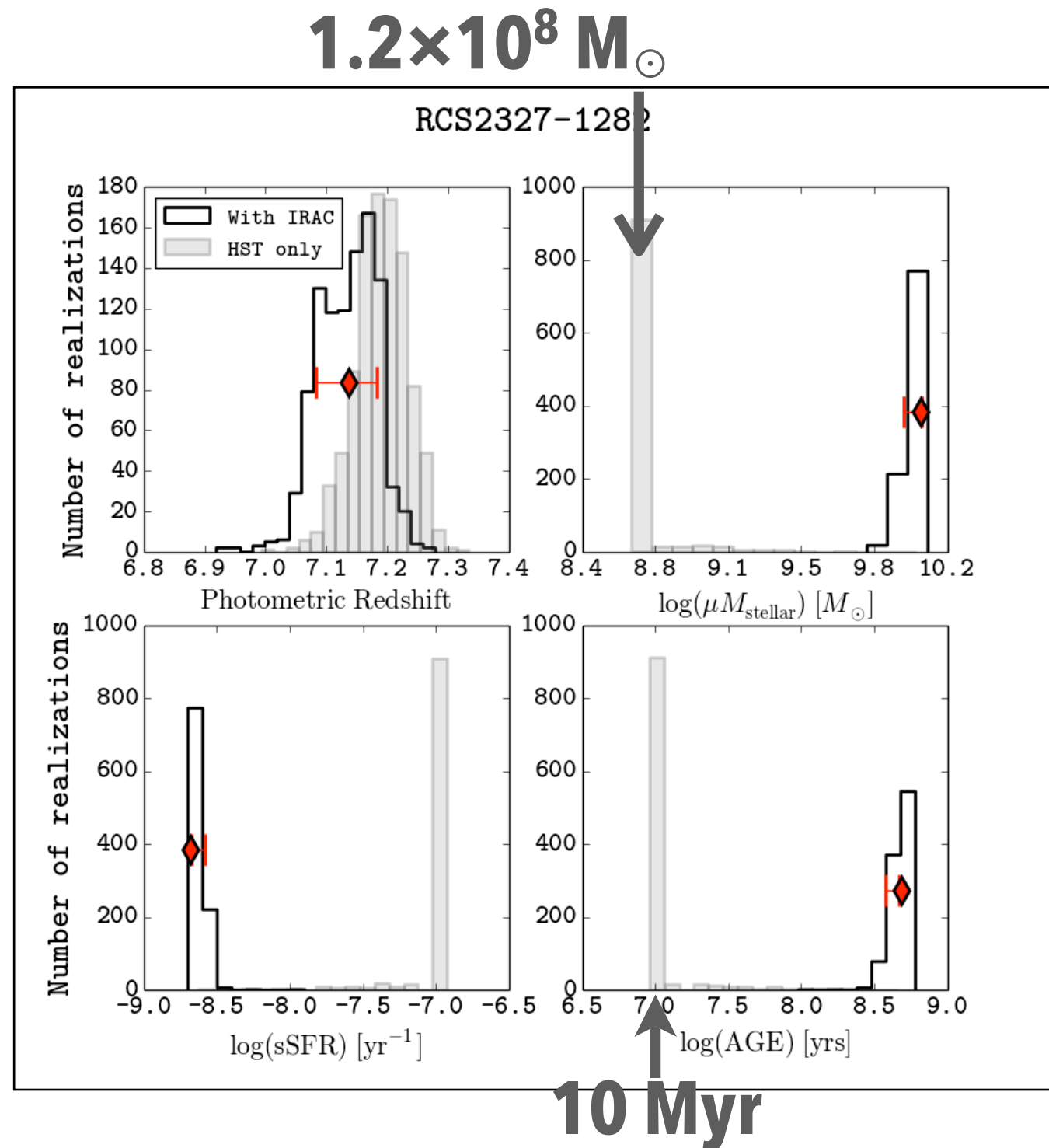
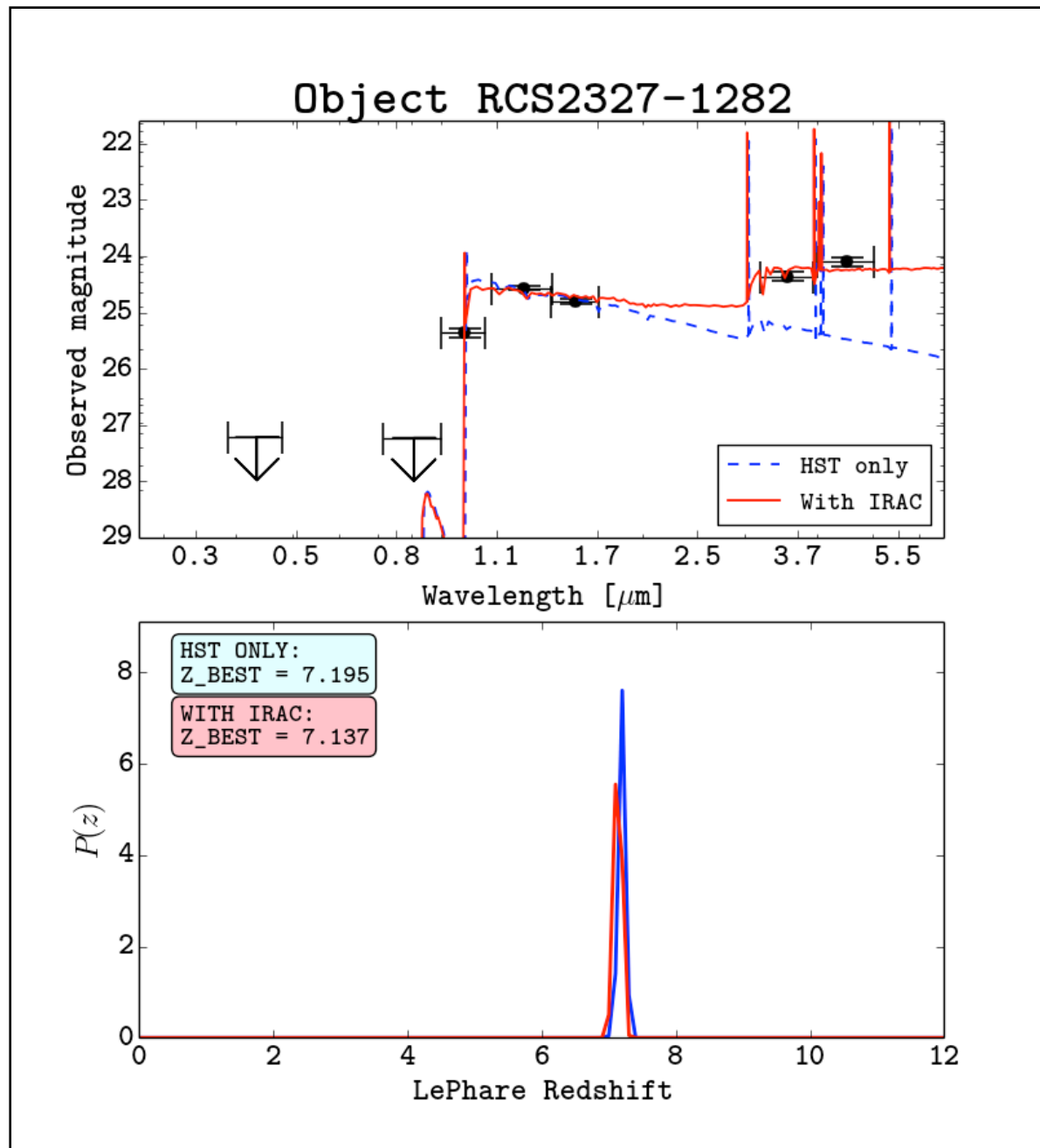
MACS1149-274 ($z_{\text{PHOT}}=6.0$; $\mu=1.8$)



