Memorial Symposium to Honor Riccardo Giacconi
National Academy of Sciences
May 29-30 2019

The STScI Years: Riccardo, Hubble, and the Early Days of JWST

Garth Illingworth
University of California Santa Cruz

STScI Deputy-Director in the mid-1980s under Riccardo

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STScI Deputy-Director in the mid-1980s under Riccardo

X-Ray astronomy pioneer, leading to Chandra
Hubble Space Telescope; European VLT; ALMA; OWL
Nobel Prize 2002

1981-1992 STScI Director

"science systems engineering"

Riccardo's vision was that a "science systems engineering" approach was needed at STScI to ensure a high-level of operational scientific productivity from such a complex science observatory. This was a key factor in Hubble's success

This approach has become the baseline for later major projects and missions

Riccardo played a central role in "resetting" how we do astronomy

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the many sides of Riccardo:

visionary

focus on science

tough

driven

integrity

considerate

impetuous

great sense of humor

gdi

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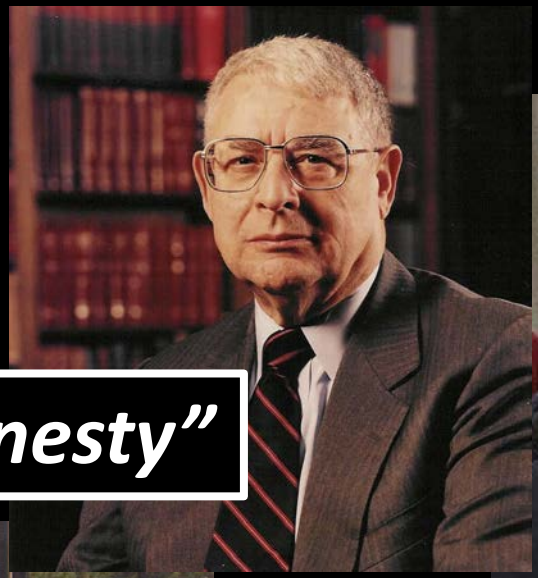

"ruthless intellectual honesty"

gdi


1990
gdi

“start working on the next big mission
– it will take a very long time”

gdi

“start working on the next big mission
– it will take a very long time”

Riccardo surprised me in the mid-1980s with these words, especially since we had yet to launch “Space Telescope”!

Pierre Bely, Peter Stockman and Garth then began to develop the concept of NGST – the Next Generation Space Telescope – a passively-cooled infrared very large space telescope in high orbit

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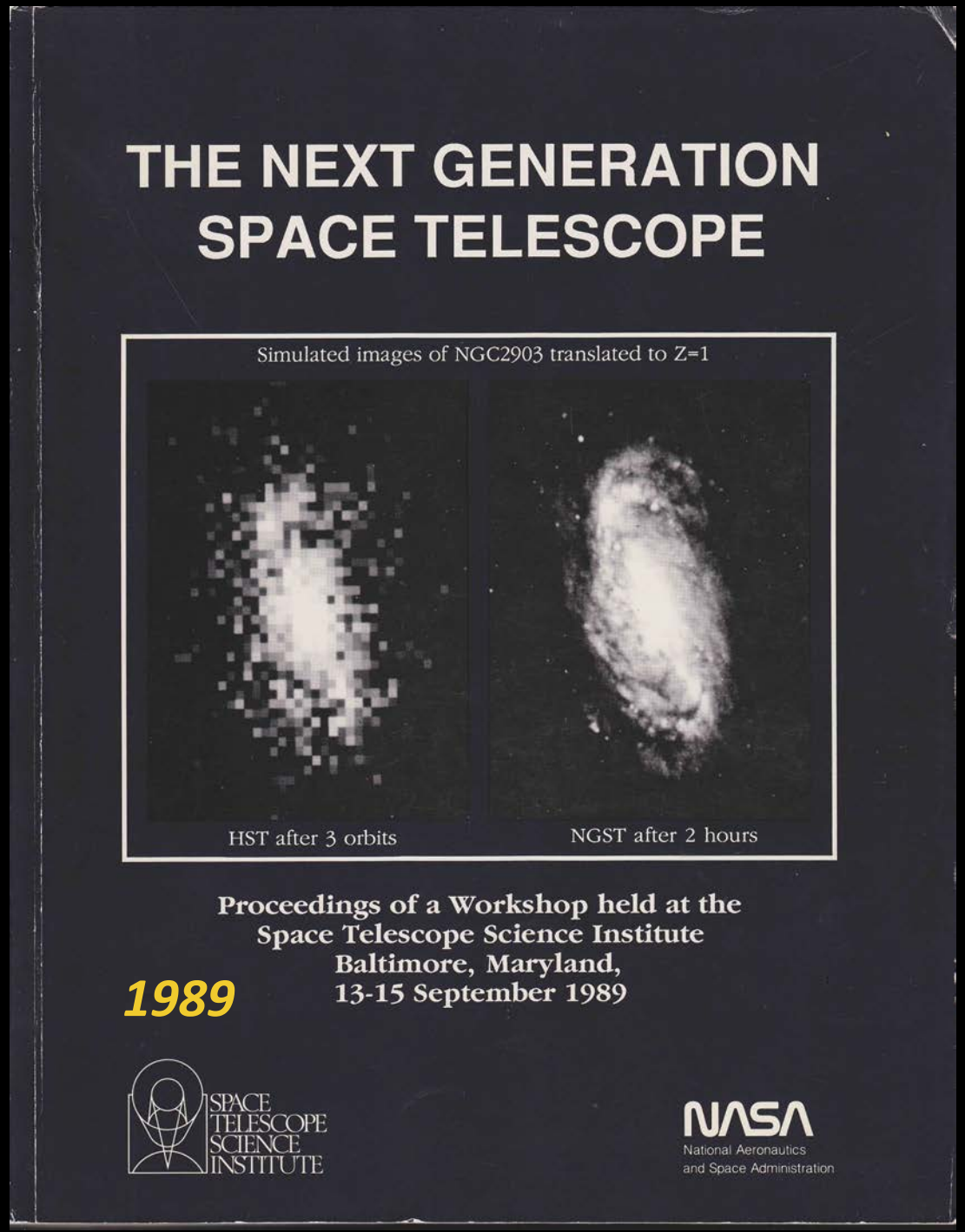

the outcome of several years of work was this conference in 1989 (30 years ago!) – which Riccardo helped bring about and which greatly benefited from the support of Ed Weiler and Charlie Pellerin at NASA

the baseline was a passively-cooled IR 10 m telescope in a high earth orbit with UV-Optical capability

see 2016 STScI Newsletter article
NGST: The Early Days of JWST
www.ucolick.org/~gdi/early_jwst/

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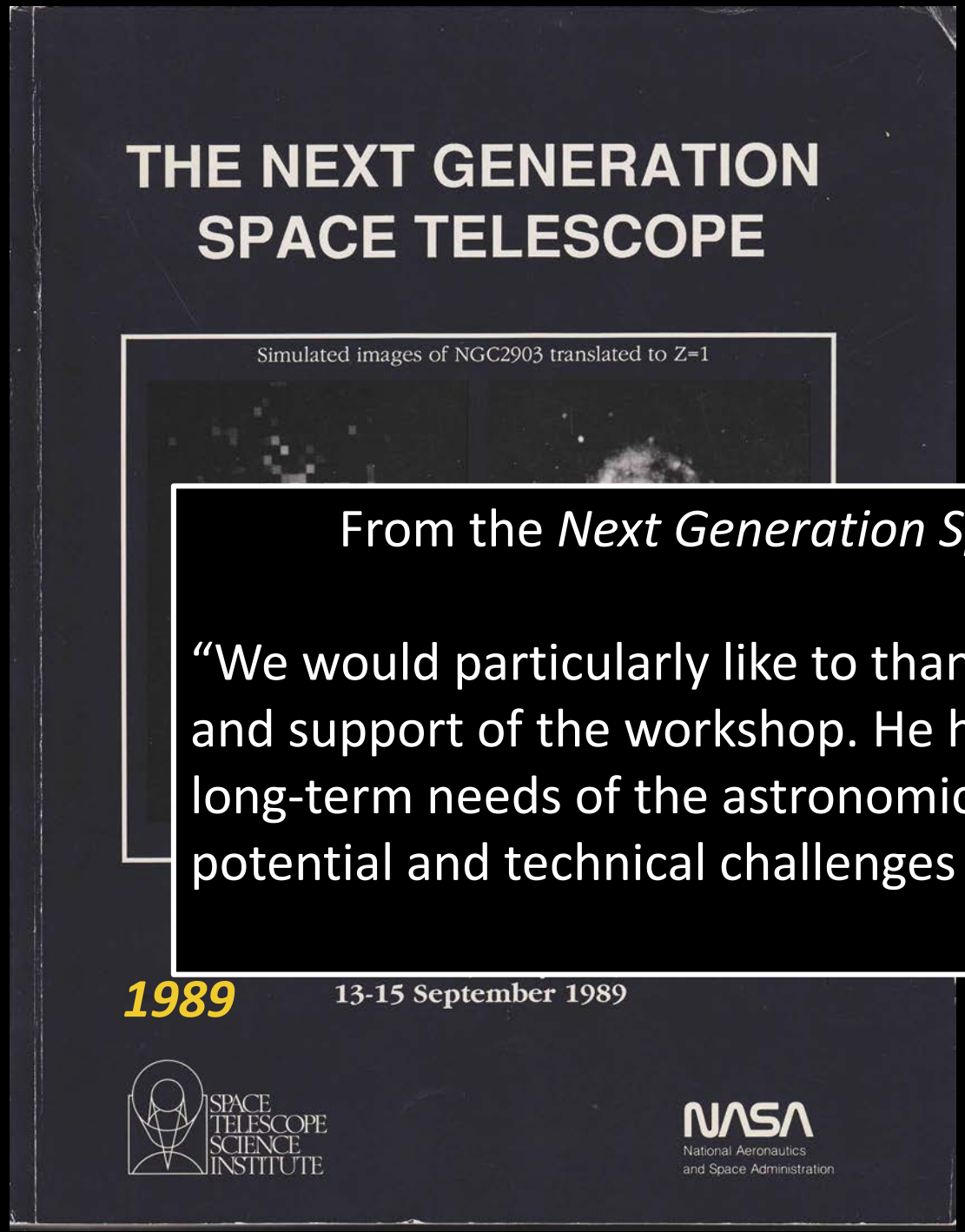

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From the *Next Generation Space Telescope* conference Foreword:

"We would particularly like to thank Riccardo Giacconi for his keen interest and support of the workshop. He had urged us for some time to think of the long-term needs of the astronomical community and to explore the scientific potential and technical challenges of a successor to HST."

see 2016 STScI Newsletter article
NGST: The Early Days of JWST
www.ucolick.org/~gdi/early_jwst/

