

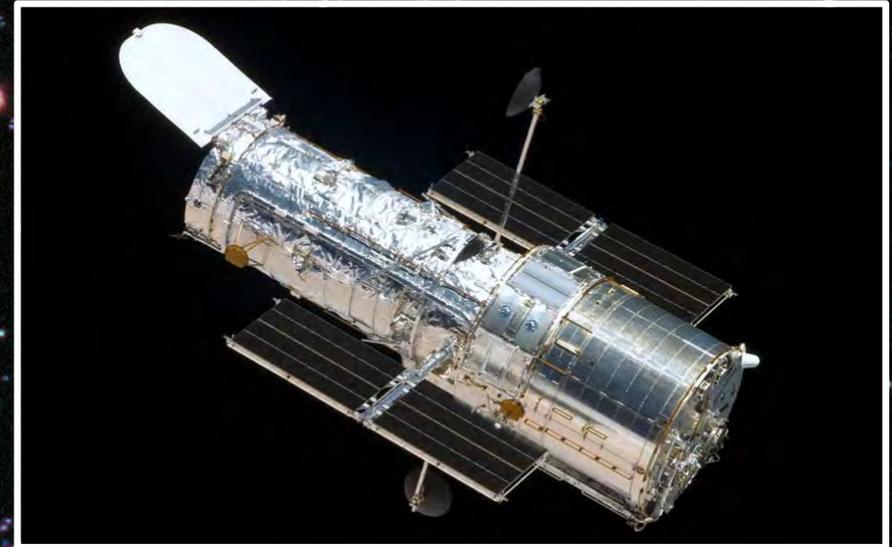


Unveiling the Universe: Hubble Space Telescope's 30th Anniversary

Unveiling the Universe with Hubble Deep Fields: A Hubble Greatest Hit



Garth Illingworth
University of California Santa Cruz



firstgalaxies.org

AAS Science Writer Briefing

30 years and going strong....



2009

our last (close) view of Hubble



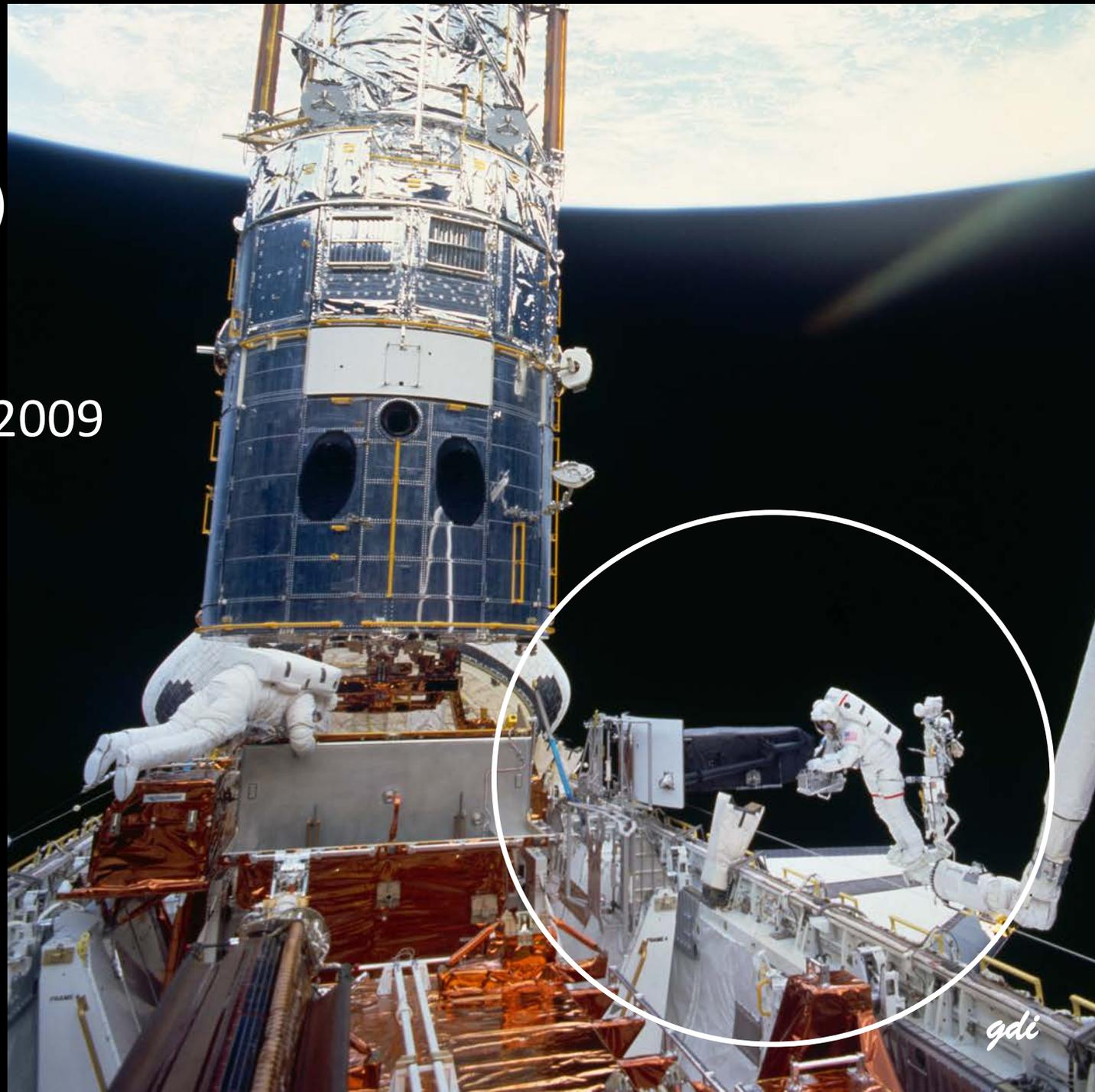
*the first deep Hubble image
the "Hubble Deep Field" in 1995*

Bob Williams
and the HDF Team

Hubble Wide Field Camera 3
(infrared & UV)
+ Repaired Advanced Camera (ACS)

