

Technical aspects of how JWST can measure First Light, Reionization, and Galaxy Assembly.

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Abstract

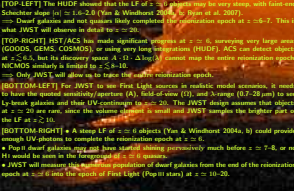
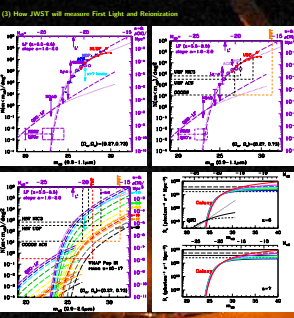
We review the technical aspects of how the 6.5 meter James Webb Space Telescope (JWST) can measure First Light, Reionization, Galaxy Assembly (see Slavov et al. and other posters), building on lessons learned from the Hubble Space Telescope (HST), We show what combination of area, depth, and wavelength coverage are needed for JWST to detect a sufficient number of First Light objects, and to measure their evolving luminosity function (LF). In detail, JWST will map the epoch of First Light through Pop III star dominated objects at redshifts $z=6-20$, and its transition to the first Pop II stars in dwarf galaxies. The expected steep faint-end of the dwarf galaxy LF at redshifts $z=6-7$ likely provided the UV flux needed to finish reionization.

We discuss: (1) what deep JWST images will look like compared to the Hubble UltraDeep Field (HUDF), given JWST's expected PSF performance; (2) simulations of what nearby galaxies observed in their restframe UV-optical light by HST would look like to JWST at very high redshifts; (3) quantitative methods to determine structural parameters of faint galaxies in deep JWST images as a function of cosmic epoch to delineate the progress of galaxy assembly; (4) to what extent JWST's short-wavelength performance — which needed to be relaxed in the 2005 redefinition of the telescope — will affect JWST's ability to accurately determine faint galaxy parameters; and (5) Ultra-deep JWST images will run into the instrumental and natural confusion limits. A new generation of algorithms may be needed to automatically detect, measure and classify objects in very crowded, ultra-deep JWST fields.

We demonstrate an interactive web-tool on a laptop that lets the user pan and zoom 3-D through the HUDF data-base from redshifts $z=0$ to $z=6$, with all galaxy images sorted versus spectro-photometric redshift, and visualize what JWST will add from AB=29.5–32.0 mag and between redshifts $z=7-20$. This work was funded by NASA JWST Interdisciplinary Science grant NAGS12468 from OSFC, and grant HST/10141975 from STScI, operated by AURA for NASA, under contract NAS 5-30555.

Outline

- What is JWST and how will it be deployed? (see e.g., posters by Cohen & Doyon, Hainauts, Wright et al.)
- What instruments and sensitivity will JWST have? (see e.g., posters by Gardner, M. Rieke, Slavov et al.)
- How can JWST measure First Light and Reionization?
- How can JWST measure Galaxy Assembly
- Predicted Galaxy Appearance for JWST at $z \approx 1-15$
- JWST's short- λ performance affects measurements of faint galaxy parameters
- Will deep JWST images run into the confusion limit?



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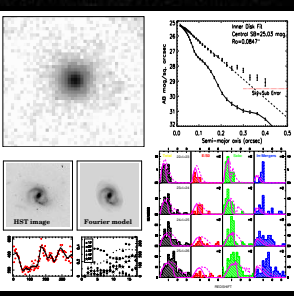
(3) How can JWST measure First Light and Reionization?

