Low Masses, Small Sizes, More Excitement

Preliminary Low-Mass Quiescent Galaxy Sizes from *JWST* PRIMER and UNCOVER

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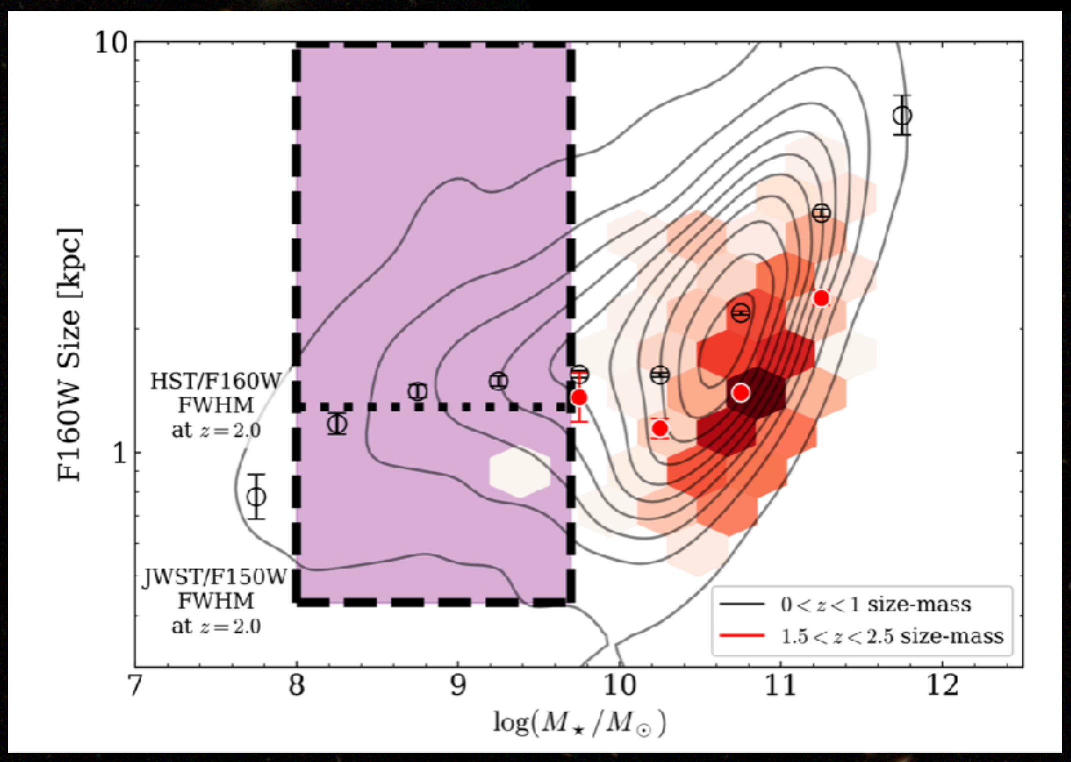
Moving on from the Flatline? The Low-Mass Quiescent Size-Mass Relation

The size-mass relation is a fundamental relationship in studies of galaxy evolution. Several studies using *HST* imaging have found that low-mass quenched galaxies are similar in size to similar-mass star-forming galaxies, or put differently: the quiescent size-mass relation flattens [1-3].

It is unclear if this behavior is real or simply a product of certain limitations of *HST*:

1. Resolution effects - at $z\sim2$, the size-mass flattening occurs right at the F160W FWHM
2. Biased light-weighted sizes - at higher z, sizes measured at shorter wavelengths may be biased due to *outshining*, since these bands can miss a significant fraction of mass contained in redder low-mass stars

The higher spatial resolution and redder wavelength coverage of *JWST* will be crucial in determining if the flattening of the low-mass quiescent size-mass relation is real and what implications it has on galaxy evolution.