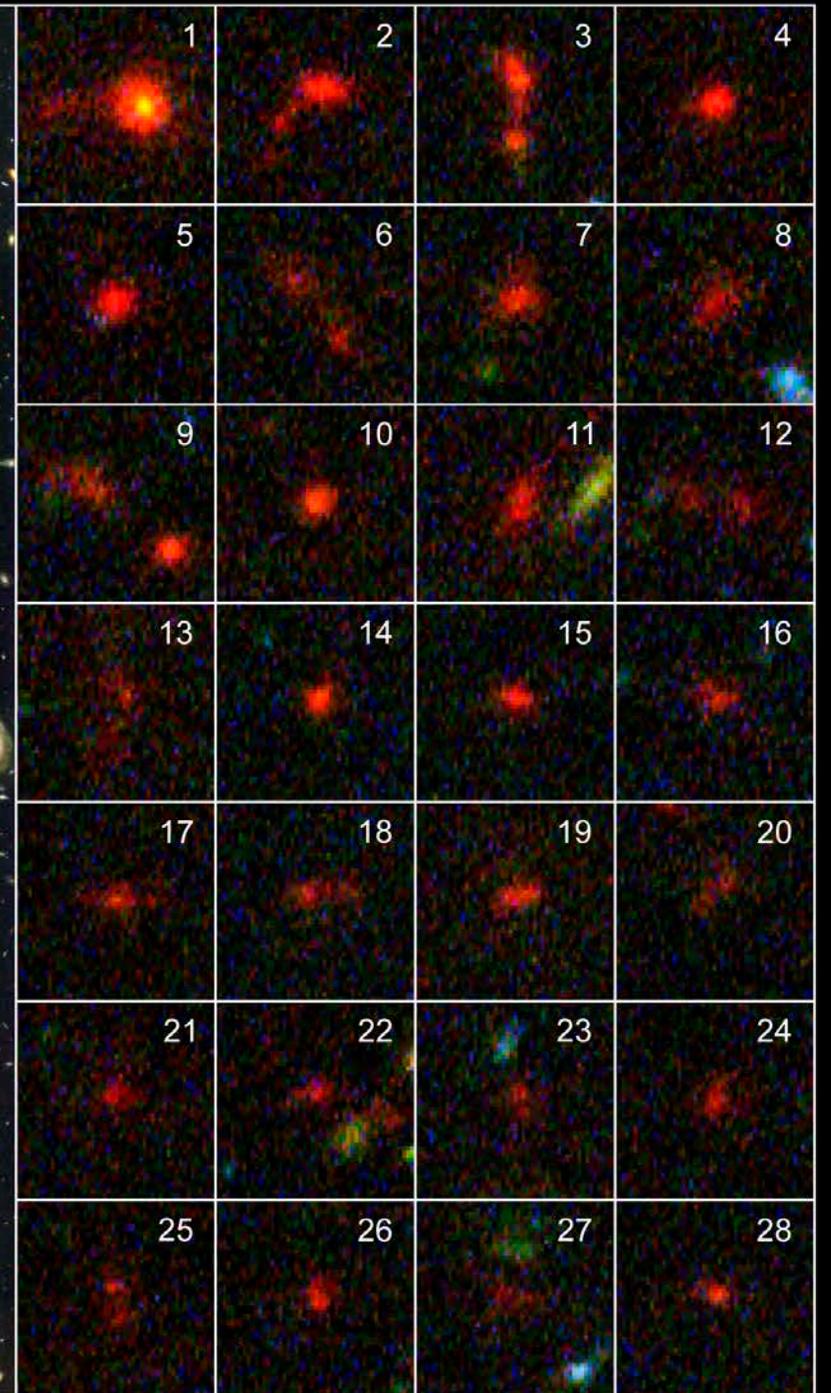


2009

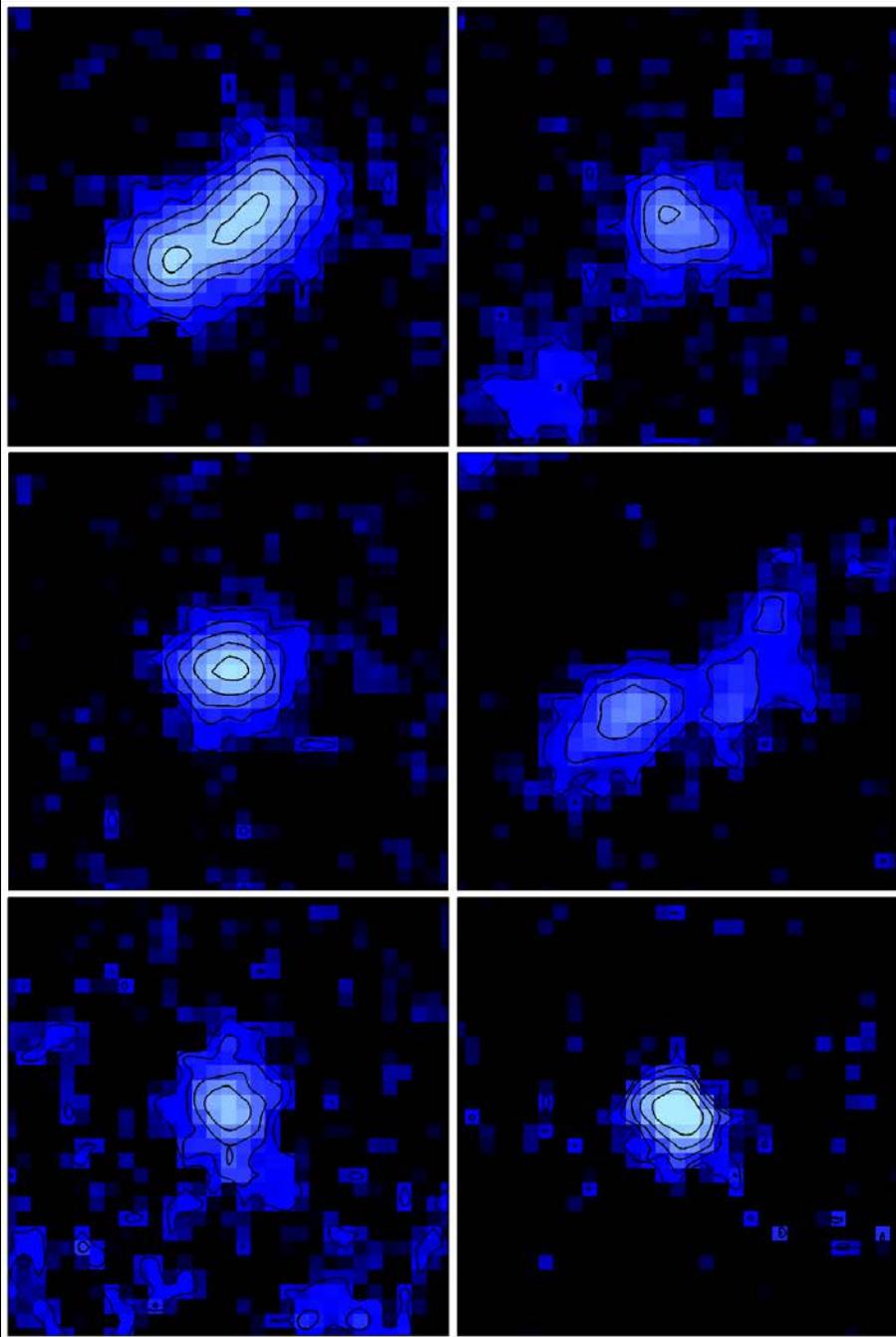


*distant galaxies
13 billion years ago*

HUDF + HUDF09



a sample of bright galaxies
about 8-900 million years after the Big Bang



