BUFFALO Meeting | July 12 2021

COSMOS2020

new insights into galaxy assembly and evolution at high-z

John R. **Weaver**

PhD Fellow @ Cosmic Dawn Center, Univ. of Copenhagen

@astroweave

with Olivier Kauffmann, Marko Shuntov, Iary Davidzon, Olivier Ilbert, Gabe Brammer, Peter Capak, Clotilde Laigle, Bo Milvang-Jensen, Paul B.C. Hsieh, Andrea Moneti, Henry J. McCracken, Sune Toft

and the rest of the COSMOS team

Danmarks Grundforskningsfond
Danish National Research Foundation

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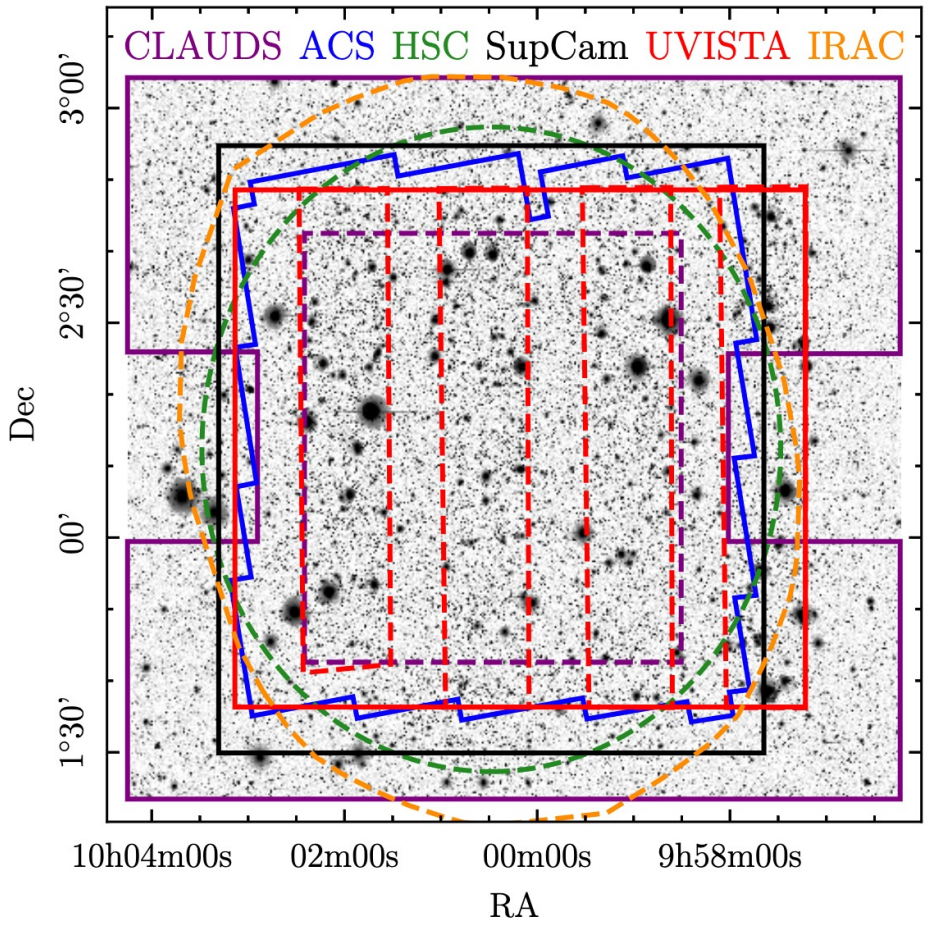
DAWN

COSMOS2020 *at a glance*

NIR-selected catalog of ~1M galaxies over 2 deg^2

{Weaver et al., submitted}



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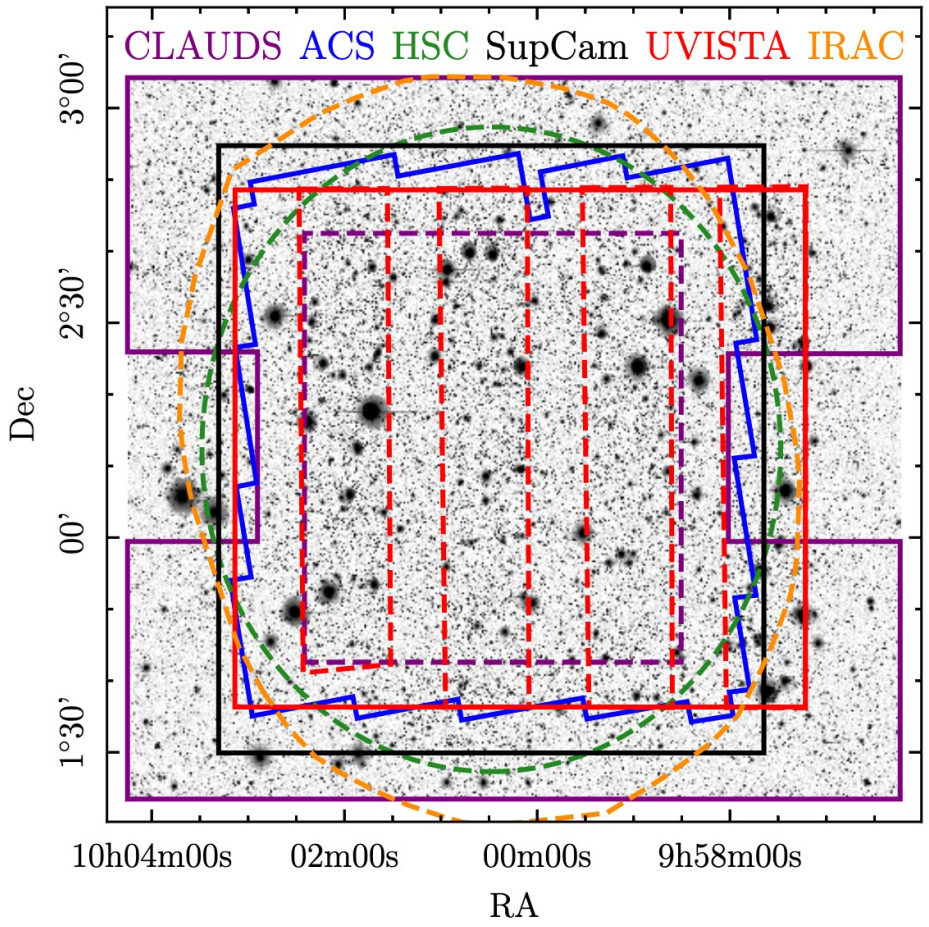

