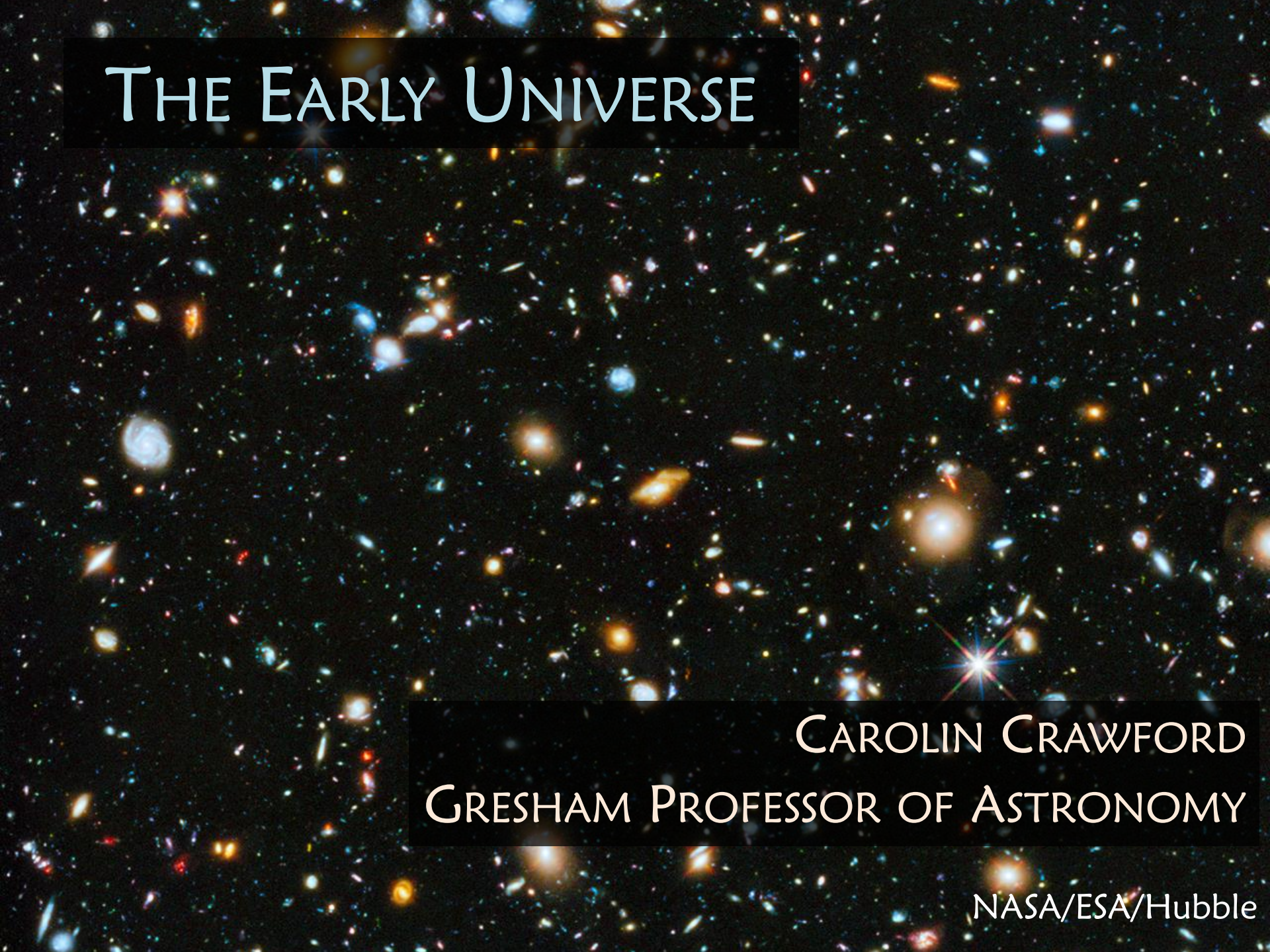
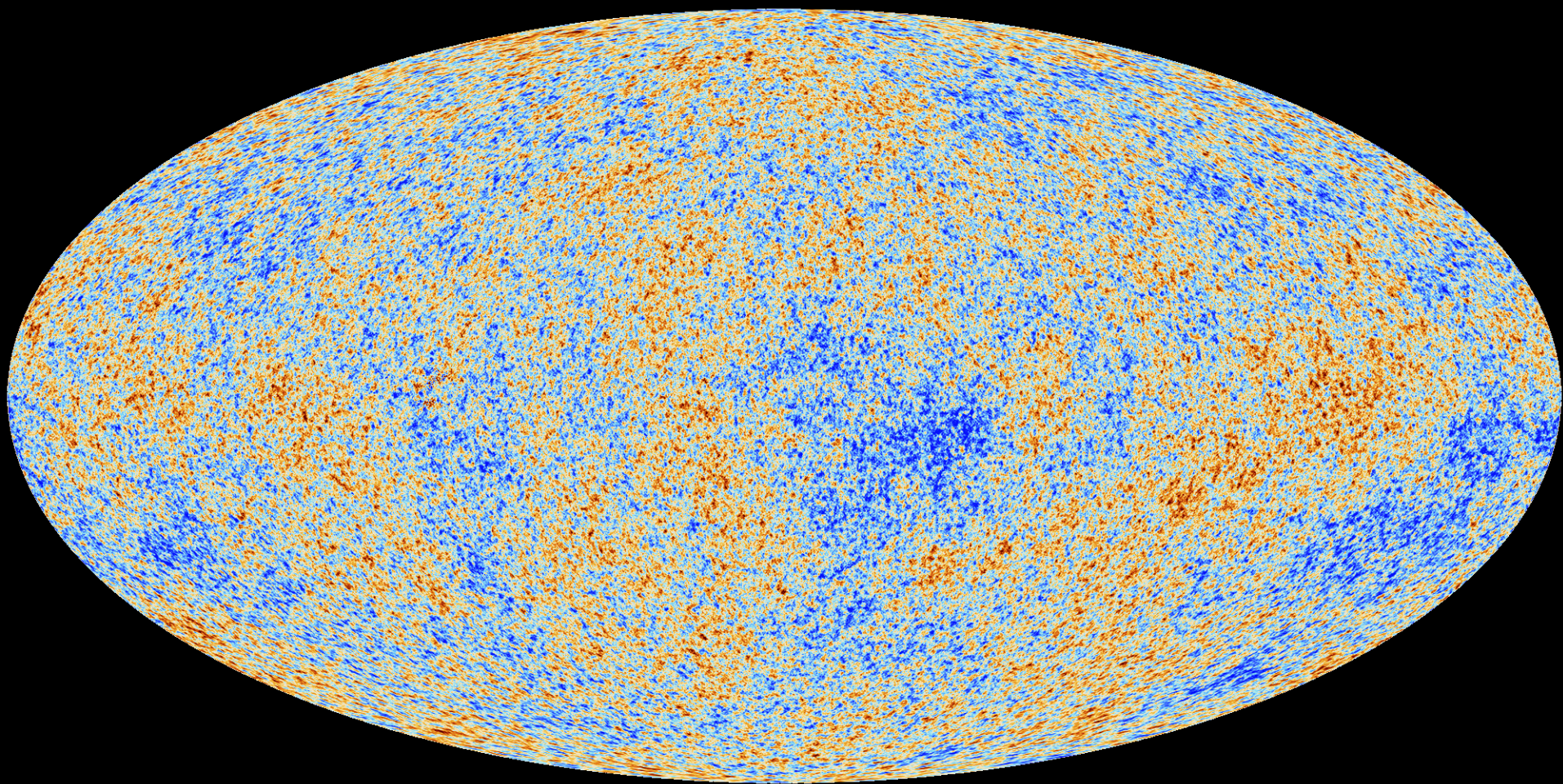