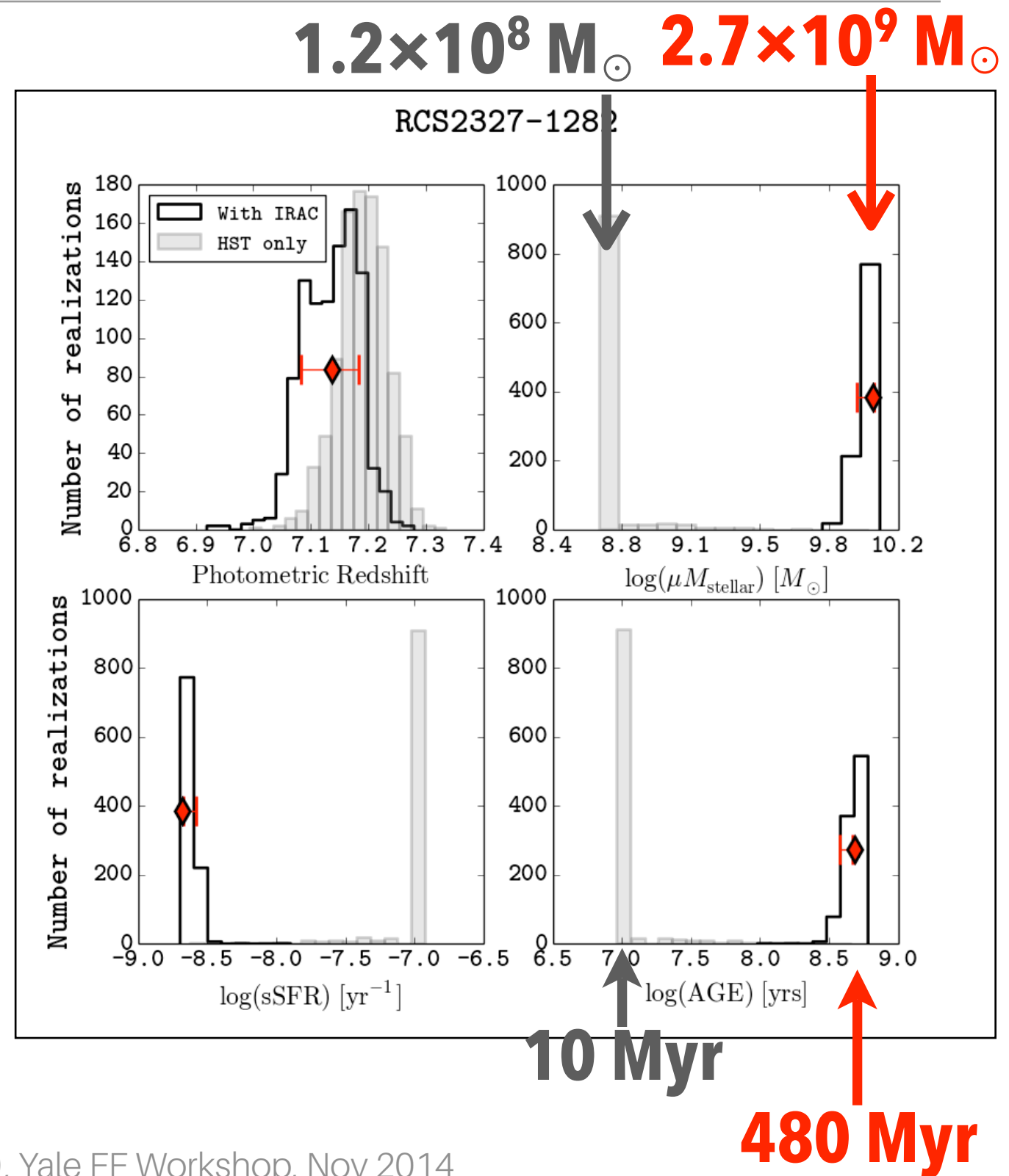
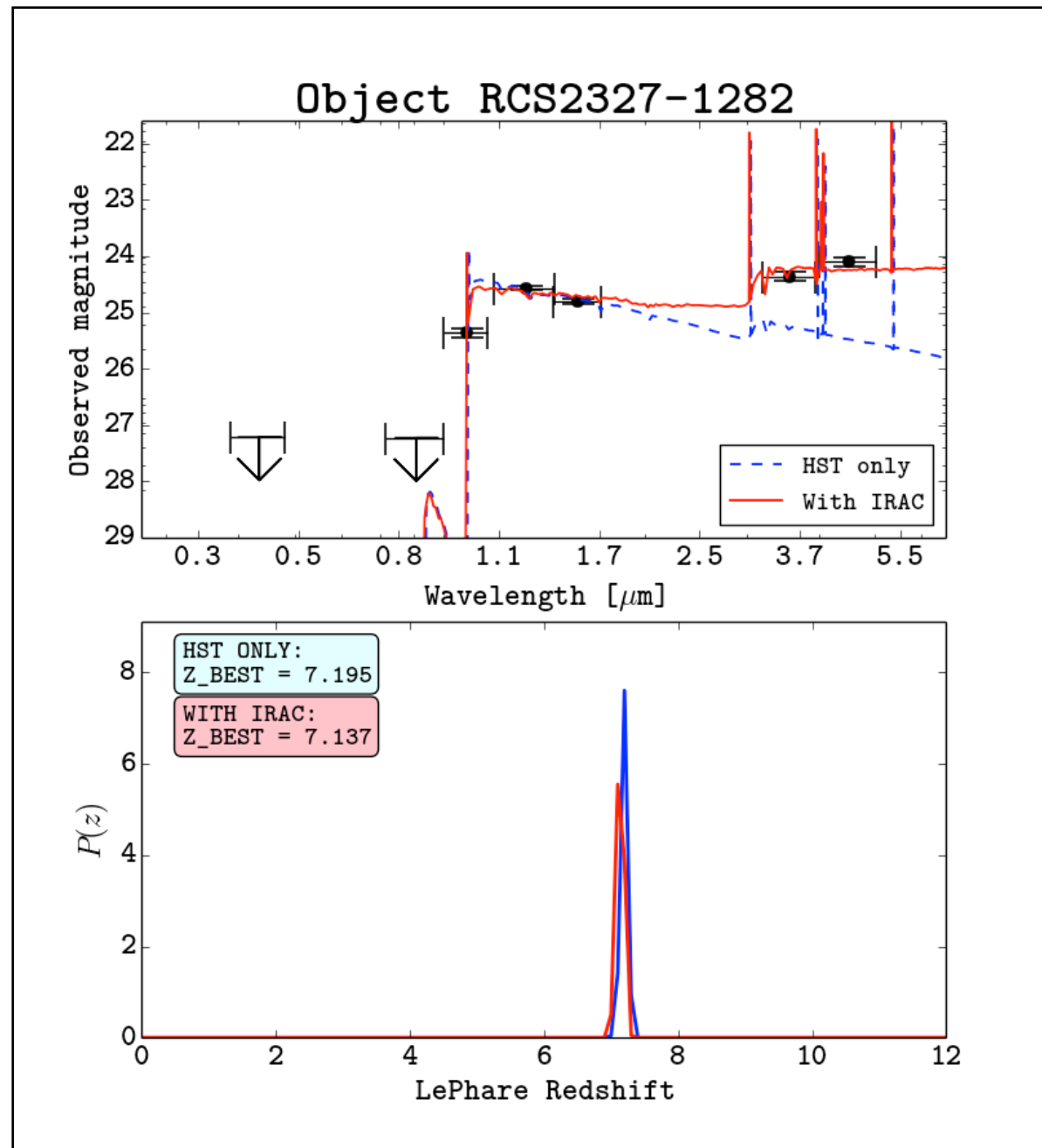
RCS2327-1282 ($z_{\text{phot}}=7.14$; $\mu=4.3$)