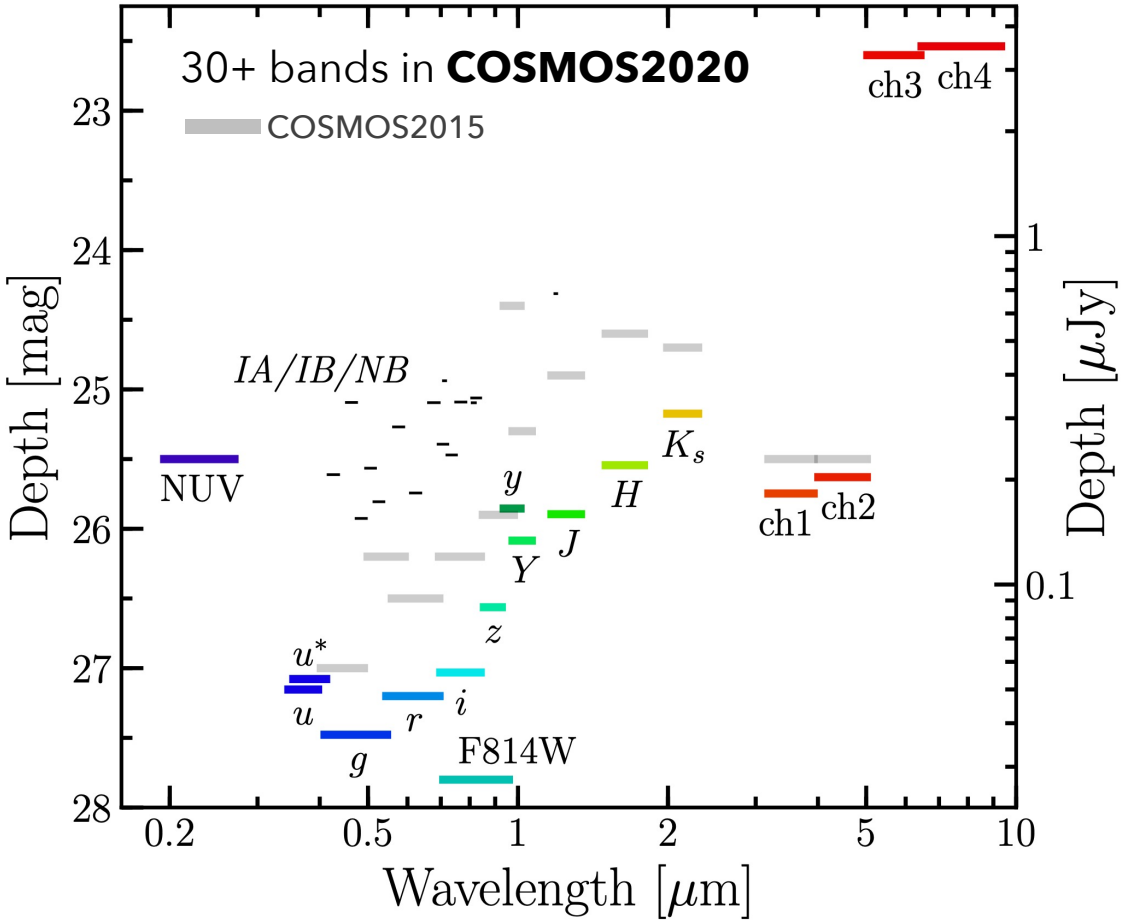

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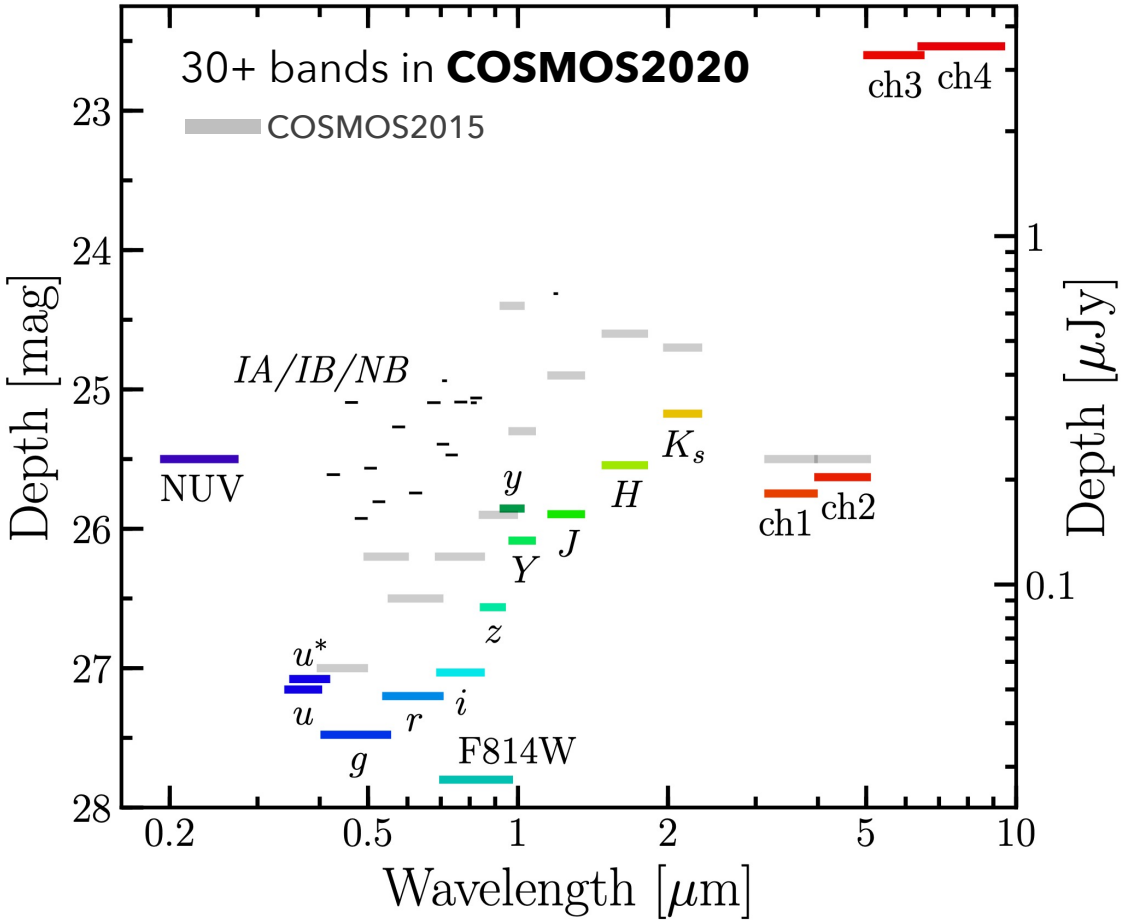

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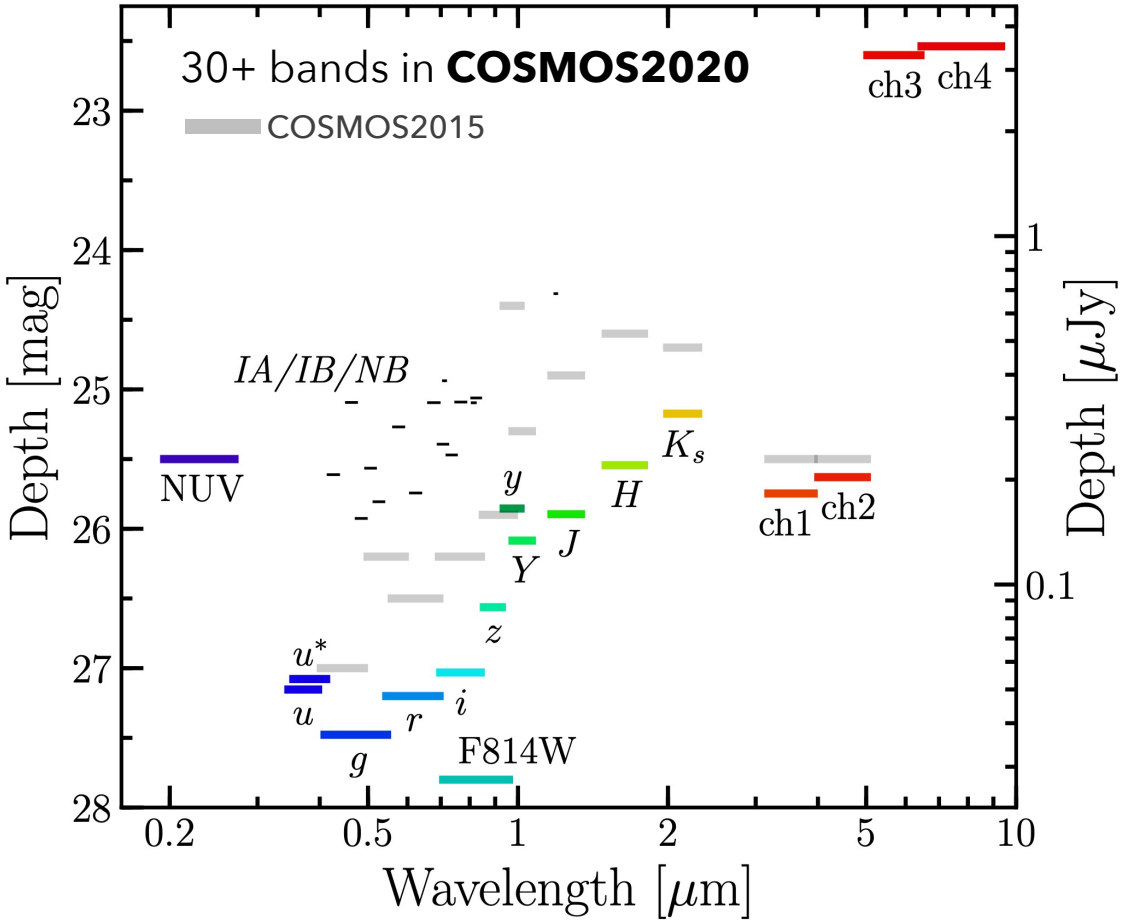
- Uses Sextractor for detection + photometry
  {Bertin & Arnouts, 1996}
- IRACLEAN for IRAC [3.6um] [4.5um]
  {Hsieh et al. 2012}
- Same strategy as COSMOS2015
  {Laigle et al. 2016}



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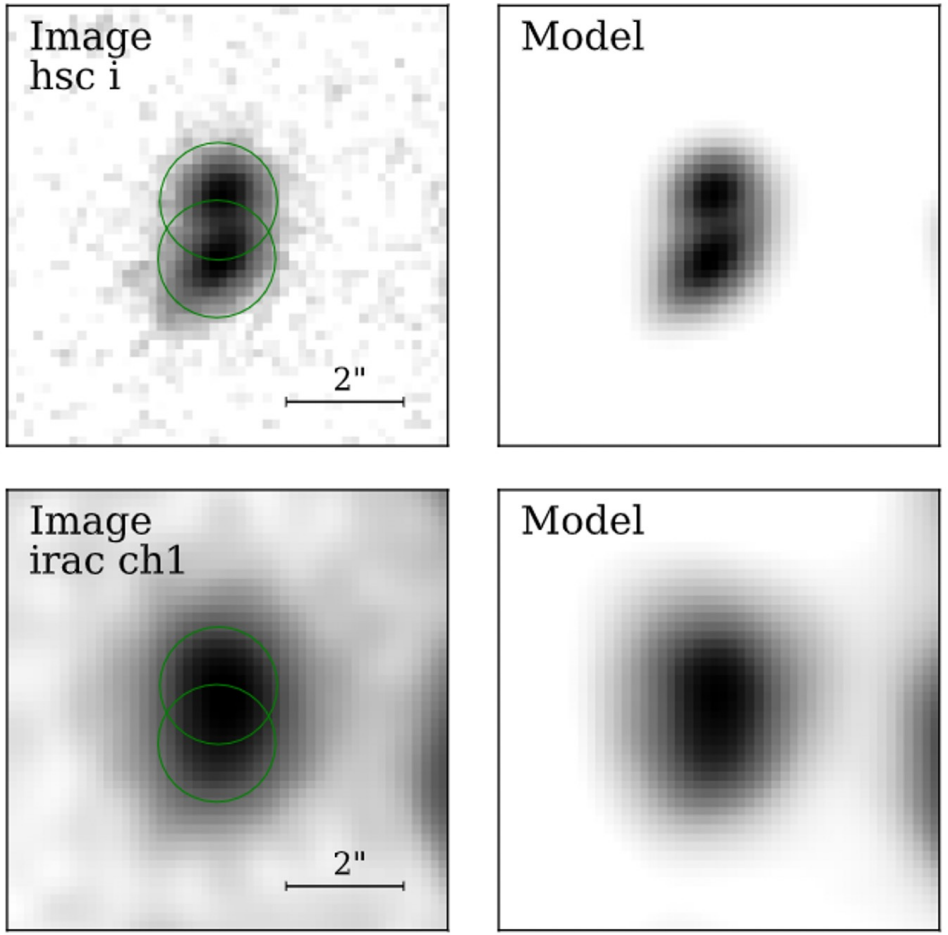
- Utilize parametric models to fit sources: **The Tractor**

  {Lang et al. 2016ab}

- Flux and position are now *model parameters*
  - ✓ Sensitivity to ultra-faint sources
  - ✓ Precise de-blending
  - ✓ Free fitting + residual statistics, shapes, sizes
- Developed a scalable + reproducible framework

  THE FARMER {Weaver et al., in prep}



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- Each paired with both two photo-z codes:

  Le Phare
  {Ilbert et al. 2006}

  EAzY
  {Brammer et al. 2008}

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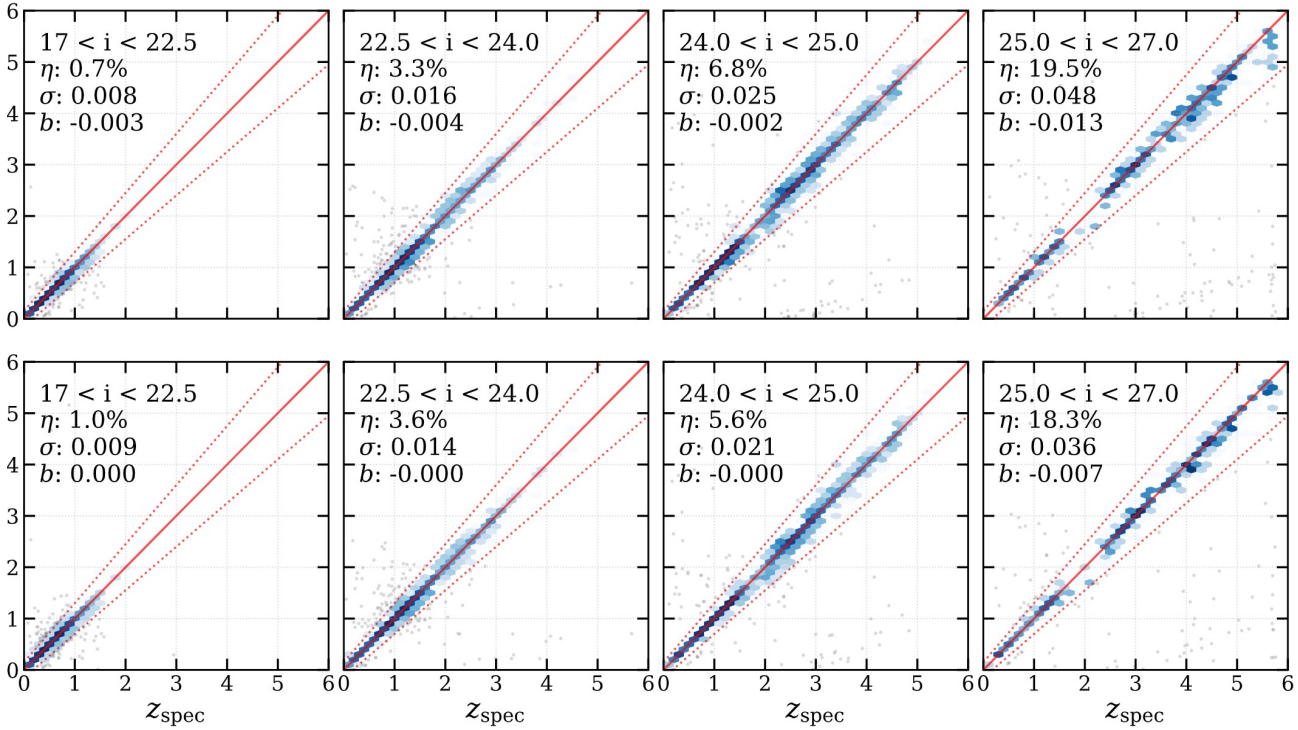
η – outlier fraction
σ – standard deviation
b – median bias

Classic {apertures}



The Farmer {models}

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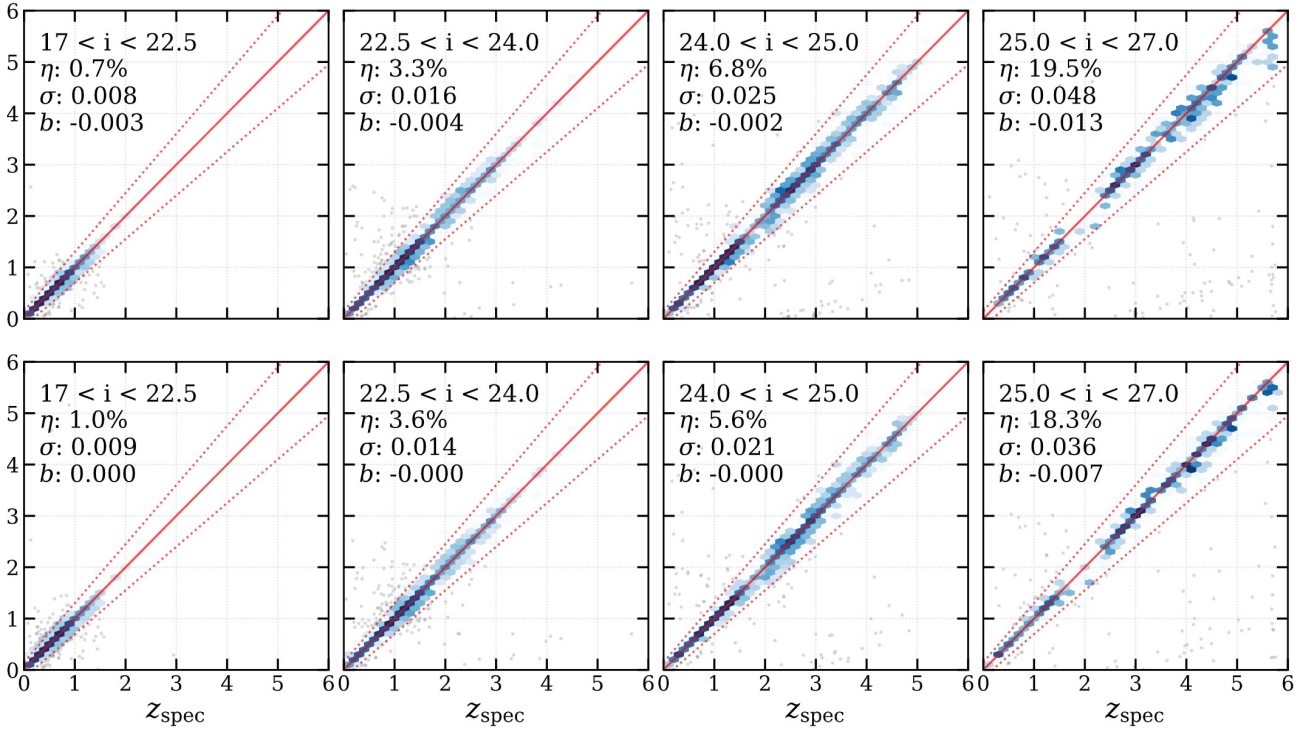
- Unprecedented photometric accuracy

  σ < 1% at i < 22.5 AB; < 5% at ~26 AB

- Low bias, low failure rate

η – outlier fraction
σ – standard deviation
b – median bias

Classic {apertures}



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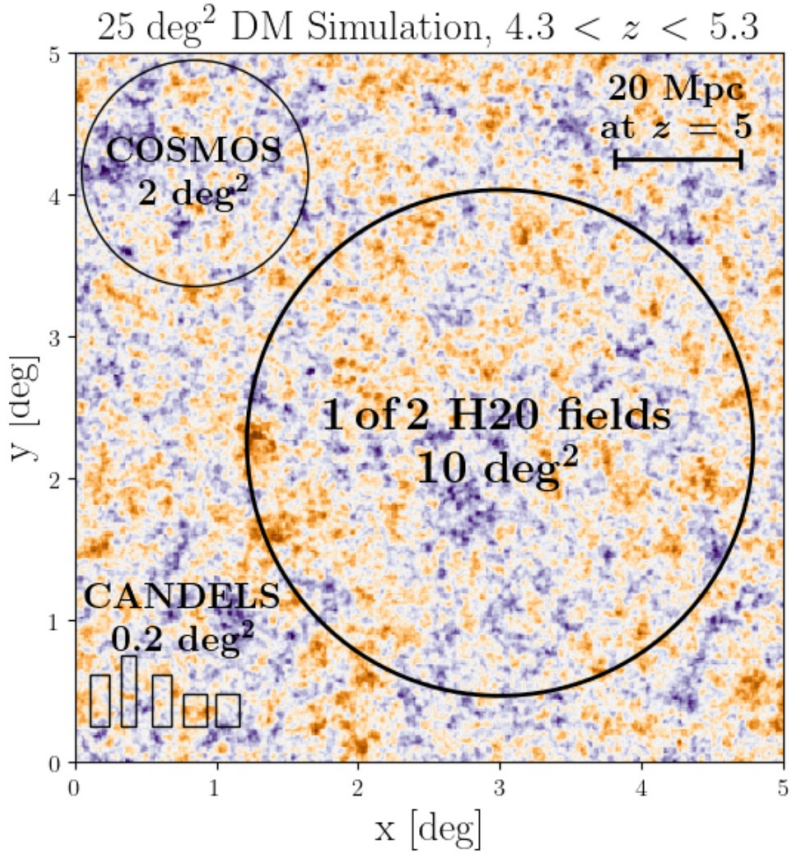
Environments dense enough to support the most massive galaxies

are found in only the largest & deepest surveys → COSMOS**2020**

Simulation of The Epoch of Reionization
{M. Alvarez et al.}



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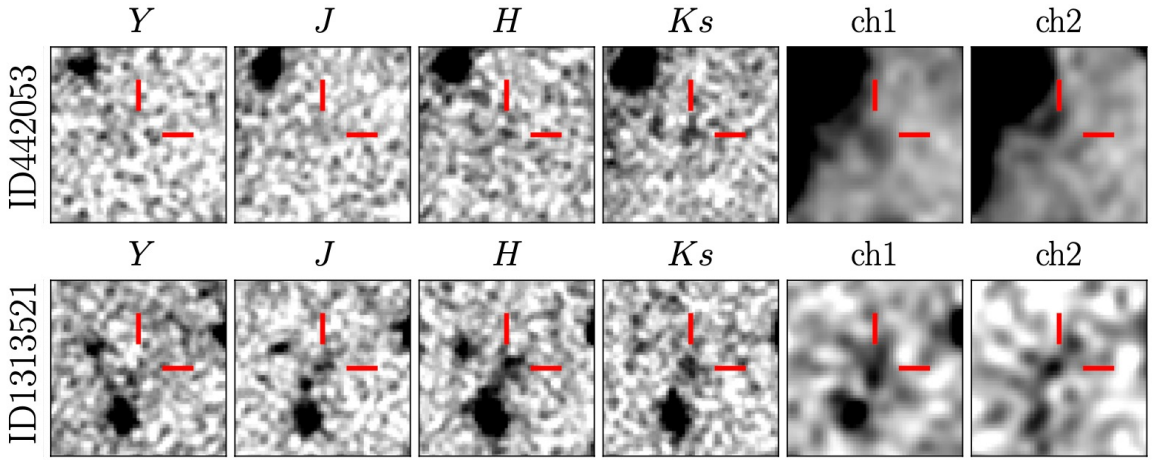
The UV Luminosity Function

New constraints on the first ultra-luminous galaxies

{Kauffmann, Ilbert, Weaver et al., in prep.}

- 31 galaxy candidates @ $z > 7.5$ over 0.8 deg^2
- New sources only found with **THE FARMER**

