

Meet the Hubble eXtreme Deep Field Observing Team

Webinar begins at 1pm EDT Thursday, September 27, 2012



Please log in before event starts if you want to ask the astronomers questions.



Ask your questions on either the **Google+ event page** or in the comments for this video at **youtube.com/hubblesitechannel**.



A vast field of galaxies in various colors and shapes against a black background. The galaxies are scattered across the frame, with some appearing as bright, distinct points of light and others as more complex, multi-colored structures. The colors range from deep blues and purples to bright oranges and reds. The overall appearance is that of a rich, multi-wavelength astronomical survey.

XDF

the eXtreme Deep Field

Garth Illingworth

UCSC

• Hubble's extraordinary XDF

- the deepest ever image of the sky
- 2 million second exposure
- ten years of images from Hubble's cameras
- 2002 - Hubble's Advanced Camera (ACS)
- 2009 - Hubble's Wide Field Camera 3 (WFC3)

making the XDF

- started with the Hubble Ultra Deep Field
- HUDF taken in 2003 using ACS
- HUDF09 taken in 2009/10 using WFC3
- numerous other images
- all combined to make XDF

why XDF?

Andromeda



- XDF is key to:
- understanding the origins of galaxies
- the search for the first galaxies
- when, and how, did galaxies form and grow
- how did our Milky Way & Andromeda form

how do early galaxies compare to those of today?

Andromeda

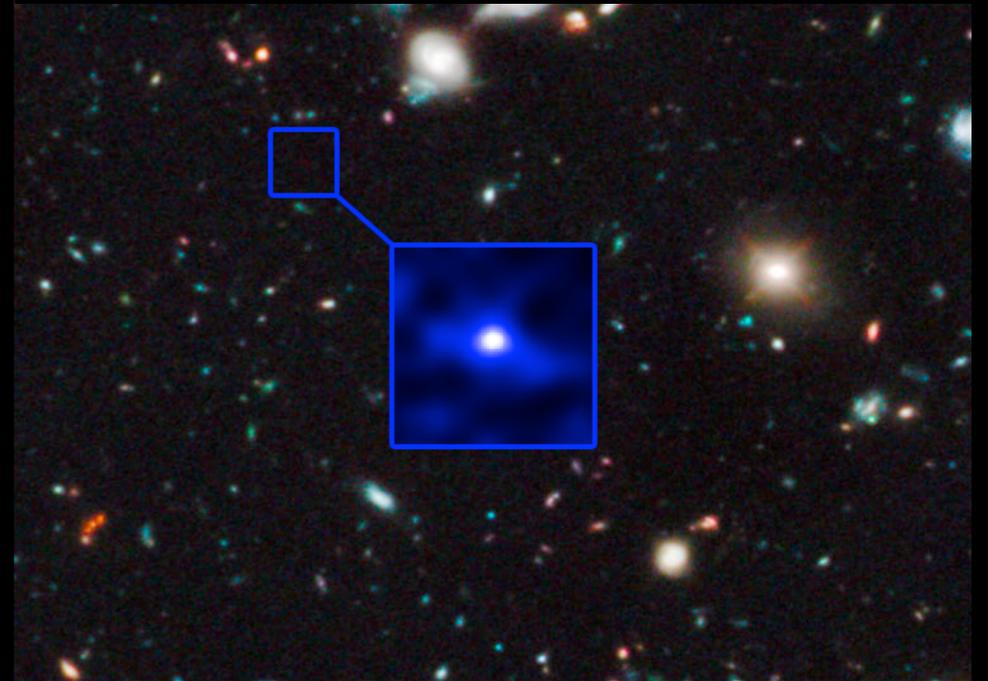


early galaxy

- compared to our Milky Way & Andromeda:
- early galaxies are full of bright, young blue stars
- forming lots of new stars and growing rapidly
- about 10% of the size
- about 1% of the mass

galaxies at the dawn of time

the most distant galaxy



- Hubble is a “time machine”
- light takes so long to reach us that we see galaxies back in time
- XDF allows us to see back in time through 96% of the life of the universe
- we see galaxies forming 13.2 billion years ago
- this is just 450 million years after the Big Bang

