

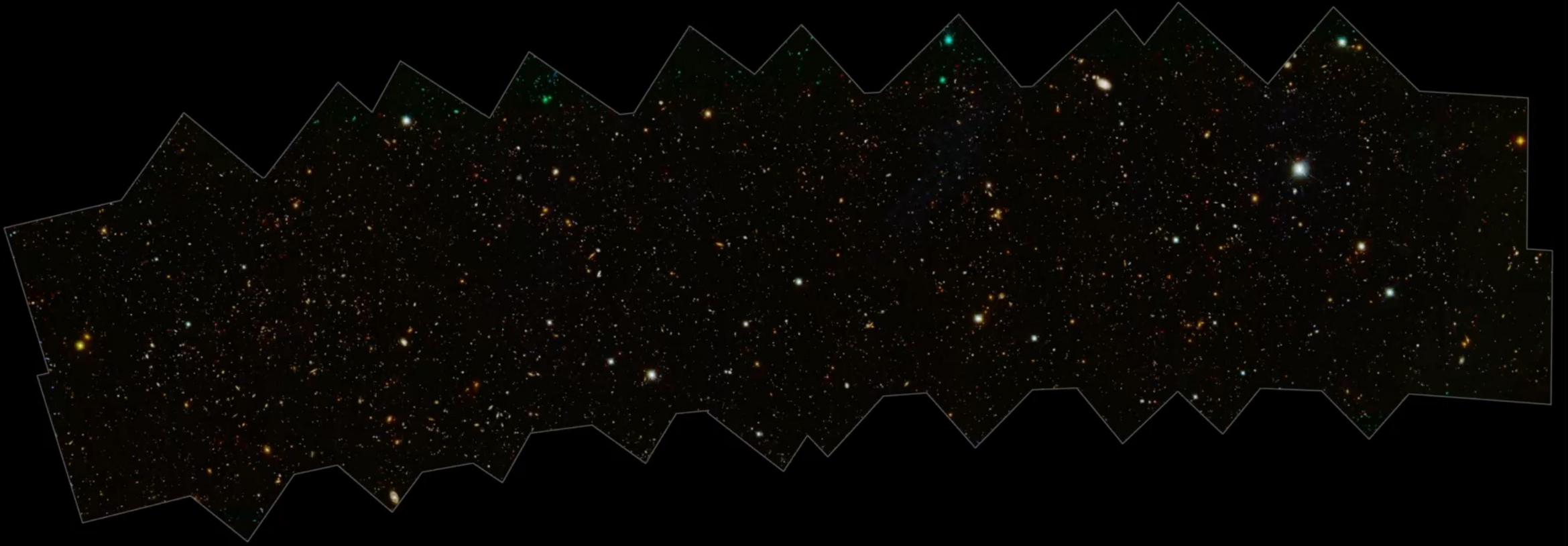
UVCANDELS: the Largest Ultraviolet Survey of Distant Galaxies by NASA's *Hubble* Space Telescope

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Harry Teplitz, Brent Smith, Rogier Windhorst, Marc Rafelski, Anahita Alavi, Seth Cohen, James Colbert, Christopher Conselice, Eric Gawiser, Norman Grogan, Yicheng Guo, Nimish Hathi, Robert Hurt, Zhiyuan Ji, Anton Koekemoer, Ray Lucas, Vihang Mehta, Laura Prichard, Brant Robertson, Michael Rutkowski, Claudia Scarlata, Ben Sunnquist, and
the **UVCANDELS** team

New UV + blue-optical view of the famous *Hubble* fields



blue color: UV + blue (new), **green** color: mid-optical, **red** color: near-infrared