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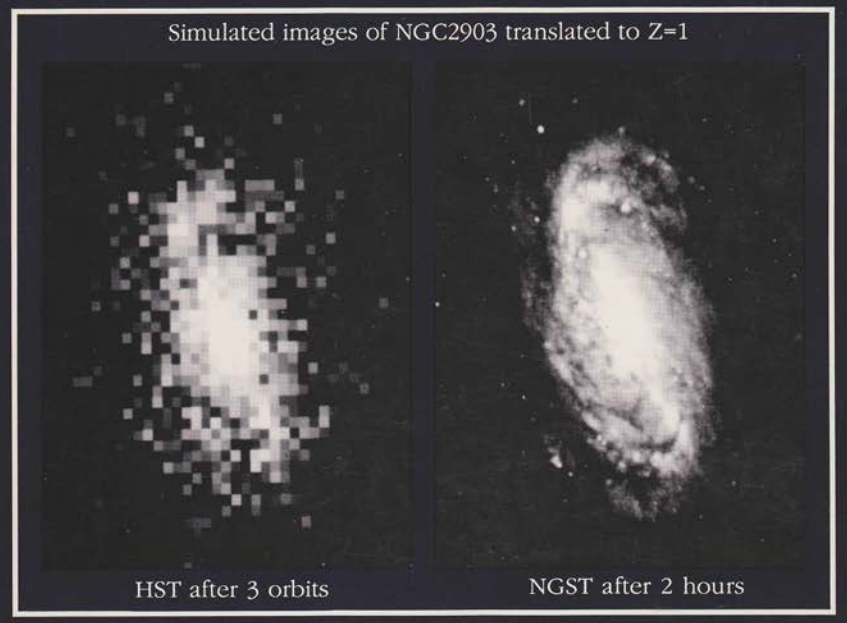
THE NEXT GENERATION SPACE TELESCOPE



Proceedings of a Workshop held at the
Space Telescope Science Institute
Baltimore, Maryland,
13-15 September 1989

1989

SPACE TELESCOPE SCIENCE INSTITUTE

NASA
National Aeronautics and Space Administration

ASTROTECH 21

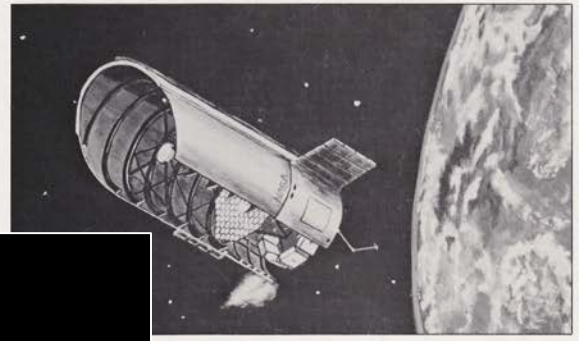
NASA HQ + JPL supported technology workshops and effort

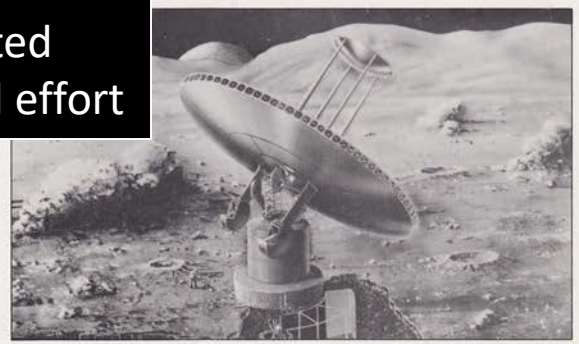
ASTROTECH 21
WORKSHOPS
SERIES II

VOLUME
4

SERIES II MISSION CONCEPTS AND TECHNOLOGY REQUIREMENTS

Workshop Proceedings: Technologies for Large Filled-Aperture Telescopes in Space





1991

September 15, 1991

JPL D-8541, Vol. 4

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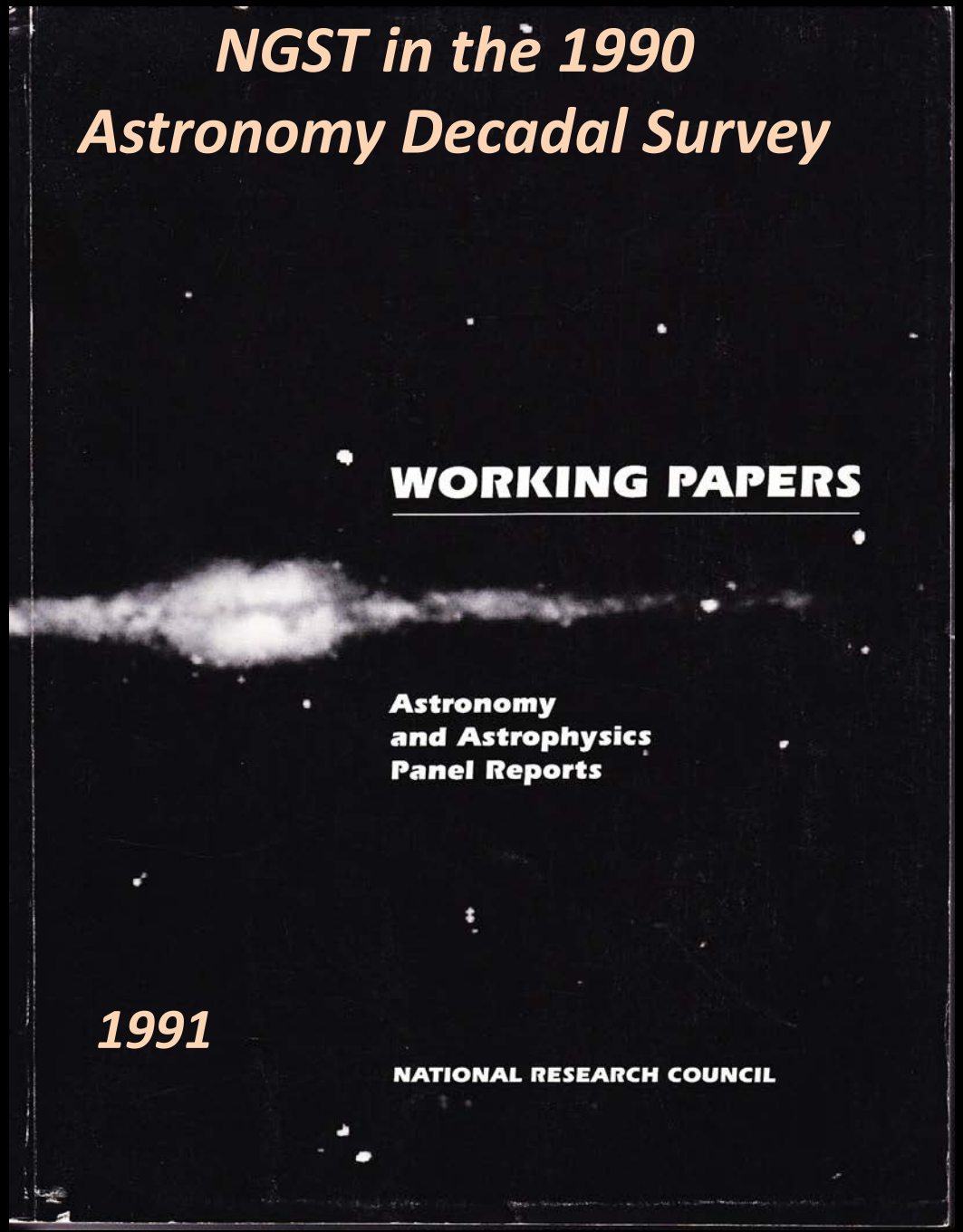
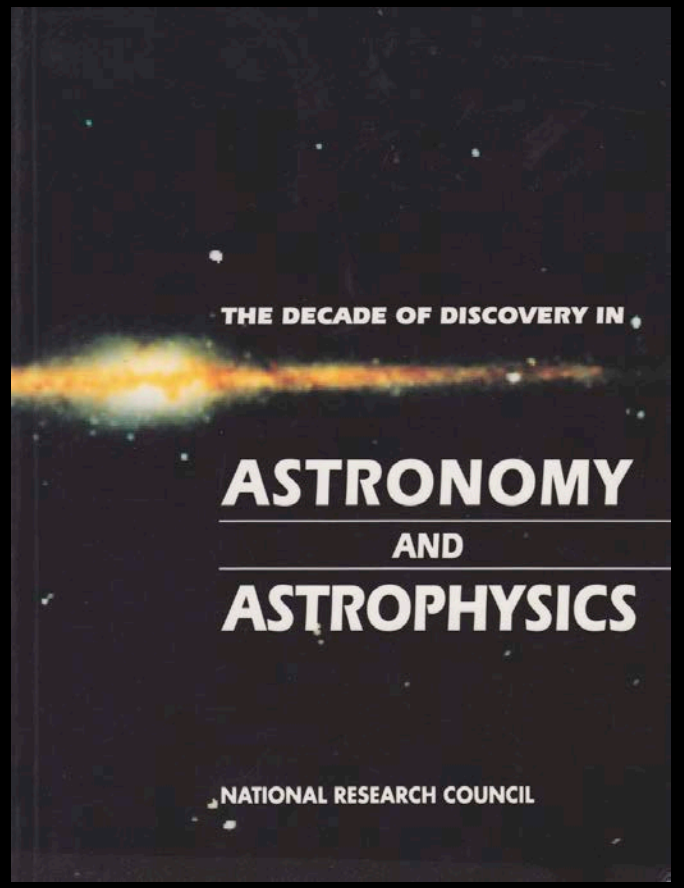
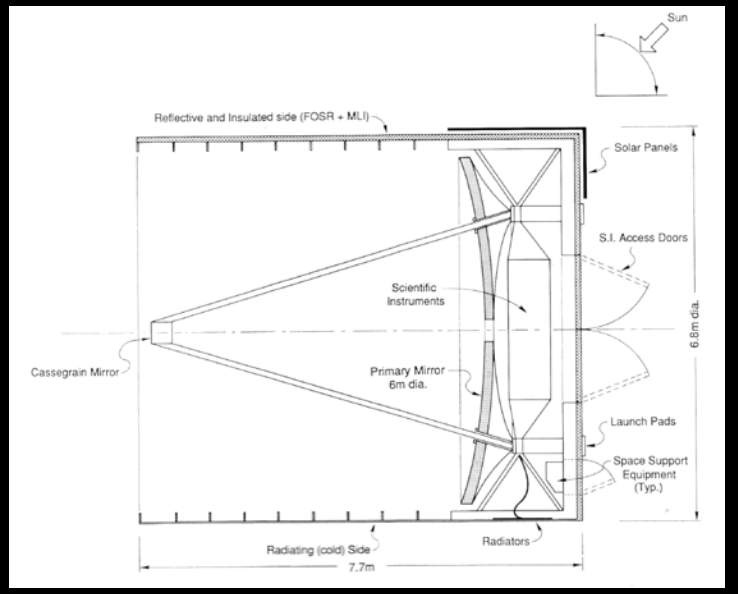
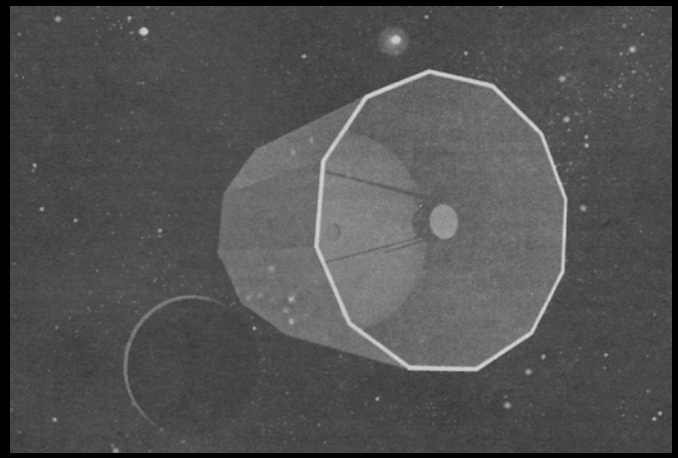
NGST in the 1990 Astronomy Decadal Survey









see [2016 STScI Newsletter article](http://www.stsci.edu/files/live/sites/www/files/home/news/newsletters/_documents/2016-volume033-issue01.pdf#page=6)
NGST: The Early Days of JWST
www.ucolick.org/~gdi/early_jwst/ &
http://www.stsci.edu/files/live/sites/www/files/home/news/newsletters/_documents/2016-volume033-issue01.pdf#page=6