● ~Hubble resolution

XDF *eXtreme Deep Field*



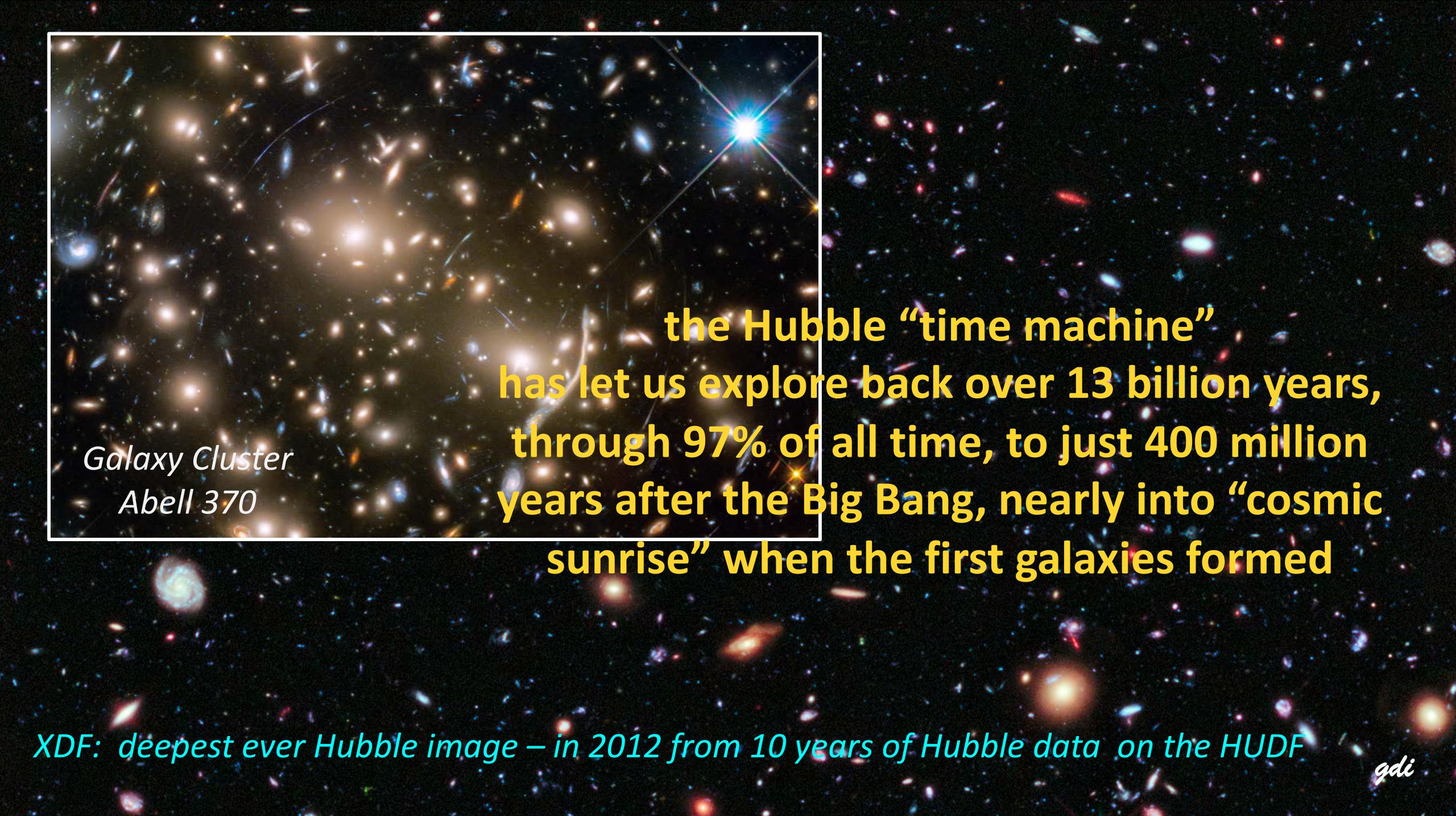
2963 HST images over 10 years on the HUDF
from 800 orbits of Hubble
for a 23 day total exposure on the HUDF!