New UV + blue-optical view of the famous *Hubble* fields

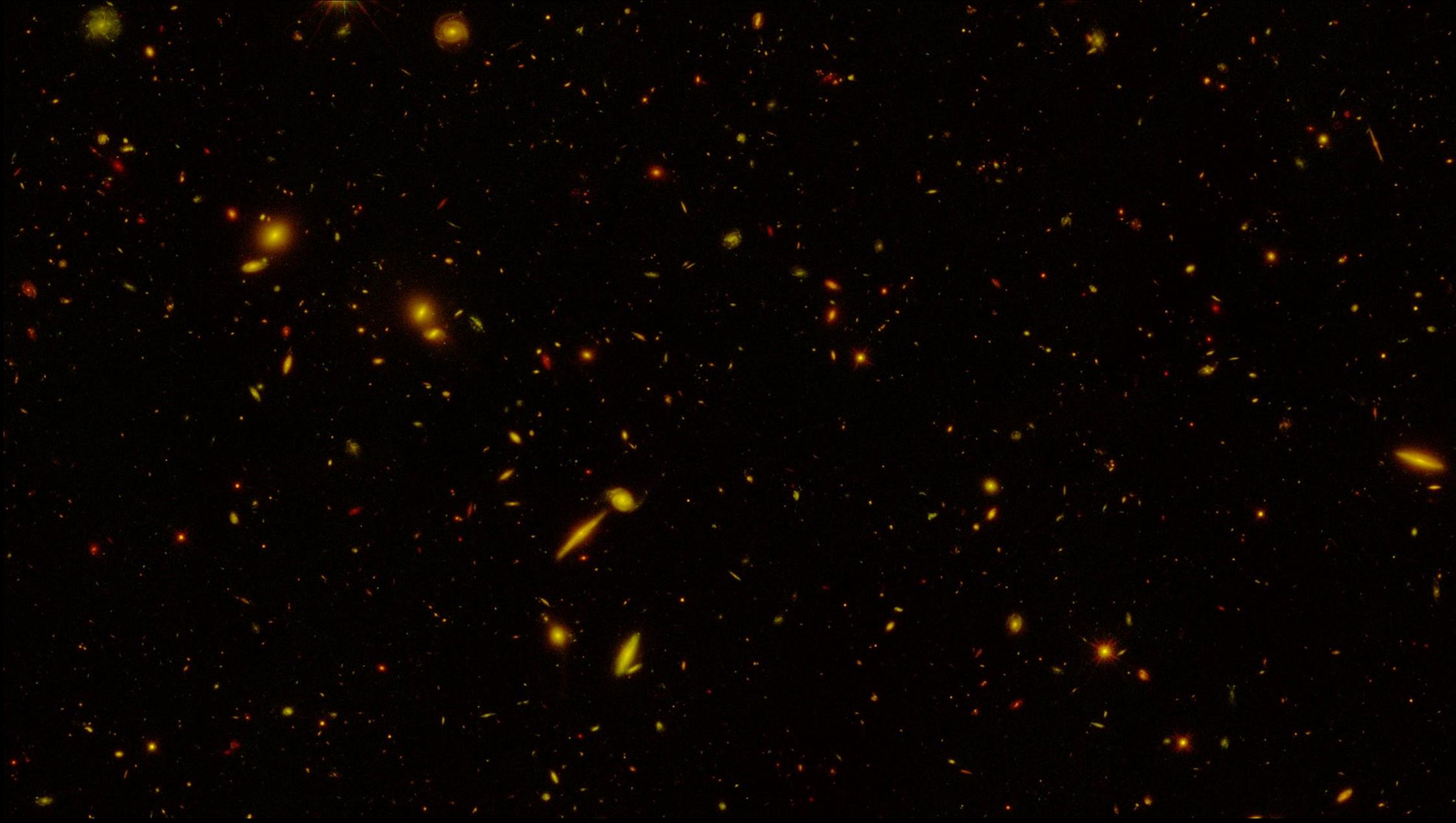
The entire survey: ~140,000 galaxies



This picture (3'.9x2'.2): >5,000 galaxies

blue: UV + blue (new), green: mid-optical, red: near-infrared

The entire survey: ~140,000 galaxies



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blue: UV + blue (new), **green:** mid-optical, **red:** near-infrared

The entire survey: ~140,000 galaxies



This picture (3'.9x2'.2): >5,000 galaxies

UVCANDELS: the UV imaging of the CANDELS fields

- CANDELS is *Hubble's* largest survey of distant galaxies that observes five fields in separate parts of the sky in optical and near-infrared wavelengths.