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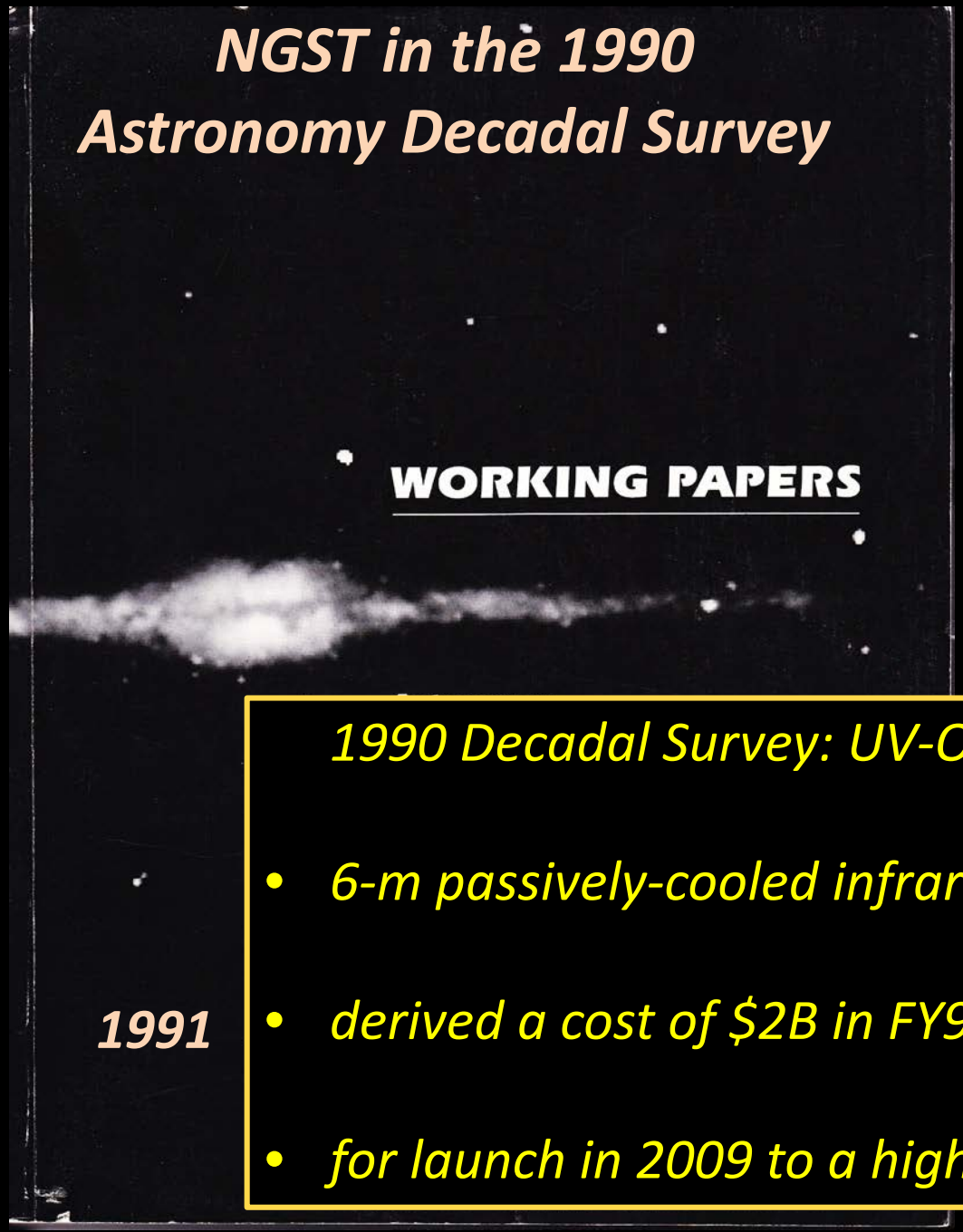

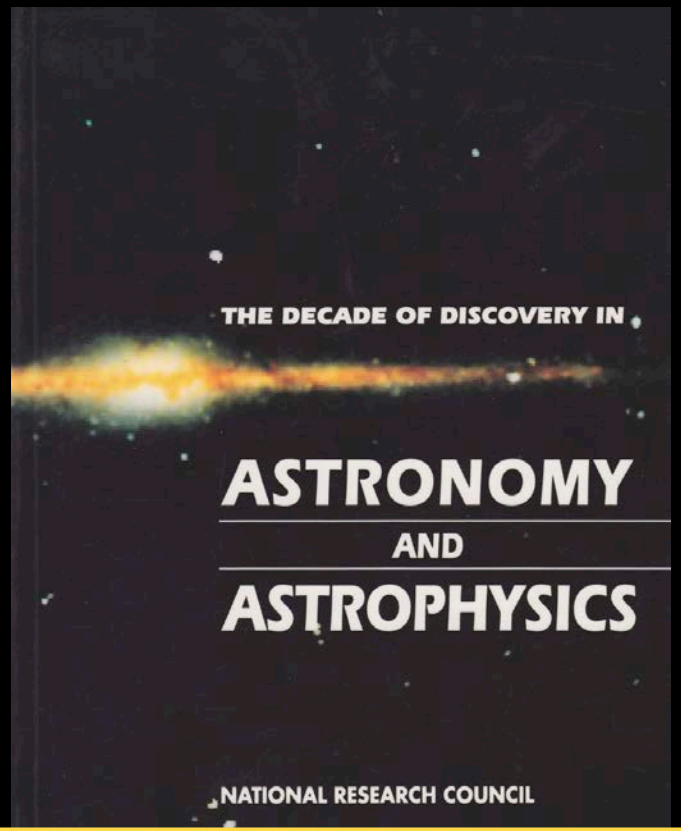

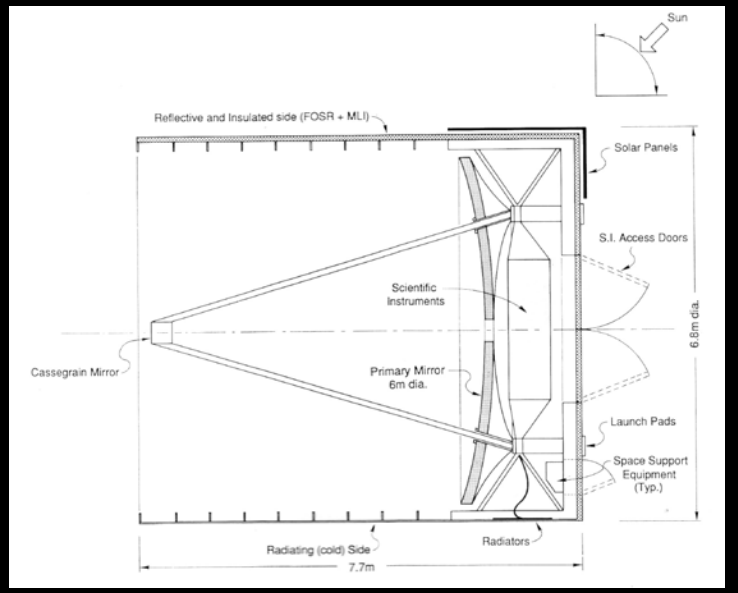

1991

1990 Decadal Survey: UV-Optical in Space Panel recommended:

- *6-m passively-cooled infrared telescope*
- *derived a cost of $2B in FY90$ (~$4B in 2018$)*
- *for launch in 2009 to a high orbit*

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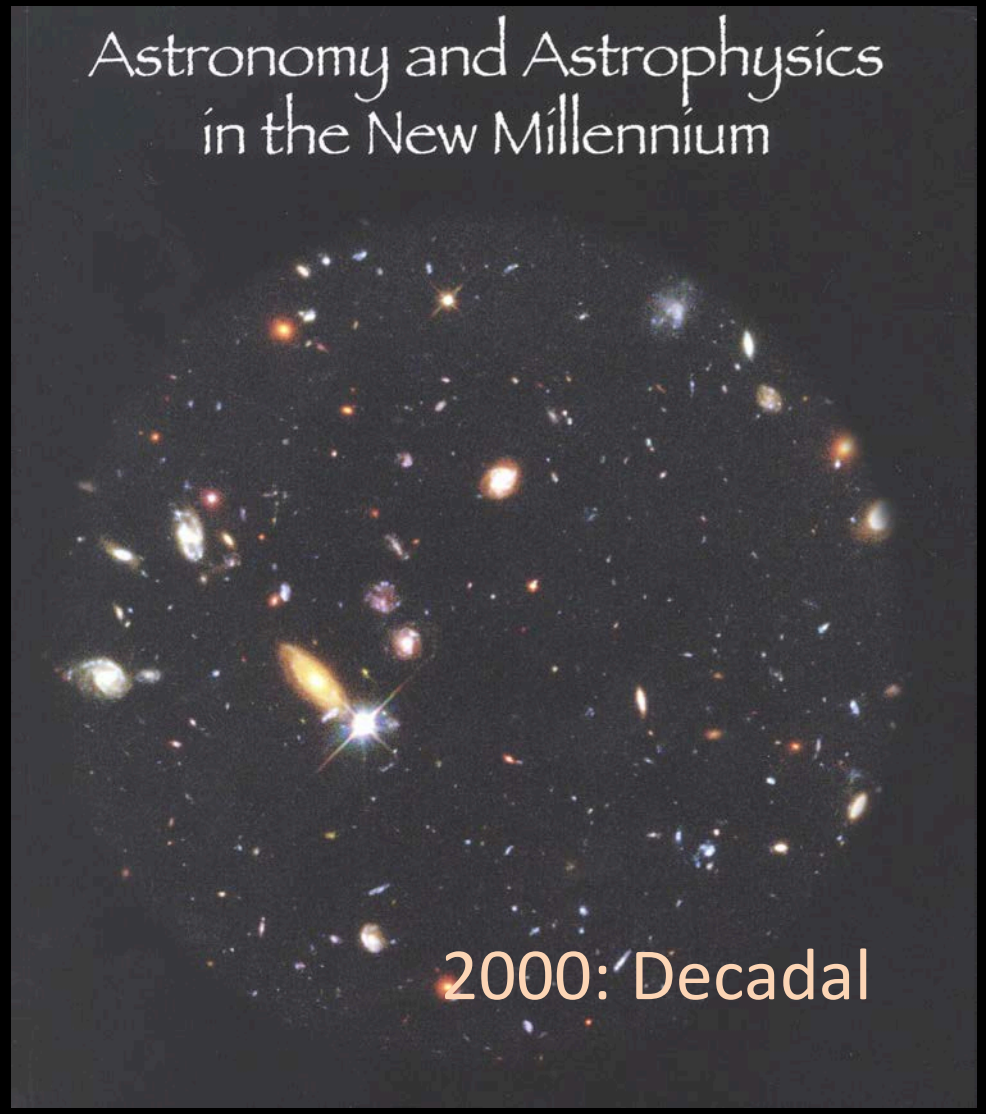
NGST recommended in 2000 Decadal Survey



www.ucolick.org/~gdi/early_jwst/

JWST cancellation challenges of 2009-2012

James Webb Space Telescope (JWST)
Independent Comprehensive Review Panel (ICRP)

