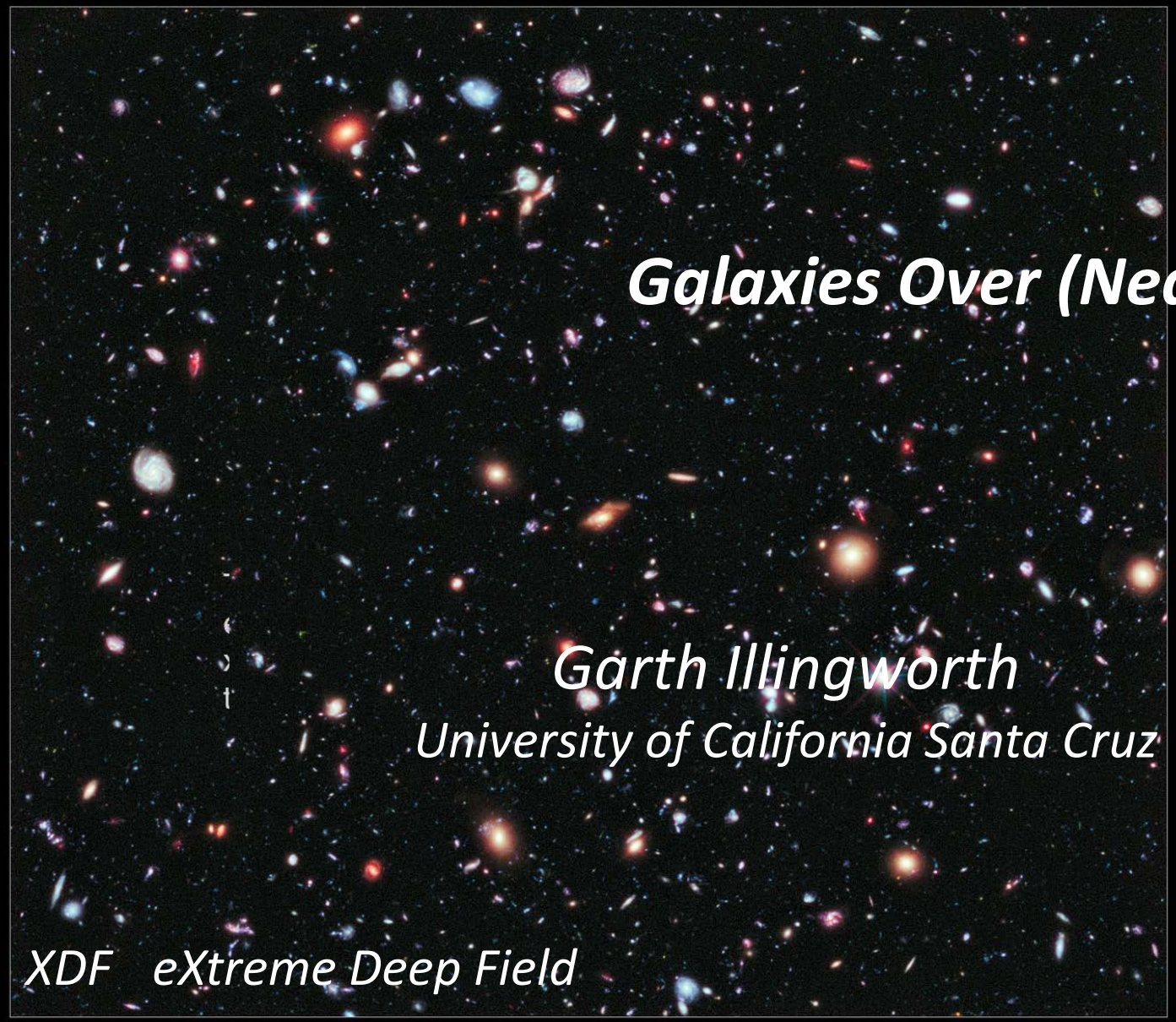
SSB ASEB June 09 2020



Galaxies Over (Nearly) All Time

Garth Illingworth

University of California Santa Cruz

XDF eXtreme Deep Field

M101

firstgalaxies.org

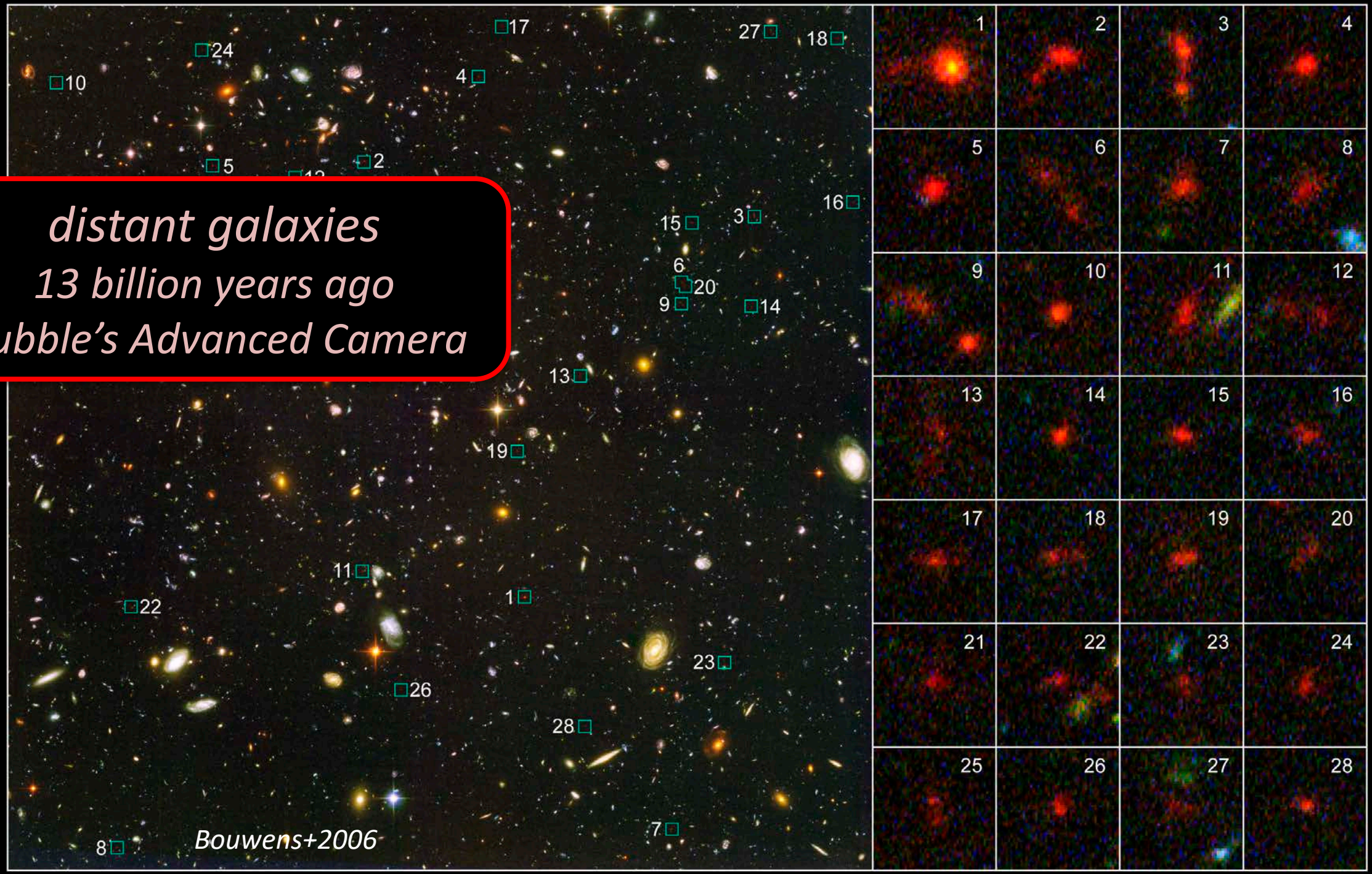

04/24/1990