*XDF: deepest ever Hubble image:
released in 2012 – from 10 years of Hubble data on the HUDF*



**the Hubble “time machine”
has let us explore back over 13 billion years,
through 97% of all time, to just 400 million
years after the Big Bang, nearly into “cosmic
sunrise” when the first galaxies formed**

XDF: deepest ever Hubble image – in 2012 from 10 years of Hubble data on the HUDF



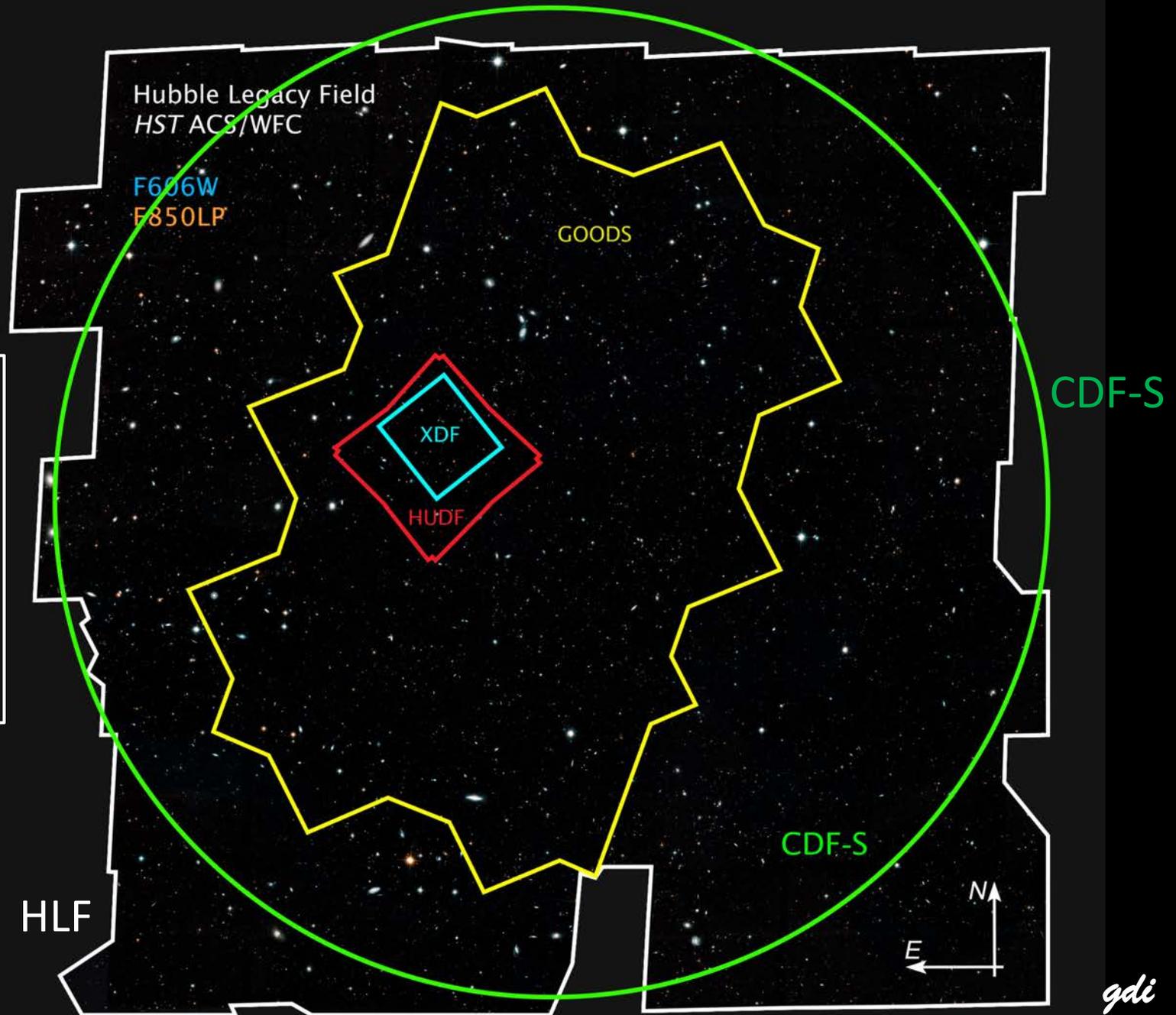
*Galaxy Cluster
Abell 370*

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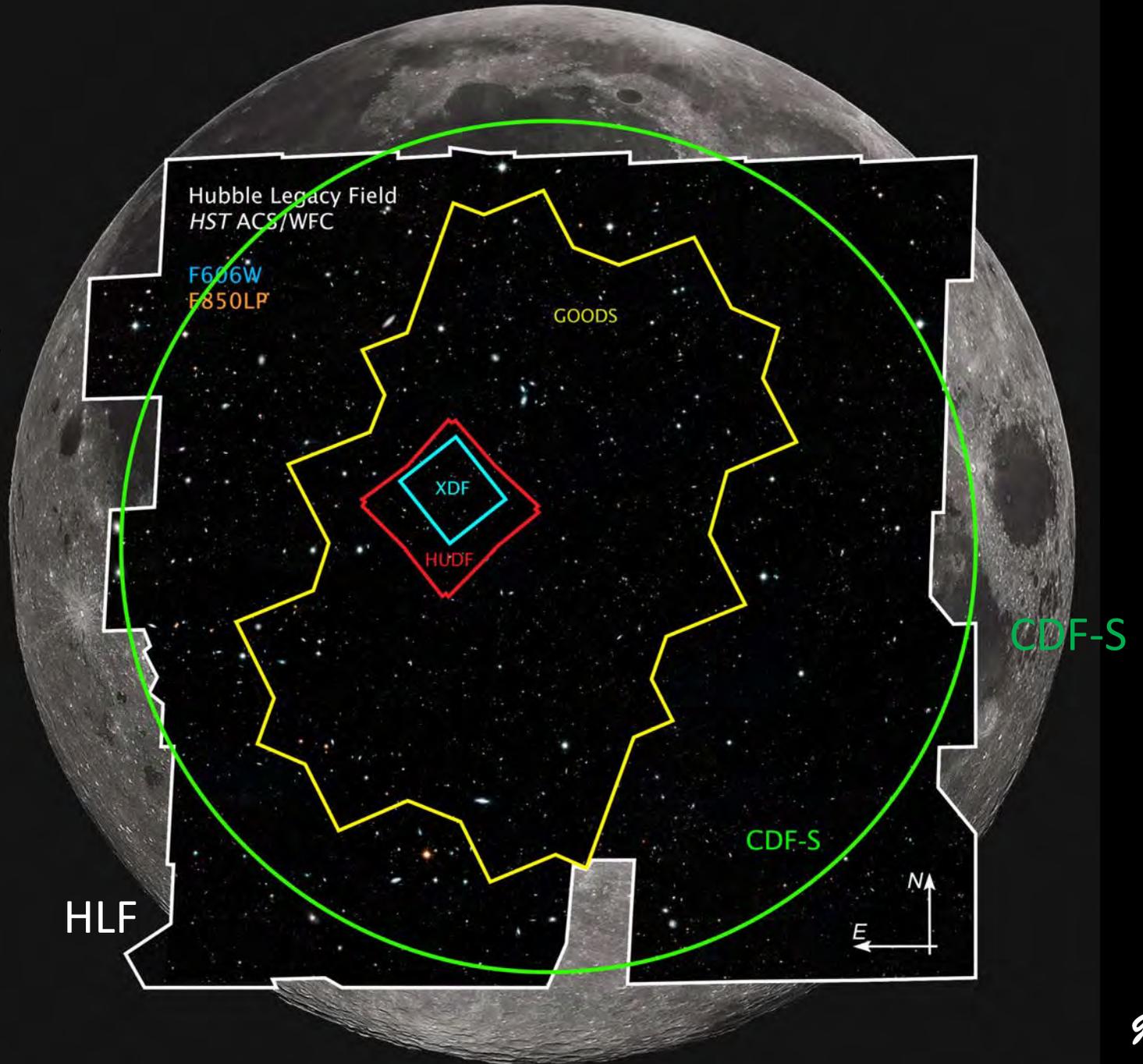
Hubble Legacy Field 2019