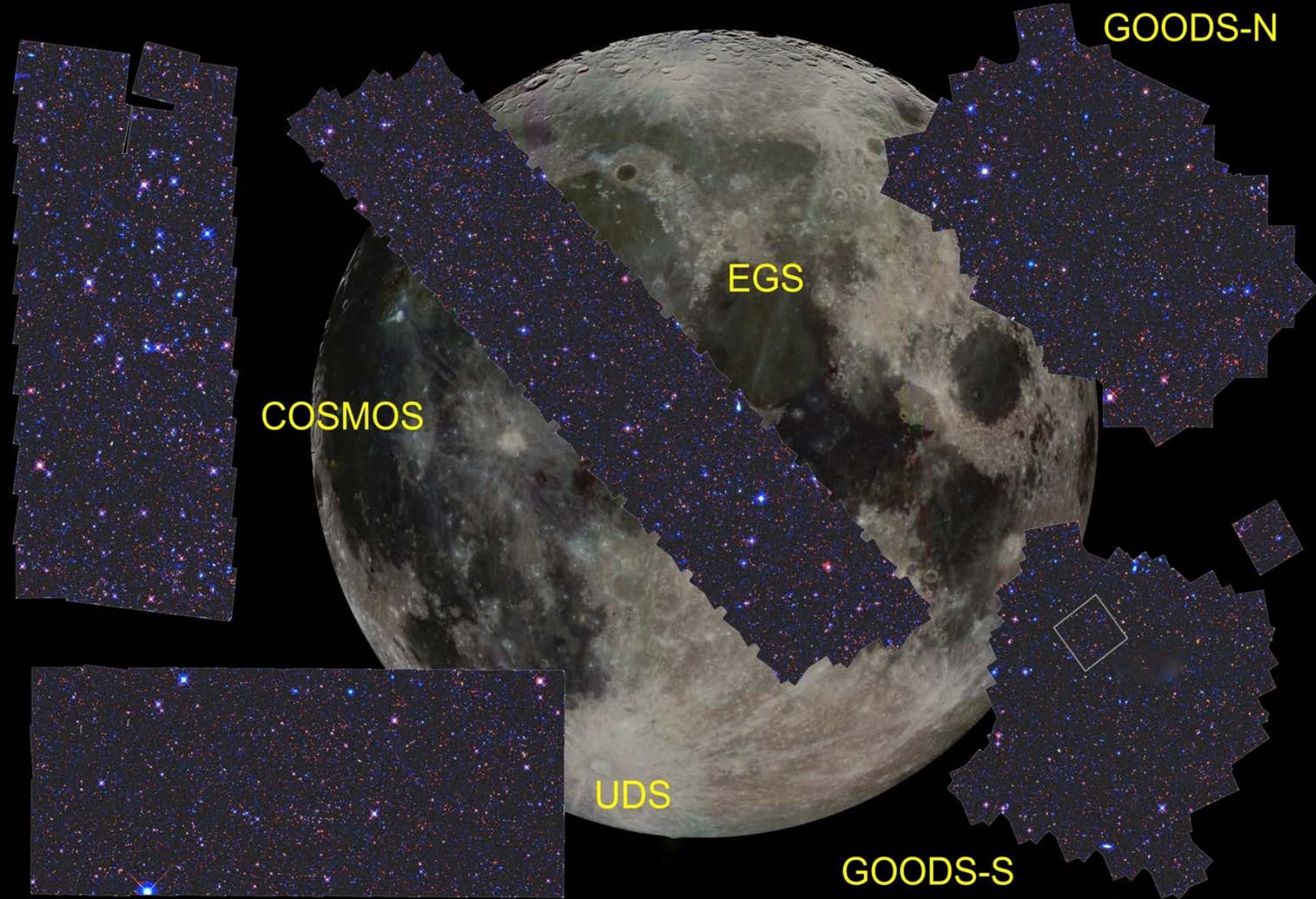