Hubble Launch

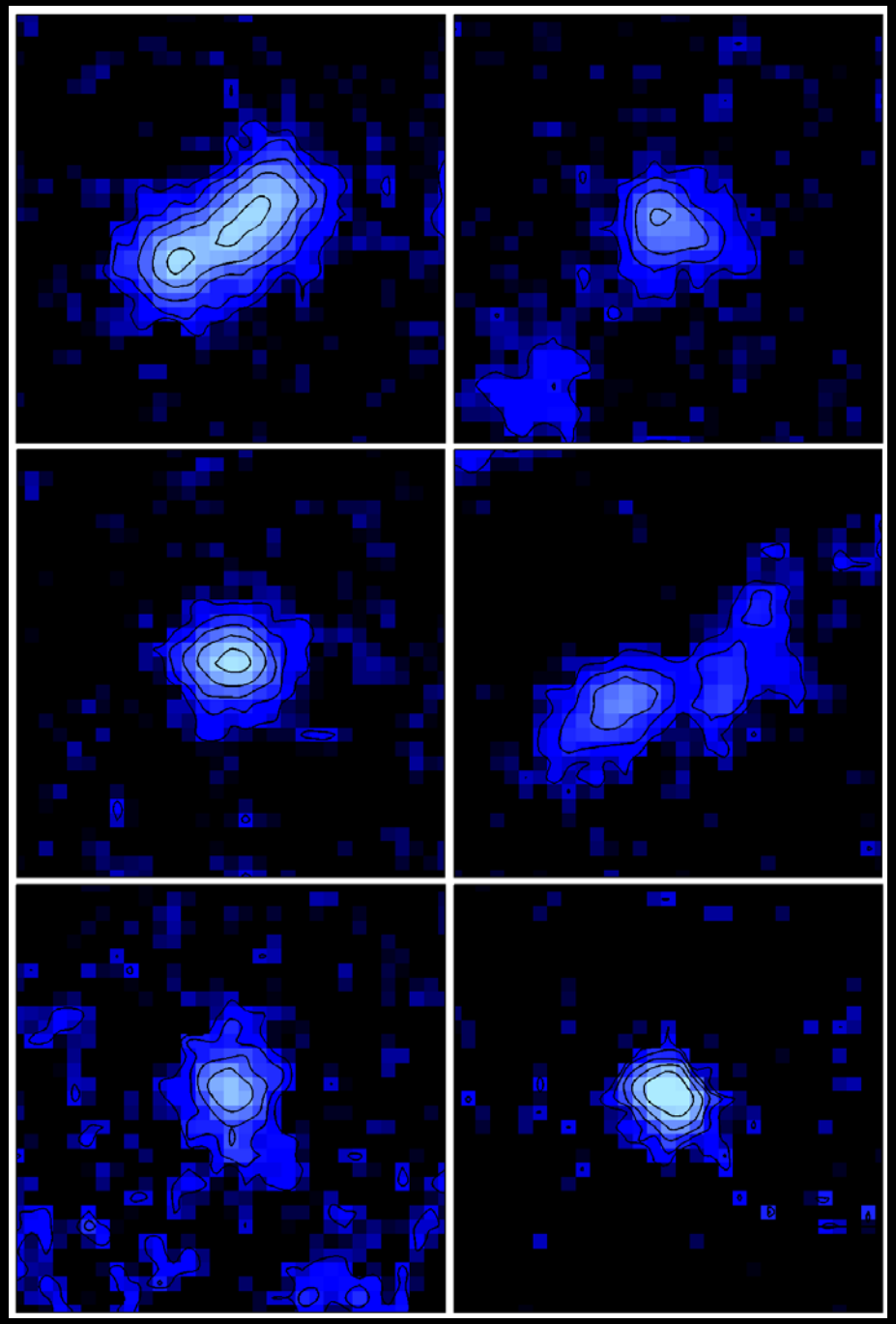

04/26/1990
Canada
gdi

the first deep Hubble image
WFPC2
the "Hubble Deep Field" in 1995

Bob Williams
and the HDF Team

gdi


distant galaxies
13 billion years ago
Hubble's Advanced Camera
Bouwens+2006
gdi