Not selected in apertures due to crowding



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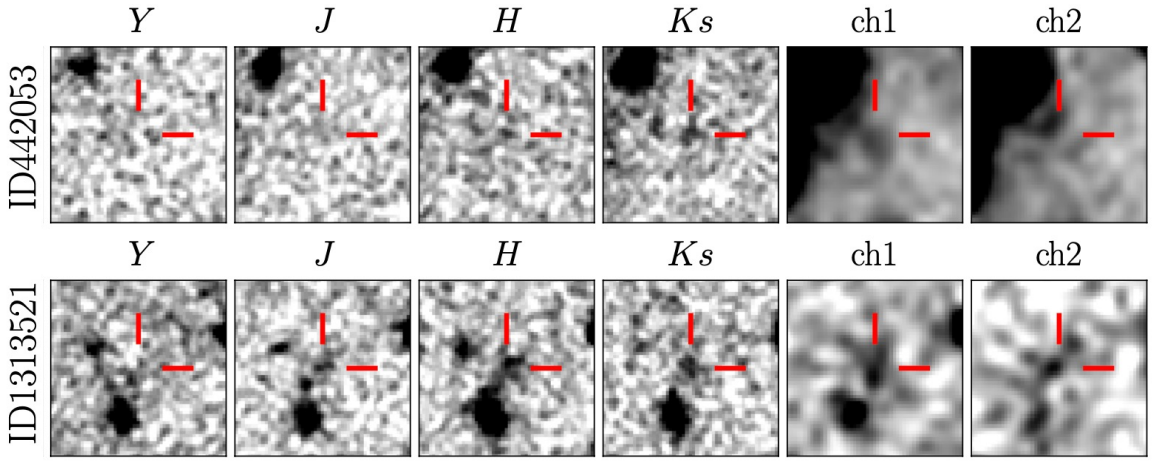

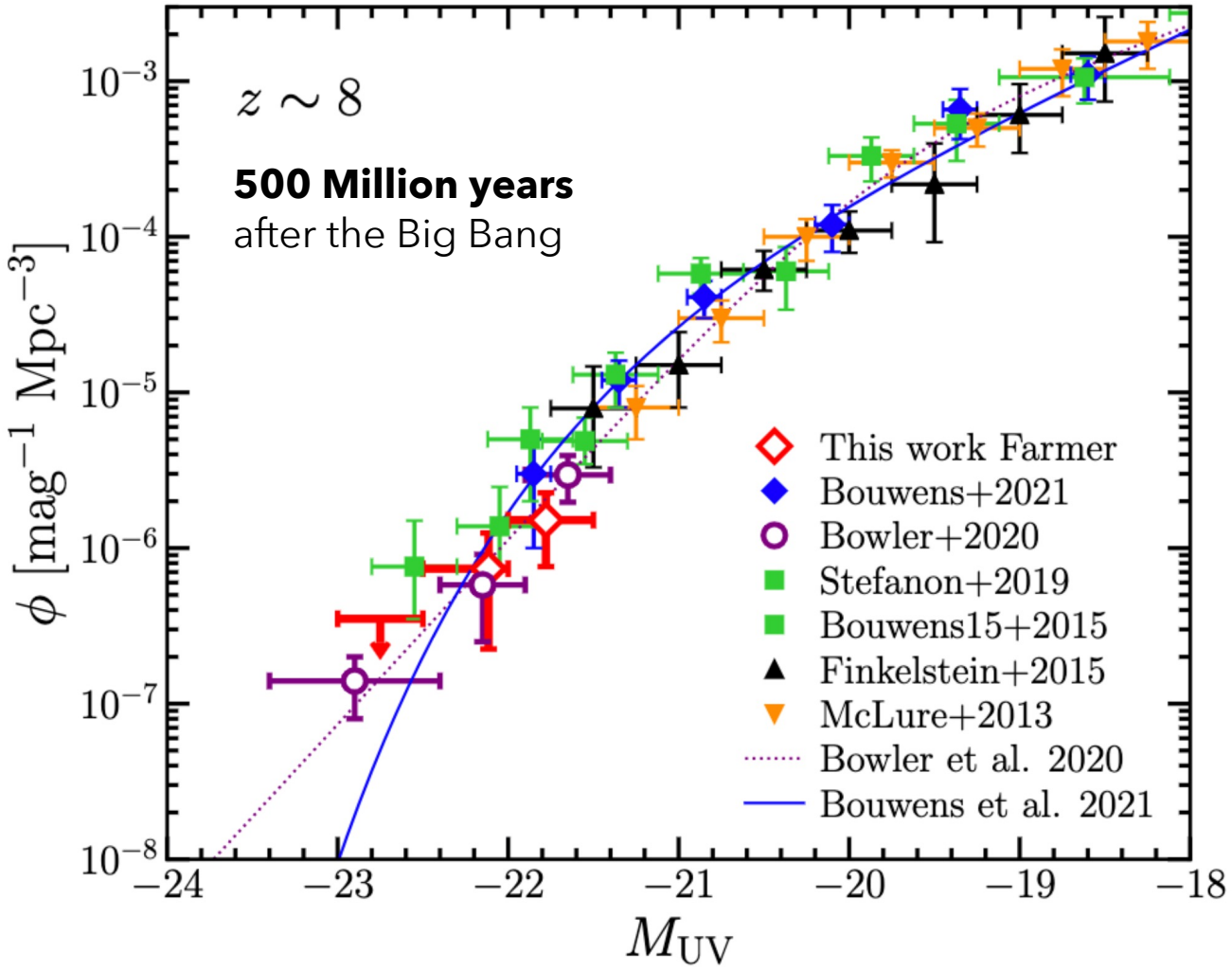

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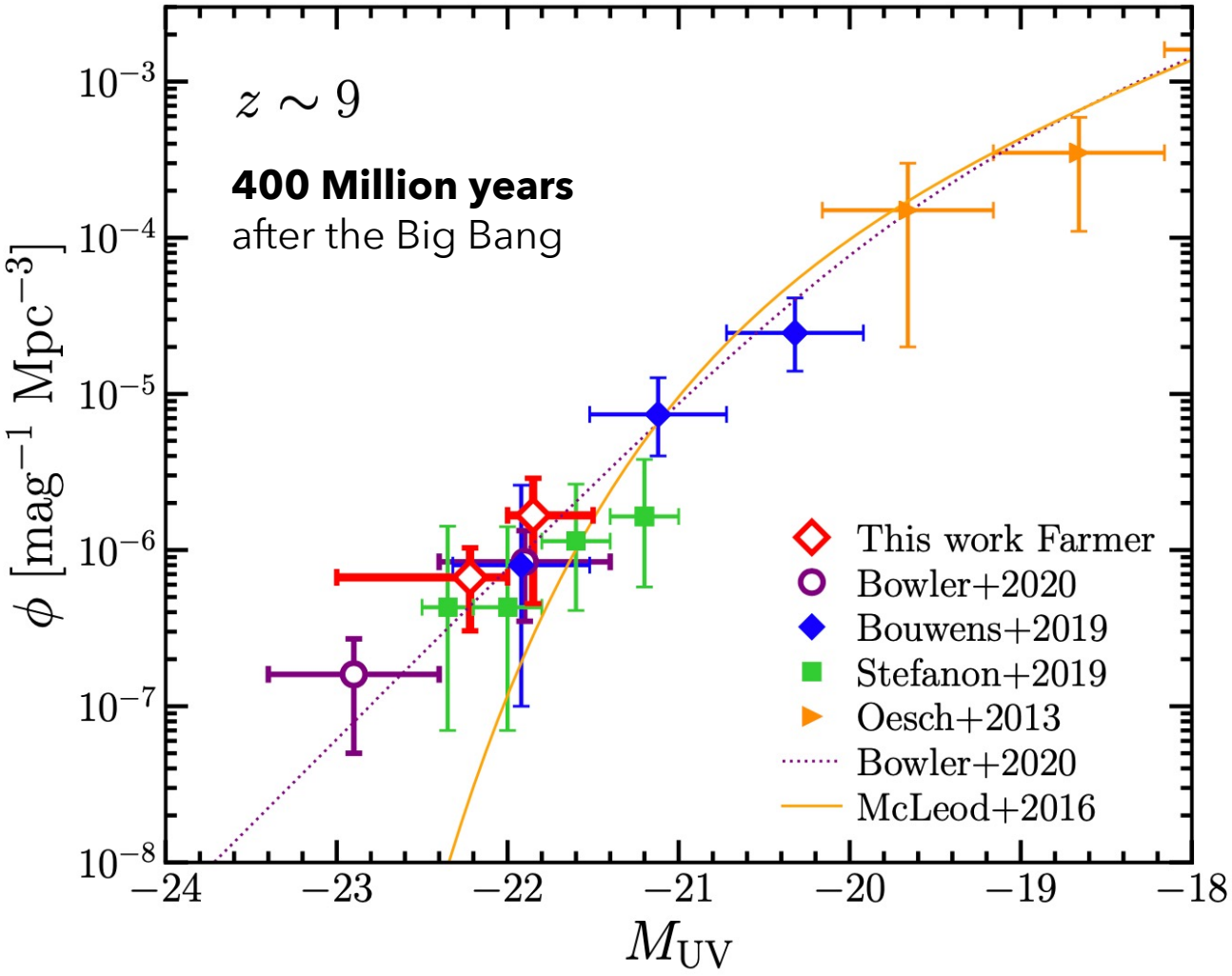

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We find an excess of $M_{UV} < -21.5$ sources