FINAL REPORT

Panel Members	
William F. Ballhaus, Jr.	The Aerospace Corporation (Ret.)
John Casani, Chair	Jet Propulsion Laboratory
Steven Dorfman	Hughes Electronics (Ret.)
David Gallagher	Jet Propulsion Laboratory
Garth Illingworth	University of California Observatories
John Klineberg	Swales Aerospace (Ret.)
David Schurr	National Aeronautics and Space Administration
Industry Consultant	
Rosalind Lewis	The Aerospace Corporation
Executive Secretary	
Marcus Lobbia	The Aerospace Corporation

2010: ICRP

October 29, 2010

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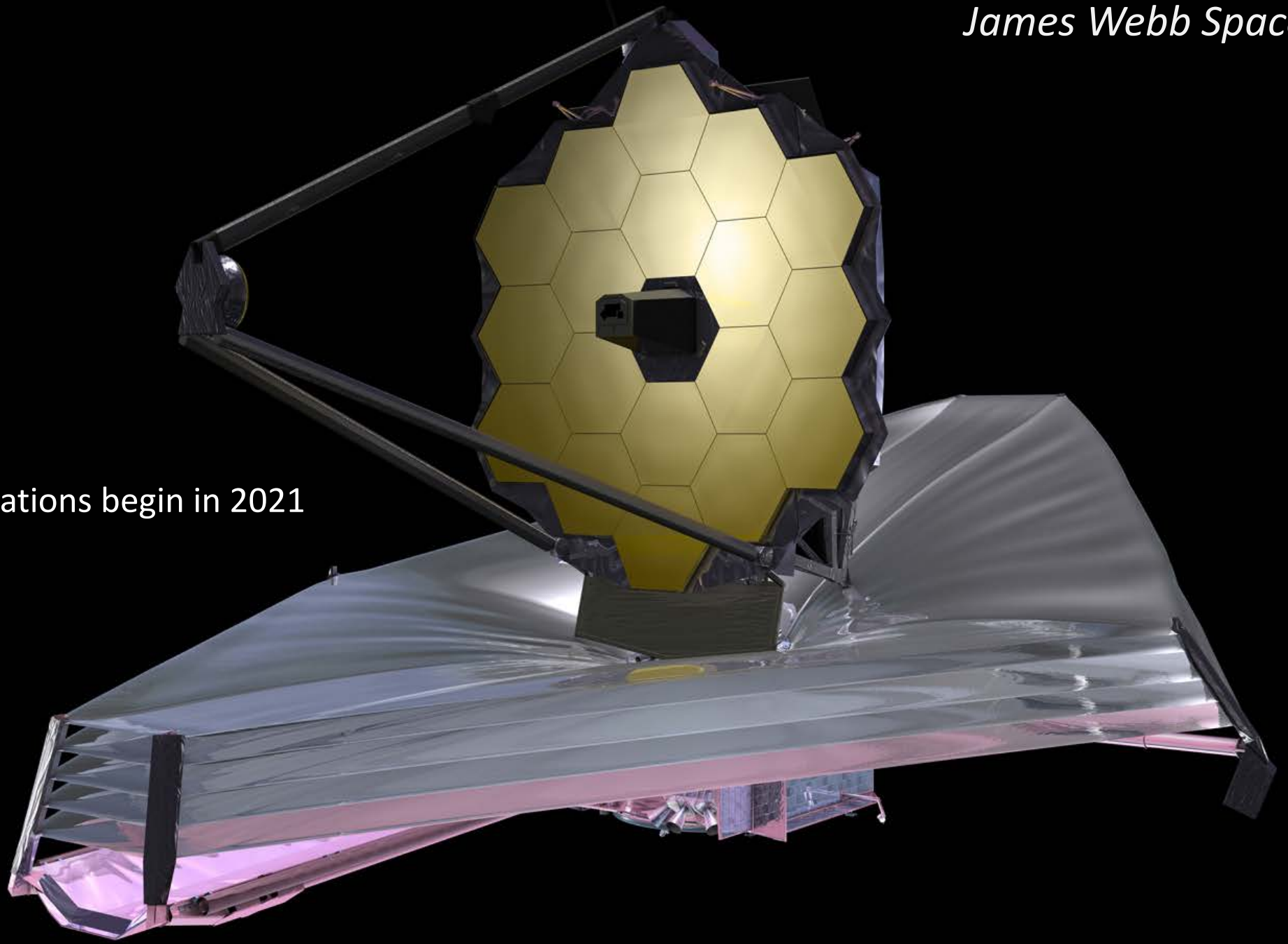
James Webb Space Telescope



science operations begin in 2021

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Hubble science

Hubble has excited us all by its journey of discovery –
revealing remarkable insights into our neighboring planets,
into young galaxies at the far reaches of the universe and
into the nature of the universe itself

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the first deep Hubble image

the "Hubble Deep Field" in 1995

Bob Williams
and the HDF Team

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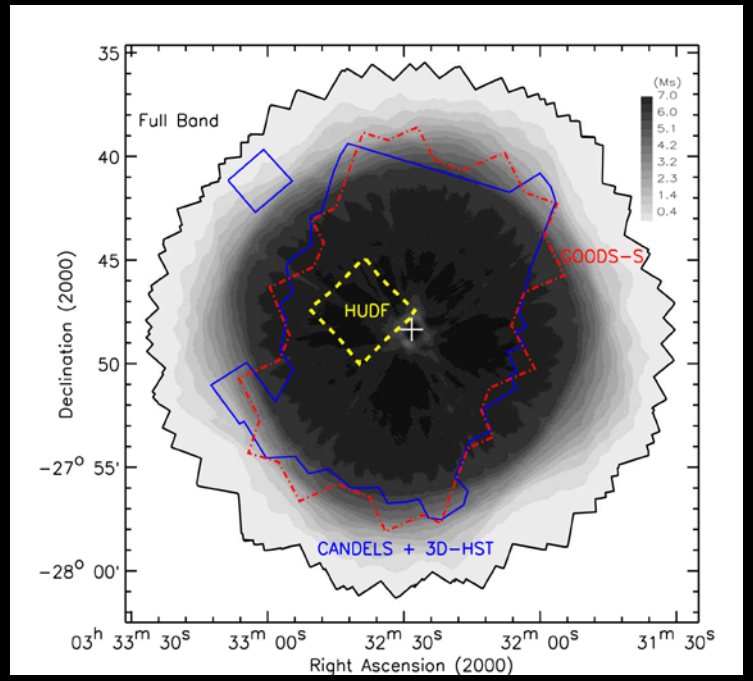
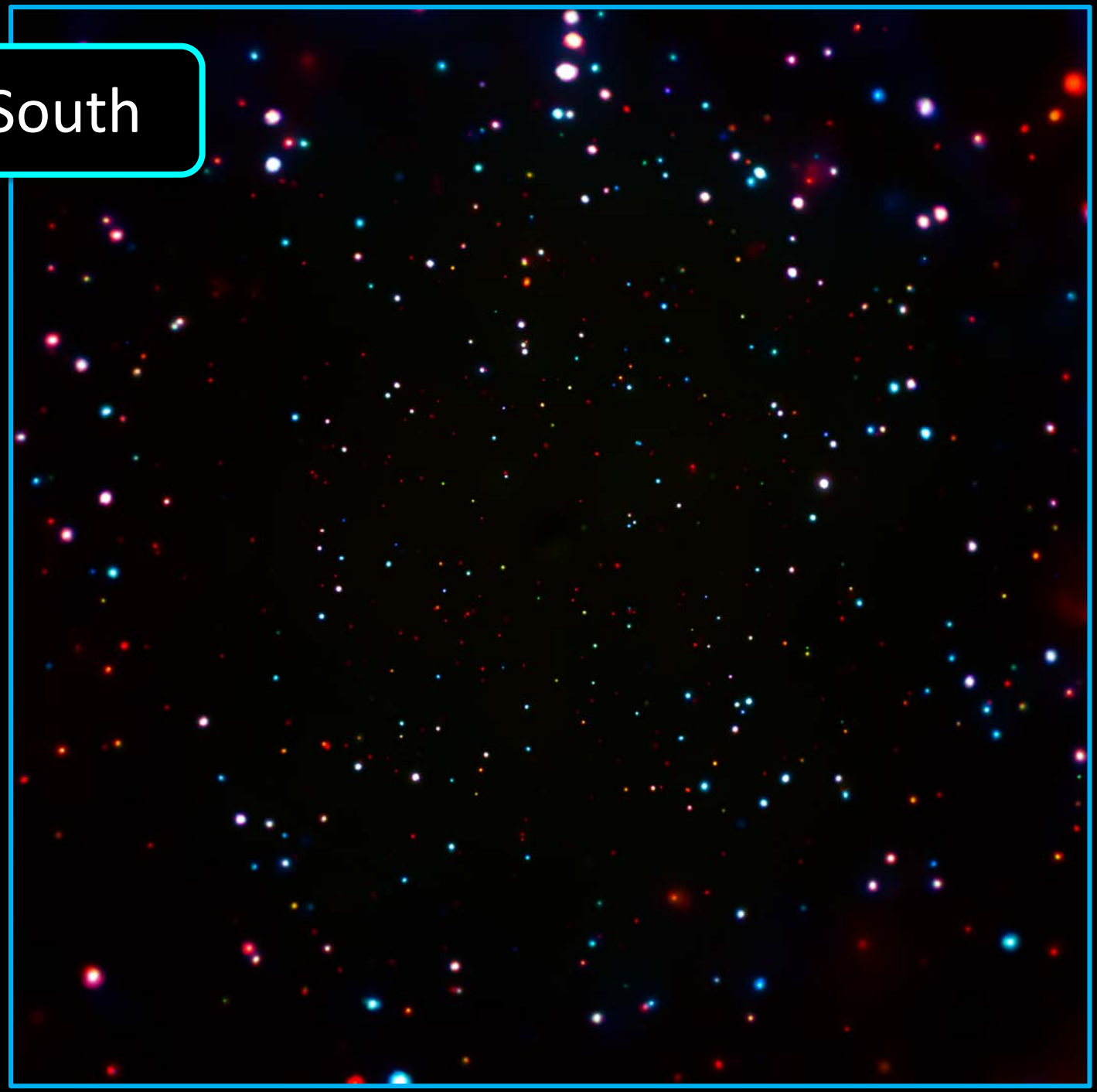
Chandra Deep Field – South