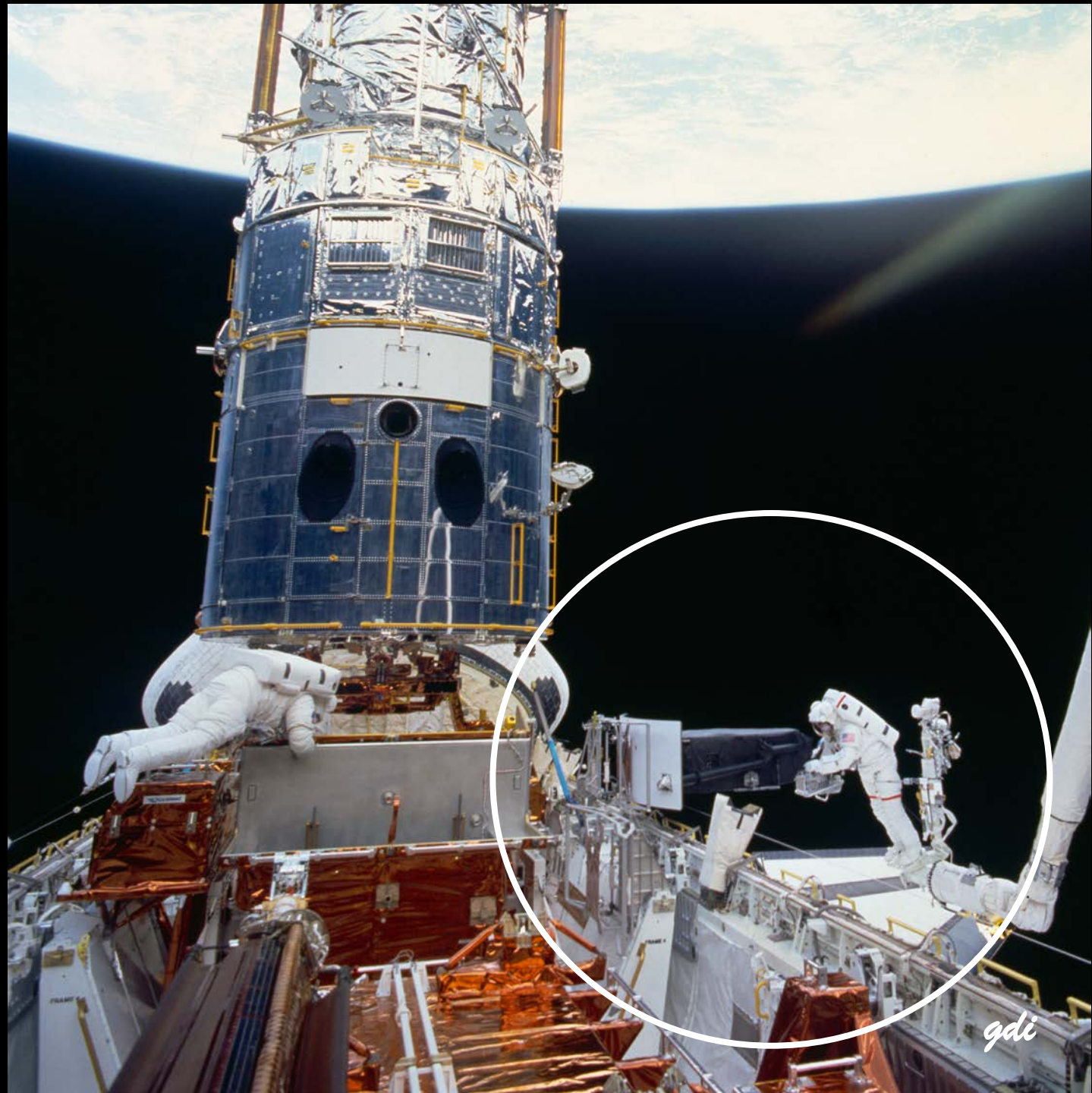
a sample of bright galaxies looking back in time ~13 billion years to ~800 million years after the Big Bang

~Hubble resolution

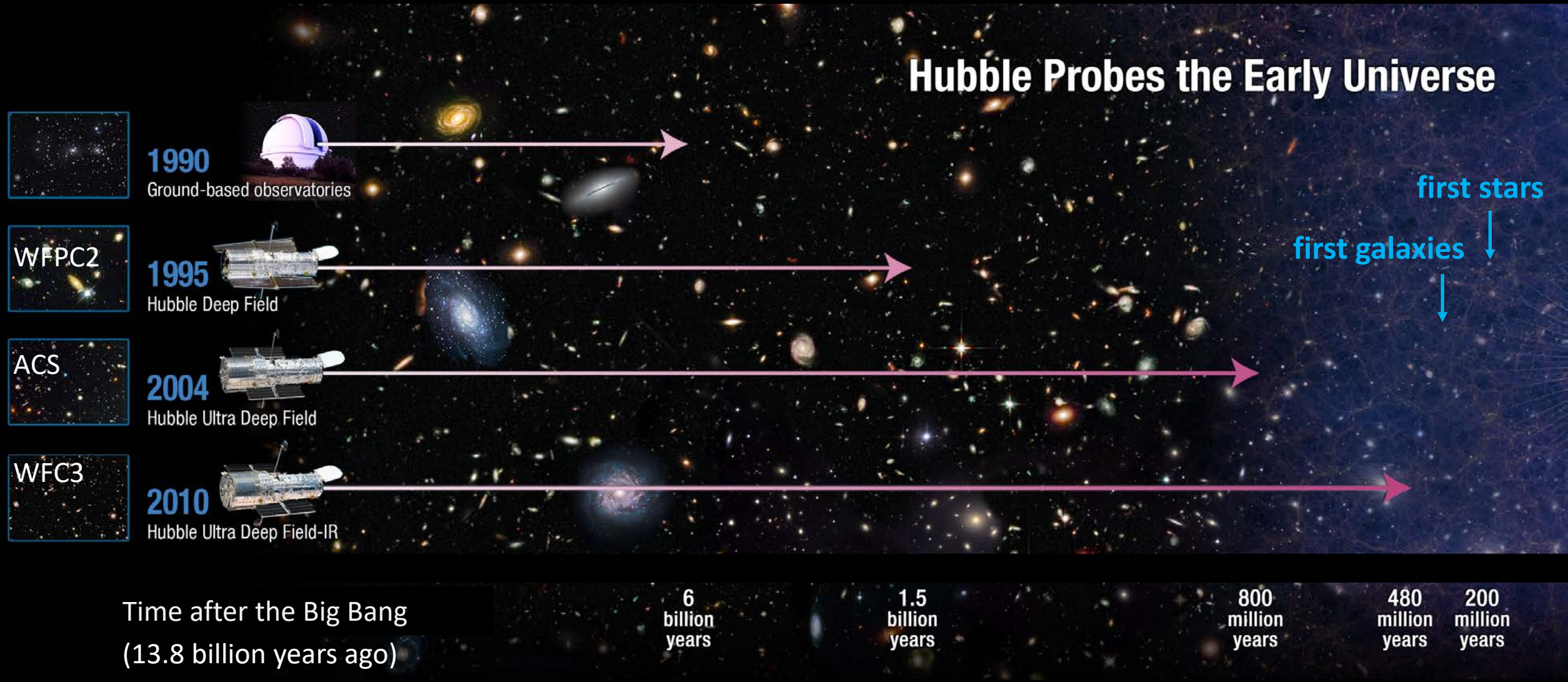
gdi

Hubble Wide Field Camera 3 (WFC3 IR & UVIS)