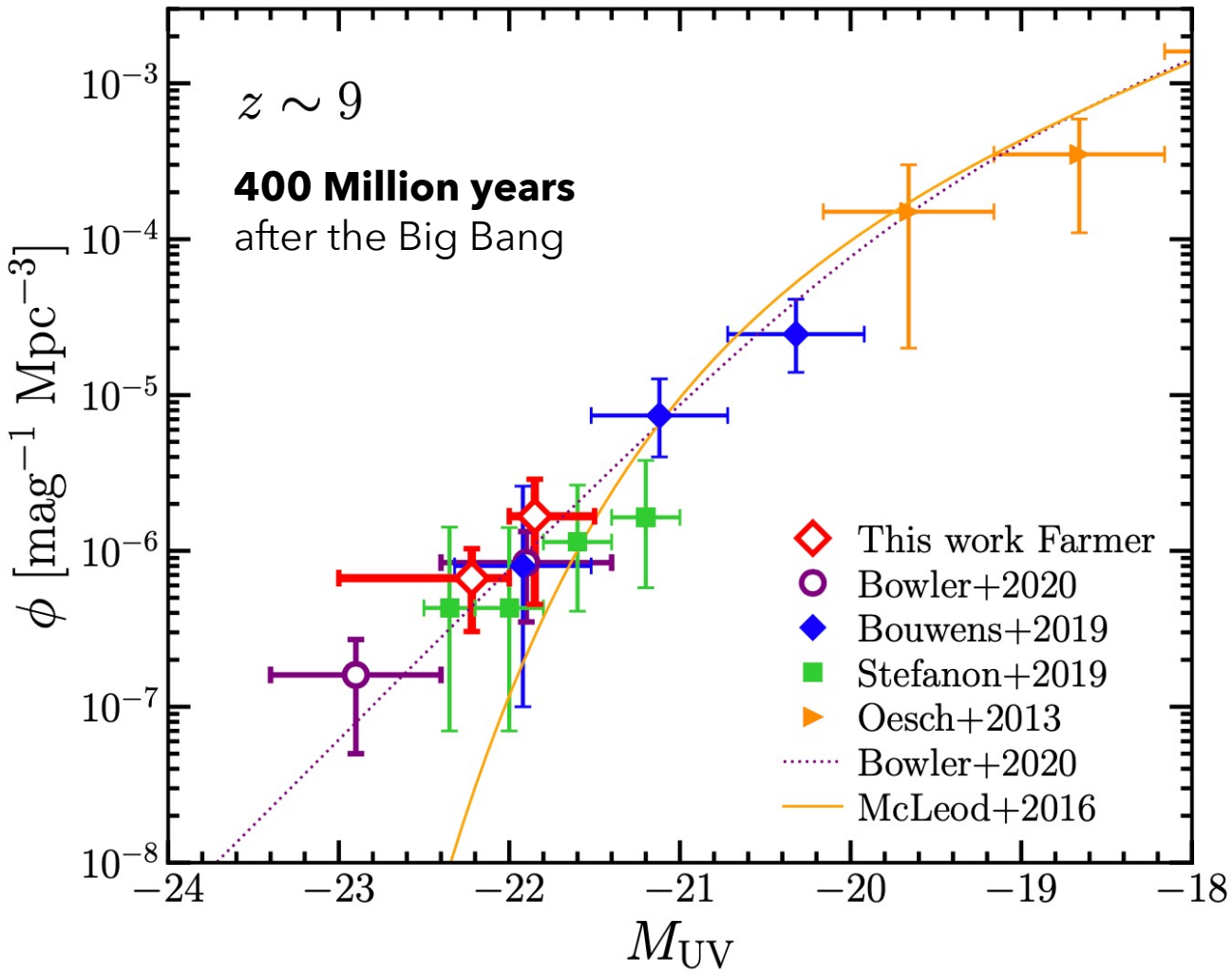
{Consistent with previous work; e.g., Stefanon et al. 2019, Bowler et al. 2020}

Could quenching have not begun yet?

{halo quenching; Peng et al. 2010}

Or does dust evolution complicate this picture?

{e.g., Bowler et al. 2015, Finkelstein et al. 2015}



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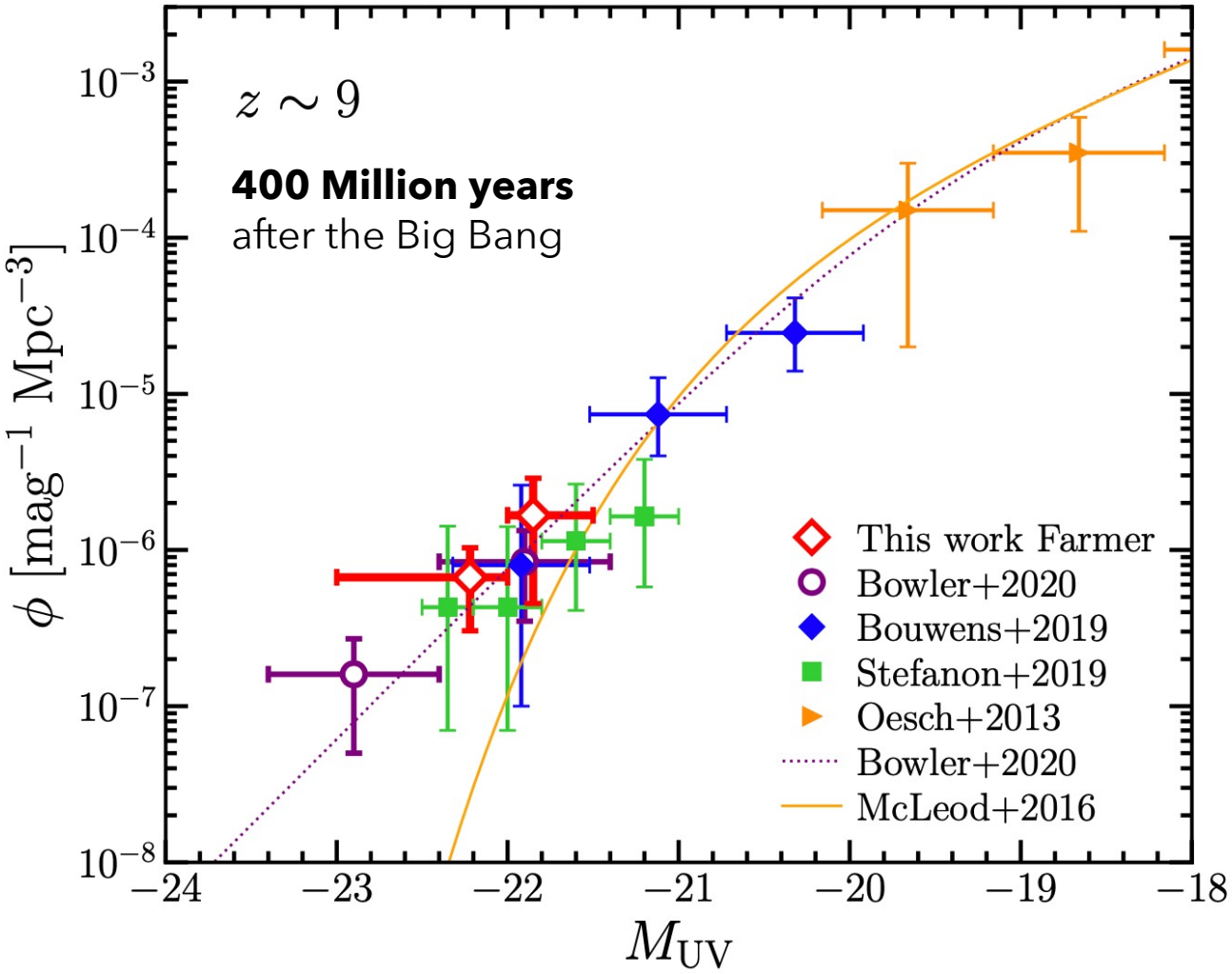

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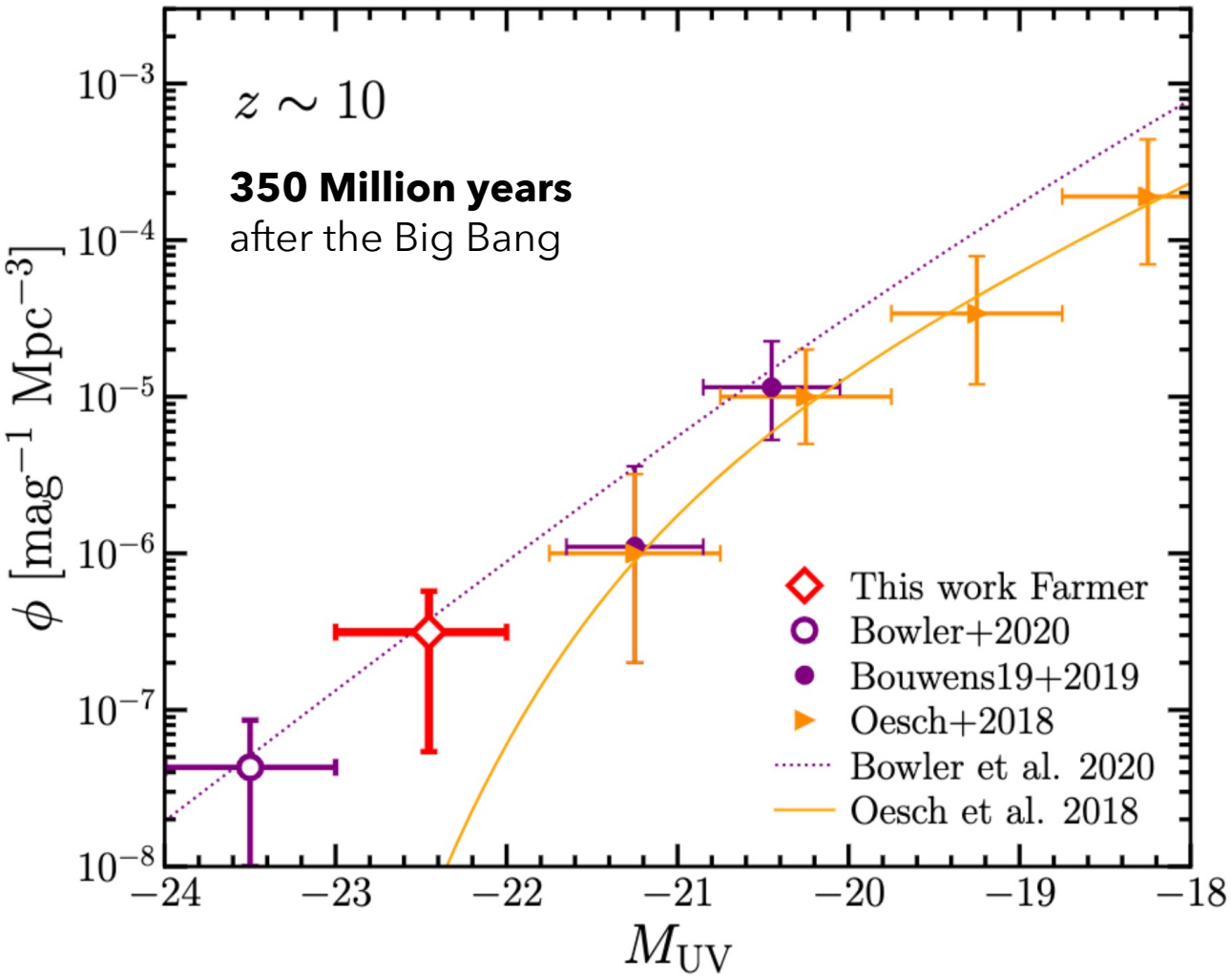