Riccardo was PI of the program that took the first Chandra images on this field





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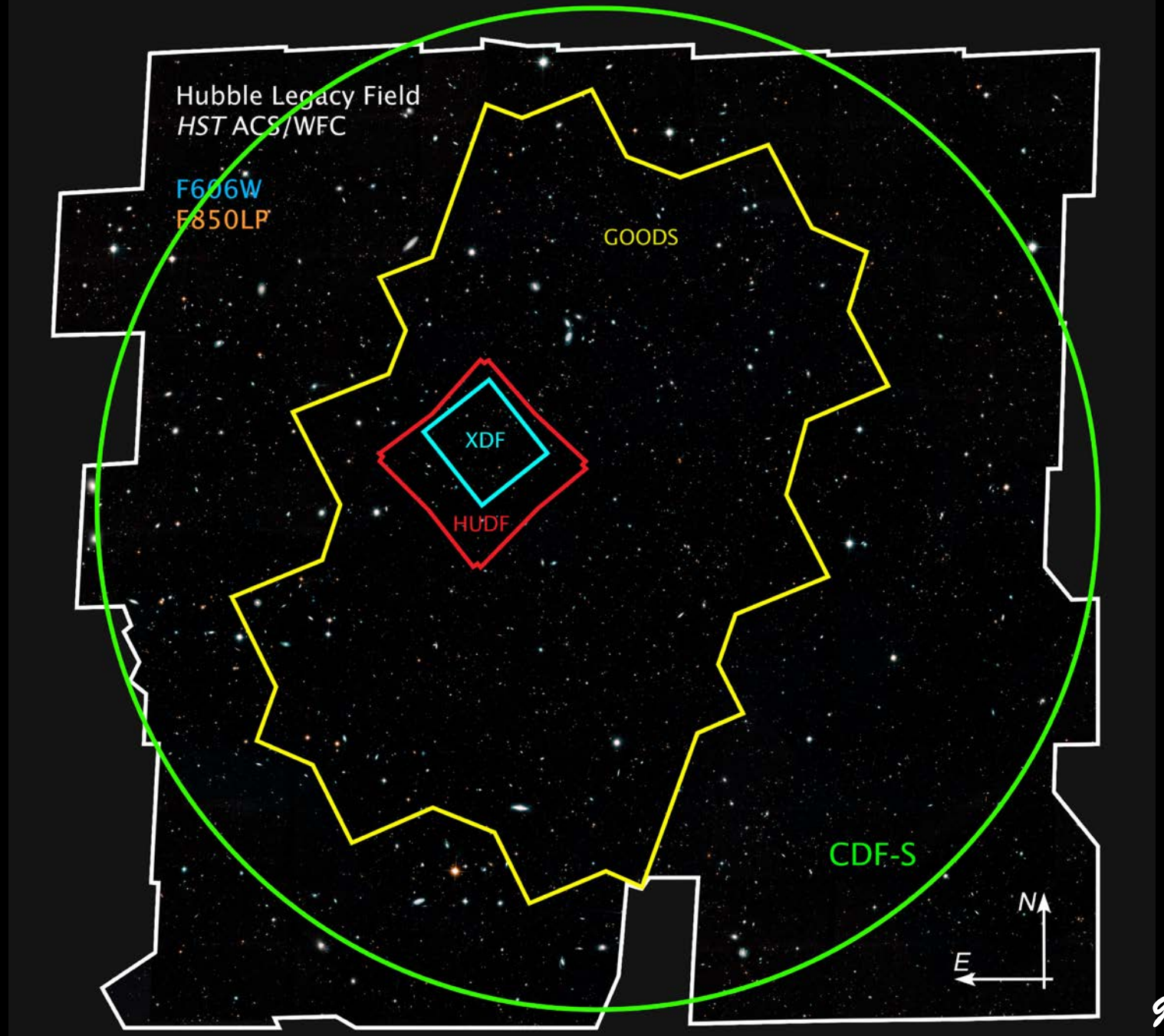
Hubble Legacy Field 2019

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



NASA, ESA, GDI, Magee + HLF Team 2019

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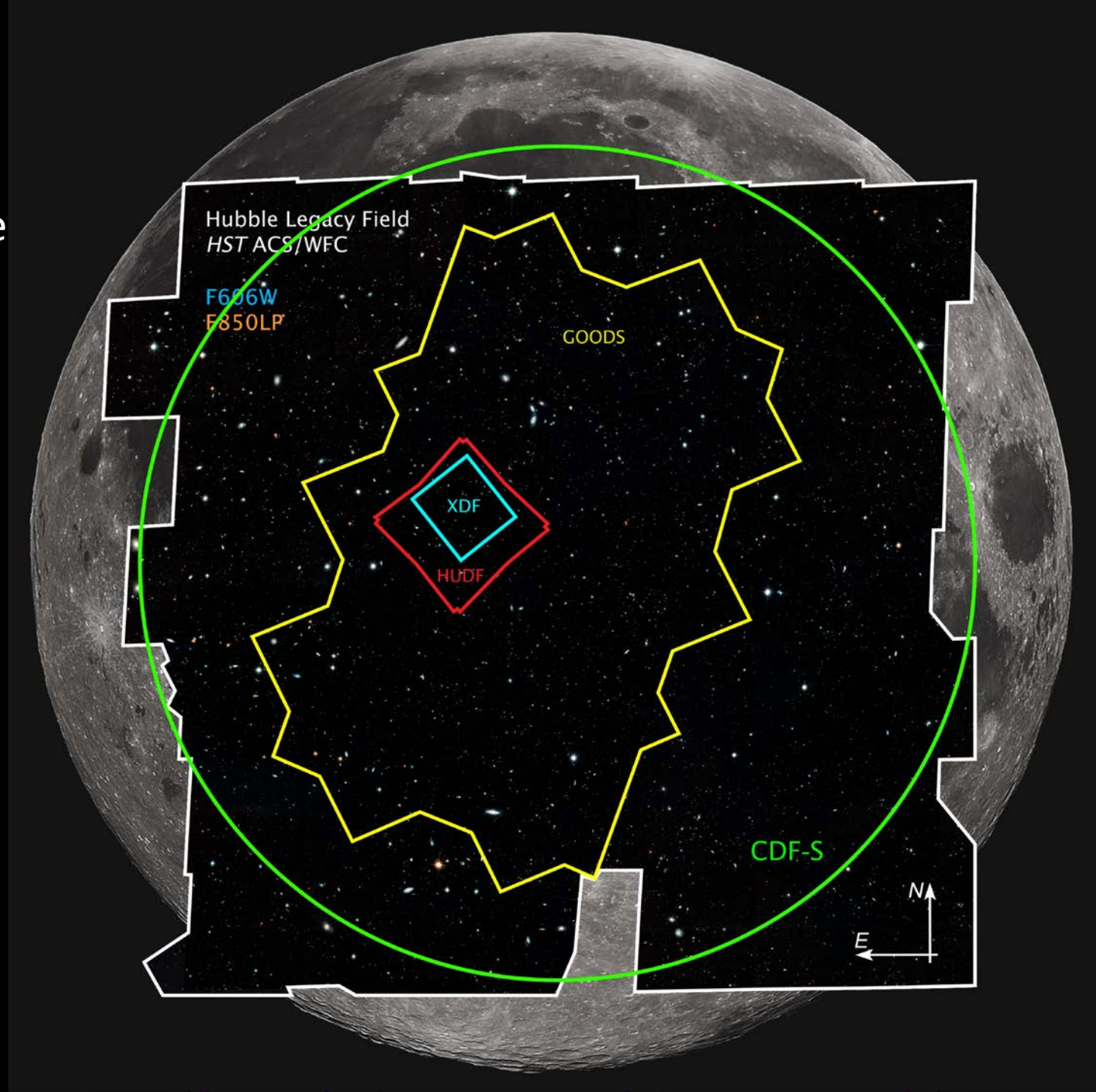
size comparison:

the Hubble Legacy Field with the Chandra Deep Field-South and a nearby astronomical object



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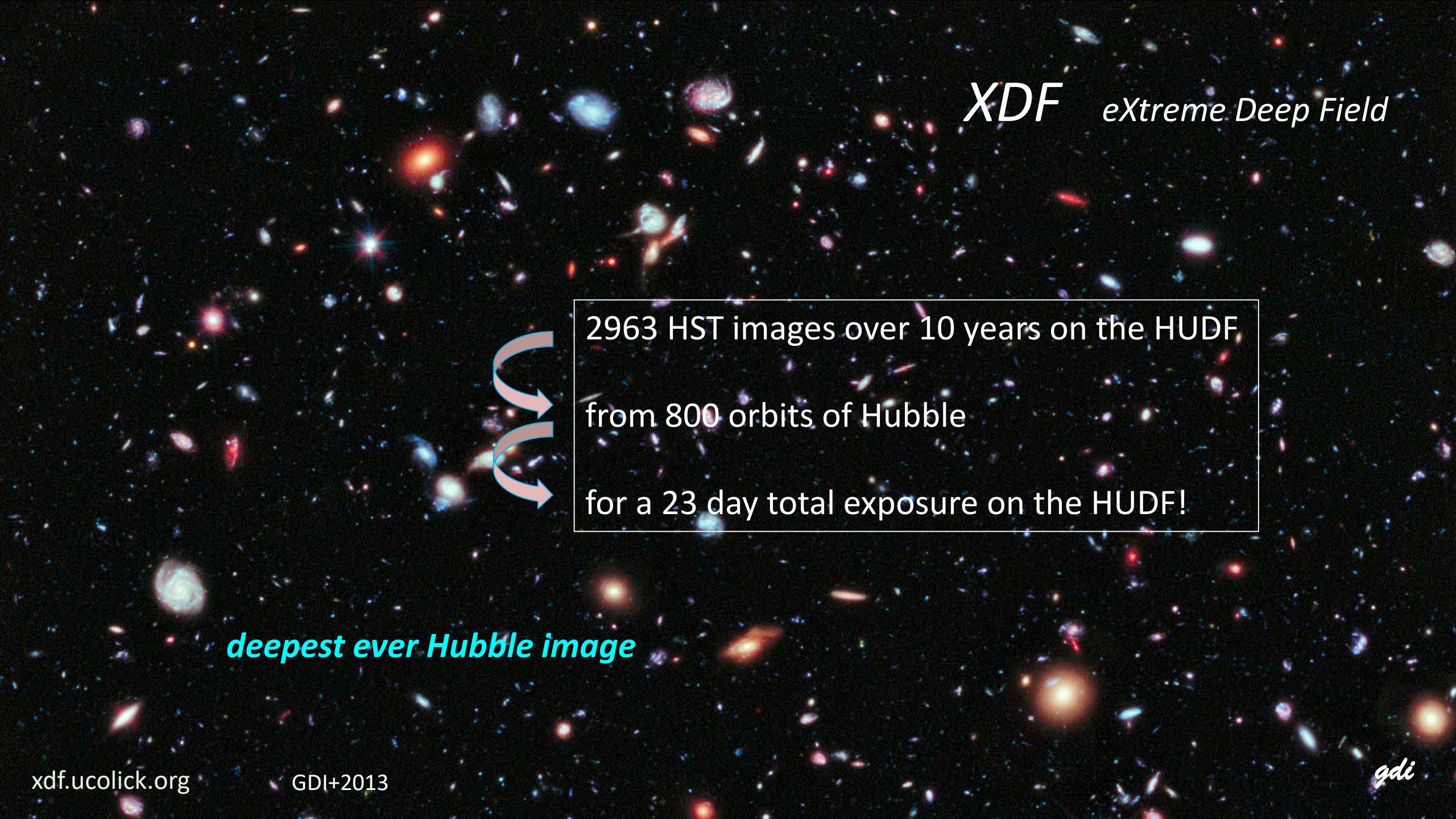
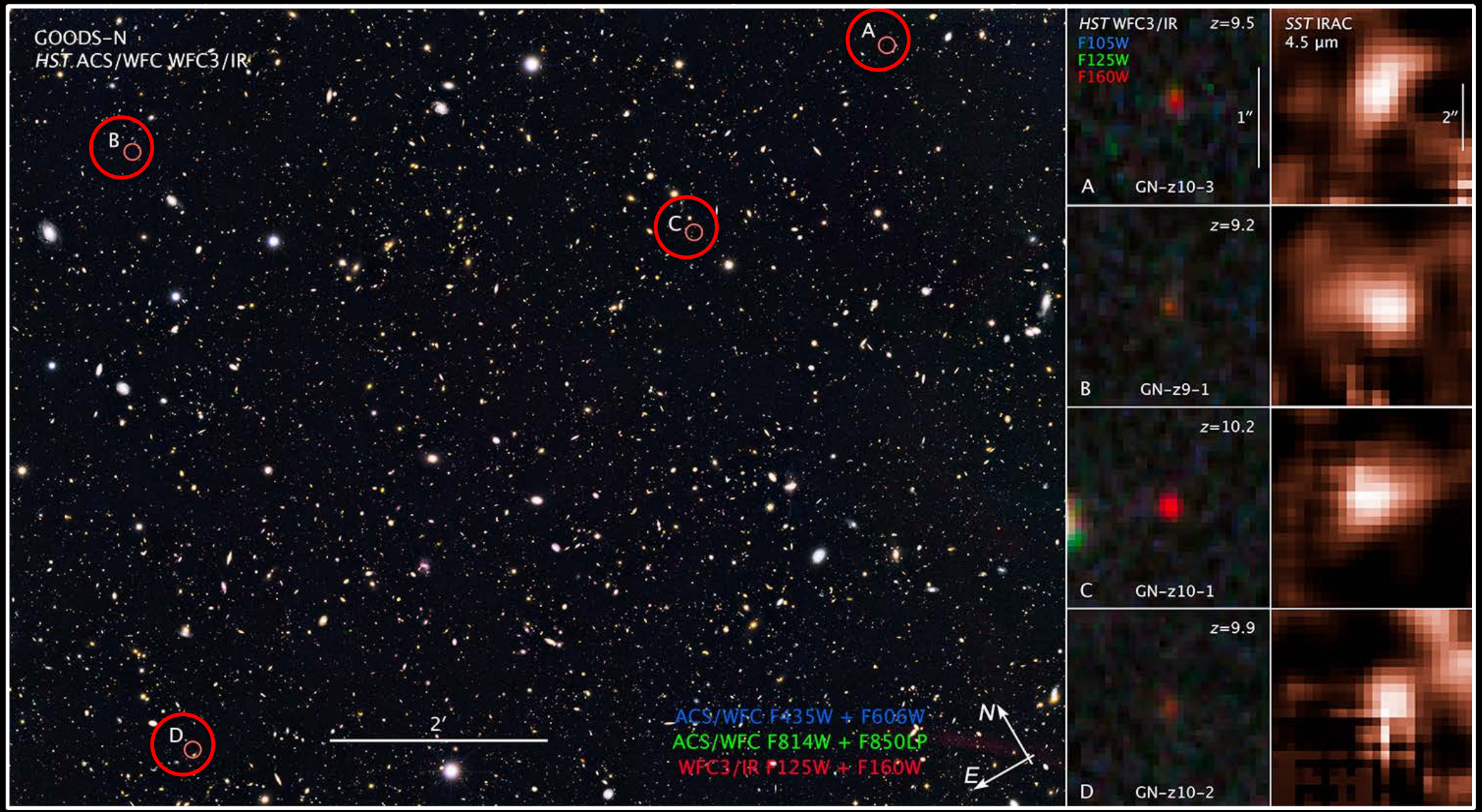
XDF eXtreme Deep Field
deepest ever Hubble image
2012
gdi