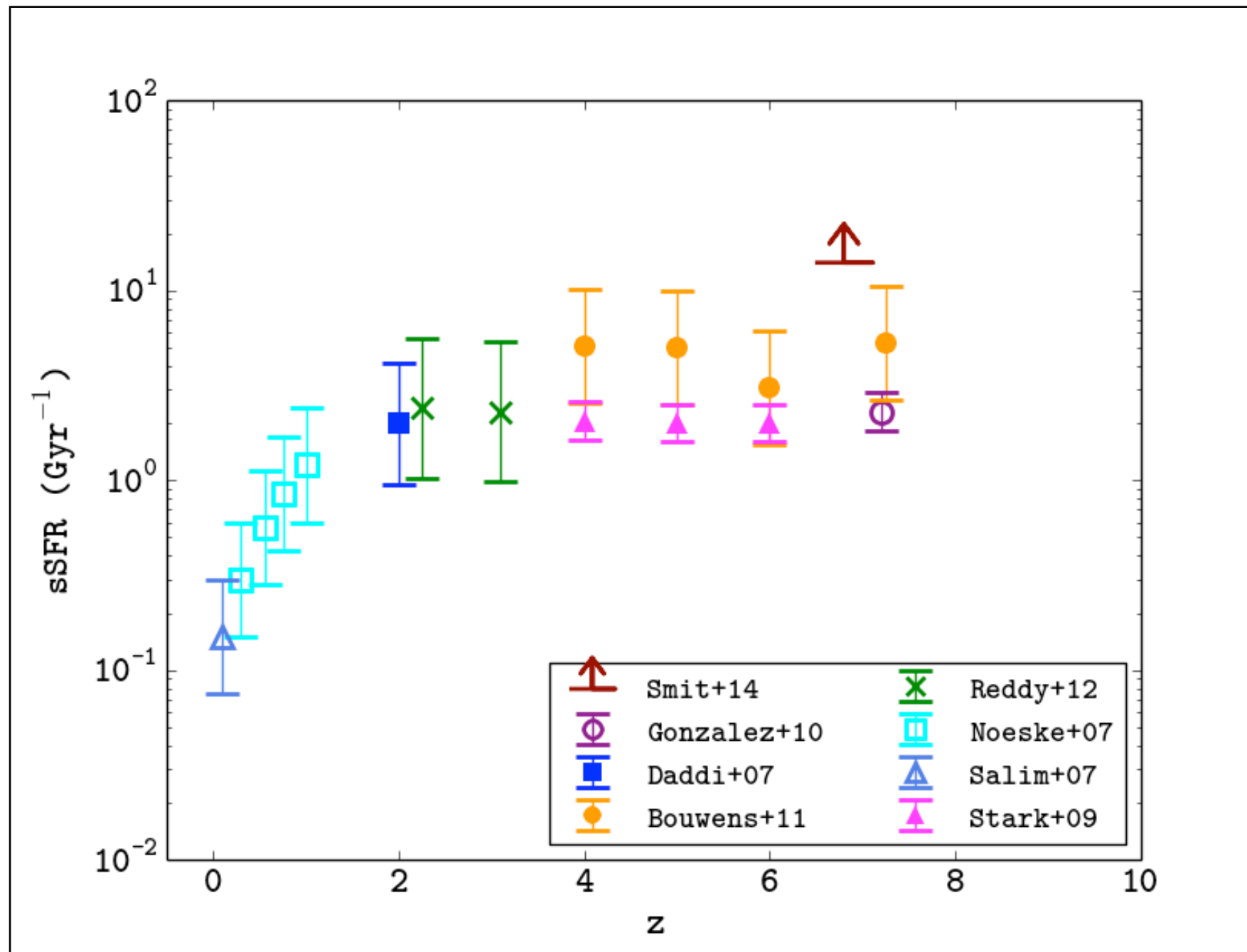
RCS2327-1282 ($z_{\text{phot}}=7.14$; $\mu=4.3$)