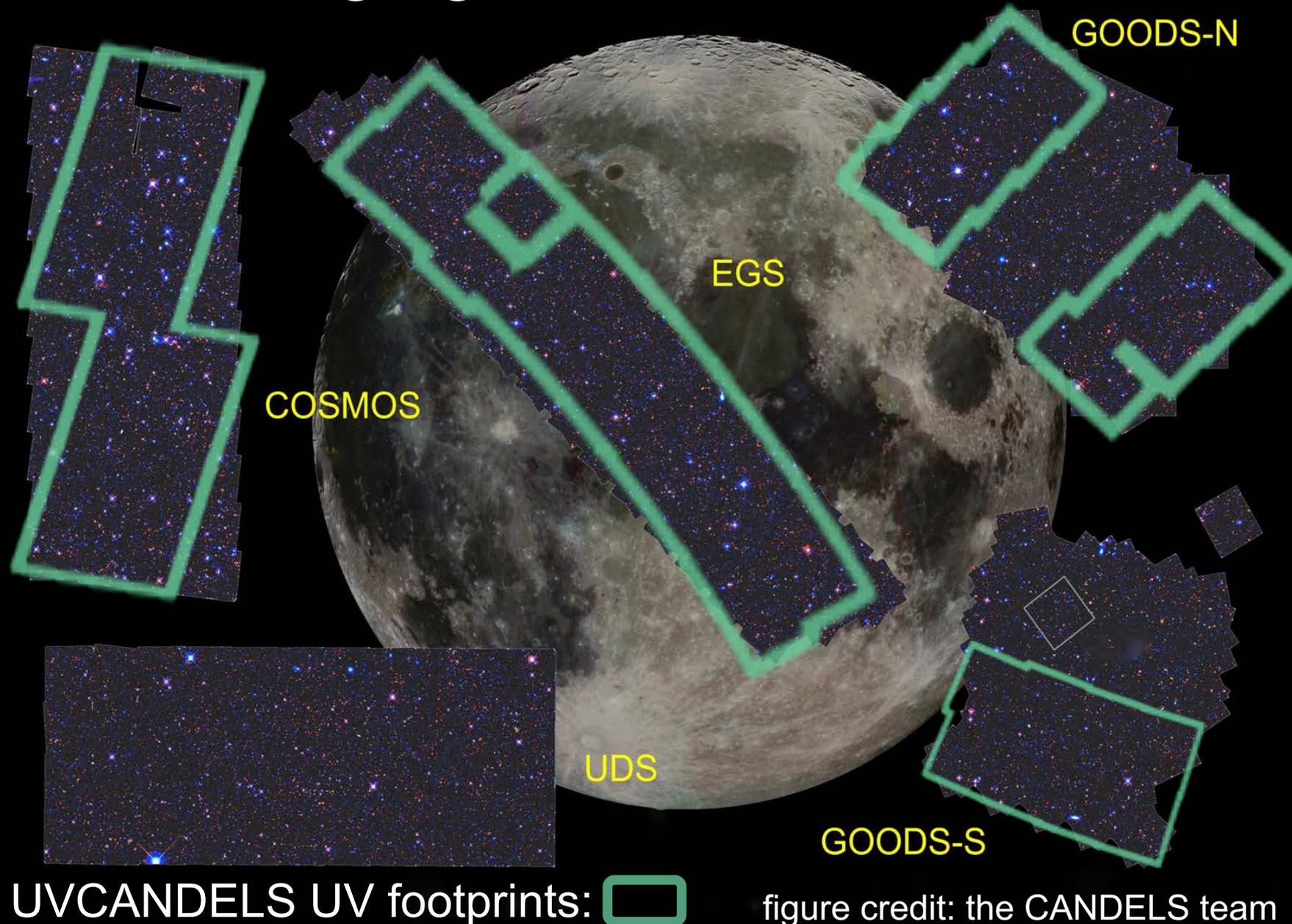