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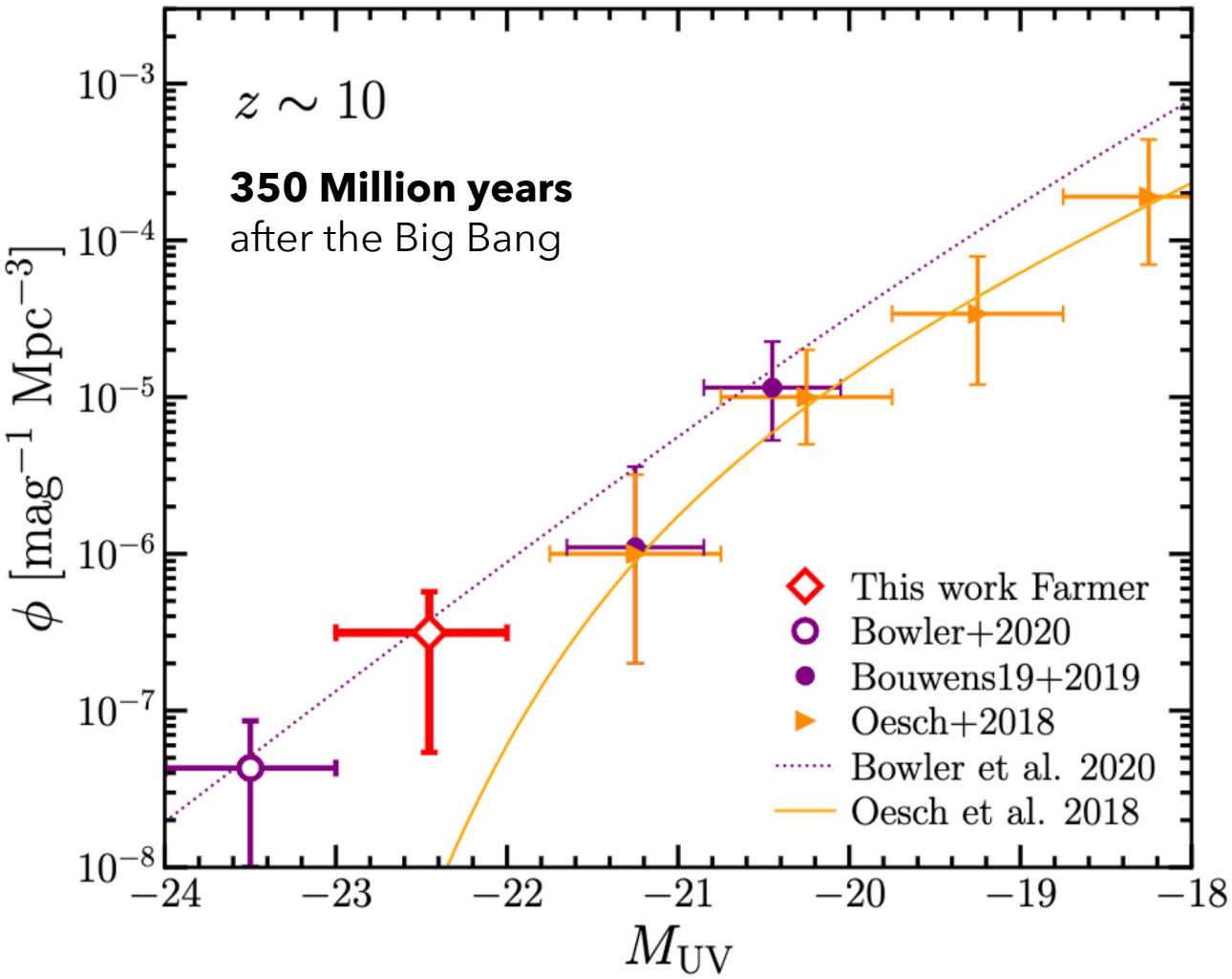
If SFRE at z~10 is similar to z~9,

we should not find such bright galaxies here.



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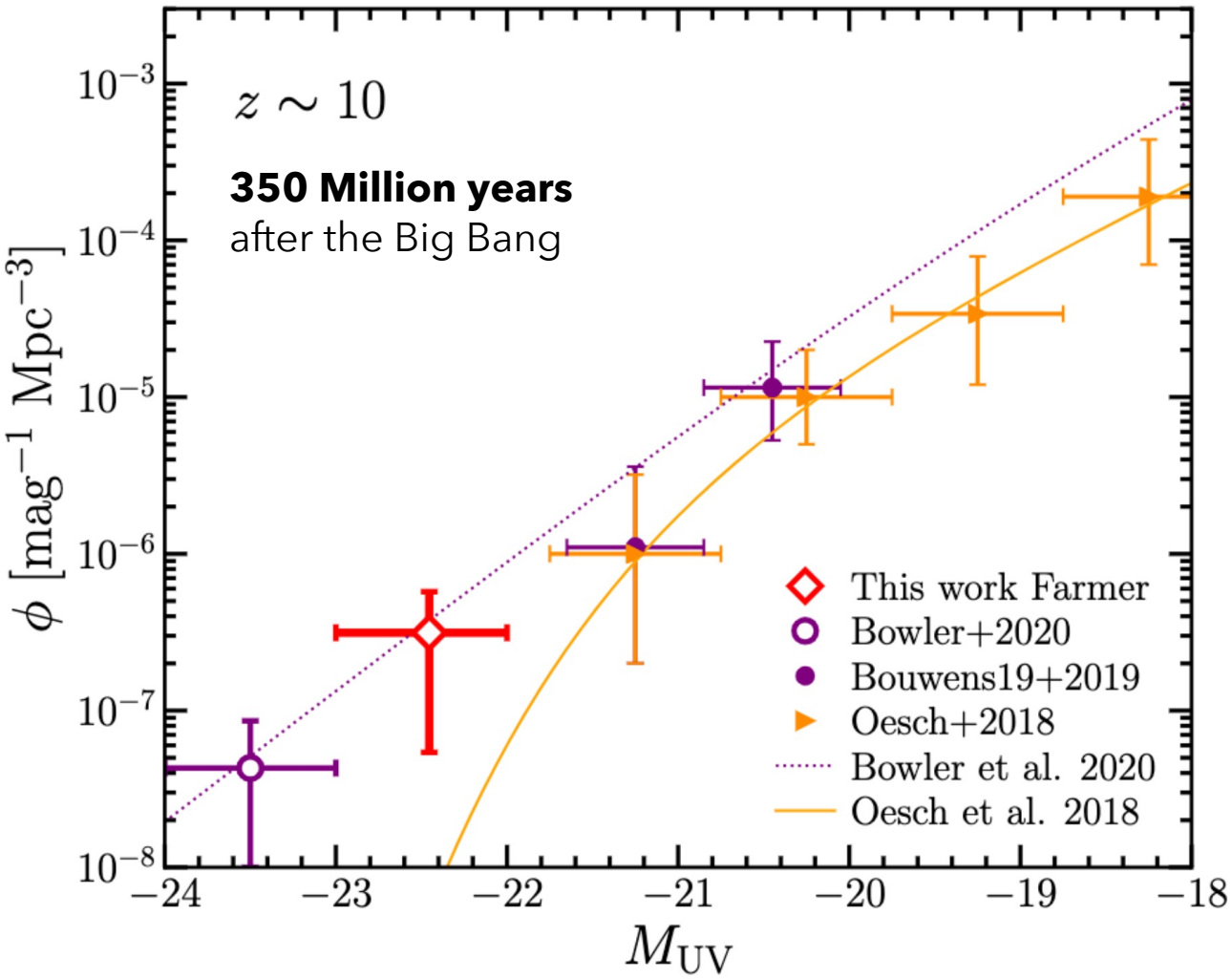
While lensing estimates are too weak at z~8-9

it may contribute to the lack of evolution at z~10

in addition to contamination



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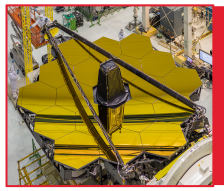


"Beasts" Cycle 1 **JWST** Program

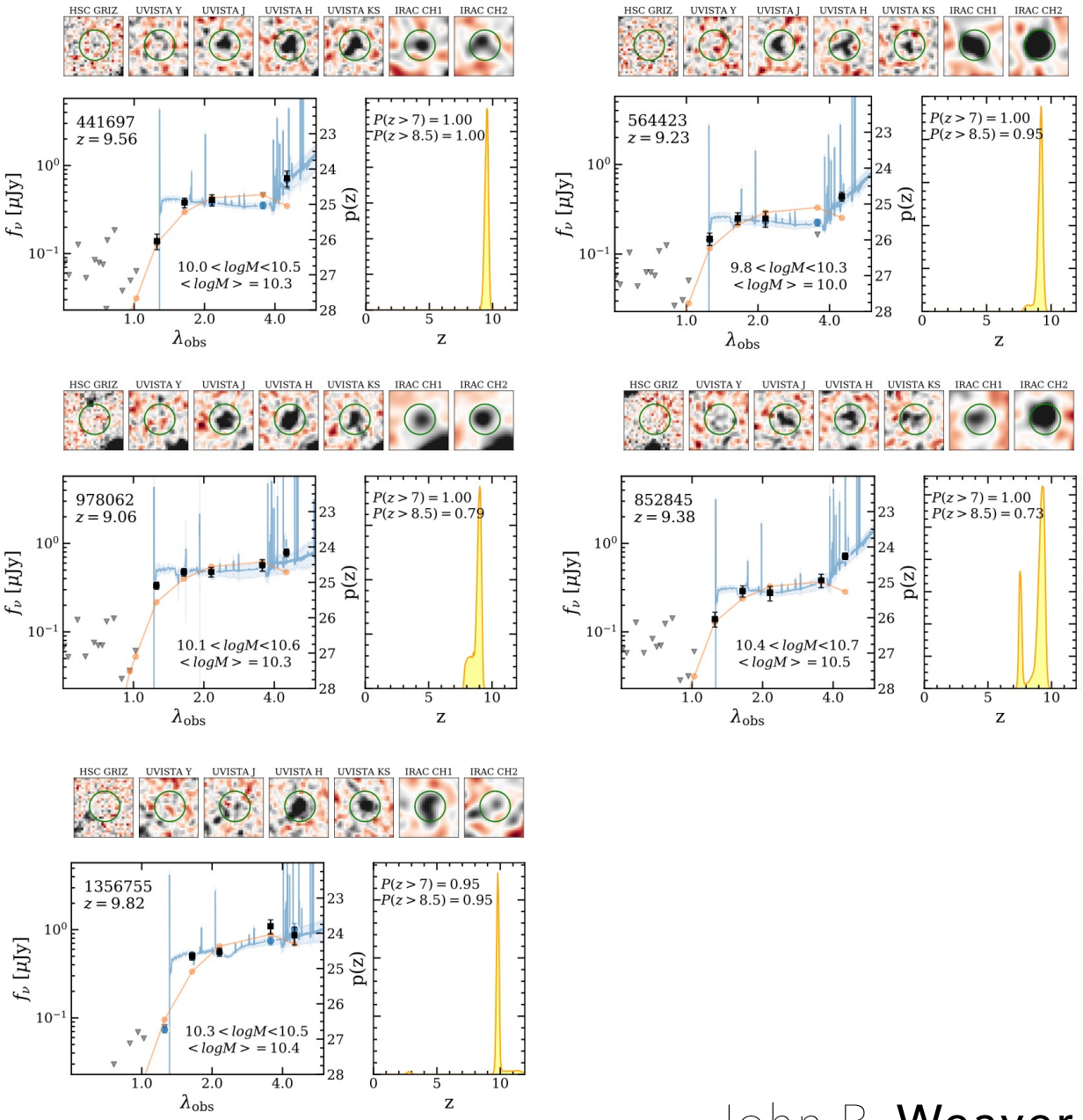
{PI: Weaver, PID 2659}

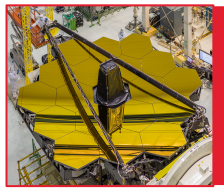
Detailed spectroscopic study of $z \sim 9$ galaxies