RCS2327-1282 ($z_{\text{phot}}=7.14$; $\mu=4.3$)

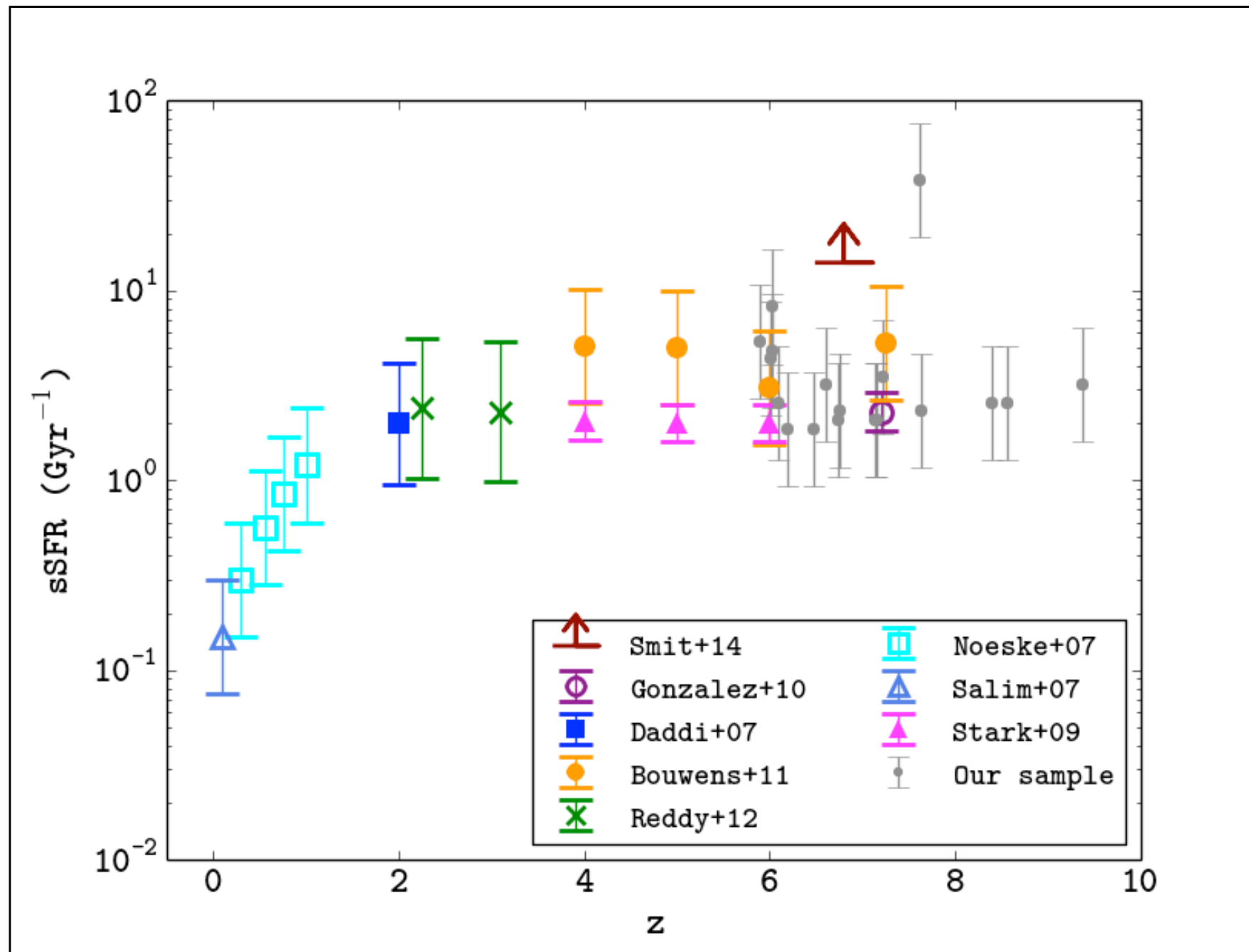


Specific Star-Formation Rate



(independent of μ)

Specific Star-Formation Rate



(independent of μ)

Summary

- We selected $z \gtrsim 6$ galaxy candidates from 8 of 10 SURFS UP clusters (including 2 Frontier Fields clusters and 4 additional CLASH clusters). We found a total of 55 $z \gtrsim 6$ galaxy candidates, 20 of them are detected at either $3.6 \mu\text{m}$ or $4.5 \mu\text{m}$ (or both) at $> 3\sigma$.
- Among the IRAC-detected galaxy candidates, their inferred specific star-formation rates are between 2 to 10 Gyr^{-1} . We do not see extreme sSFR among the IRAC-detected sample, although **strong nebular emission lines** could contribute more to the IRAC fluxes than is allowed in our SED model.

Cluster	Number	Cluster	Number
MACS0454	2	RXJ1347	2
Bullet	1	MACS1423	8
MACS0717	0	MACS2129	1
MACS0744	2	MACS2214	n/a
MACS1149	3	RCS2327	1