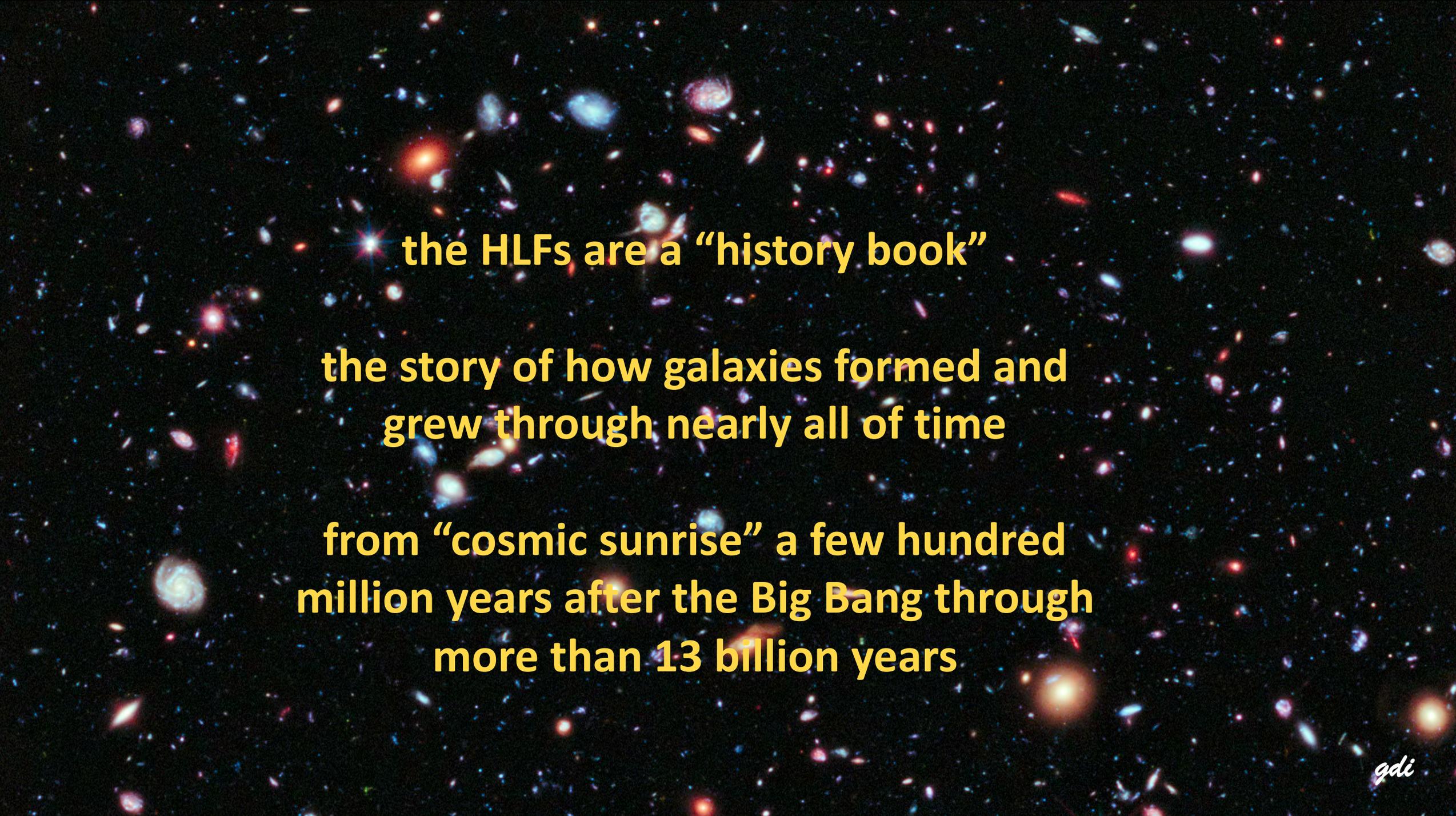
each of the three Great Observatories – Chandra, Hubble and Spitzer – have contributed about 6-7 million seconds (about 75-80 days) of exposure on this field over the last 15-20 years



size comparison:

the Hubble Legacy Field-South &
the Chandra Deep Field-South
and a nearby astronomical object
– now known as Artemis