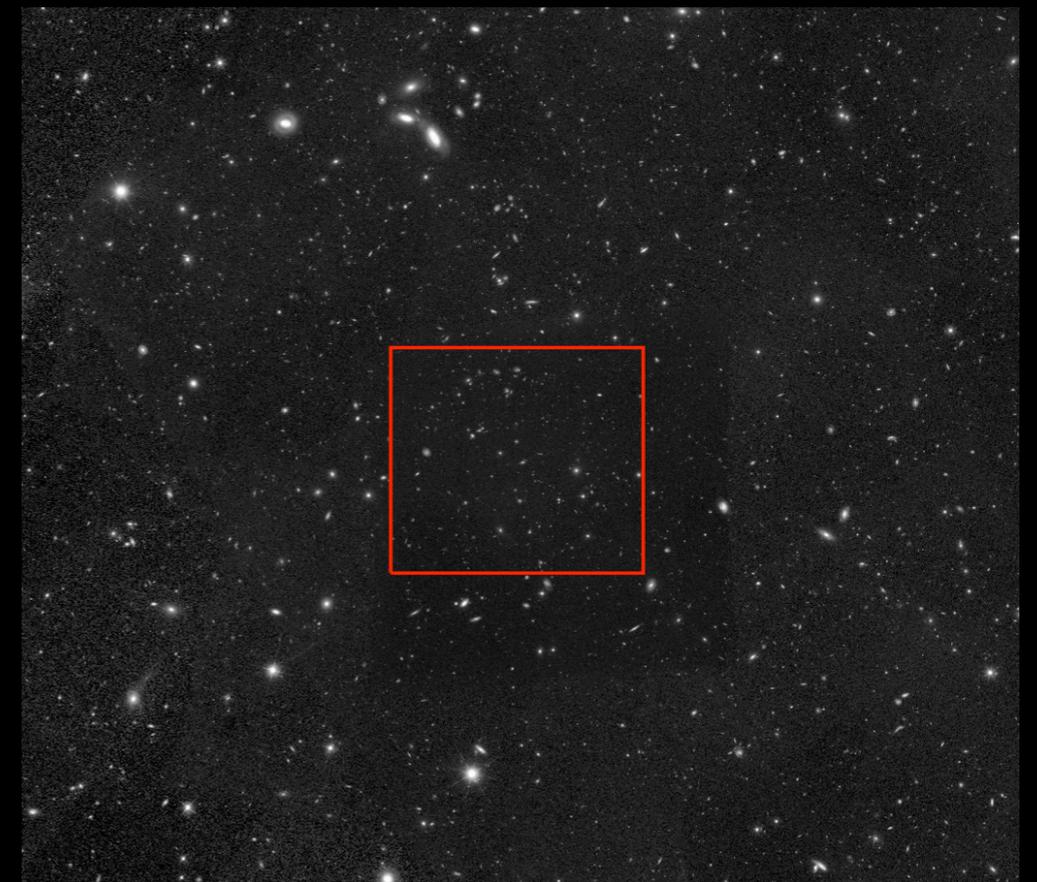
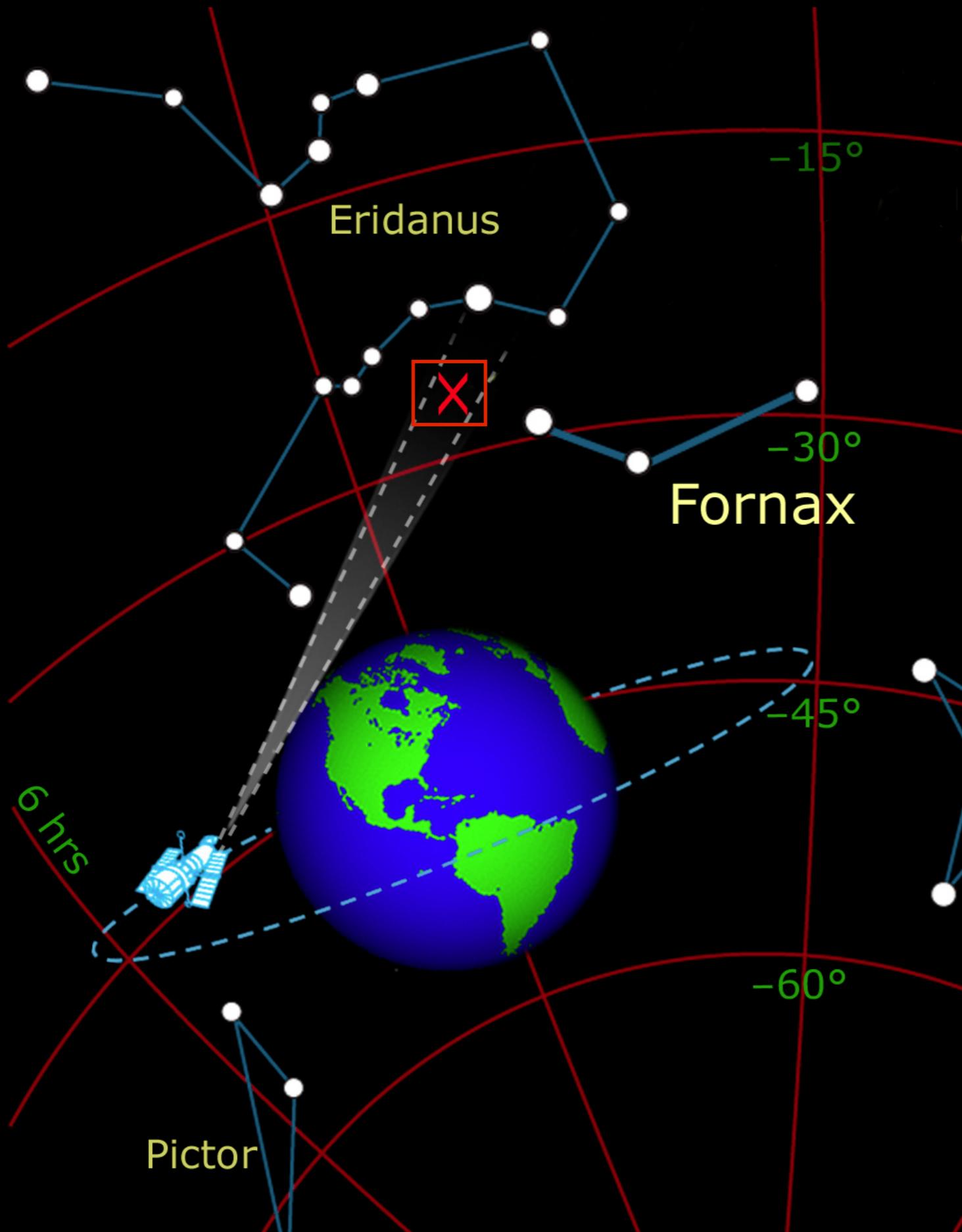
exploring the first billion years of the universe

- XDF allows us to explore for galaxies when the universe was young
- the original HUDF let us see back to about one billion years after the Big Bang
- but the first galaxies and the most dramatic changes occurred even earlier
- XDF allows us to explore to even earlier times than the HUDF

