High Redshift AGN and Their Host Galaxies: PSF-subtraction, Coronagraphy(?) & SED-fitting.

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Outline:

(1) High-z AGN and Their Host Galaxies:

PSF-subtraction, Coronagraphy? & SED-fits.

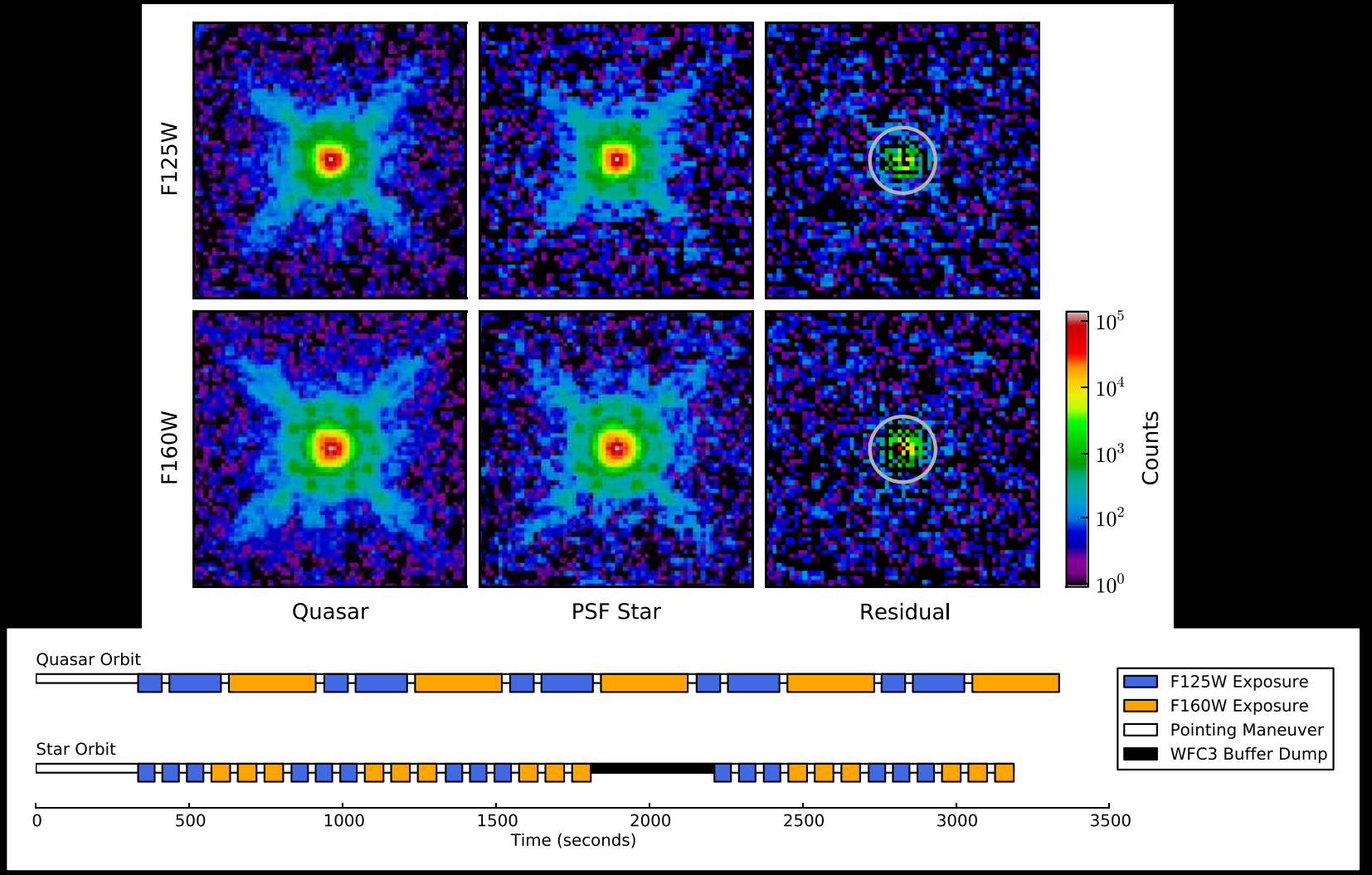
- How did Galaxy Assembly keep up with Supermassive Black-Hole Growth?