Hubble's last servicing mission – SM4



how far back we can see gets better with each new camera



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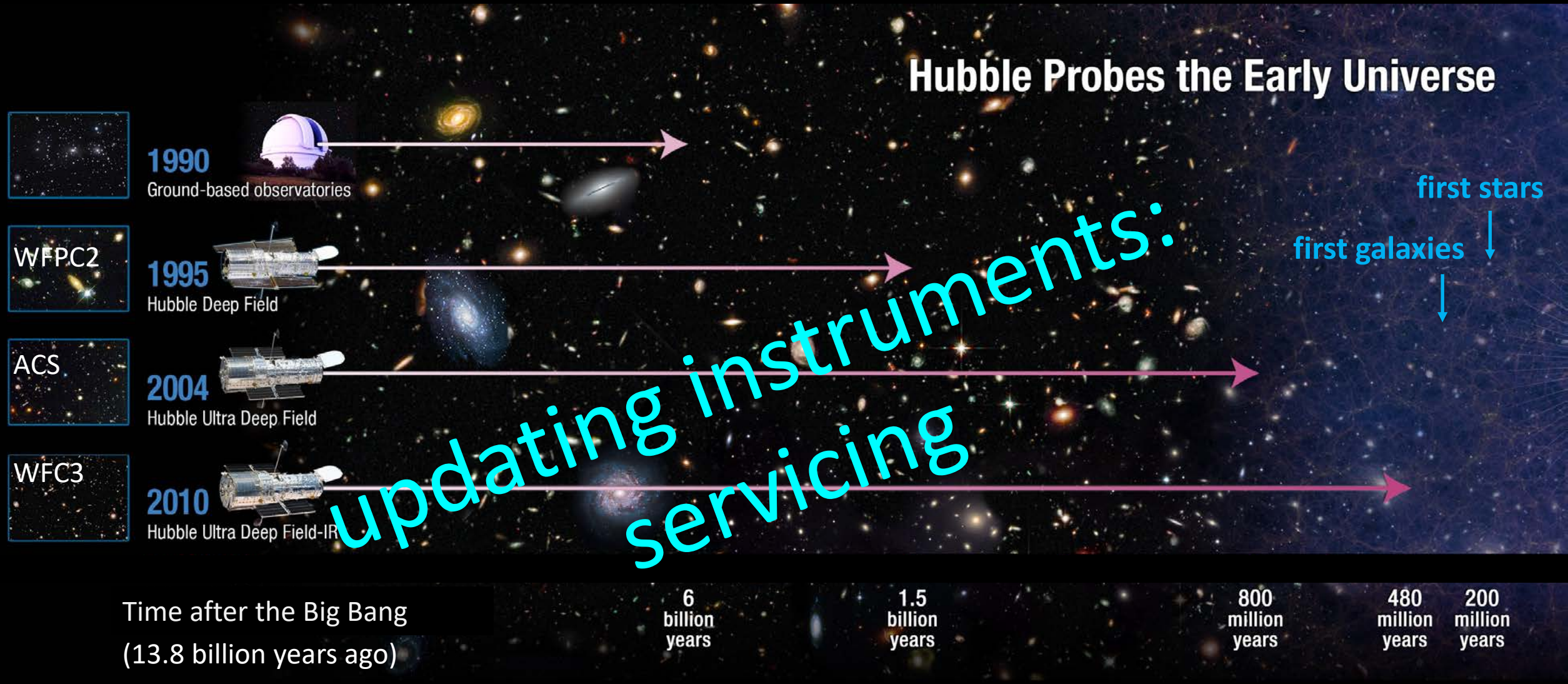

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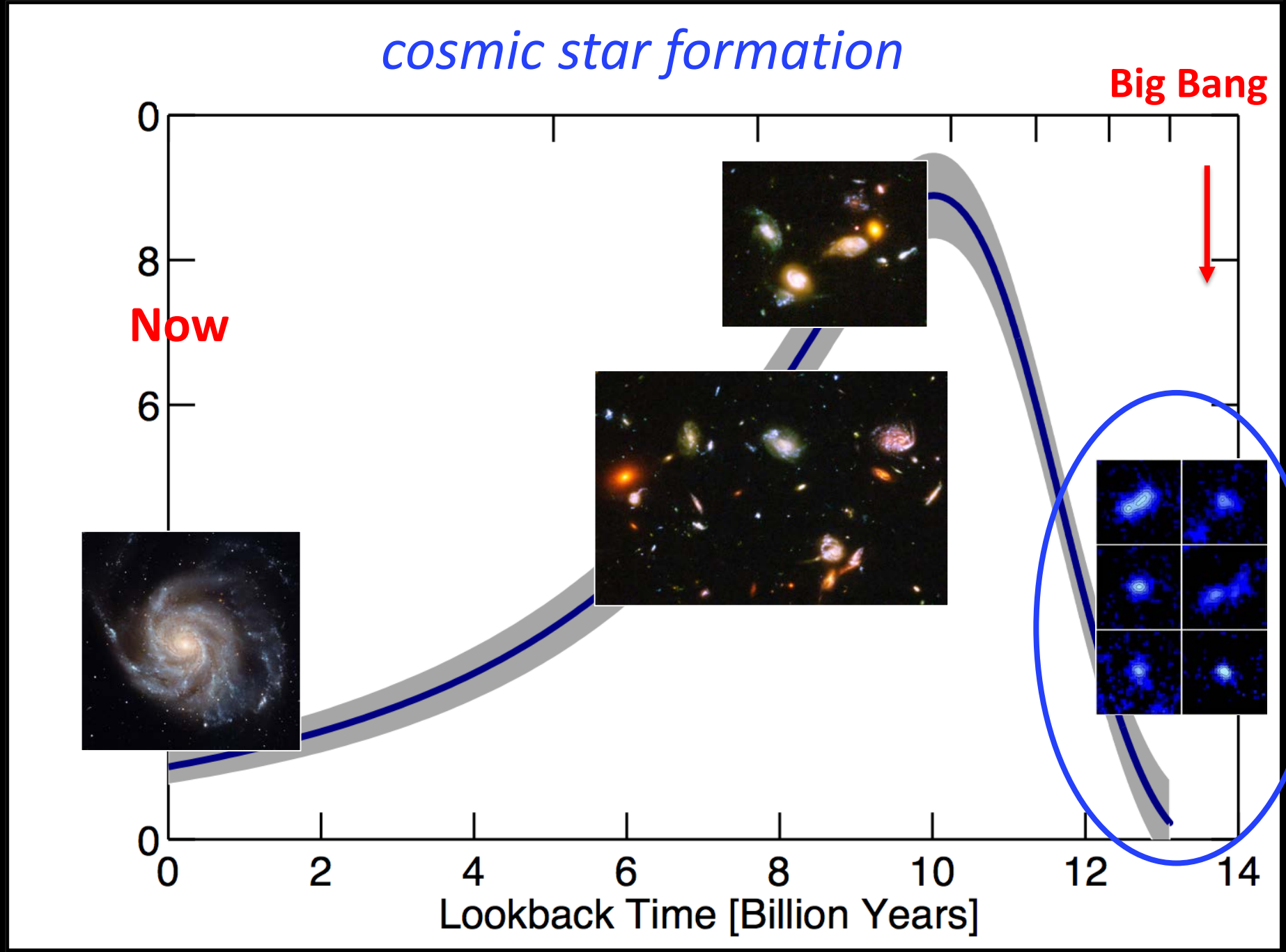