PRIMER and UNCOVER: Diverse *JWST* Datasets

The backbone of this project are two *JWST* Treasury Surveys:

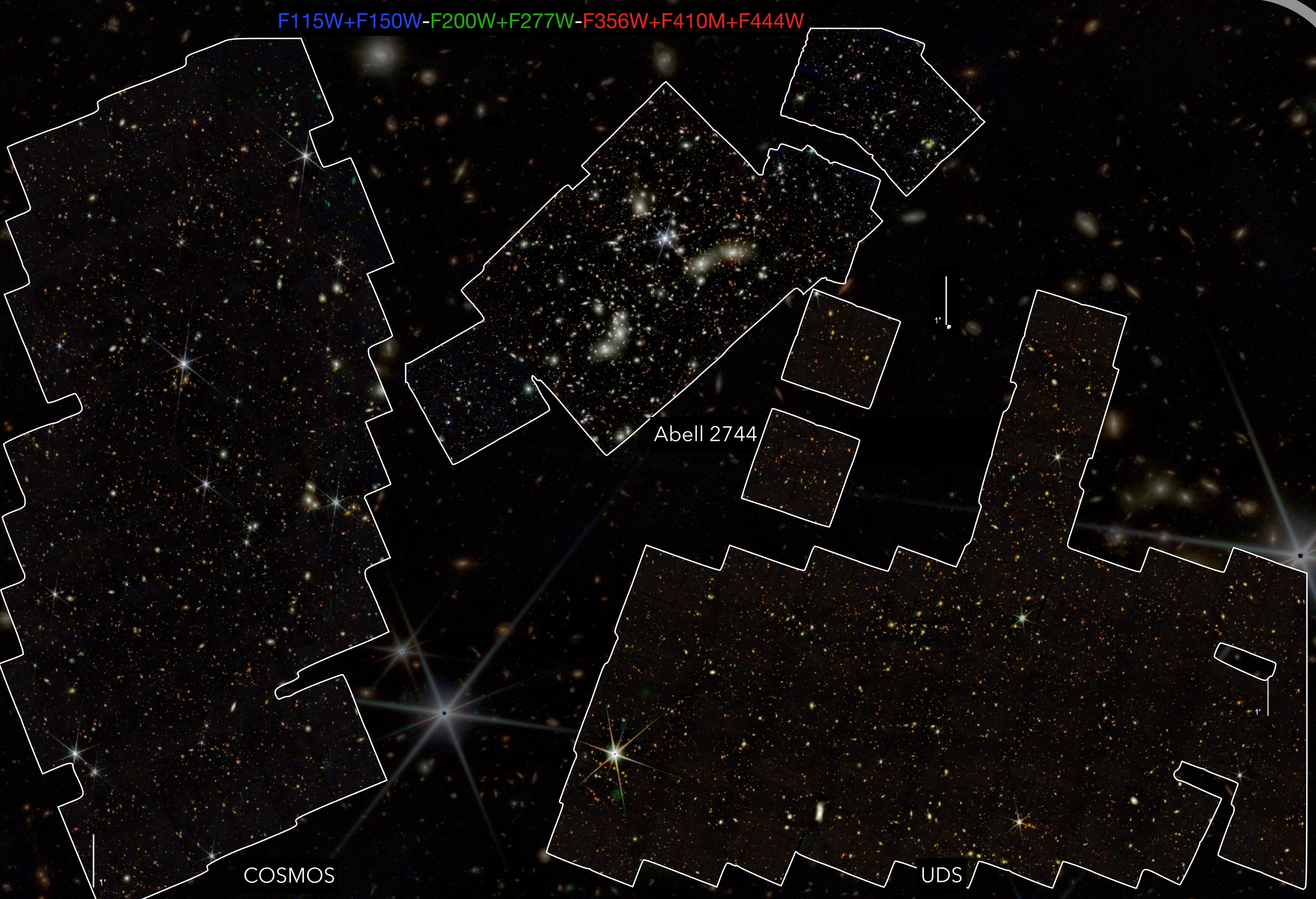
PRIMER (JWST-GO-1837 [4]):
- Covers two legacy fields (COSMOS and UDS)
- Homogeneous depth (~29 ABmag in F200W)
- 378 sq. arcmin. total
- Observations in F090W, F115W, F150W, F200W, F277W, F356W, F410M, and F444W
- Archival *HST* data