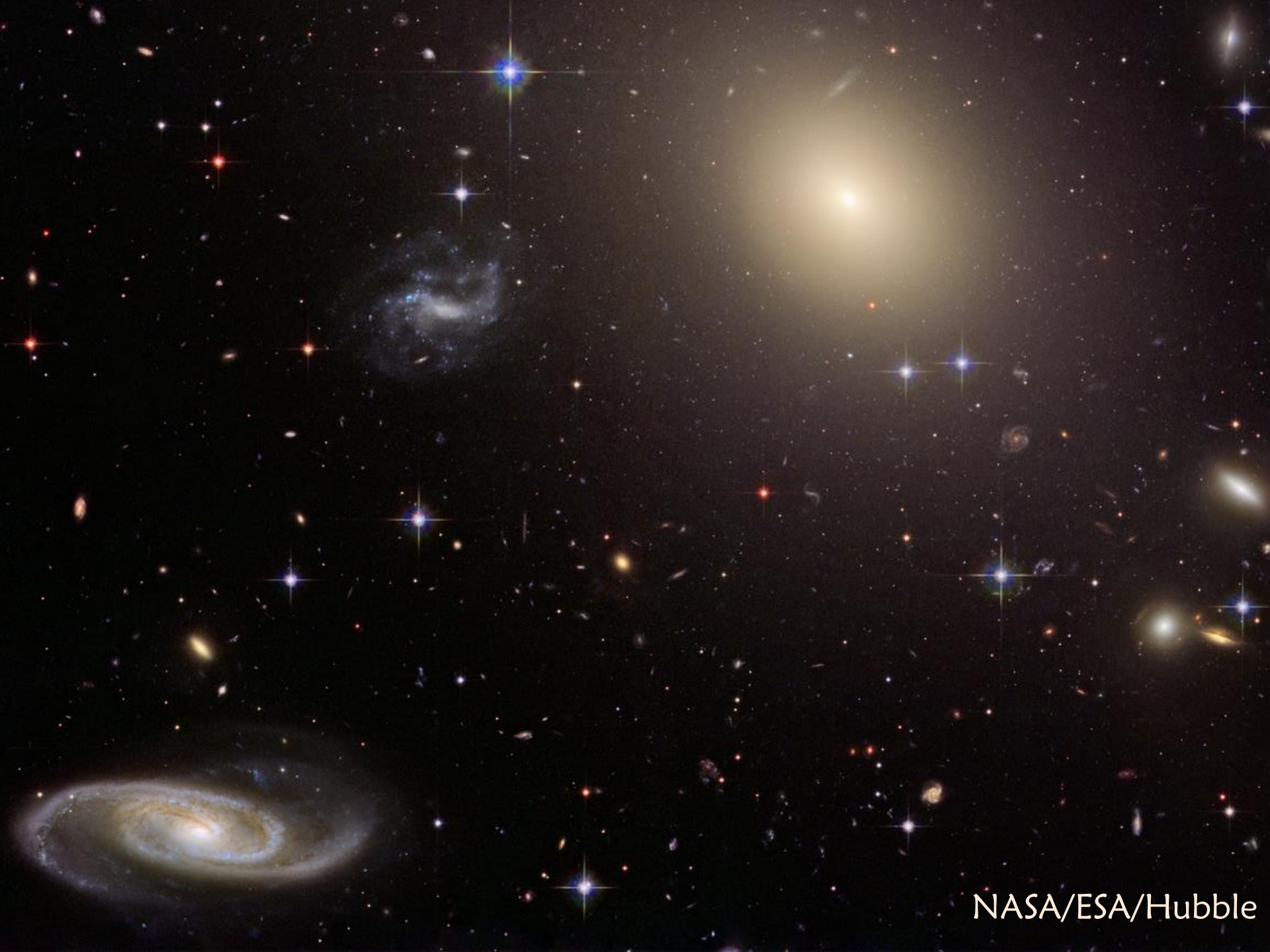
THE EARLY UNIVERSE