- **Five** robust, *ultra*-luminous galaxies ($M_{UV} \sim -22.5$)

  Will not be seen in smaller surveys (e.g. JADES)

- Characterize their mass assembly and star-formation





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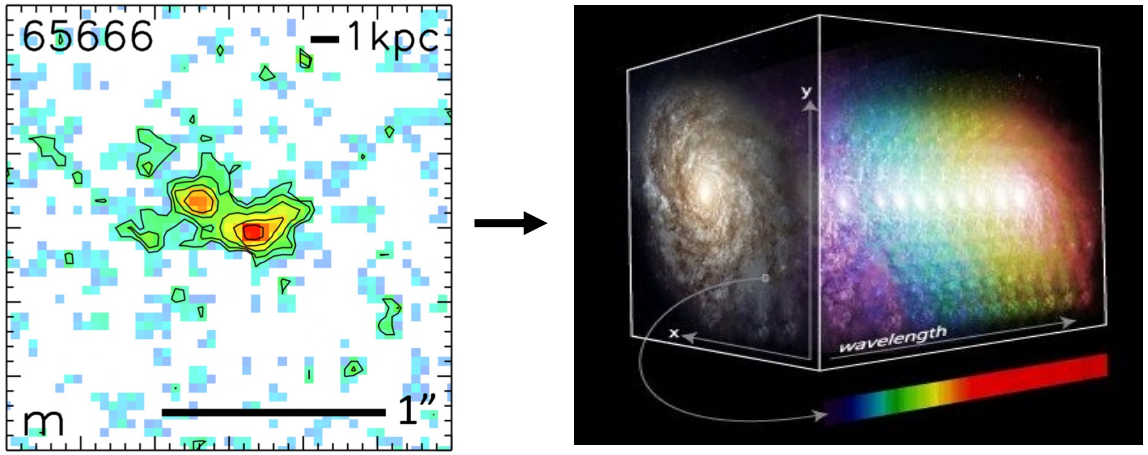
Detailed spectroscopic study of z ~ 9 galaxies

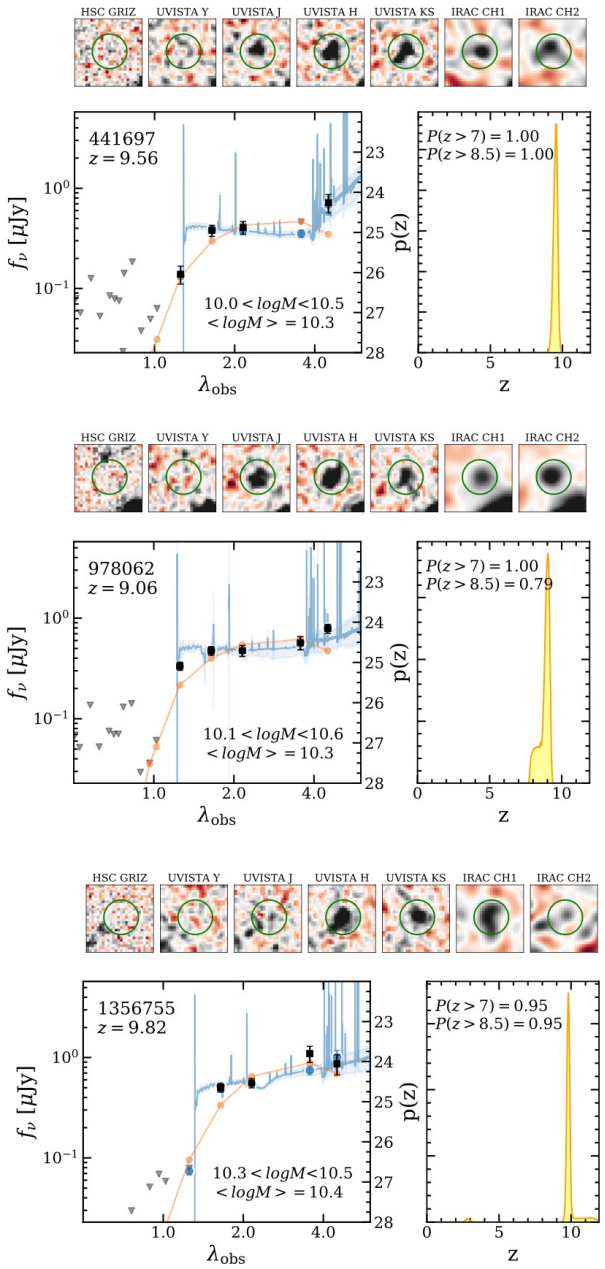
- **Five** robust, *ultra*-luminous galaxies (M_{UV} ~ -22.5)

  Will not be seen in smaller surveys (e.g. JADES)

- Characterize their mass assembly and star-formation
- Deep (Y>26) spatially resolved specta; CLEAR/PRISM



z~7; Bowler et al. 2018



COSMIC DAWN SURVEY

A 50 deg² Survey to map the high-redshift universe

https://dawn.ipac.caltech.edu/

- Includes 20 deg² of the Euclid Deep Field North and South

  Deep near-infrared selection

- Optical imaging underway from the Hawaii 2-0 Program

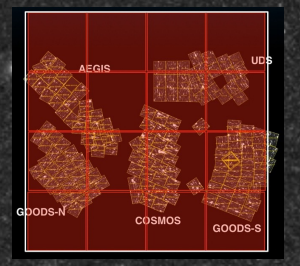
  {McPartland, … Weaver et al., in prep.} {Zalesky, … Weaver et al., in prep.}