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!
deepest ever Hubble image
xdf.ucolick.org
GDI+2013
gdi



Oesch + 2014, 2016

Hubble

Spitzer

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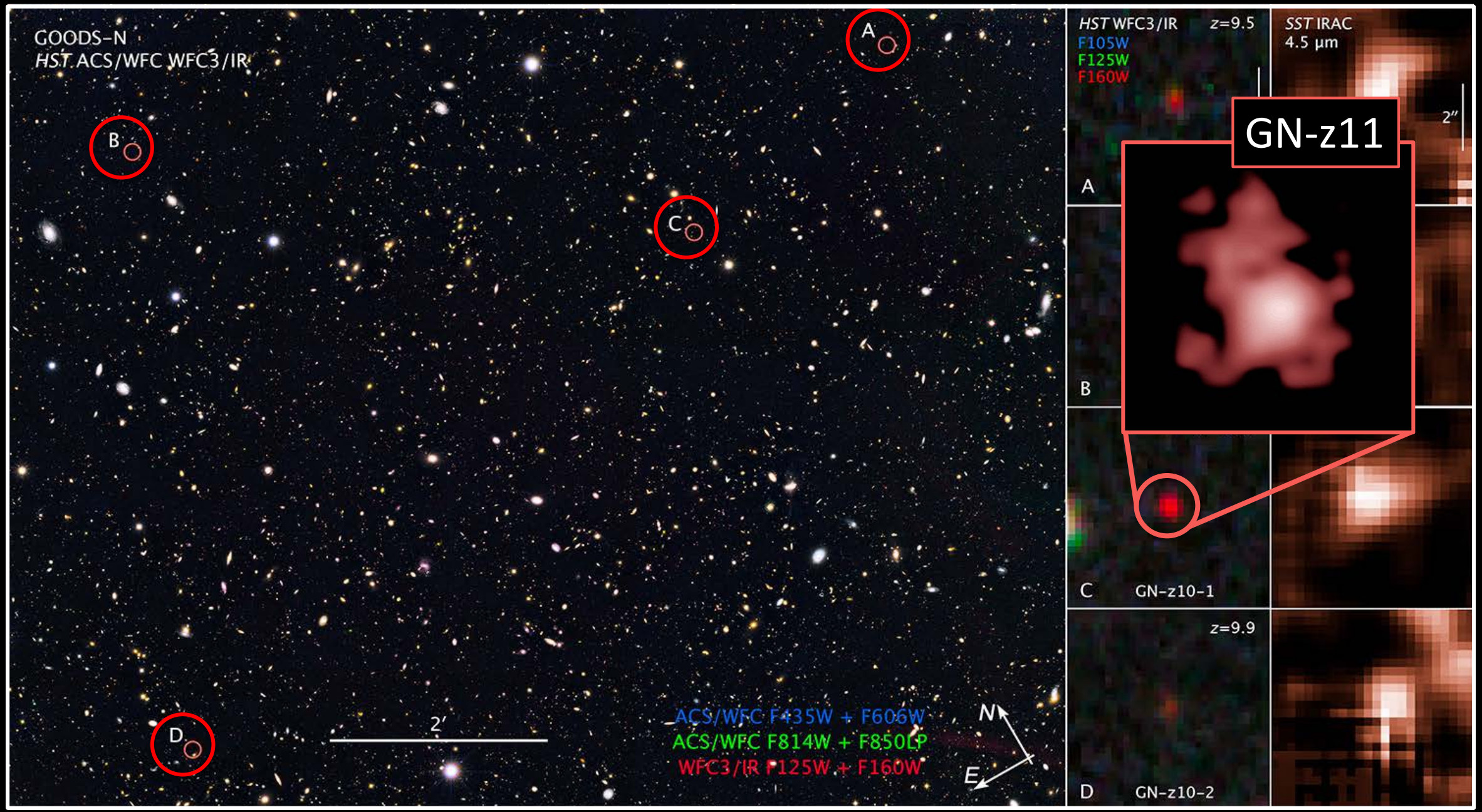

Oesch + 2014, 2016

Hubble Spitzer

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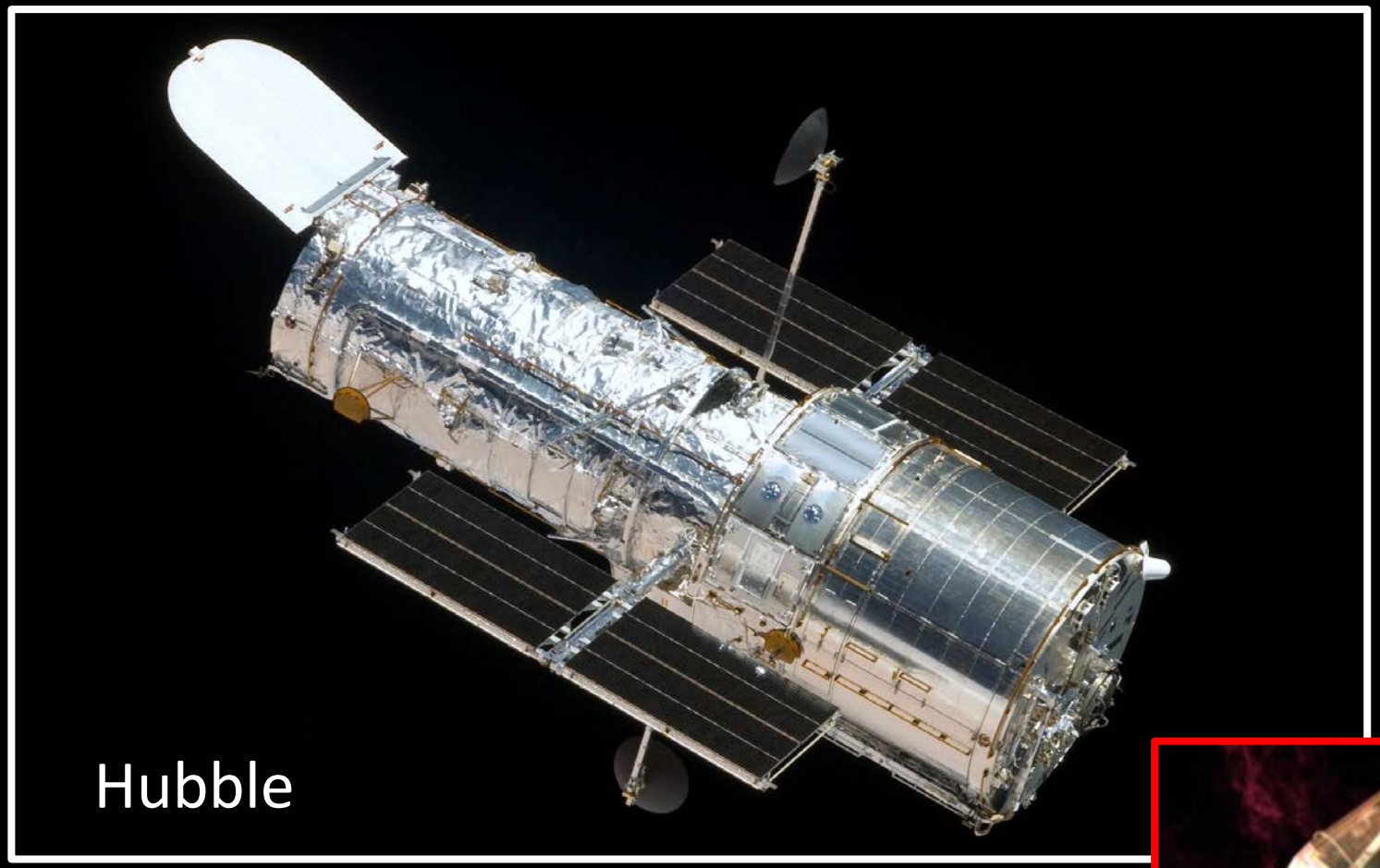
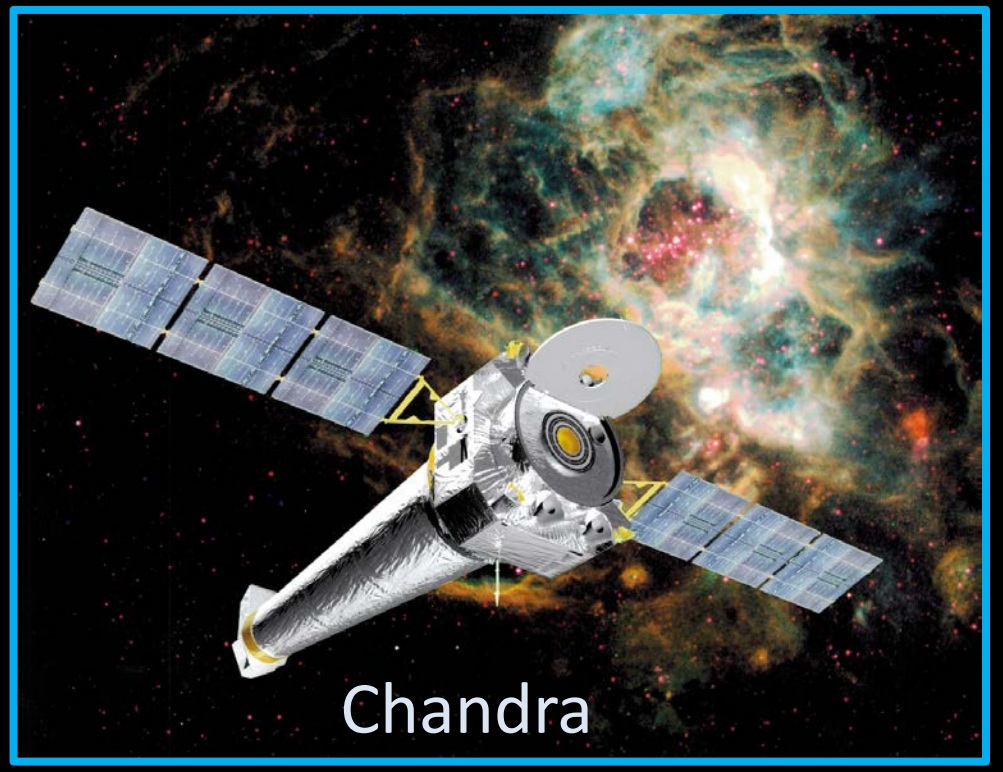
JWST and its “first light” goal