- (2) Summary and Conclusions.

Talk at the JWST GTO Workshop, Aug. 7–8, STScI, Baltimore (MD). Talks are on:

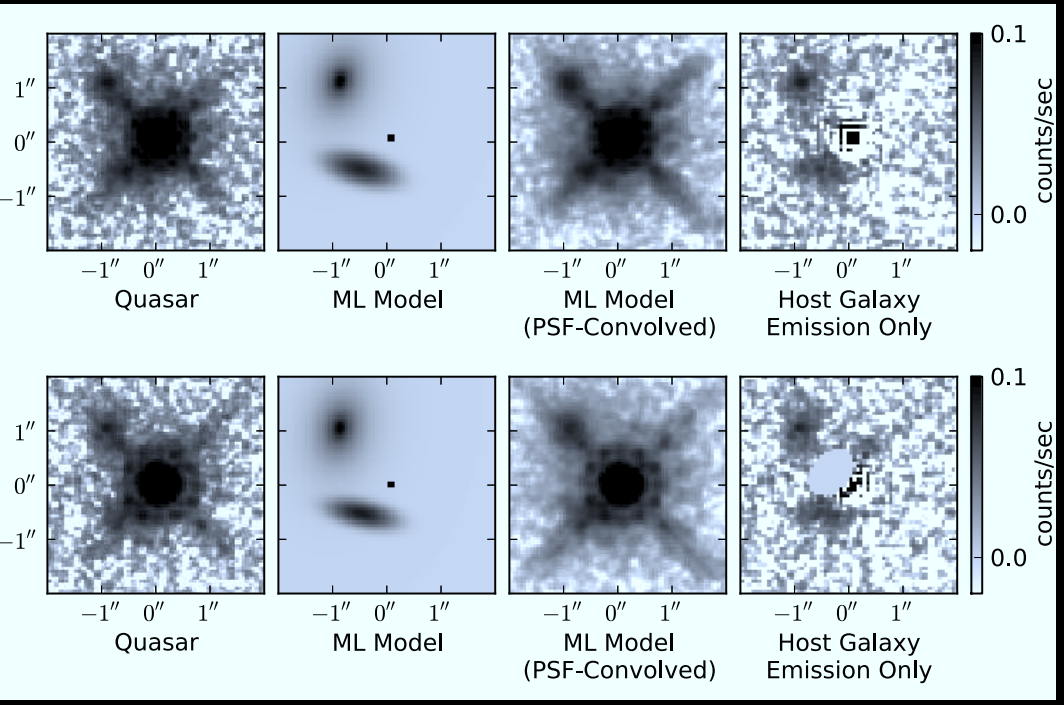
`http://www.asu.edu/clas/hst/www/jwst/jwsttalks/windhorst14_firstlight_AGNhosts.pdf`