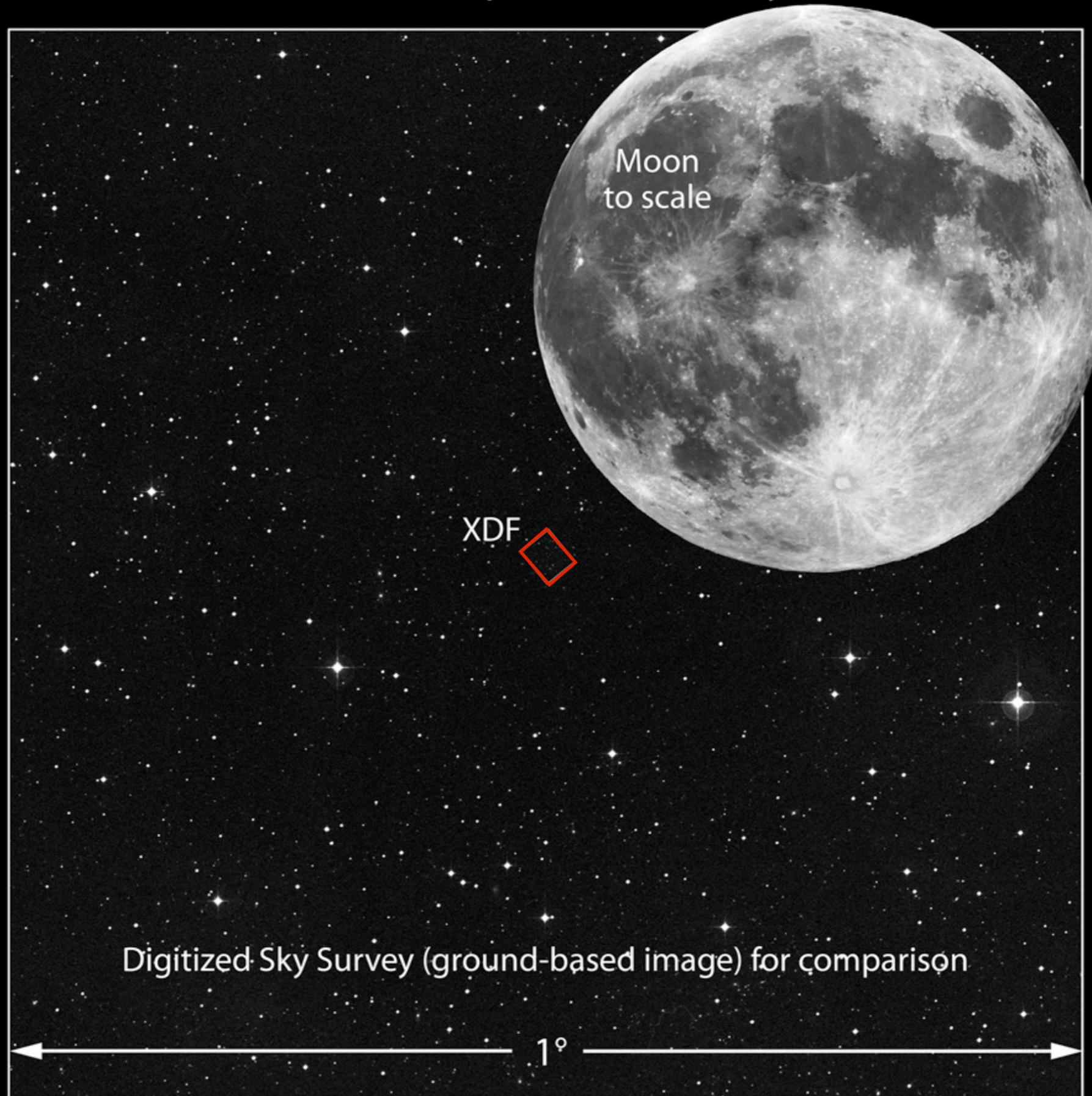
Dan Magee

UCSC

eXtreme Deep Field (XDF)



Size of Hubble eXtreme Deep Field on the Sky



Hubble and the XDF

- the most observed place in the sky
- Hubble pointed at XDF for 50 days
- over 2000 exposures
- taken over a 10 year period
- total exposure of 2 million seconds