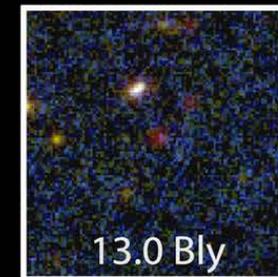
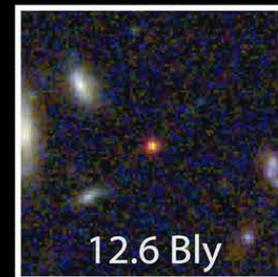
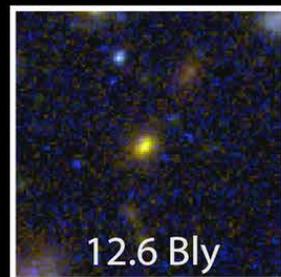
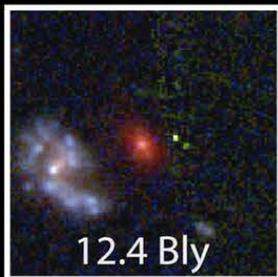
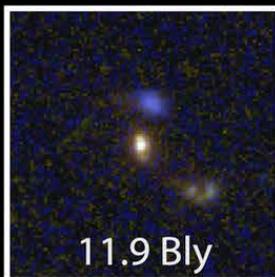
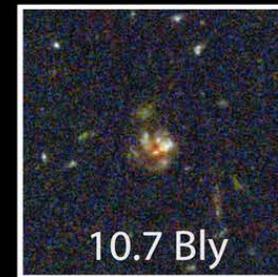
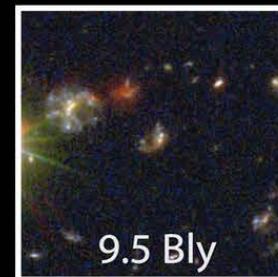
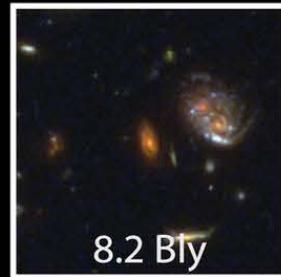
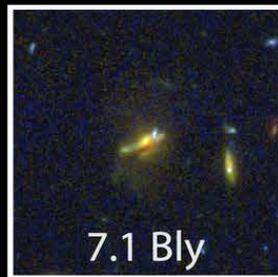
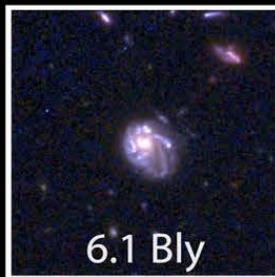
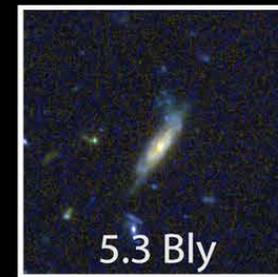
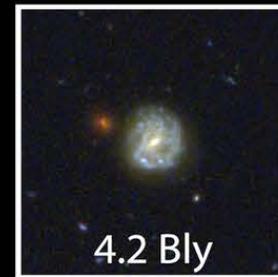
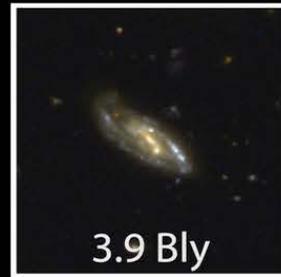
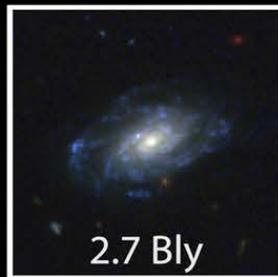
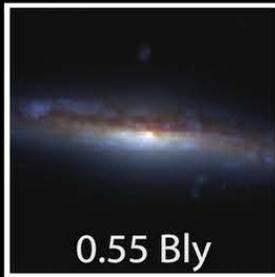


the HLFs are a “history book”

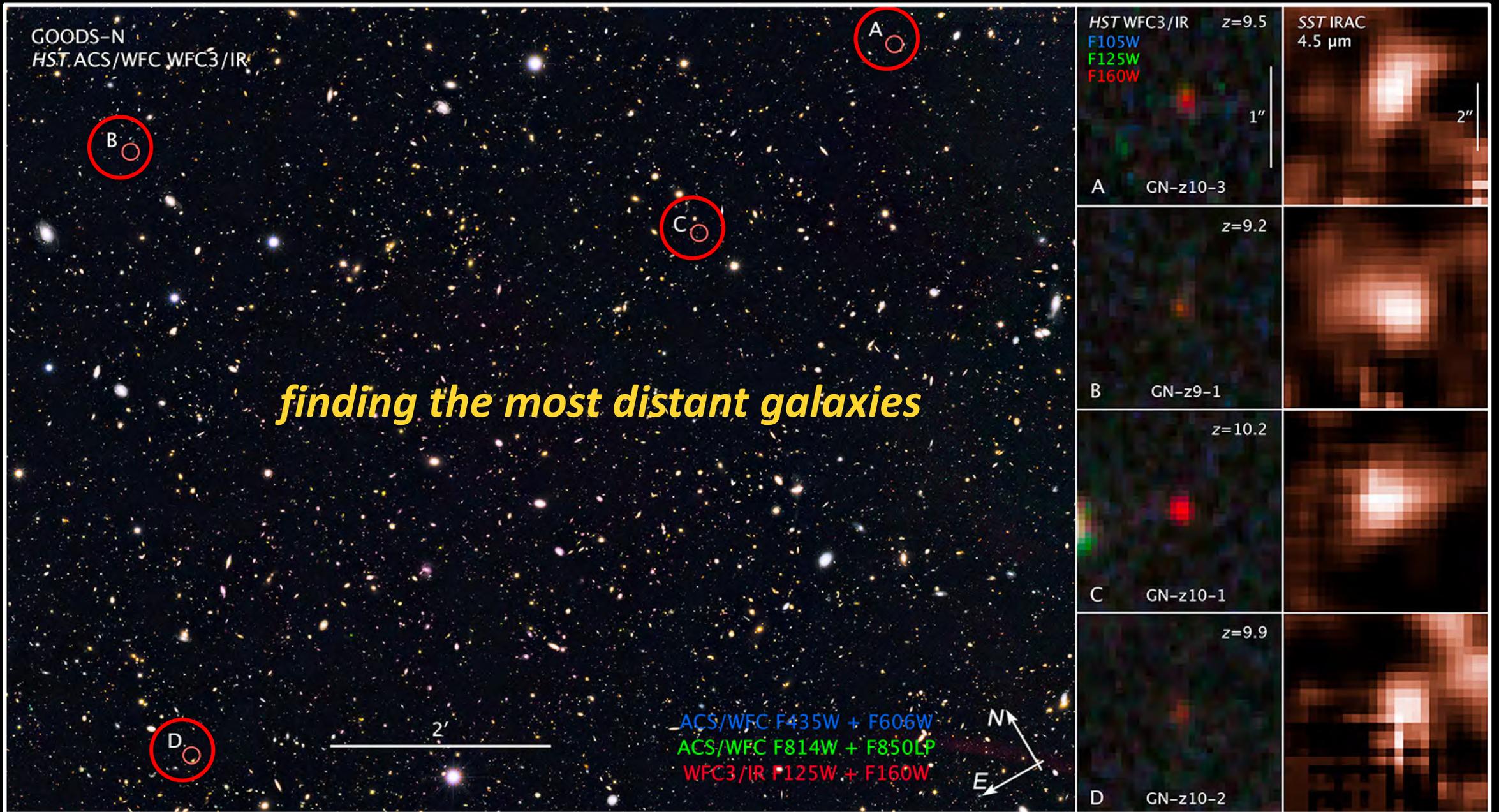
**the story of how galaxies formed and
grew through nearly all of time**