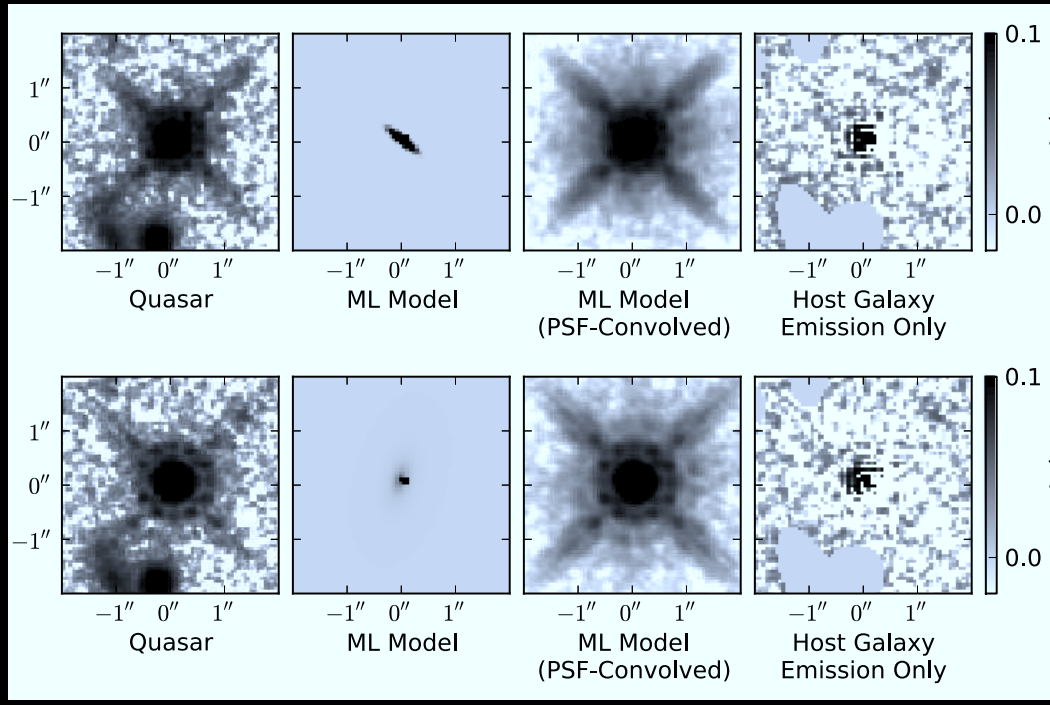
(1a) HST WFC3 observations of QSO host systems at z≃6 (age≲1 Gyr)



- Careful contemporaneous orbital PSF-star subtraction: Removes most of "OTA spacecraft breathing" effects (Mechtley ea 2012, ApJL, 756, L38).
- PSF-star (AB≃15 mag) subtracts z=6.42 QSO (AB≃18.5) nearly to the noise limit: NO host galaxy detected 100×fainter (AB≳23.5 at r≳0″.3).

(1a) WFC3: Detection of one QSO Host System at z≃6 (Giant merger?)