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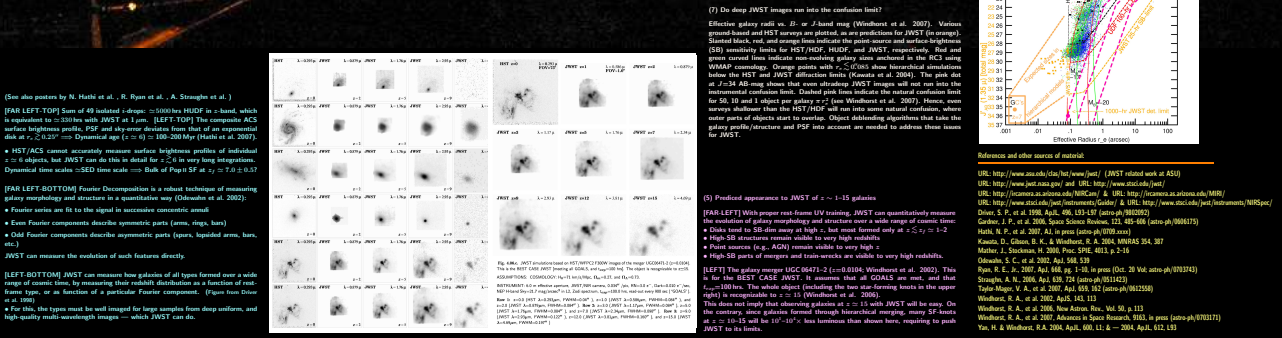
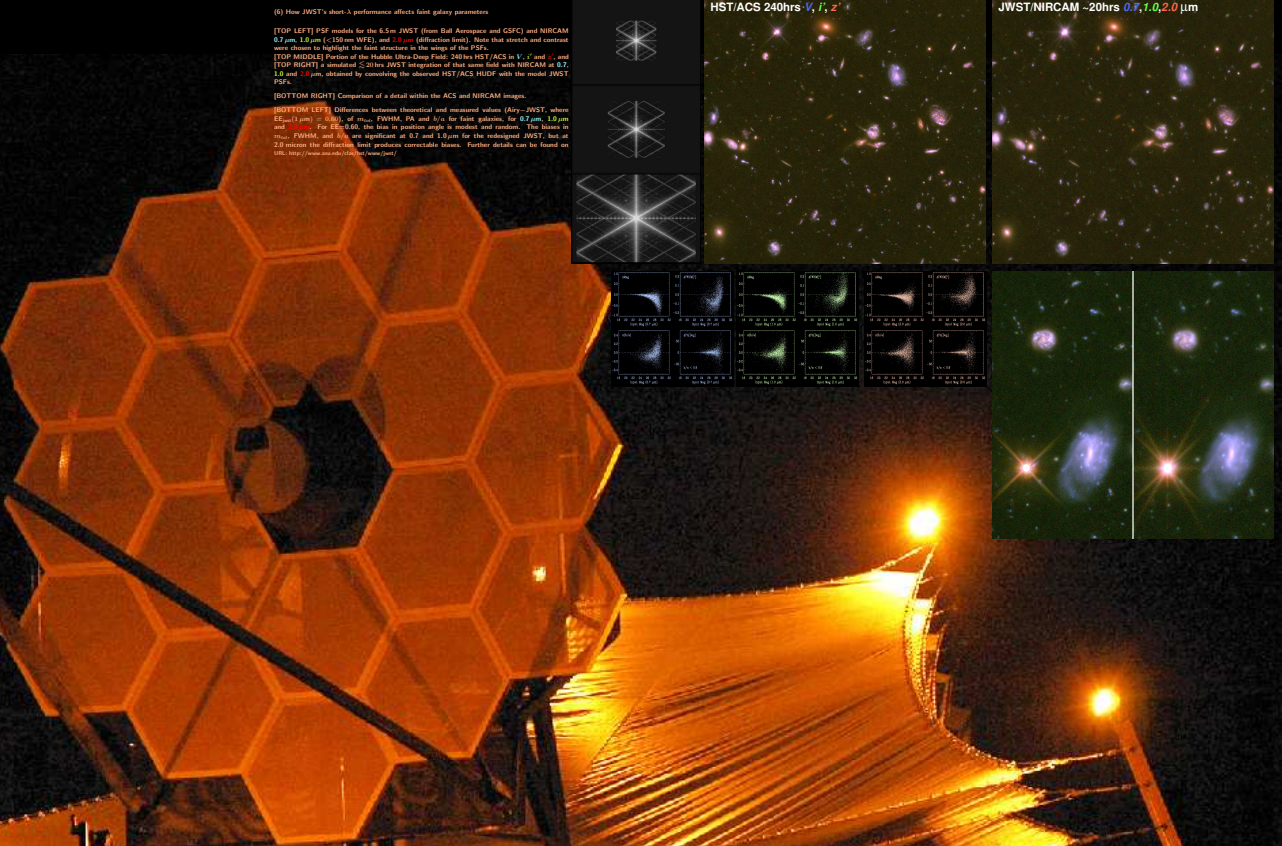
(5) Predicted Galaxy Appearance for JWST at $z \approx 1-15$

(6) JWST's short- λ performance affects measurements of faint galaxy parameters

(7) Will deep JWST images run into the confusion limit?



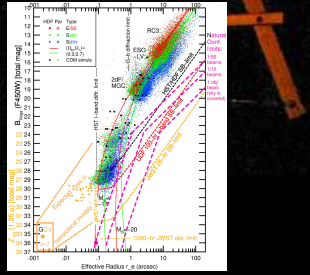
(8) How JWST will measure First Light and Reionization



(9) Predicted appearance of JWST at $z \approx 1-15$ galaxies

(10) JWST's short- λ performance affects measurements of faint galaxy parameters

(11) Will deep JWST images run into the confusion limit?



(12) JWST's short- λ performance affects measurements of faint galaxy parameters

(13) Will deep JWST images run into the confusion limit?

(14) JWST's short- λ performance affects measurements of faint galaxy parameters

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