**from “cosmic sunrise” a few hundred
million years after the Big Bang through
more than 13 billion years**

Hubble Legacy Field: Galaxies Across Time



Bly = billion light-years

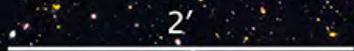


GOODS-N
HST ACS/WFC WFC3/IR

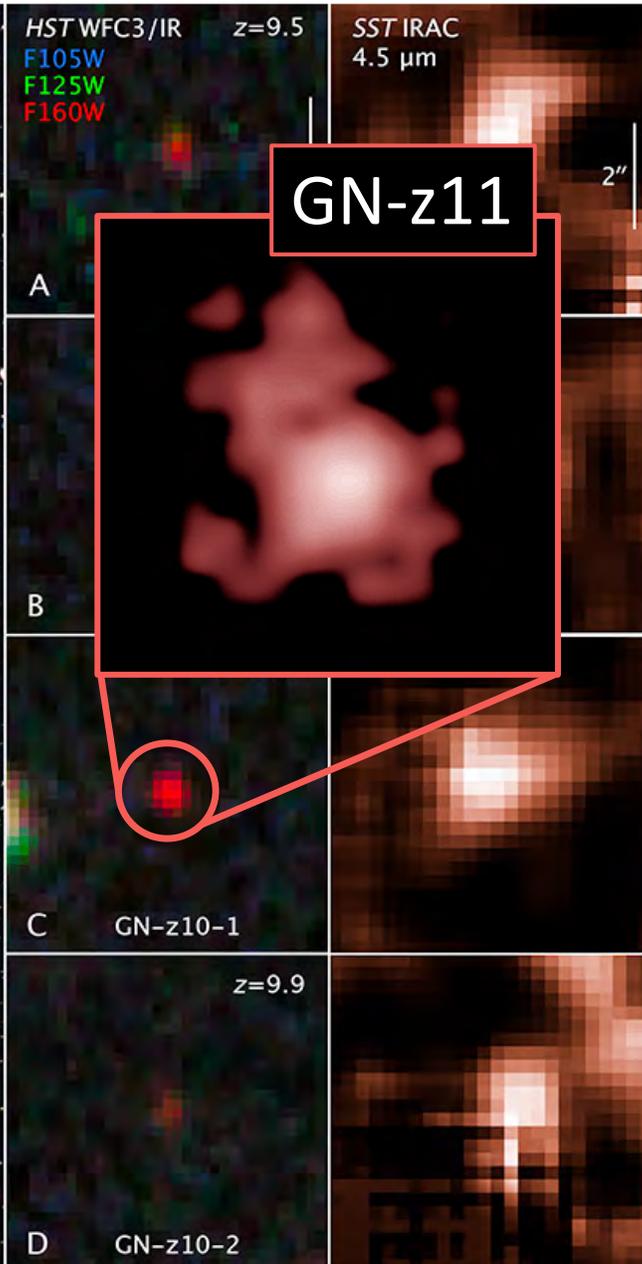


**GN-z11 seen just 400 million
years after the Big Bang**

**seeing back in time almost to
“cosmic sunrise” when the first
stars and galaxies appeared**



ACS/WFC F435W + F606W
ACS/WFC F814W + F850LP
WFC3/IR F125W + F160W



Hubble

Spitzer

gdi

What does the future hold for Hubble?