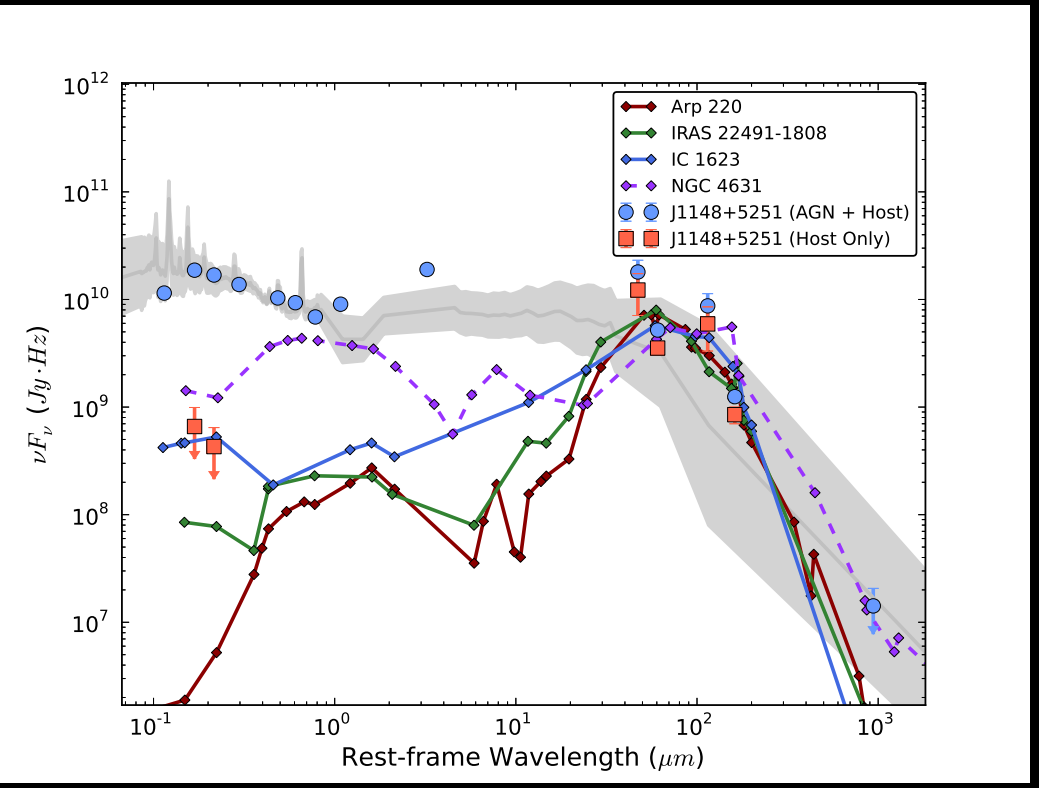


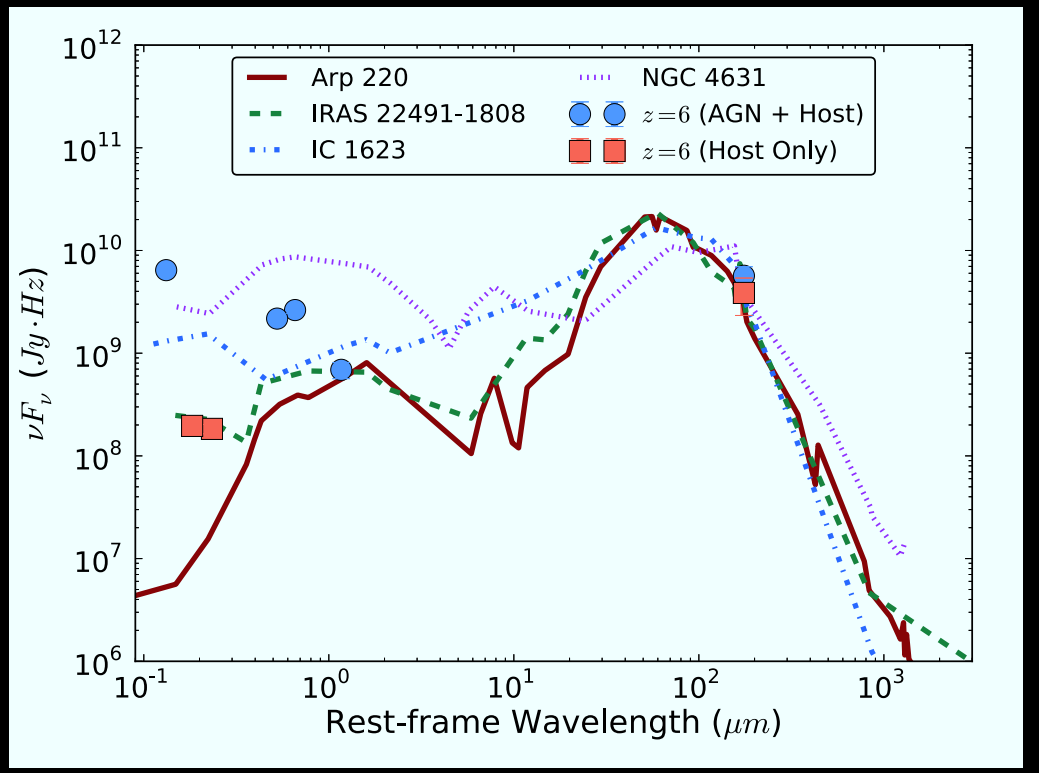
- Markov Chain Monte Carlo posterior model of observed PSF-star + Sersic light-profile. Gemini AO images to pre-select PSF stars (Mechtley^{+} 2014).
- First detection out of four z≃6 QSOs [2 more to be observed].
- One z≃6 QSO host galaxy: Giant merger morphology + tidal structure?