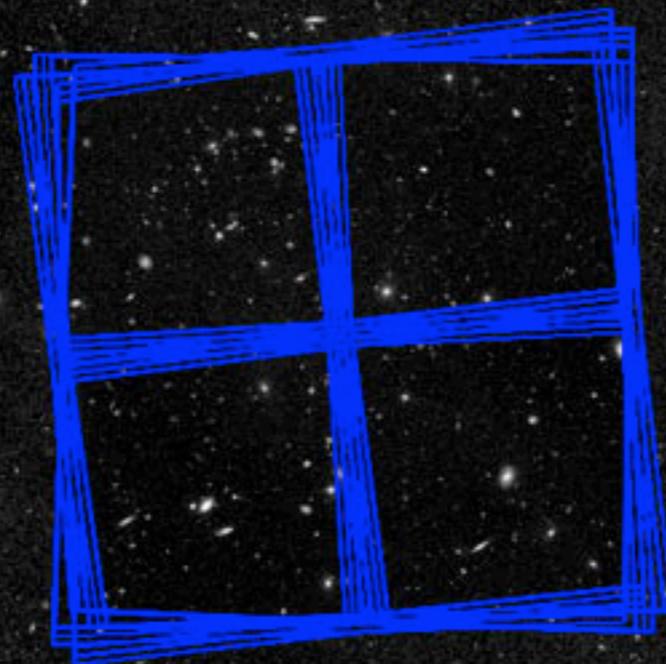
gathering the data

- downloaded all data from Hubble Archive
- 250 gigabytes of data

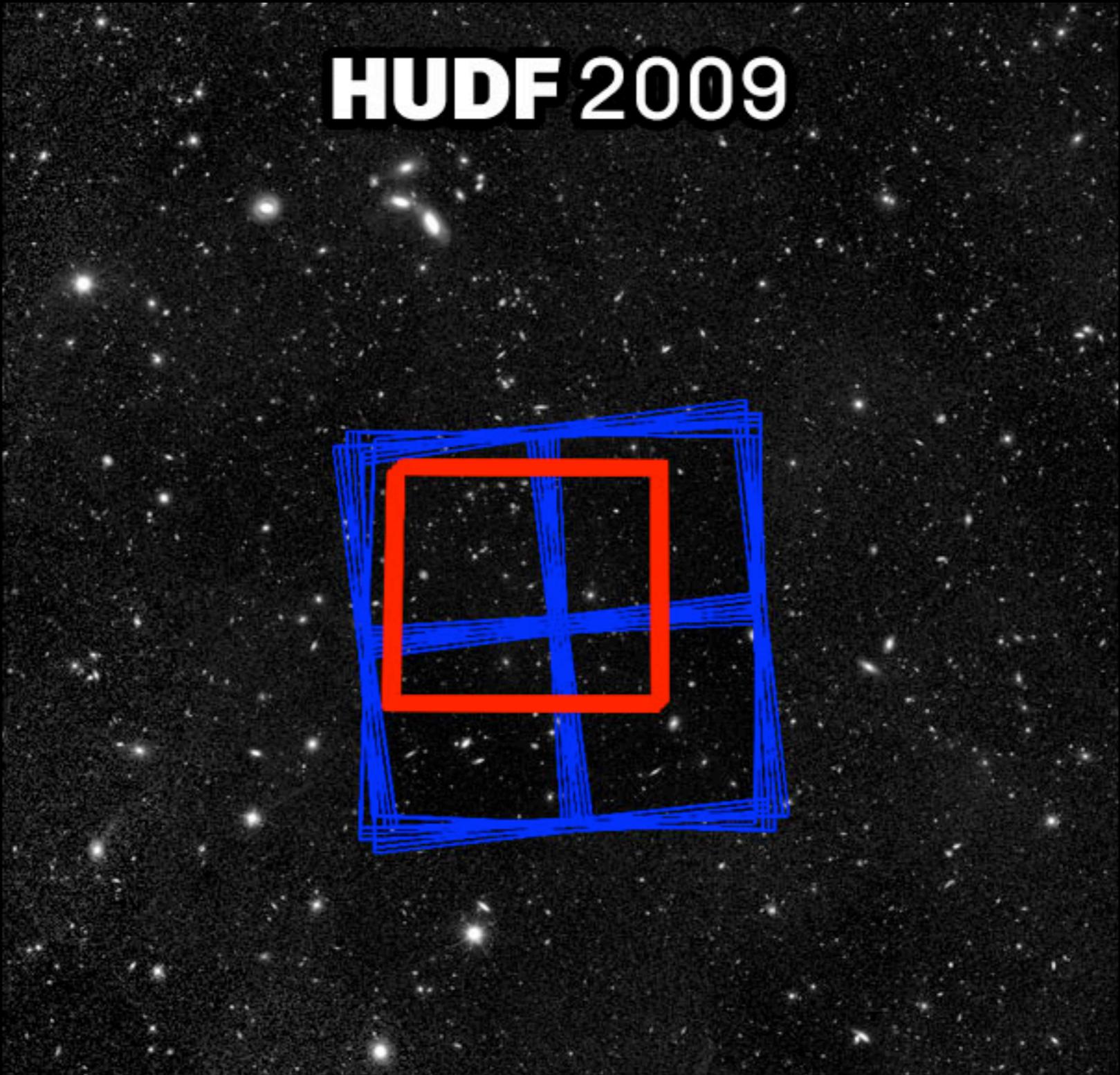
processing the data

- basic process done by Hubble Archive
- but, many more processing steps

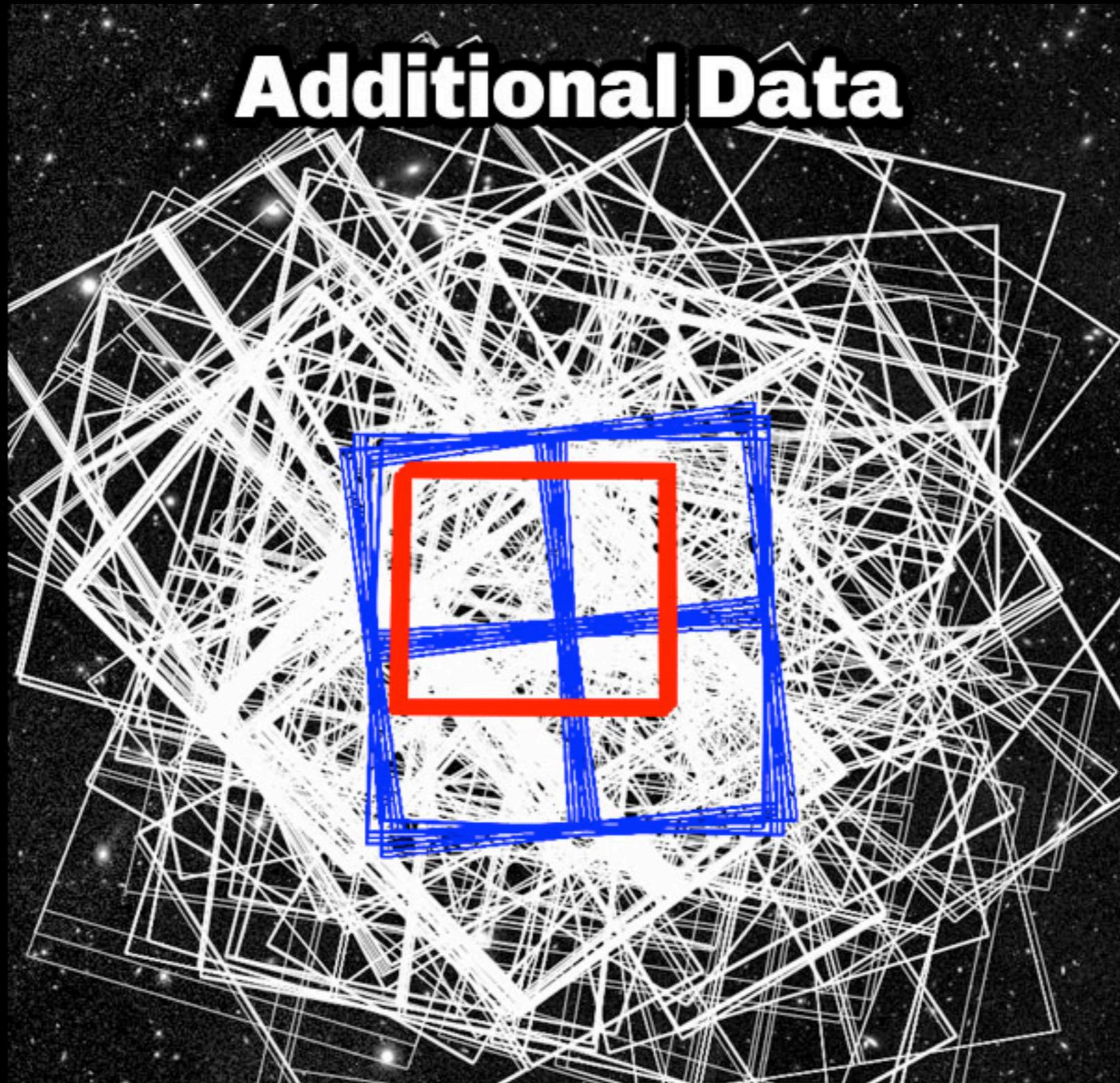
HUDF 2004

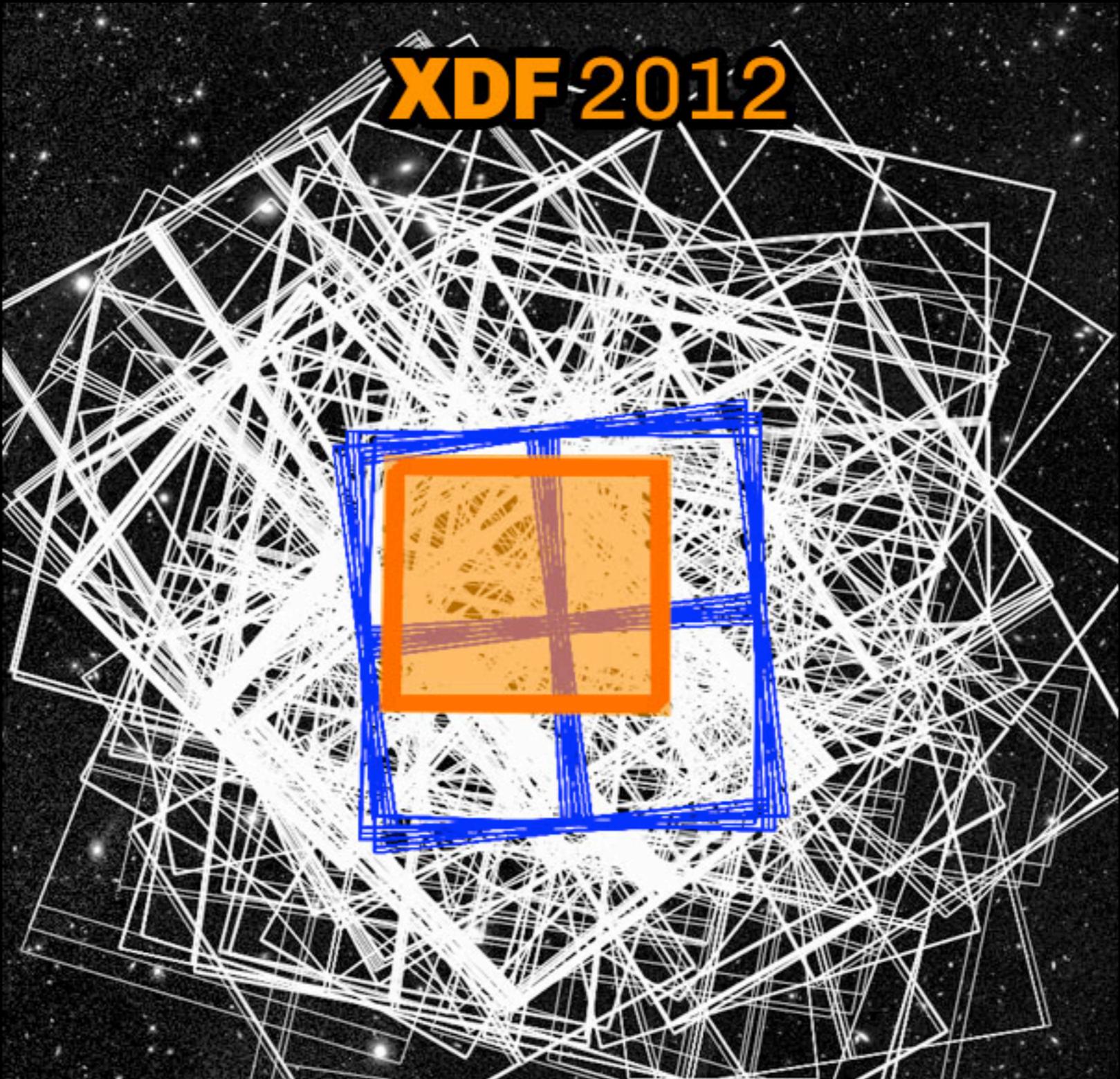


HUDF 2009



Additional Data





inspecting the exposures

- visually inspected all 2000 images
- looking for problems or artifacts in images

aligning the exposures

- need to align all exposures with each other
- how? match up objects in each exposure

combining the exposures

- exposures combined into a single “mosaic”
- optimally combine using “drizzling” process