figure credit: the CANDELS team

UVCANDELS: the UV imaging of the CANDELS fields

- CANDELS is *Hubble's* largest survey of distant galaxies that observes five fields in separate parts of the sky in optical and near-infrared wavelengths.
- UVCANDELS adds the blue-optical and UV images to four of these CANDELS fields with total sky coverage about 60% of that by the full moon.

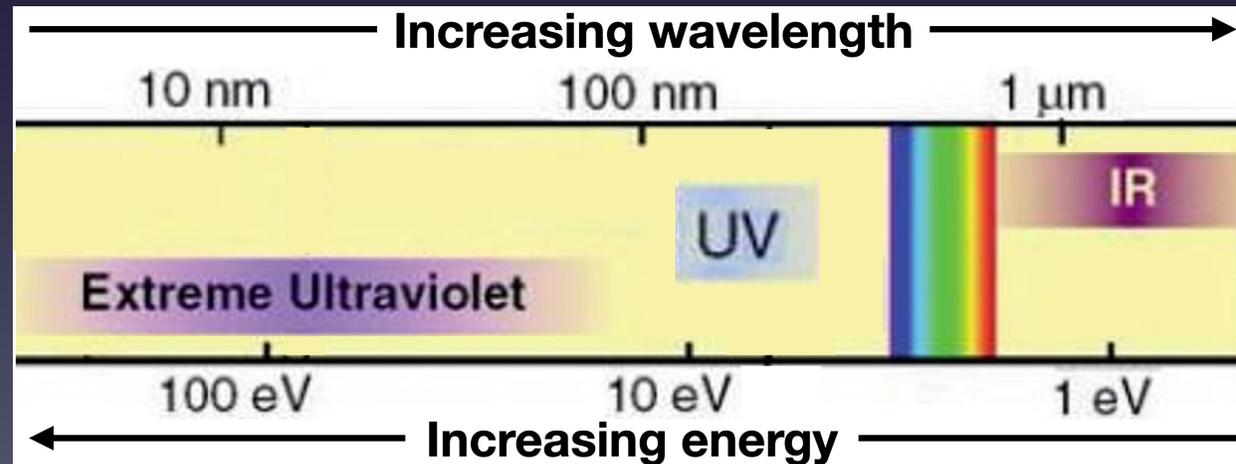


Why is ultraviolet (UV) important?

- UV light comes from the most massive (youngest and hottest) stars and provides unique insight on ongoing star formation in galaxies near and far.
- UV light from distant galaxies is shifted into visible and near-infrared (via Doppler shift) and enables *Hubble* to see galaxies as early as 13 billion years ago.

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- UV light from distant galaxies is shifted into visible and near-infrared (via Doppler shift) and enables *Hubble* to see galaxies as early as 13 billion years ago.
- The extreme UV (EUV) light produced by young massive stars is so energetic that it can ionize the hydrogen atom, i.e., splitting it into an electron and a proton.



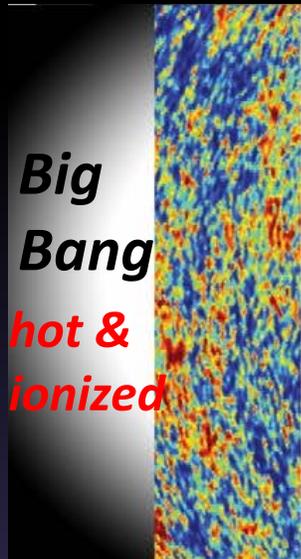
Using *Hubble* to understand Reionization: how the first galaxies ended the dark age

billions of
years ago: 13.8

0

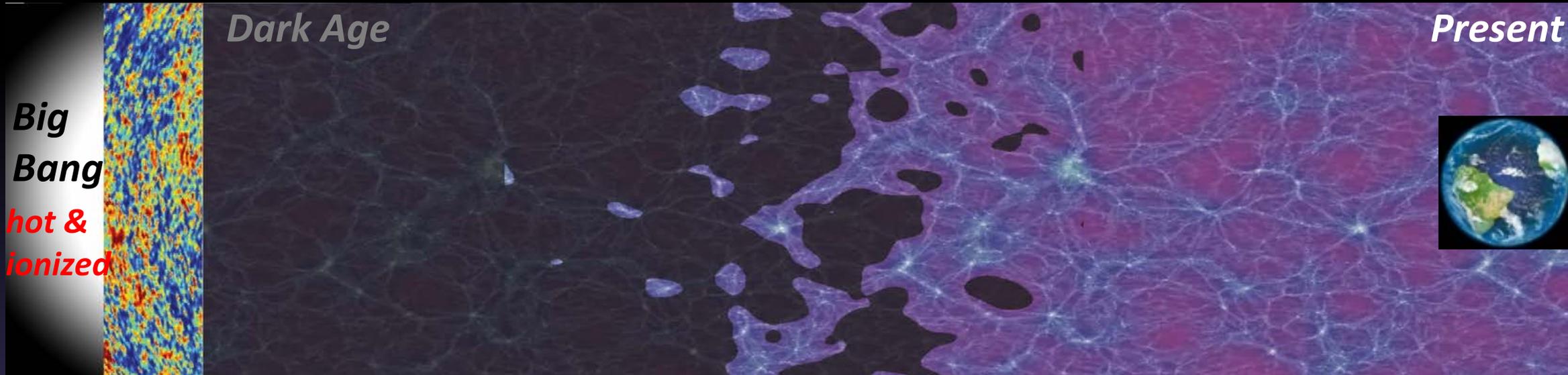
a brief
history
of the
cosmos:

**Big
Bang**
*hot &
ionized*



Dark Age

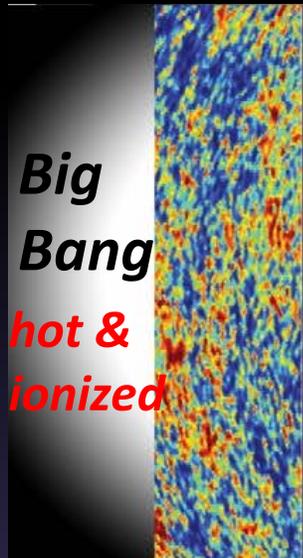
Present



Using *Hubble* to understand Reionization: how the first galaxies ended the dark age

billions of
years ago: 13.8

a brief
history
of the
cosmos:



Dark Age

13.5

Reionization

Extreme UV light is
absorbed and lost.

first galaxies as early as
13.5 billion years ago

Present

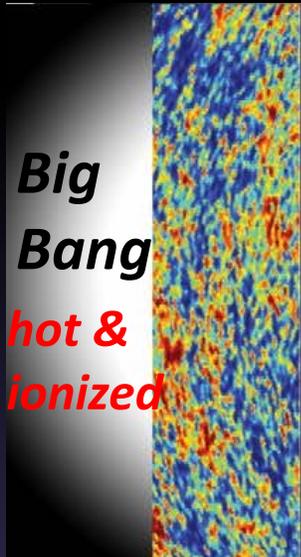


- The EUV light from hot massive stars in the first galaxies is believed to be the driver of Reionization. But even JWST can't see it, because these EUV photons are entirely absorbed and lost before they can reach us.

Using *Hubble* to understand Reionization: how the first galaxies ended the dark age

billions of
years ago: 13.8

a brief
history
of the
cosmos:



Dark Age

13.5

Reionization



*first galaxies as early as
13.5 billion years ago*

absorbed

11

Extreme UV light



*analogous galaxies in
more recent epochs*

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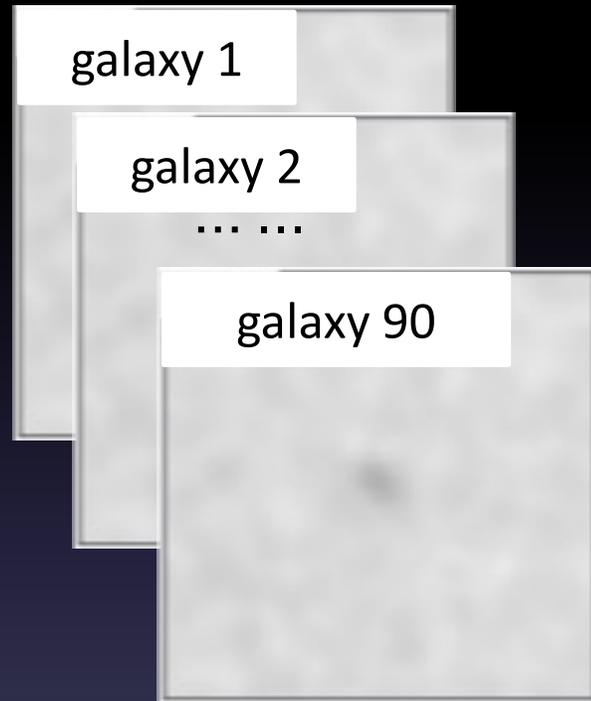
Present



- The EUV light from hot massive stars in the first galaxies is believed to be the driver of Reionization. But even JWST can't see it.
- To learn how these EUV photons escape from their host galaxies, we have to find galaxies that are similar to the first ones but in more recent epochs, and study the EUV photons coming out of these analogous galaxies.