- Supported by largest Spitzer mission *ever*

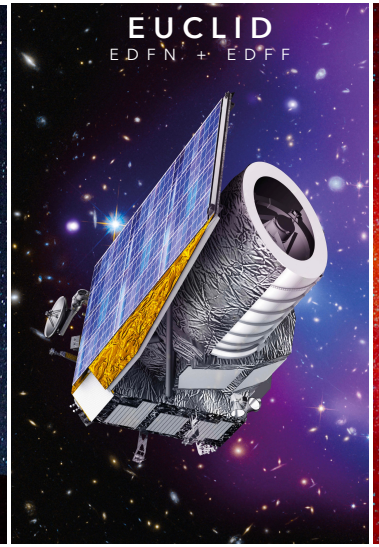
  {Moneti, … Weaver et al., in prep.}

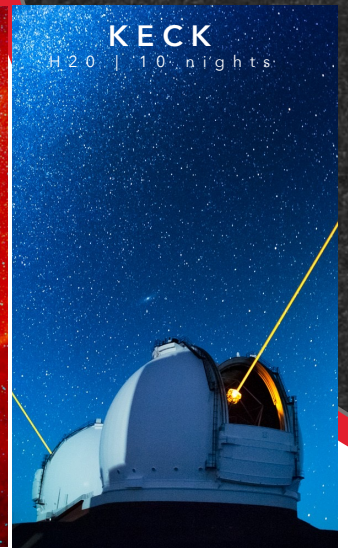
A view into the deep universe

Spitzer/IRAC 3.6um @ the North Ecliptic Pole



Euclid FOV





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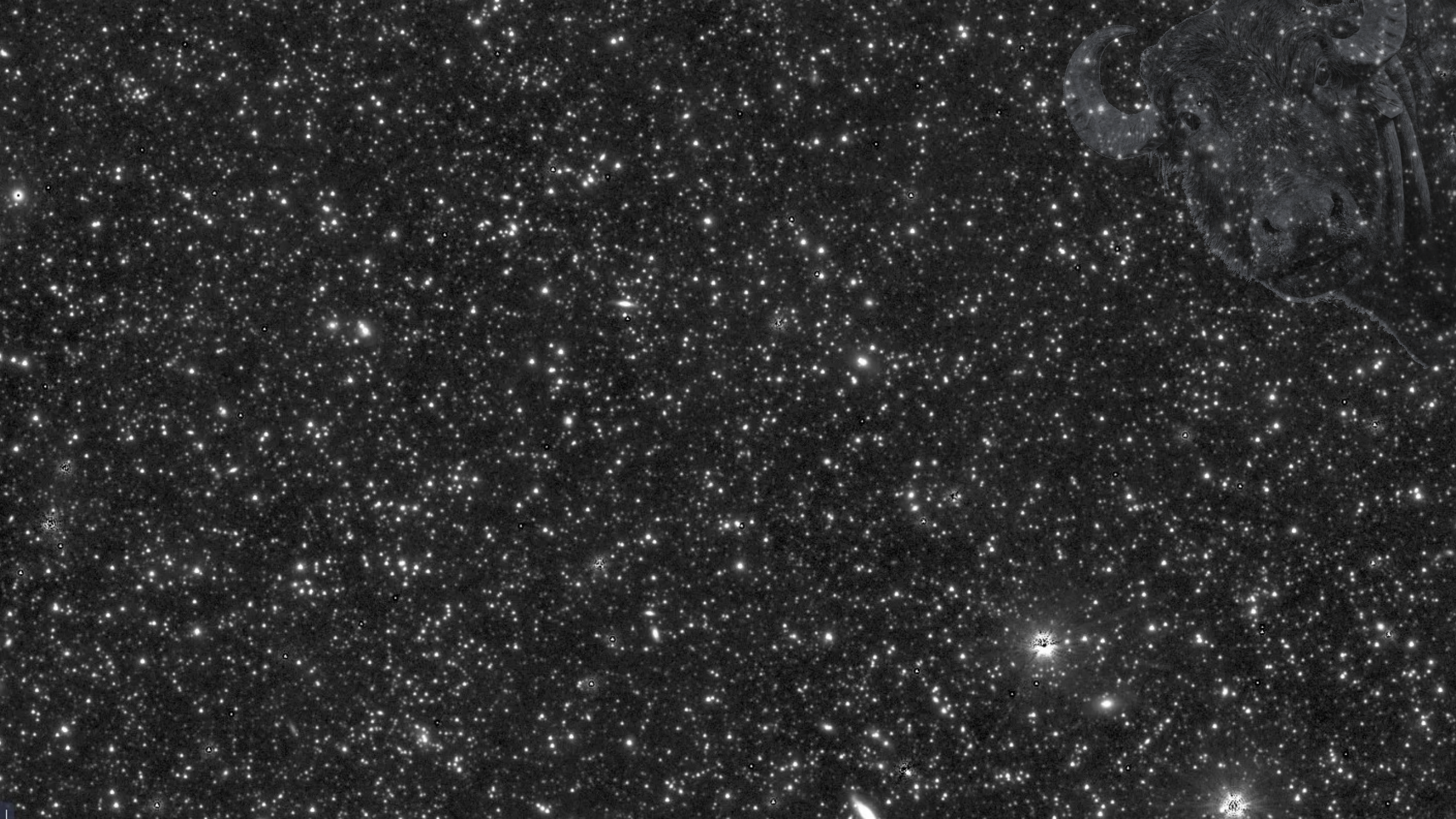
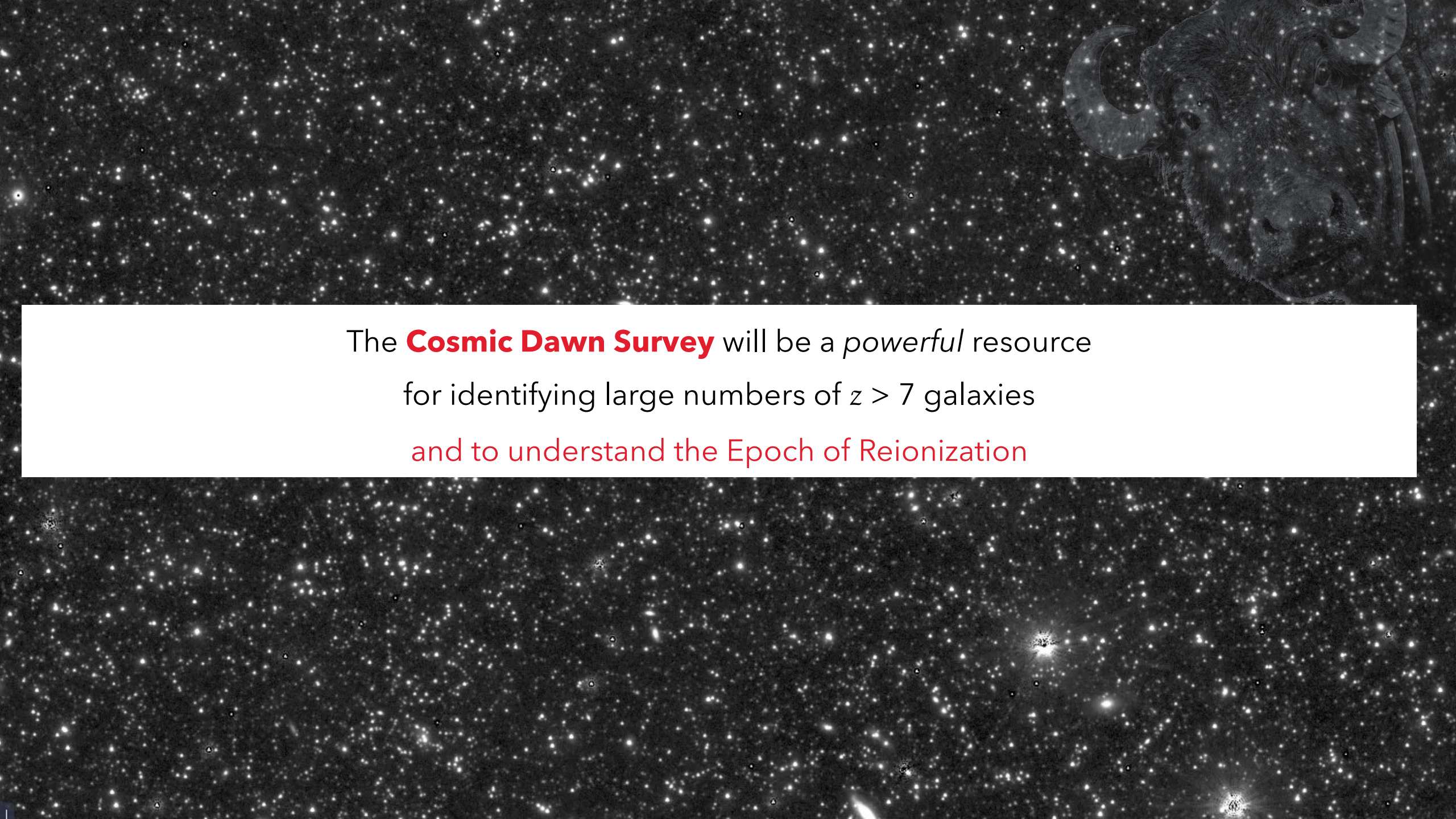




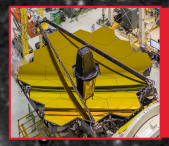
The **Cosmic Dawn Survey** will be a *powerful* resource

for identifying large numbers of $z > 7$ galaxies

and to understand the Epoch of Reionization

THE FARMER
{Weaver et al., in prep}

Interested in working together?
I'm on the market. **Get in touch!**



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john.weaver@nbi.ku.dk
or find me on slack

COSMIC DAWN SURVEY

International collaborations
Euclid | Subaru | Keck | Spitzer

{Moneti, … Weaver et al., subm.}
{McPartland, … Weaver et al., in prep.}
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COSMOS2020
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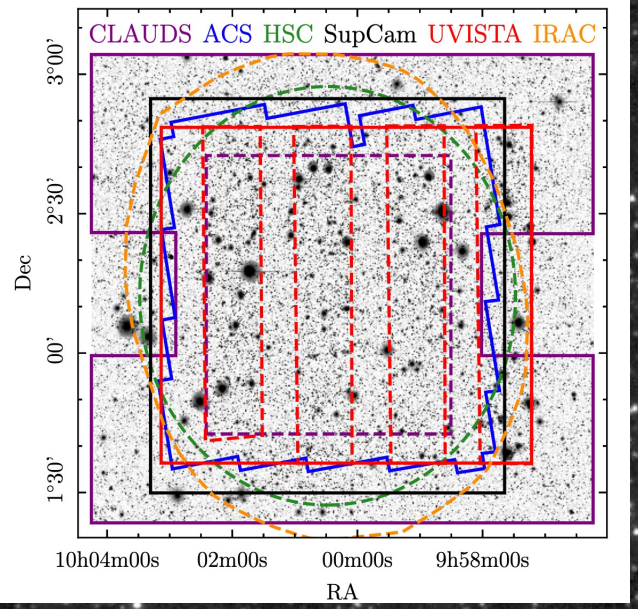

UV Luminosity Function
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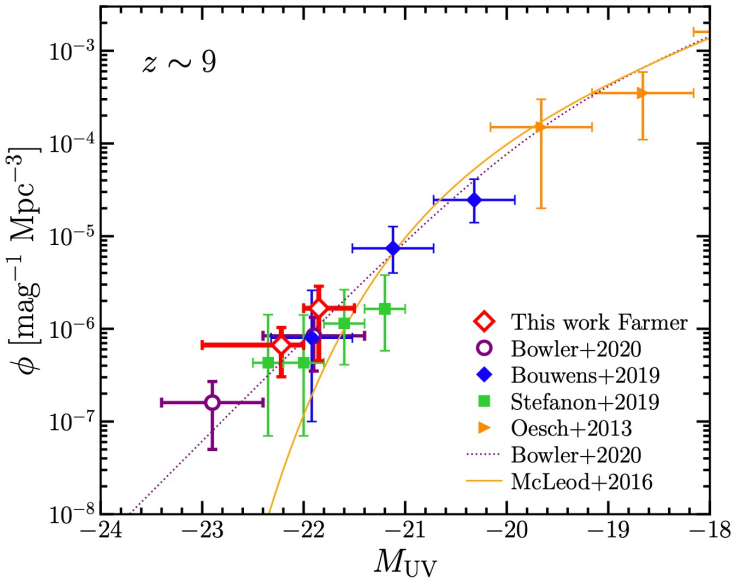
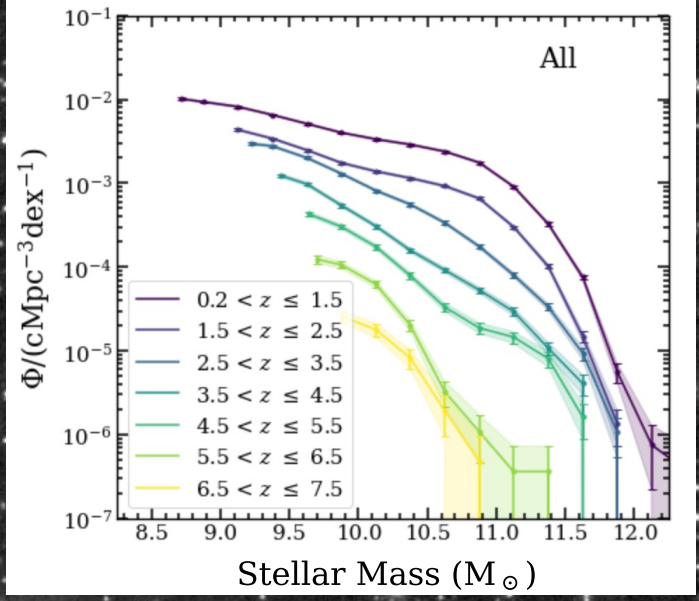
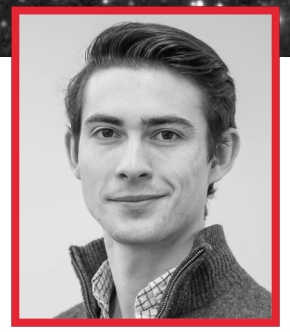


Stellar Mass Function
{Weaver et al., in prep.}





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