Will JWST
lessen interest
in Hubble?

the full JWST Observatory in
the clean room at Northrop
with its sunshield deployed

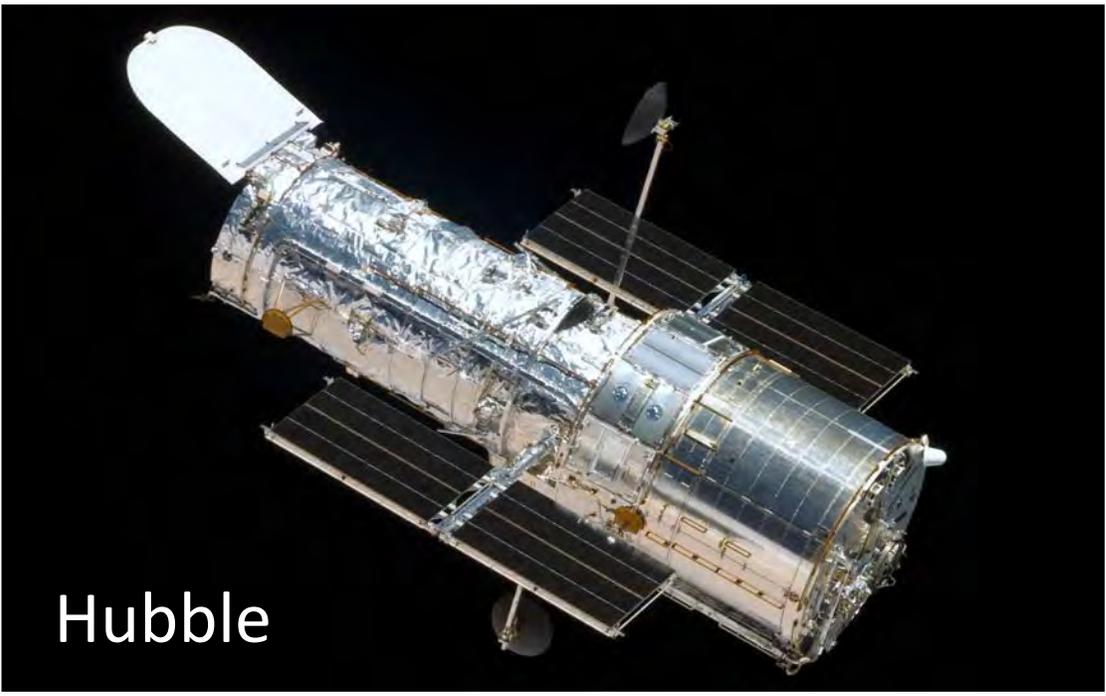


Will JWST
lessen interest
in Hubble?

No!
Hubble has unique
capabilities in the JWST era

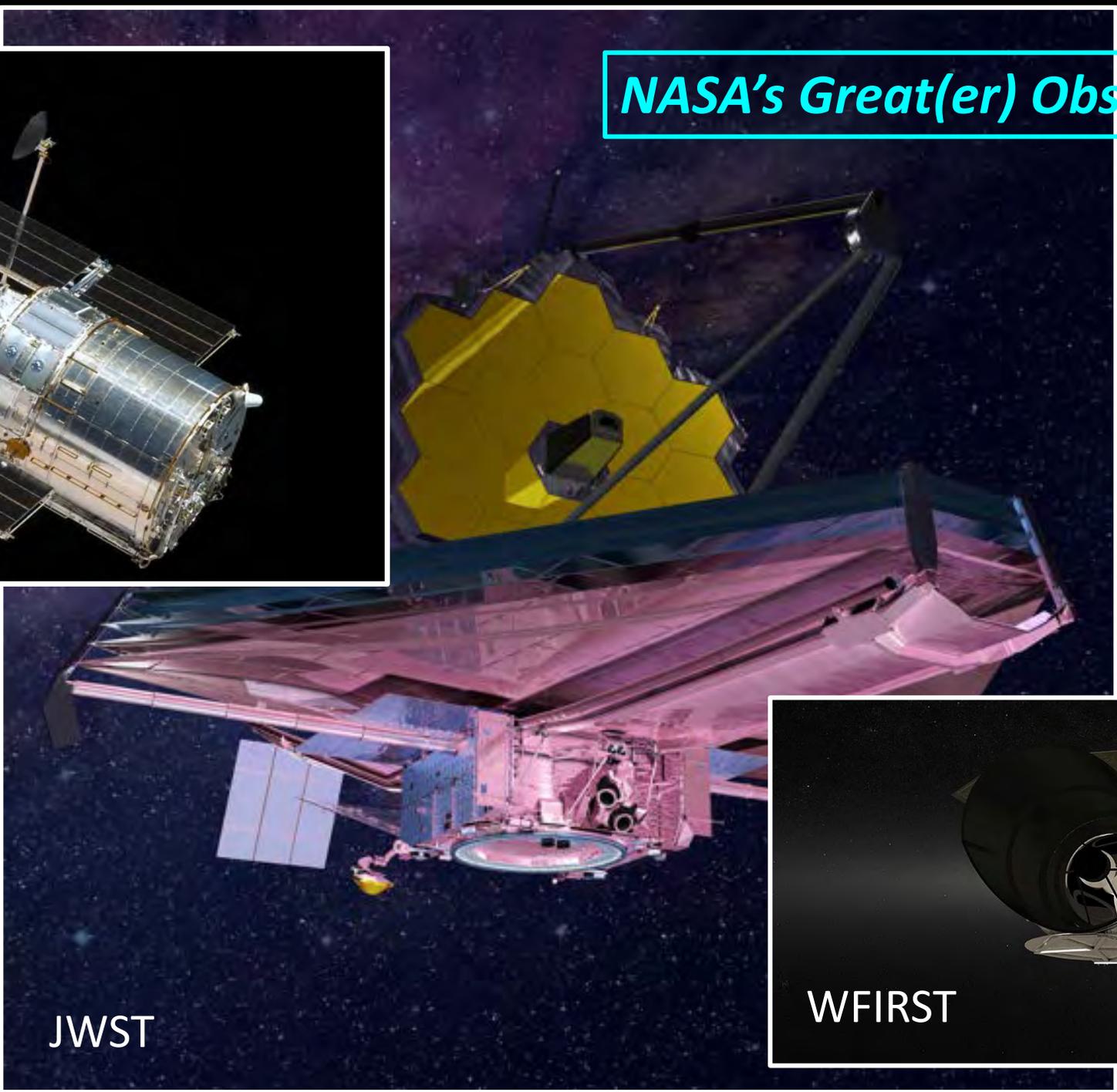
the full JWST Observatory in
the clean room at Northrop
with its sunshield deployed

NASA's Great(er) Observatories



Hubble

the “Synergy Suite” of complementary Greatest Observatories



JWST



WFIRST

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