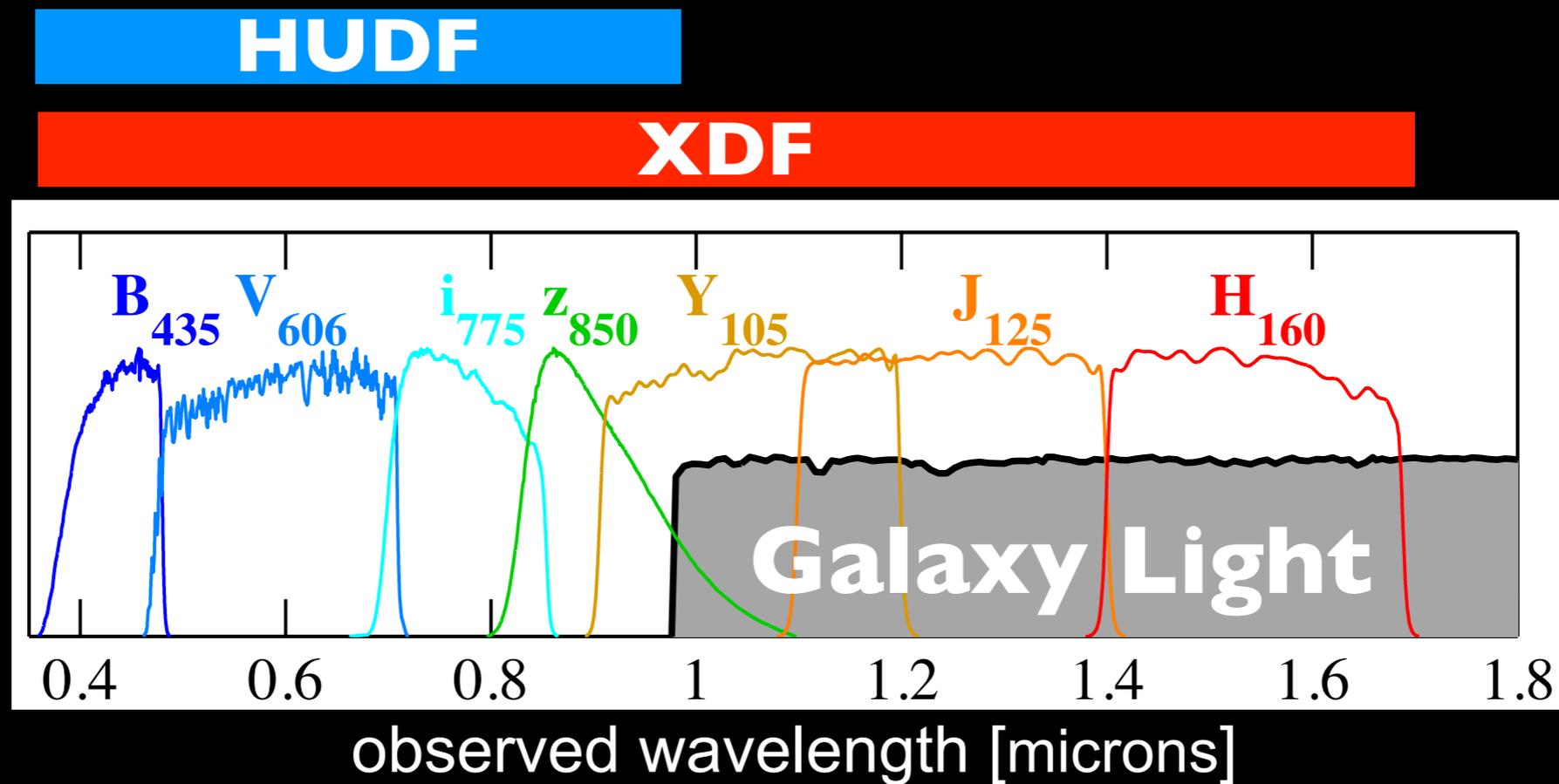
the final mosaics

- use final mosaics to create color picture
- *image processing ends and science begins*