- Same J+H structure! Blue UV-SED colors: (J–H)≃0.19, constrains dust.
  - IRAS starburst-like SED from rest-frame UV–far-IR, A_{FUV}∼1 mag.
- M_{AB}^{host}(z≃6)≲–23.0 mag, i.e., ∼2 mag brighter than L*(z≃6).

⇒ z≃6 QSO duty cycle ≲10^{-2} (≲10 Myrs); 1/4 QSO's close to Magorrian.

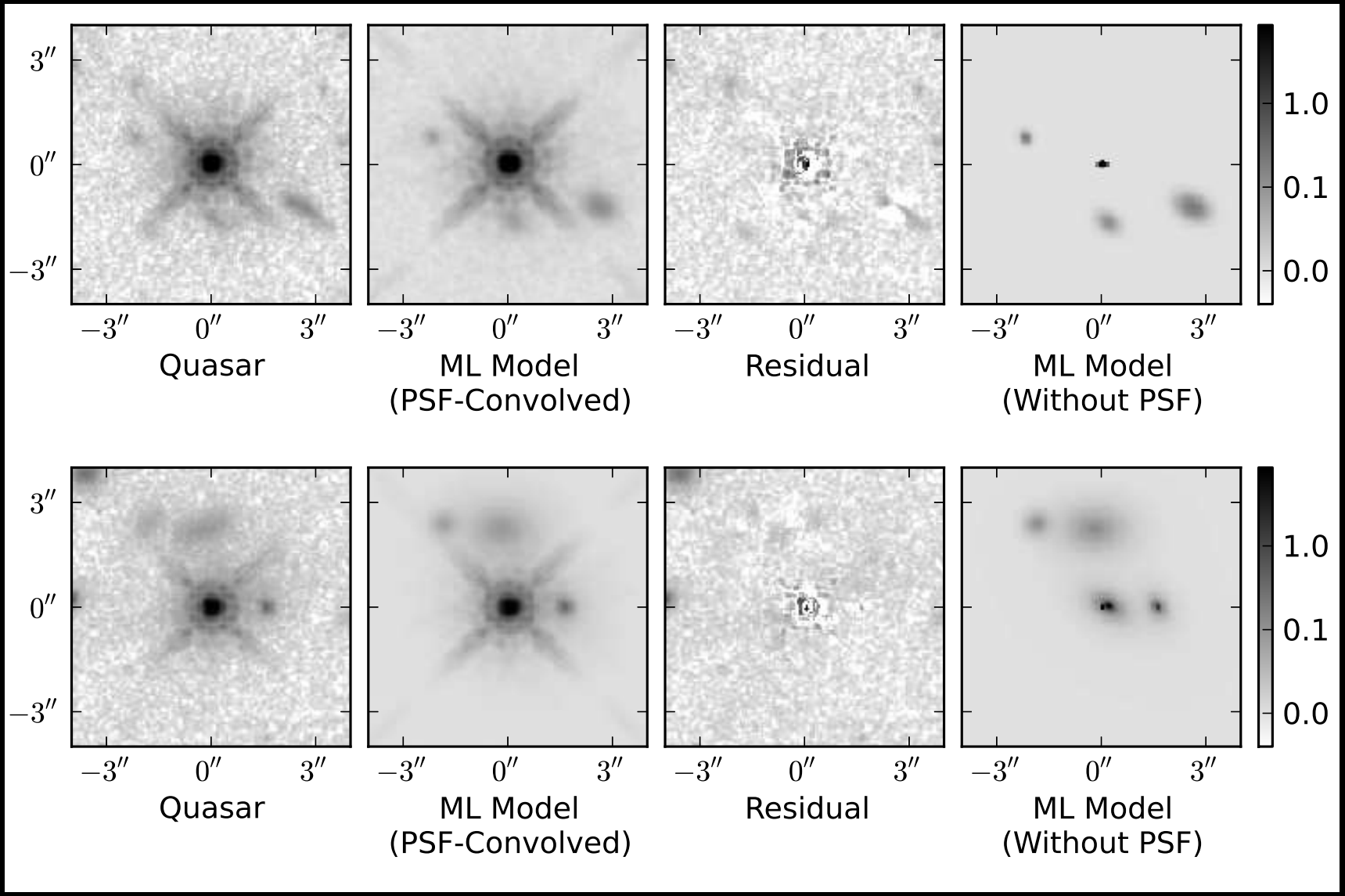
(1a) HST WFC3 observations of dusty QSO host galaxies at z≃6