An intriguing hint of the extreme UV signals

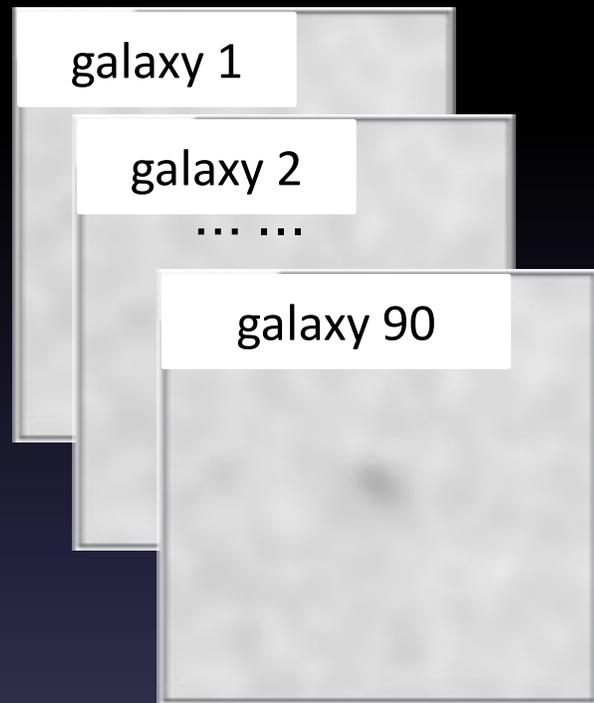
Combine 90 galaxies at ≥ 11 billion years ago, that are most analogous to the first galaxies, to study how their EUV photons escape.



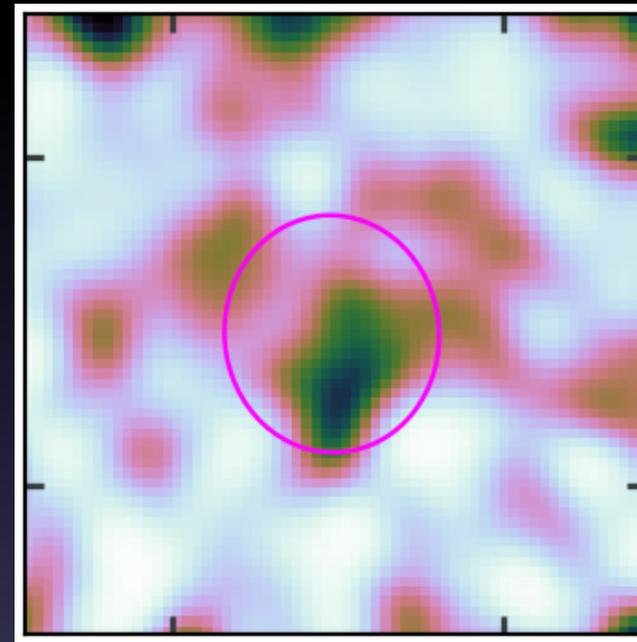
see the science talk by Wang et al. (Program Number: 224.06) today at 2:50pm

An intriguing hint of the extreme UV signals

Combine 90 galaxies at ≥ 11 billion years ago, that are most analogous to the first galaxies, to study how their EUV photons escape.



Stacked Extreme UV



Tantalizing indication of extreme UV signals in the central region from this combination of analogous galaxies.

- This finding is in support of the key role that hot massive stars played in causing Reionization.

see the science talk by Wang et al. (Program Number: 224.06) today at 2:50pm

UVCANDELS: the largest UV survey of distant galaxies ever done by *Hubble*

- The UVCANDELS data suggest an intriguing hint of the rare extreme UV signals from galaxies at ≥ 11 billion years ago, in support of the key role that hot massive stars played in causing Reionization.
- For questions, please contact:
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626-390-1140
hit@ipac.caltech.edu
- The full-color pictures and our story (credit: Whitney Clavin) can be found in the Caltech news: <https://www.caltech.edu/about/news/thousands-of-galaxies-shine-in-ultraviolet-light-in-new-hubble-image>
- Science data are available at the Mikulski Archive for Space Telescopes as a High Level Science Product starting today: <https://archive.stsci.edu/hlsp/uvcandels>