Pascal Oesch

UCSC

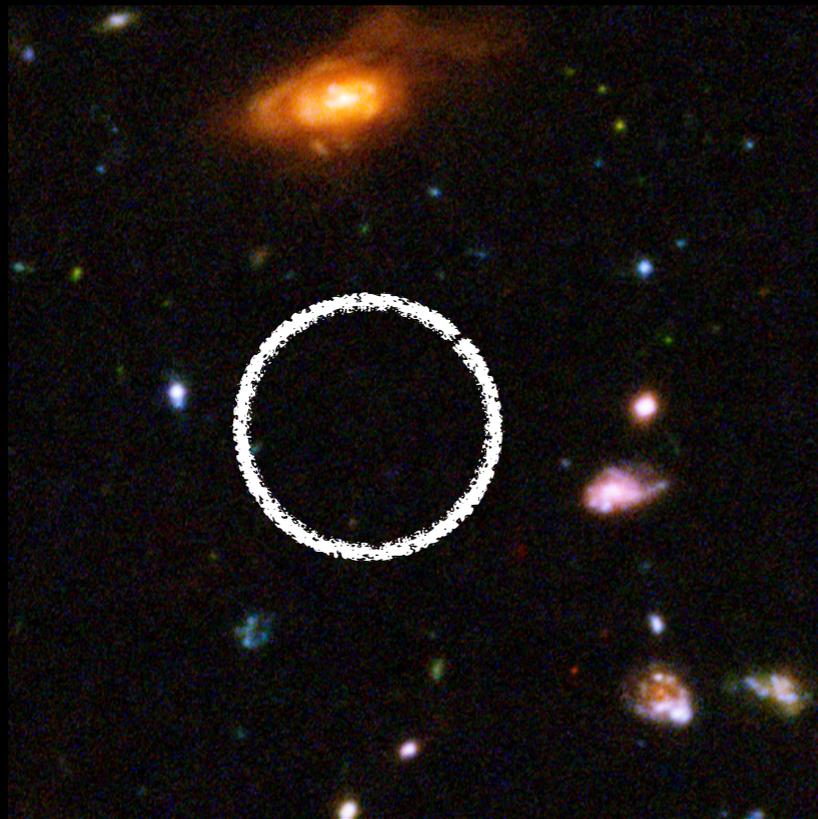
how XDF lets us see the early universe



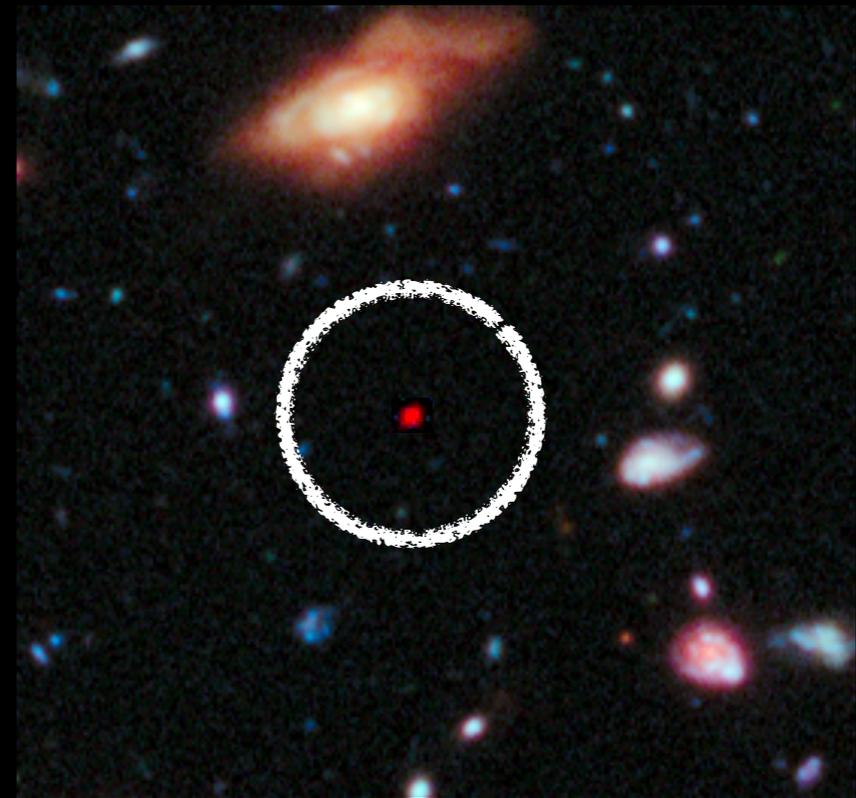
galaxies earlier than 800 Myr after the Big Bang can only be seen in infrared light (redward of our vision)

we need near-infrared images to see them!

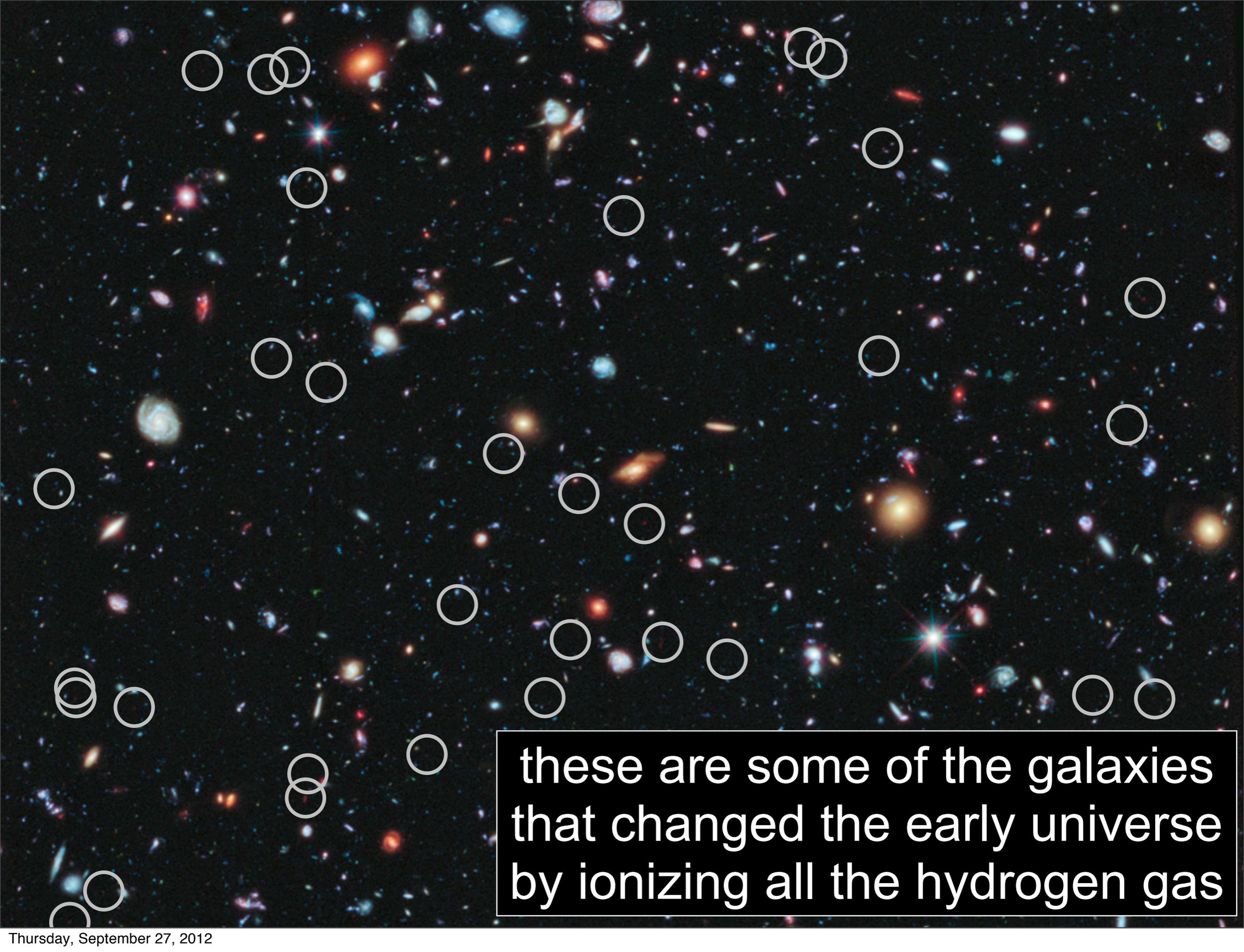
XDF reveals galaxies unseen in our deepest visible-light HUDF images