NASA's Great Observatories

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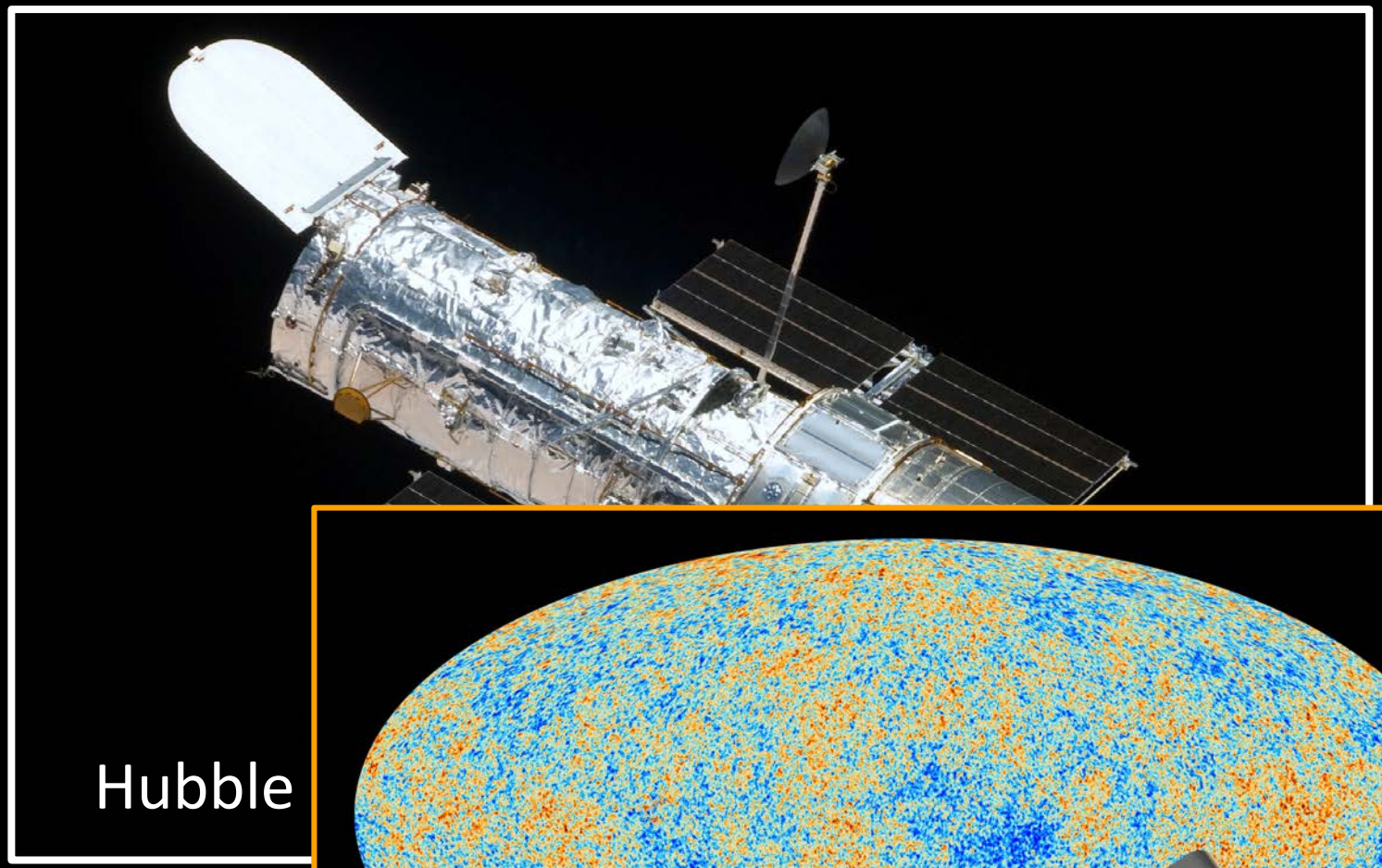
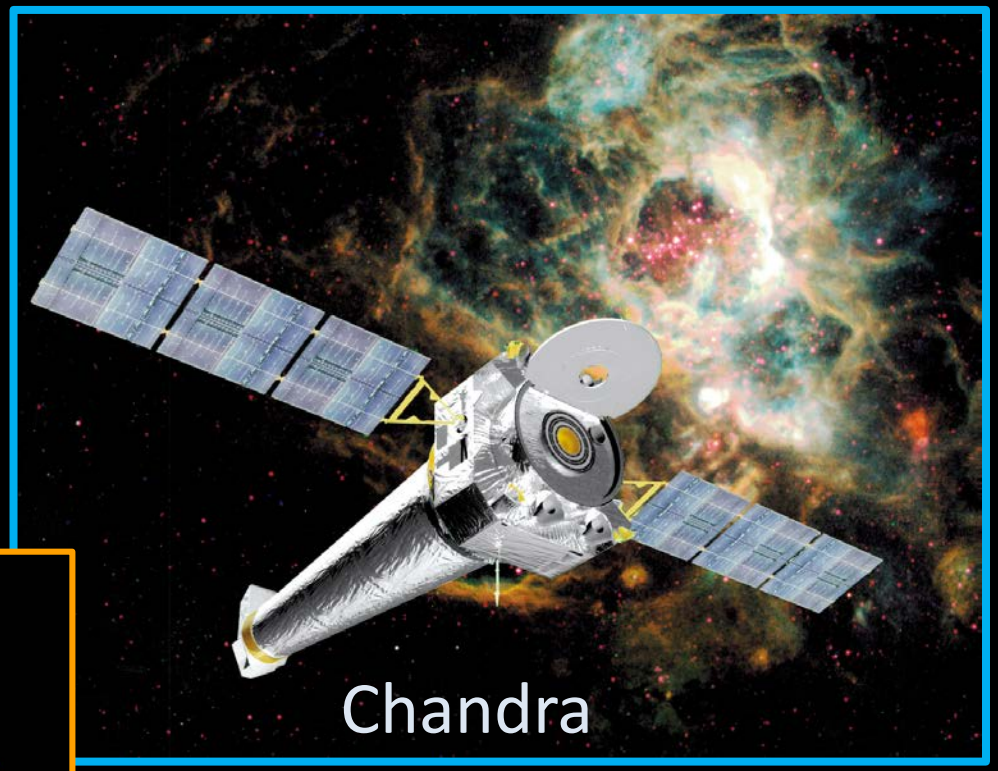
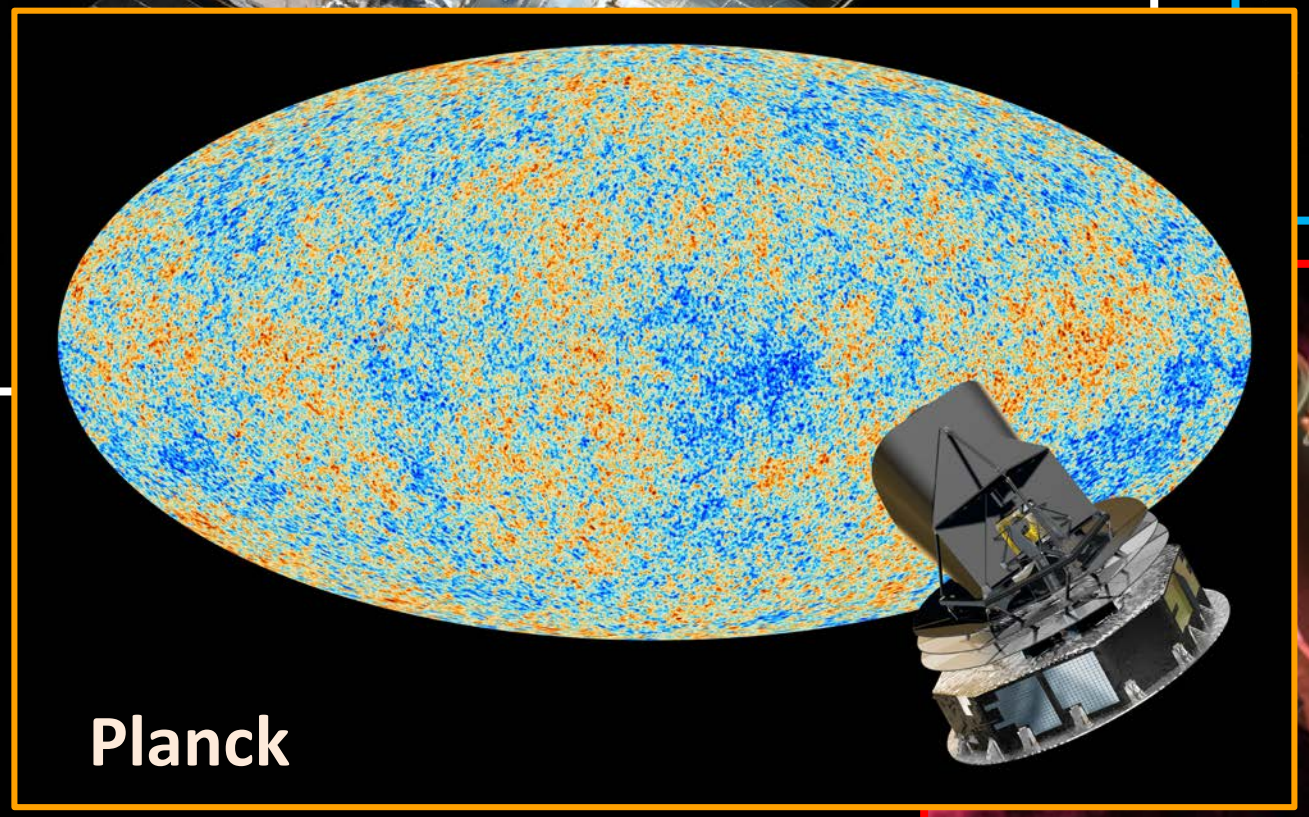