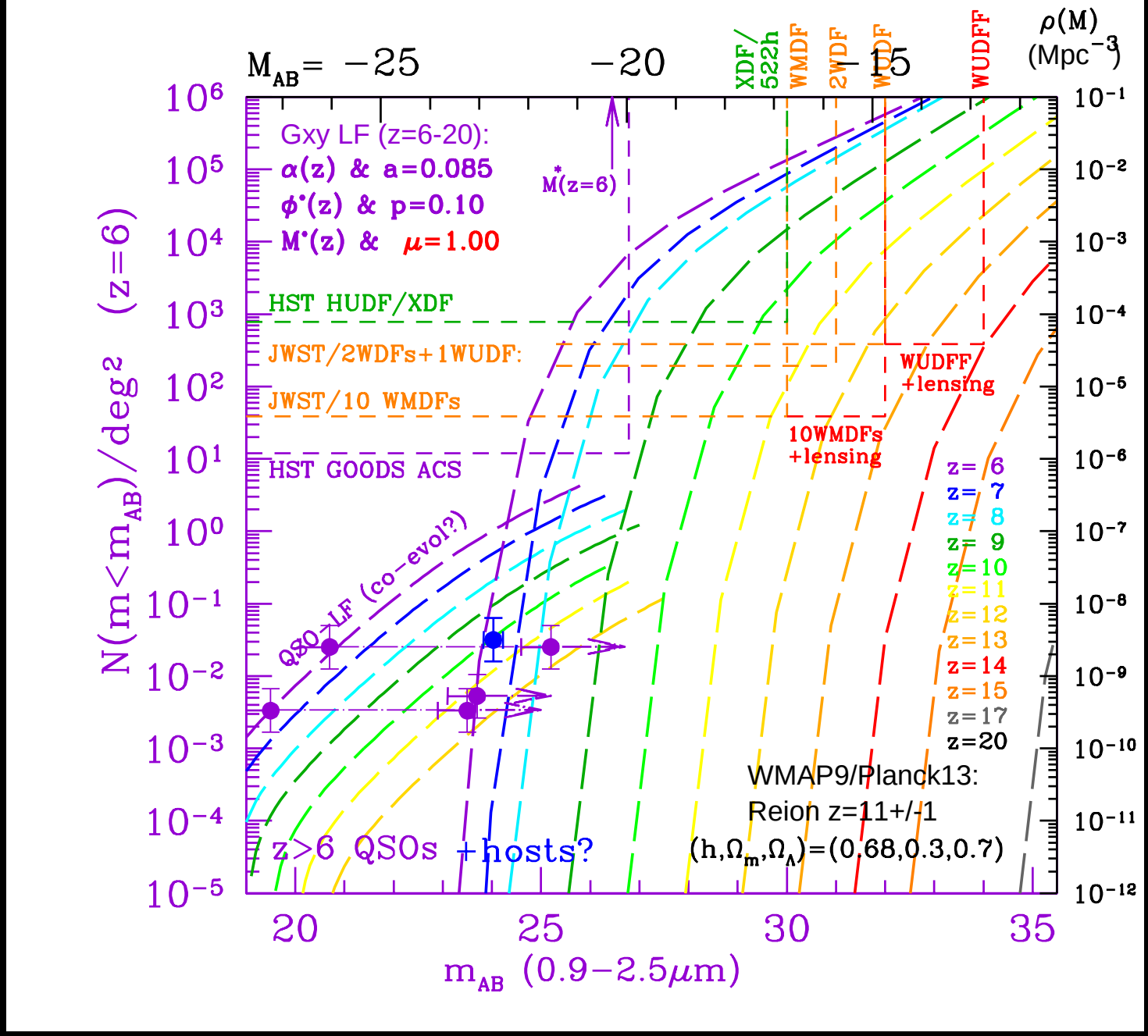


- Blue dots: z≃6 QSO SED, Grey: Average radio-quiet SDSS QSO spectrum at z≳1 (normalized at 0.5μ). Red: z≃6 host galaxy (WFC3+submm).
- Nearby fiducial galaxies (starburst ages≲1 Gyr) normalized at 100μm: [LEFT] Rules out z=6.42 spiral or bluer host galaxy SEDs for 1148+5251. (U)LIRGs & Arp 220s permitted (Mechtley et al. 2012, ApJL, 756, L38). [RIGHT] Detected QSO host has IRAS starburst-like SED from rest-frame UV–far-IR, A_{FUV}(host)∼1 mag (Mechtley 2013 PhD; et al. 2014).
- JWST (+Coronagraphs?) can do this ≳10× fainter: will do 2 in GTO time.

(1b) WFC3 observations of QSO host galaxies at z≃2 (evidence for mergers?)



- Markov Chain Monte Carlo posterior model of observed PSF-star + Sersic light-profile: merging neighbors (some with tidal tails?; Mechtley, Jahnke, MPI, Koekemoer, Windhorst et al. 2014).
- JWST (+Coronagraphs?) can do this $\gtrsim$10× fainter: in rest-frame V for z$\gtrsim$6.



Same as before, but pessimistic M^* (z) evolution parameter: μ=1.0.

- If so, JWST surveys would need lensing to see most $\gtrsim$11 objects.
- Add z$\simeq$6 QSO host galaxy limits (or fluxes) by Mechtley$^+$ (2012, 2014).

Conclusions re. JWST Observations of z≳6 Host Galaxies

(1) JWST studies of the host galaxies of AGN at z≳6 will require:

• Consideration of the likely very dusty host galaxy nature, given the limited fraction of faint host system detections with WFC3 IR at z≳6.

• Given the likely small host galaxy sizes ($\boldsymbol{r_{hl}}$), *very careful contemporaneous PSF subtraction* may work better than Coronagraphy.

(2) Purpose of this Conference: Coordinate closely with MIRI (G. Rieke et al.) and other GTO teams an optimal plan to observe host galaxies of AGN at z≳6.

This IDS GTO team will likely do 1–2 QSO's at z≳6.

SPARE CHARTS

- References and other sources of material shown:

http://www.asu.edu/clas/hst/www/jwst/ [Talk, Movie, Java-tool]

http://www.asu.edu/clas/hst/www/ahah/ [Hubble at Hyperspeed Java–tool]

http://www.asu.edu/clas/hst/www/jwst/clickonHUDF/ [Clickable HUDF map]

http://www.jwst.nasa.gov/ & http://www.stsci.edu/jwst/

http://ircamera.as.arizona.edu/nircam/

http://ircamera.as.arizona.edu/MIRI/

http://www.stsci.edu/jwst/instruments/nirspec/

http://www.stsci.edu/jwst/instruments/fgs

Gardner, J. P., et al. 2006, Space Science Reviews, 123, 485–606

Mather, J., & Stockman, H. 2000, Proc. SPIE Vol. 4013, 2

Windhorst, R., et al. 2008, Advances in Space Research, 41, 1965

Windhorst, R., et al., 2011, ApJS, 193, 27 (astro-ph/1005.2776).