the history of star formation over 97% of all time

figure credit:
Pascal Oesch

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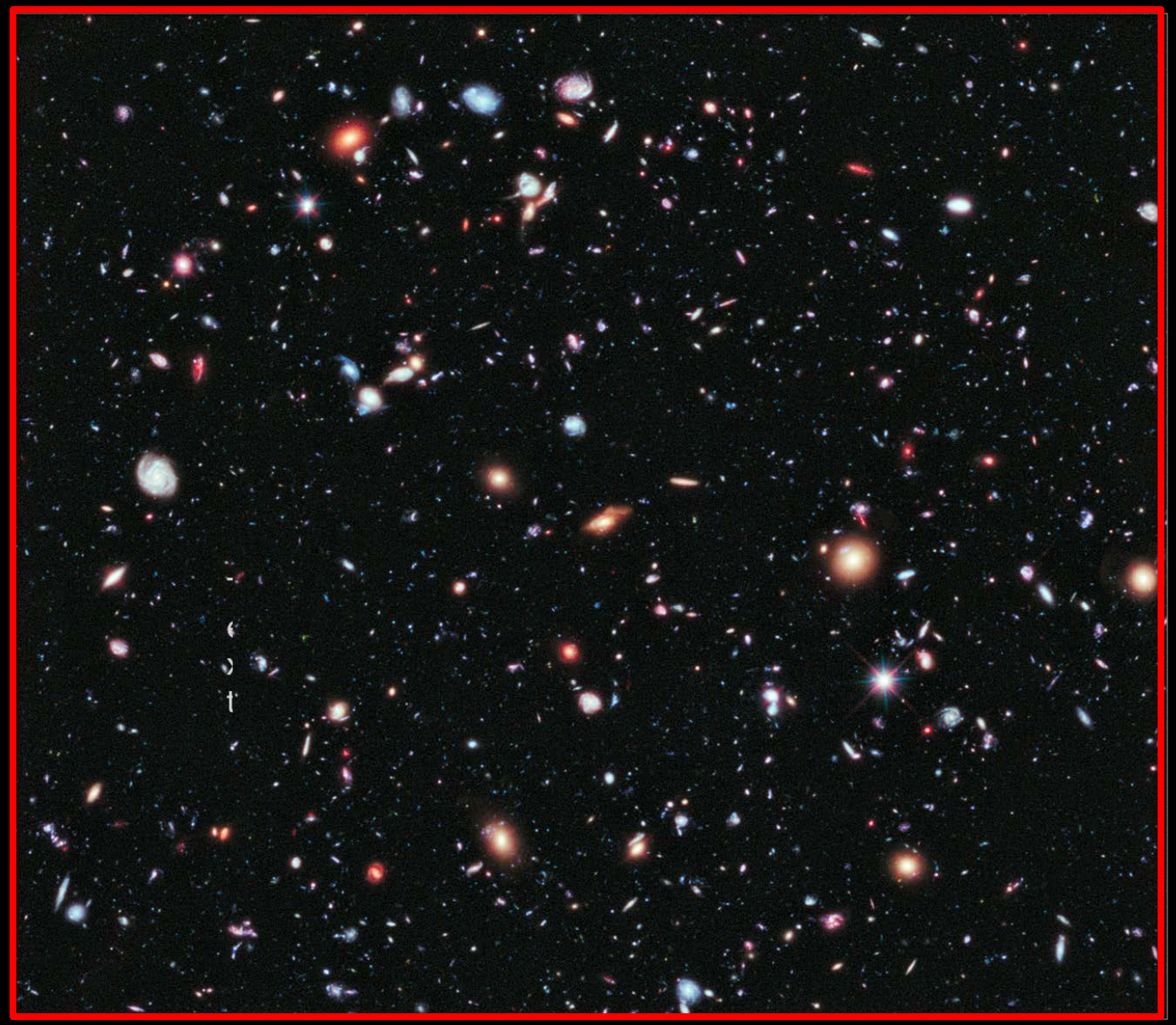
XDF (eXtreme Deep Field)

deepest ever Hubble image

2963 HST images over a decade from 2003-2012

from 800 orbits of Hubble

for a 23 day total exposure



A decade of imaging on the Hubble Ultra Deep Field
The deepest image of the Universe

