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, May 17, 2016; National Research Council, Victoria (BC, Canada).

(1a) HST WFC3 observations of QSO host systems at $z \approx 6$ (age $\lesssim 1$ Gyr)


- PSF-star ($AB \approx 15$ mag) subtracts $z=6.42$ QSO ($AB \approx 18.5$) nearly to the noise limit: NO host galaxy detected $100 \times$ fainter ($AB \gtrsim 23.5$ at $r \gtrsim 0''3$).
(1a) WFC3: Detection of one QSO Host System at $z \approx 6$ (Giant merger?)

- First detection out of four $z \approx 6$ QSOs [2 more to be observed].
- One $z \approx 6$ QSO host galaxy: Giant merger morphology + tidal structure?
- Same J+H structure! Blue UV-SED colors: $(J-H) \approx 0.19$, constrains dust.
  - IRAS starburst-like SED from rest-frame UV–far-IR, $A_{FUV} \sim 1$ mag.
  - $M_{host}^{AB}(z \approx 6) \lesssim -23.0$ mag, i.e., $\sim 2$ mag brighter than $L^*(z \approx 6)$. 
HST WFC3 observations of dusty QSO host galaxies at \( z \sim 6 \)

- **Blue dots:** \( z \sim 6 \) QSO SED, **Grey:** Average radio-quiet SDSS QSO spectrum at \( z \gtrsim 1 \) (normalized at 0.5 \( \mu m \)). **Red:** \( z \sim 6 \) host galaxy (WFC3+submm).

- **Nearby fiducial galaxies** (starburst ages \(< 1 \) Gyr) normalized at 100 \( \mu m \):
  - [LEFT] Rules out \( z=6.42 \) spiral or bluer host galaxy SEDs for 1148+5251. 
  - [RIGHT] Detected QSO host has IRAS starburst-like SED from rest-frame UV–far-IR, \( A_{FUV} \)(host) \( \sim 1 \) mag (Mechtley 2013 PhD; et al. 2016).

- **JWST (+Coronagraphs?)** can do this \( \gtrsim 10 \times \) fainter: will do 2 in GTO time.
(1b) WFC3 observations of QSO host galaxies at $z \simeq 2$ (evidence for mergers?)

- JWST (+Coronagraphs?) can do this $\gtrsim 10 \times$ fainter: in restframe V for $z \gtrsim 6$. 
Conclusions re. JWST Observations of \( z \gtrsim 6 \) Host Galaxies

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

- Consideration of the likely very dusty host galaxy nature, given the limited fraction of faint host system detections with WFC3 IR at \( z \gtrsim 6 \).
- Given the likely small host galaxy sizes \( (r_{hl}) \), 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 (NIRISS) an optimal plan to observe host galaxies of AGN at \( z \sim 2–6 \).

This IDS GTO team will likely do two QSO’s at \( z \gtrsim 6 \) and two at \( z \sim 2 \).