Hubble



Chandra



Planck

Spitzer

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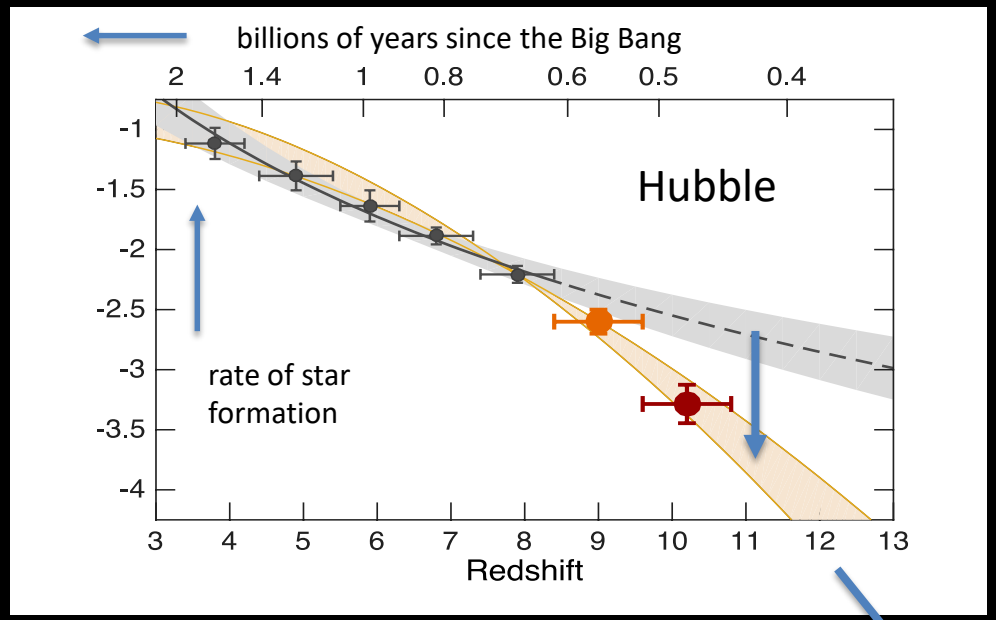
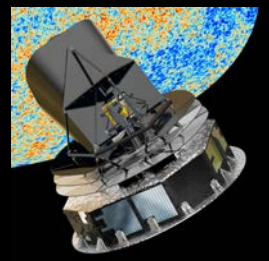
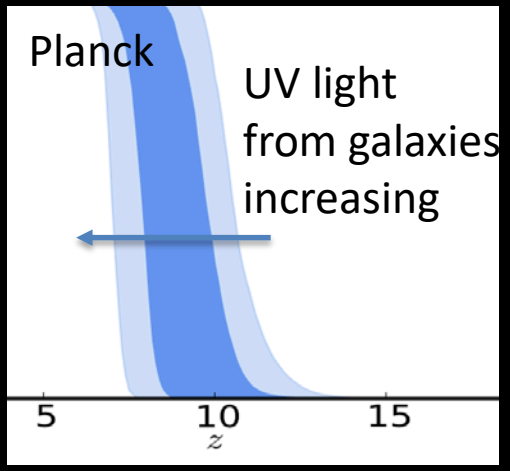


will JWST see the "first galaxies"?





large 10X drop + galaxy turn-on

☛ suggest dramatic changes in galaxies at 300-500 million years – a time where JWST will be able to see faint galaxies ☚

JWST will show us how the earliest galaxies formed and grew

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2021 - the beginning of a new era...

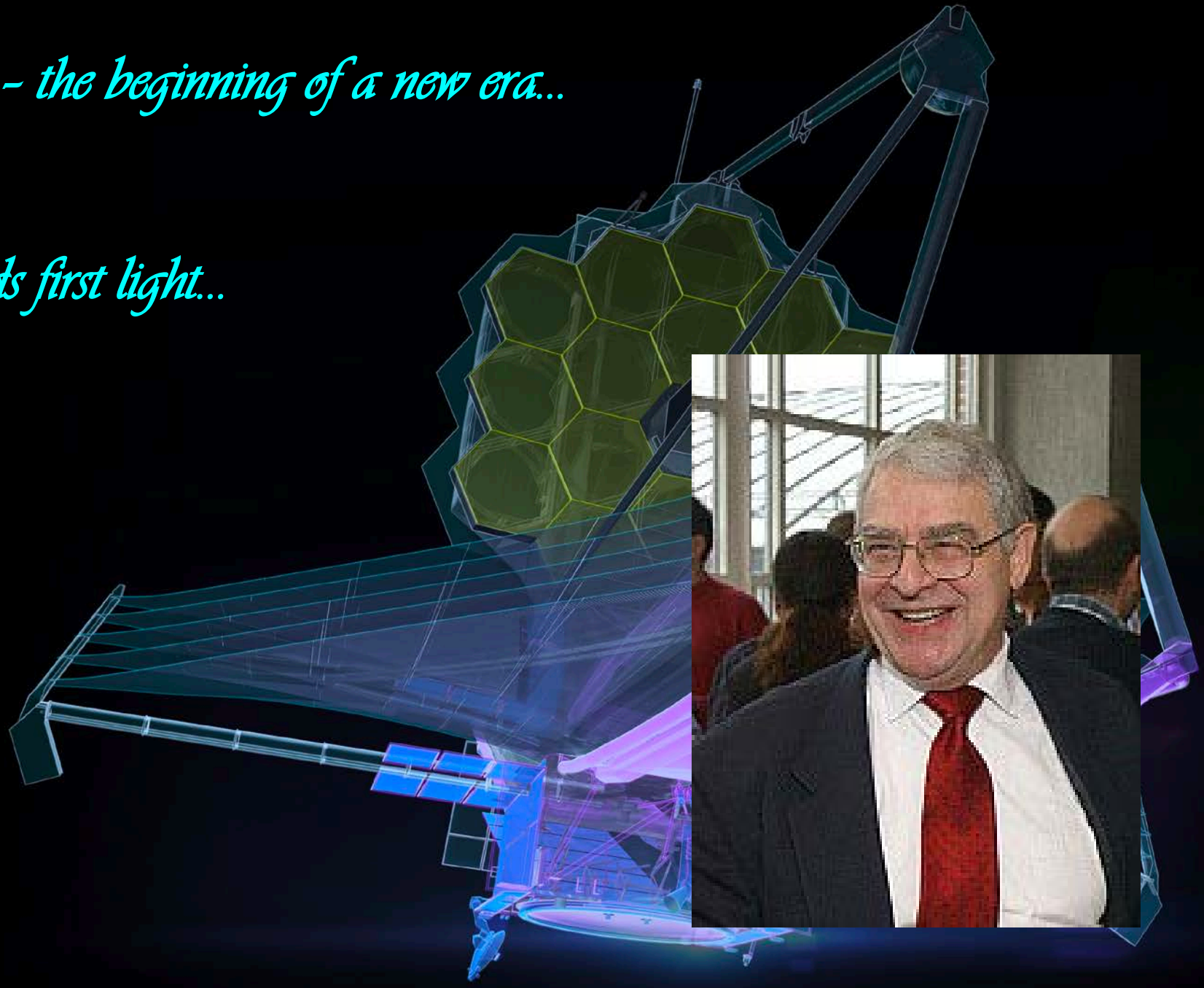
towards first light...

our
"cosmic sunrise"
telescope

gdi

2021 - the beginning of a new era...

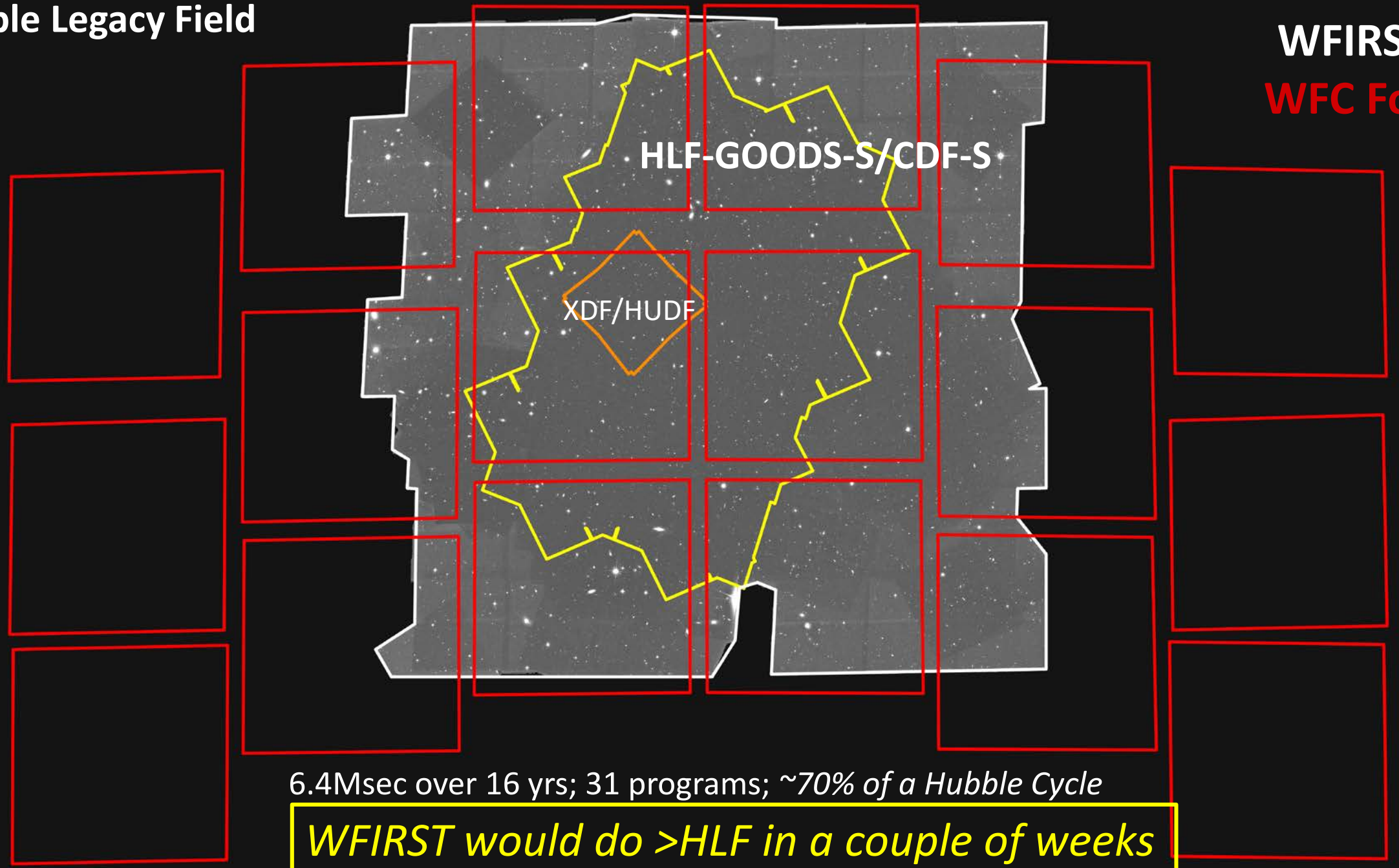
towards first light...



our
"cosmic sunrise"
telescope

gdi

Hubble Legacy Field



6.4Msec over 16 yrs; 31 programs; *~70% of a Hubble Cycle*

WFIRST would do >HLF in a couple of weeks

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