GDI+2013

xdf.ucolick.org

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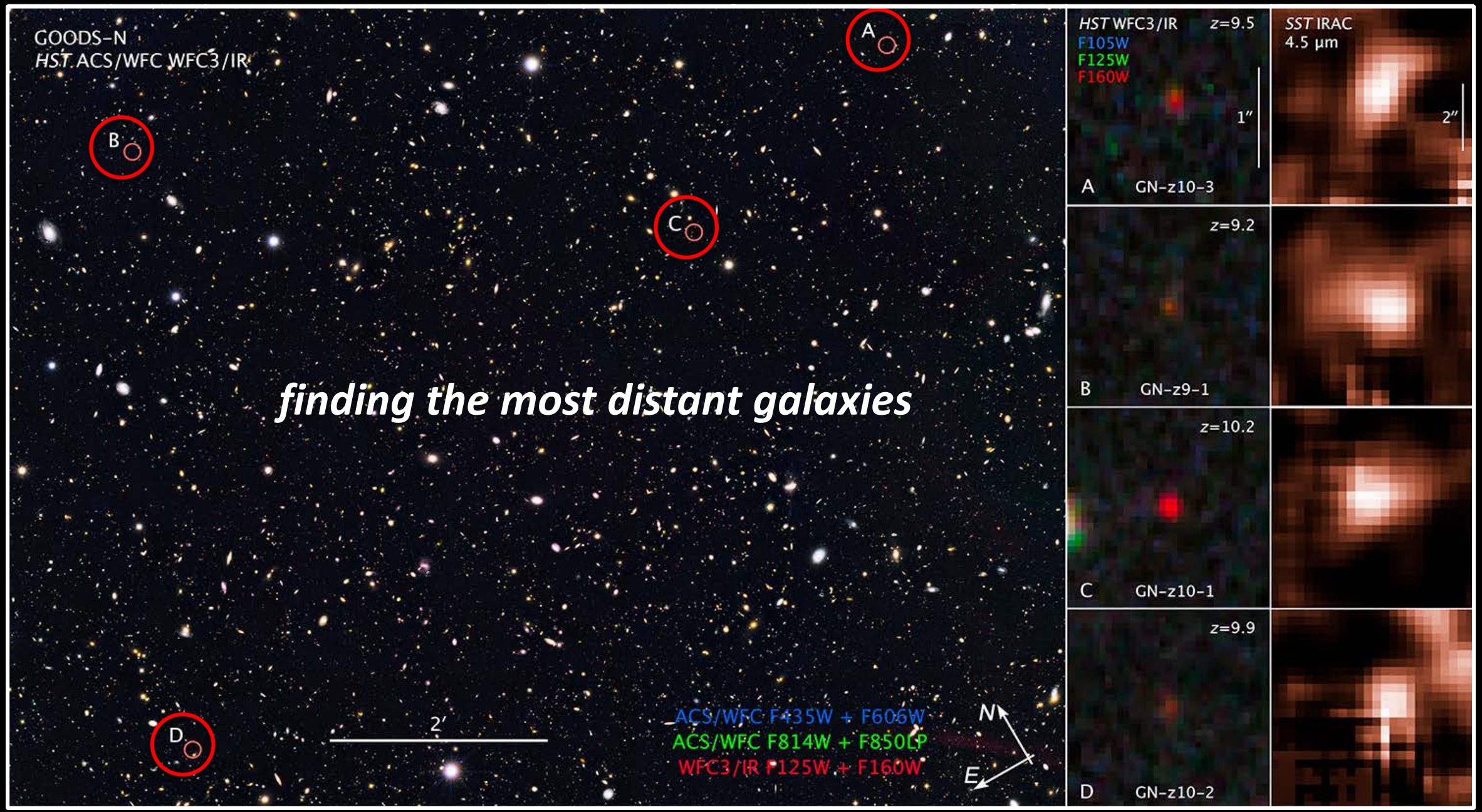

Oesch + 2014, 2016

Hubble

Spitzer

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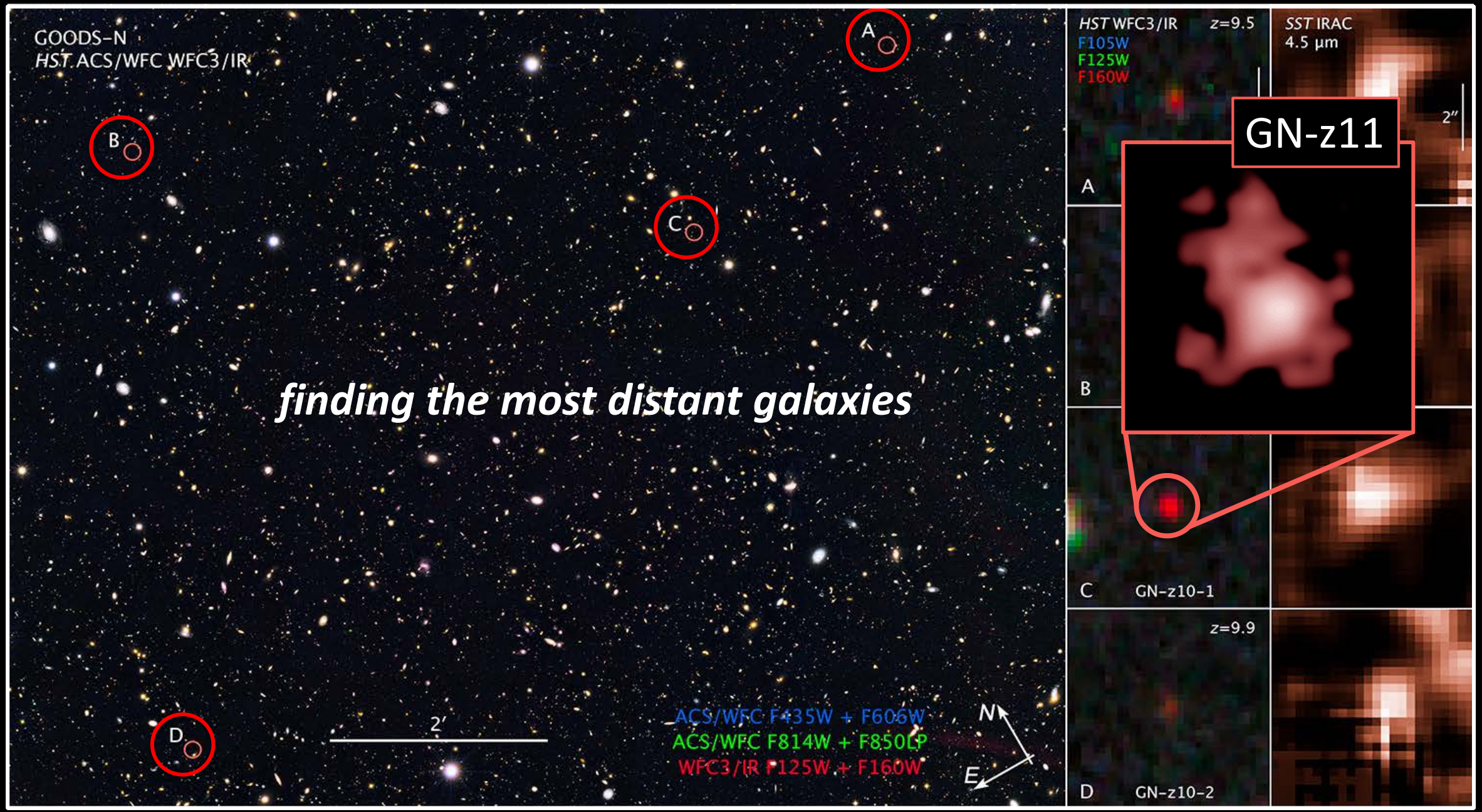