UNCOVER (JWST-GO-2561, [5]):
- Targets the Abell-2744 lensing cluster
- Deepest-to-date publicly available survey (>29 ABmag in F200W without corrections for lensing)
- 45 sq. arcmin. total
- Observations in F090W, F115W, F150W, F200W, F277W, F356W, F410M, and F444W
- Archival *HST* data

These datasets are crucial to this project for several reasons:

1. 3x better spatial resolution than *HST* at comparable wavelengths
2. Redder wavelength coverage to combat outshining
3. Depth and significant area to find faint, rare low-mass quiescent galaxies
4. Several different fields to reduce cosmic variance

Robust HST+JWST photometric catalogs have been made for UNCOVER and PRIMER. The UNCOVER catalog is available for public use [6], check out John Weaver's poster for more info!



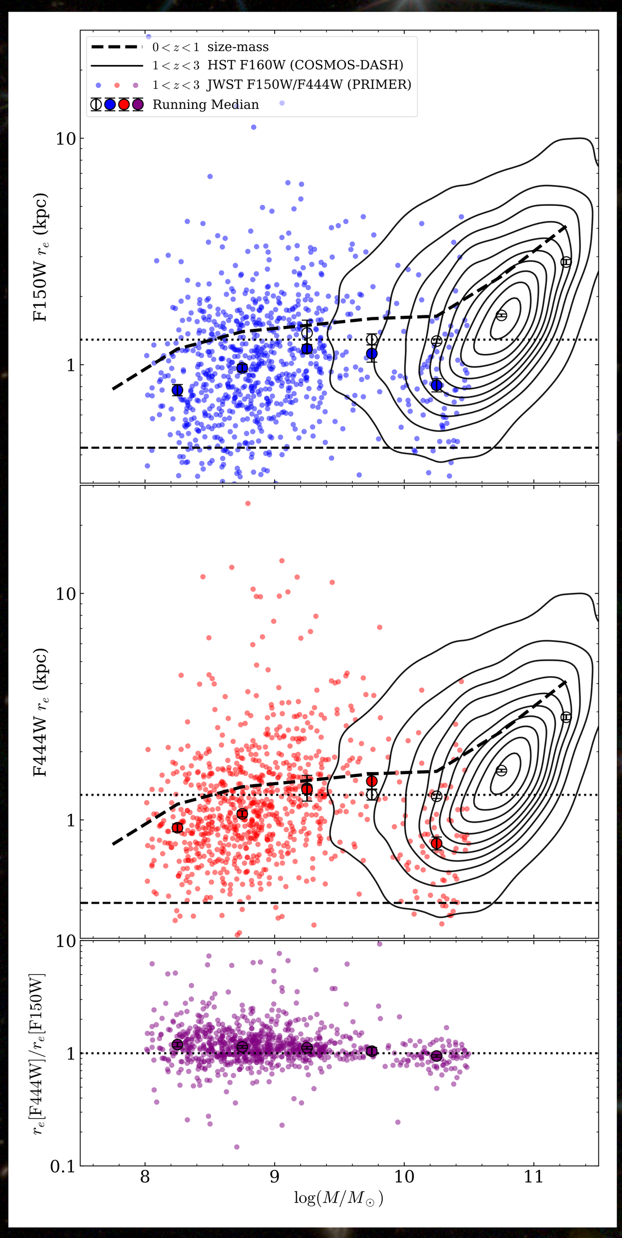
Redder and Resolved: First Look Low-Mass Quiescent Sizes with *JWST*

The initial sample of 864 low-mass quiescent galaxies is obtained using:

- S/N in F150W and F444W >10
- Selections on eazy [7] measurements:
  - $1<z<3$
  - $8<\log(M/M_{sun})<10.5$
  - $(U-V)>0.8(V-J)+0.7$

Morphologies are fit using GALFIT [8] with empirical PSFs made from the imaging data itself. Fits are done to both the F150W and F444W filters.