previous image
HUDF



new image
XDF



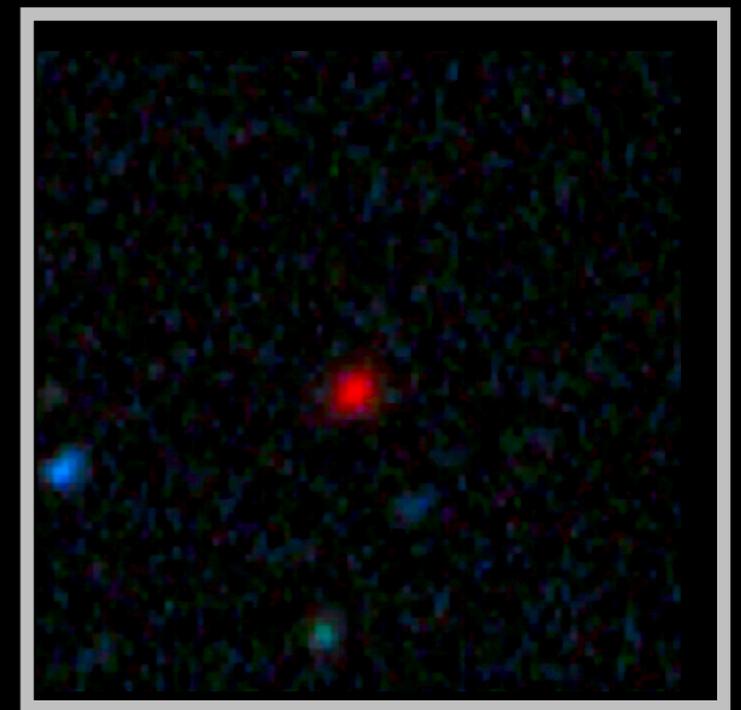
these are some of the galaxies that changed the early universe by ionizing all the hydrogen gas

a red galaxy is not necessarily in the very early universe

red galaxy colors can also be a sign for old stars or for a lot of dust, which absorbs blue light

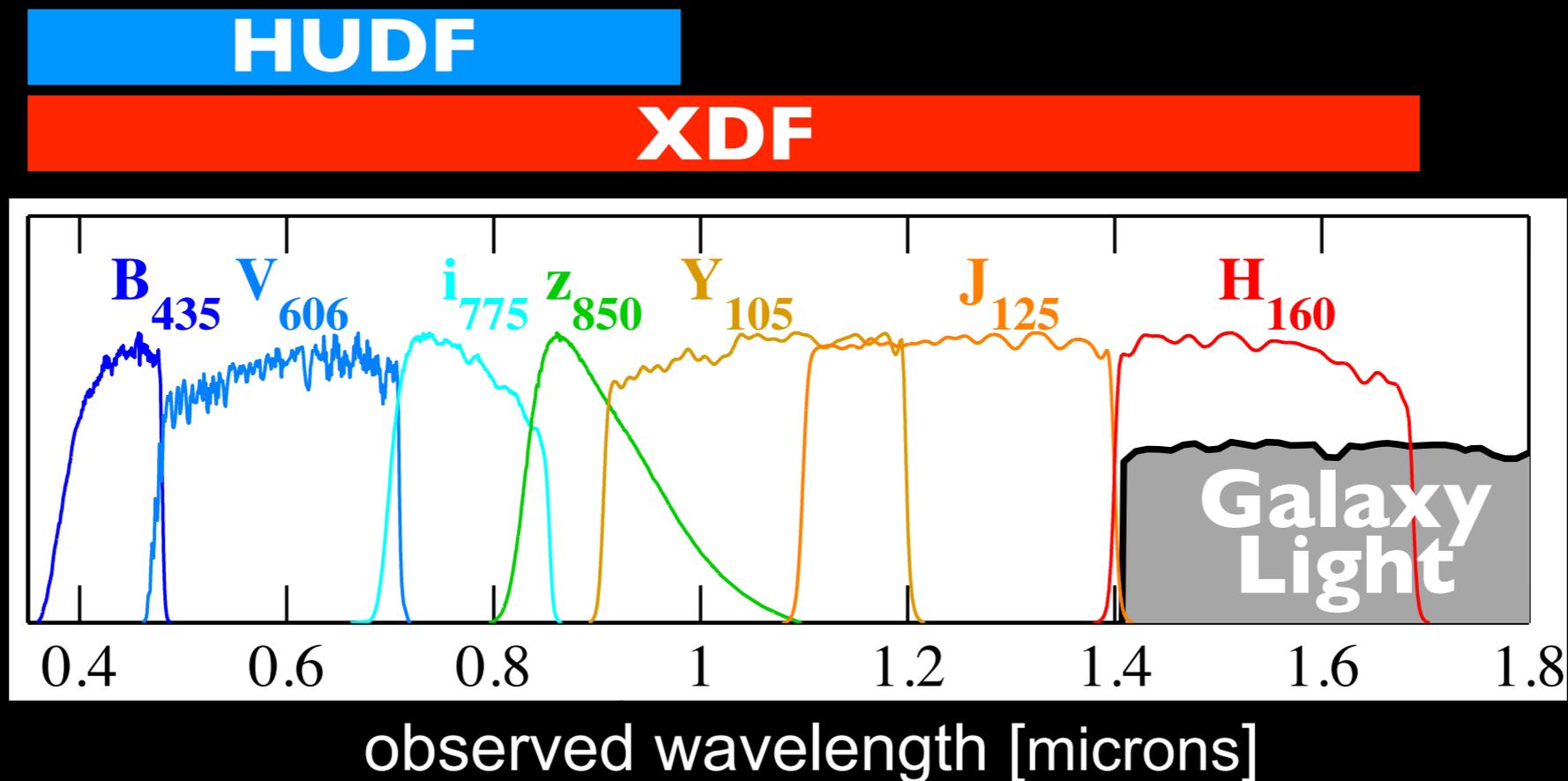


these two galaxies are at a distance of about half the age of the universe



this galaxy is about 13 billion light years away

Hubble is at its limit for finding any earlier galaxies



galaxies earlier than about 400 million years after the Big Bang will remain invisible to Hubble's cameras

JWST will discover the first galaxies

Meet the Hubble eXtreme Deep Field Observing Team

Thank you for watching!

A recording of this webinar will be available for replay shortly
at **[youtube.com/hubblesitechannel](https://www.youtube.com/hubblesitechannel)**.