Oesch + 2014, 2016

Hubble Spitzer

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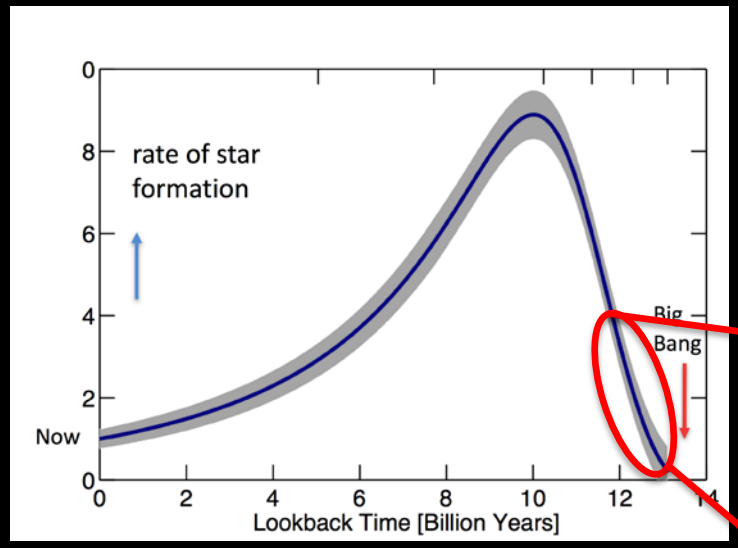
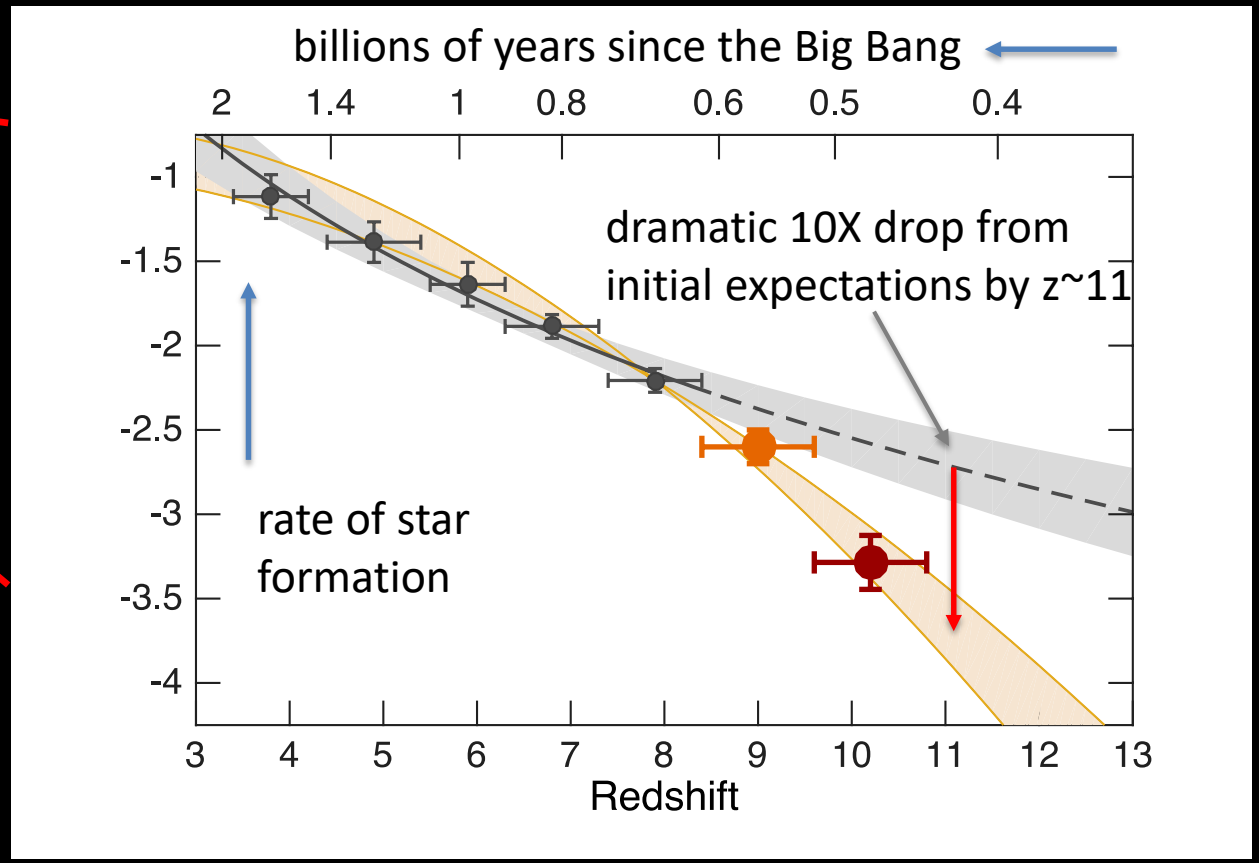
way fewer galaxies than expected at redshift 10!



Hubble has explored to the beginning of time to the realm of the "first galaxies"