In general, the size-mass flattening persists at cosmic noon in both F150W and F444W. However, quenched galaxy sizes measured in *JWST* at $\log(M/M_{sun})\sim10.5$ are significantly smaller than those measured with *HST*, possibly due to the resolution limits of *HST* F160W. This dip in the quiescent size-mass relation could be the result of changing quenching mechanisms between low- and high-mass galaxies, e.g. high-mass quenching is driven by mass while low-mass quenching is driven by environment. Similar sizes are measured at 1.5 and 4.4 μm.



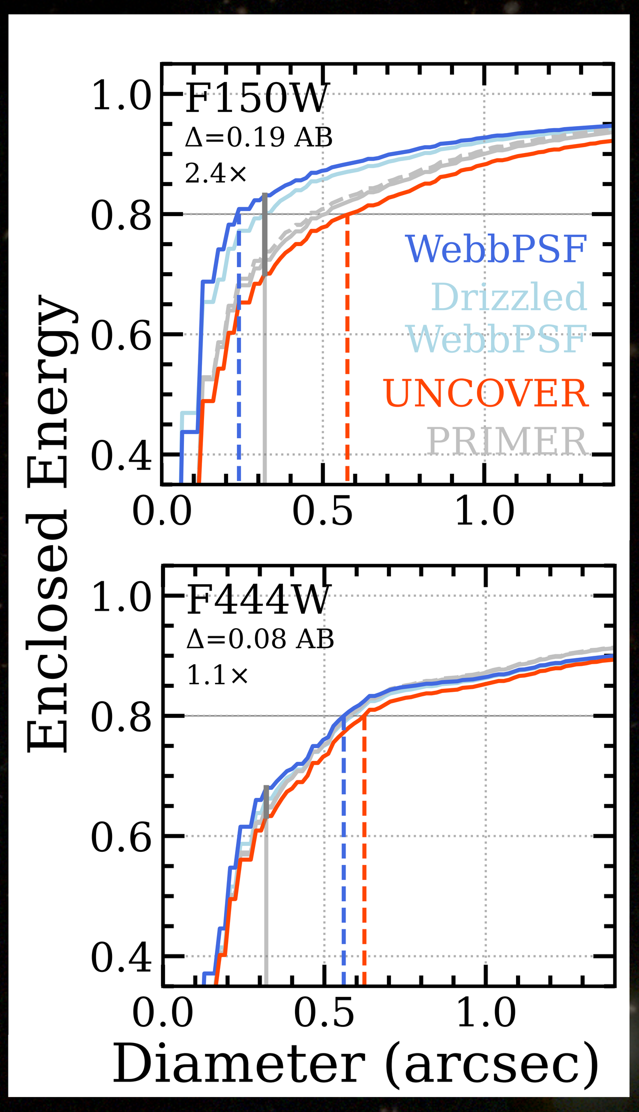
Modern-Day Morphologeurs: Future Steps

The initial sample of low-mass quiescent galaxies will be refined after SPS modeling is run for the PRIMER catalogs using the Prospector-β model [8] which will provide more accurate redshifts, stellar masses, and star-formation rates.

Primary improvements to measurements will be driven by the creation of a new Sérsic fitting code, which handles model fitting similar to GALFIT [7] but using Python and Bayesian forward modeling for estimating uncertainties.

Early work with *JWST* data has revealed several issues with the PSF. Point sources taken from imaging are significantly broader, especially at shorter wavelengths than theoretical PSFs from WebbPSF [8-9]. This effect could be driven by scattered light and thus is field dependent [6].

Moreover, point sources can vary in size across a given field, meaning empirical PSFs should take this effect into account. The new Sérsic fitting code should include an error budget for the PSF, which will be propagated into final uncertainties.



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