galaxies are evolving very rapidly earlier than 650 million years

Bouwens+2019

Oesch+2017

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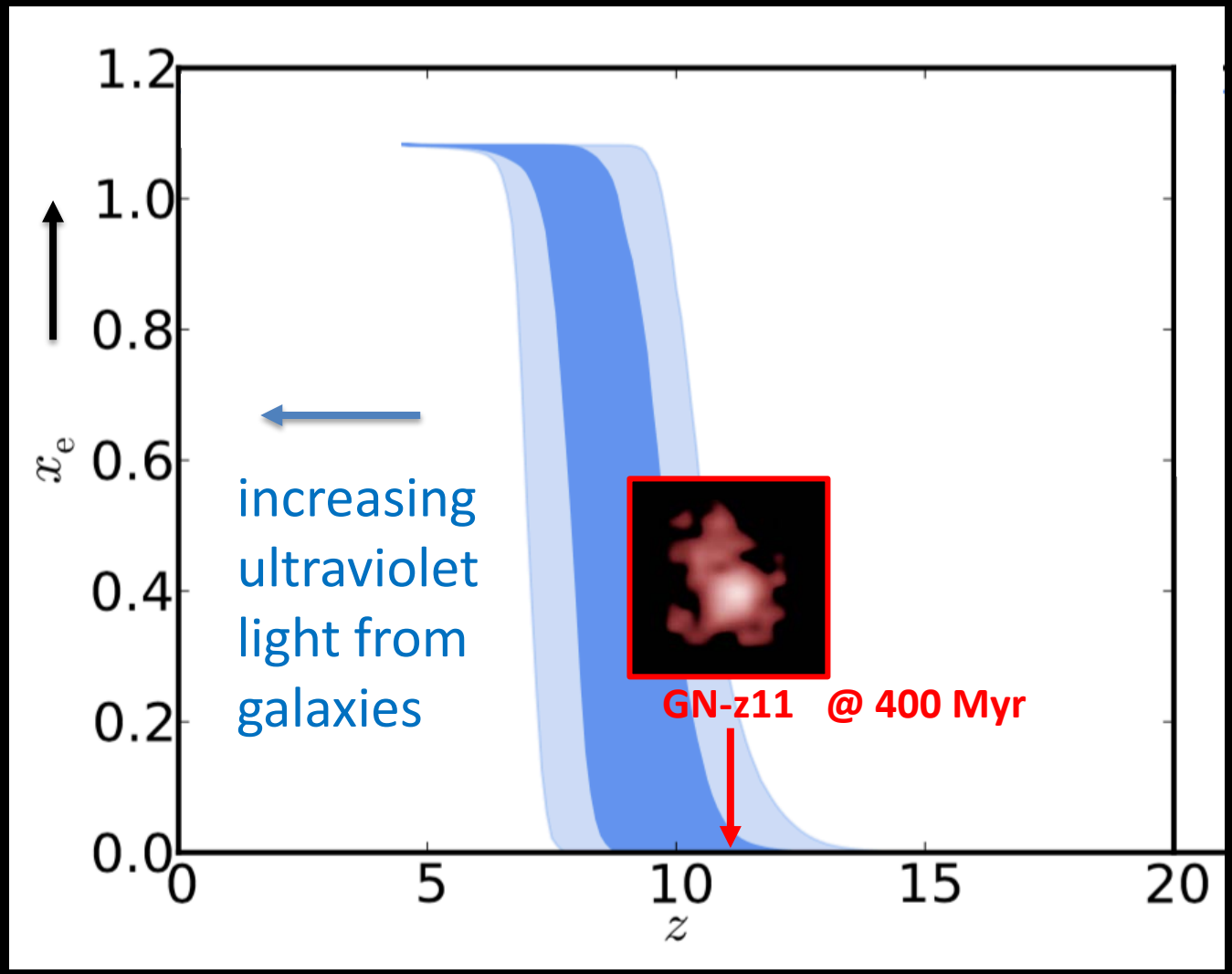
the most distant galaxy

hydrogen reionized



GN-z11 is a pathfinder into the epoch of the earliest galaxies

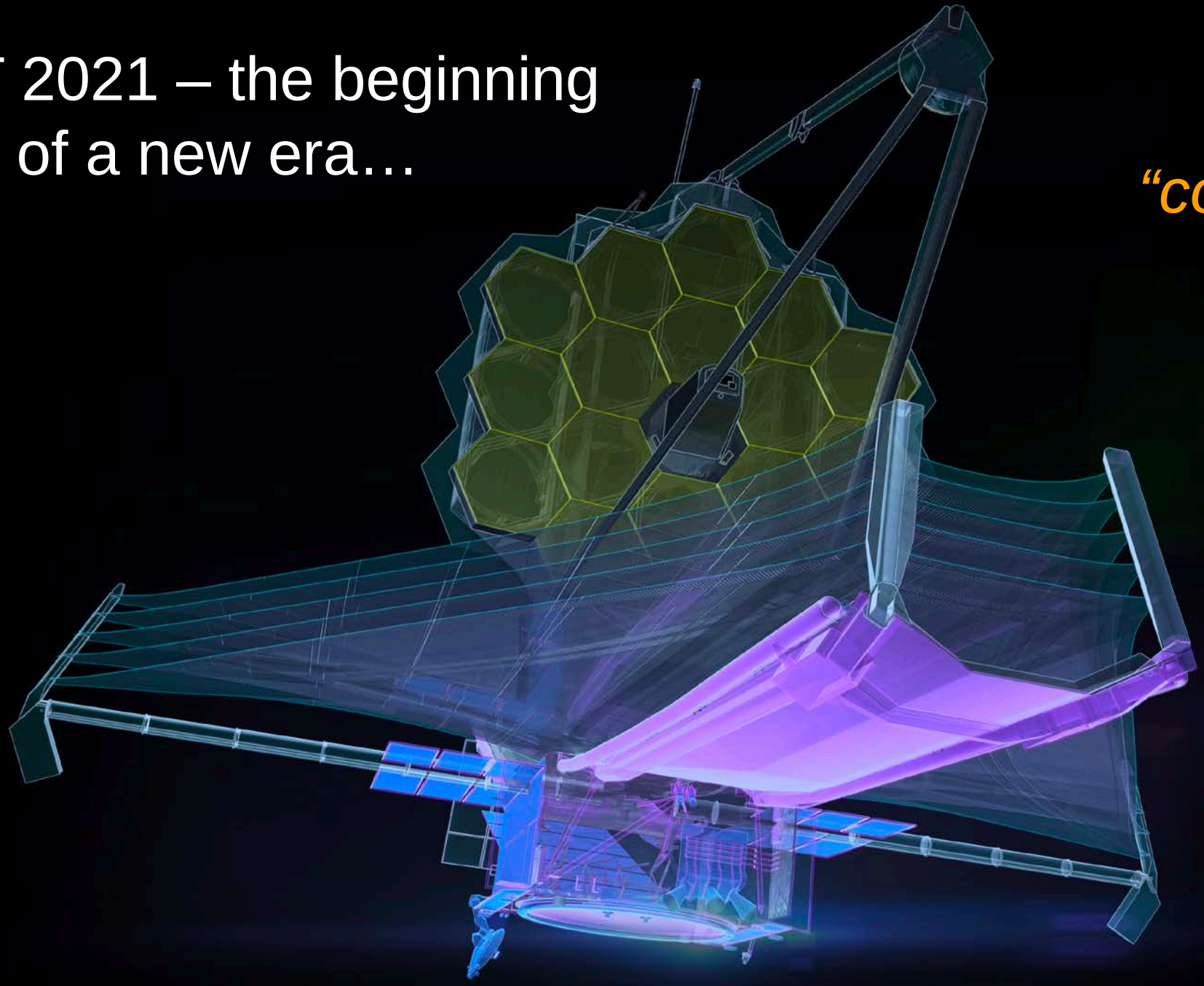
looking back through 97% of all time to GN-z11

Planck Collaboration VI 2018

Oesch + 2014, 2016

gdi

JWST 2021 – the beginning of a new era…



our “cosmic sunrise” telescope

exploring in search of “first light”

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