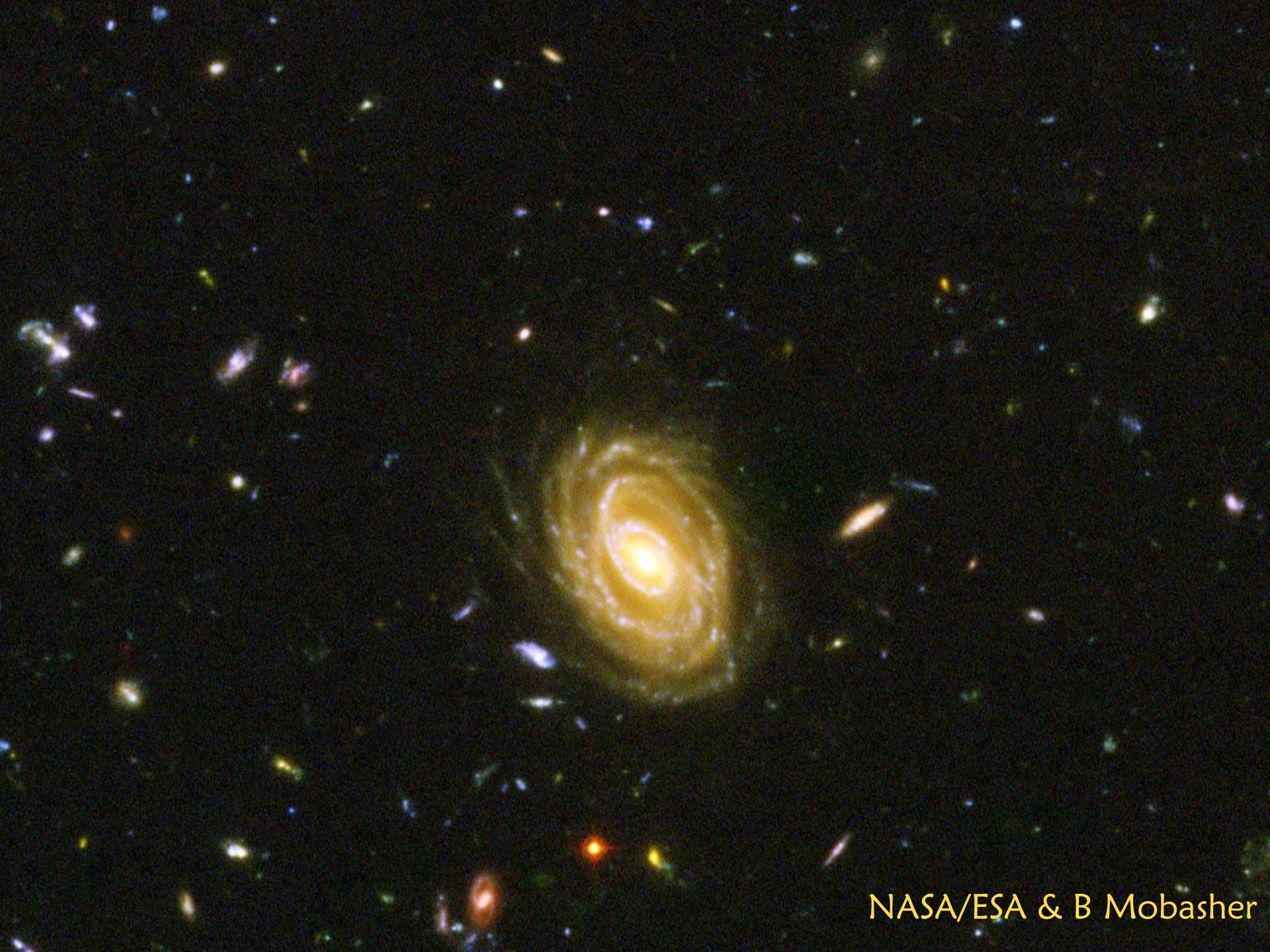
CAROLIN CRAWFORD
GRESHAM PROFESSOR OF ASTRONOMY

NASA/ESA/Hubble





NASA/ESA/Hubble

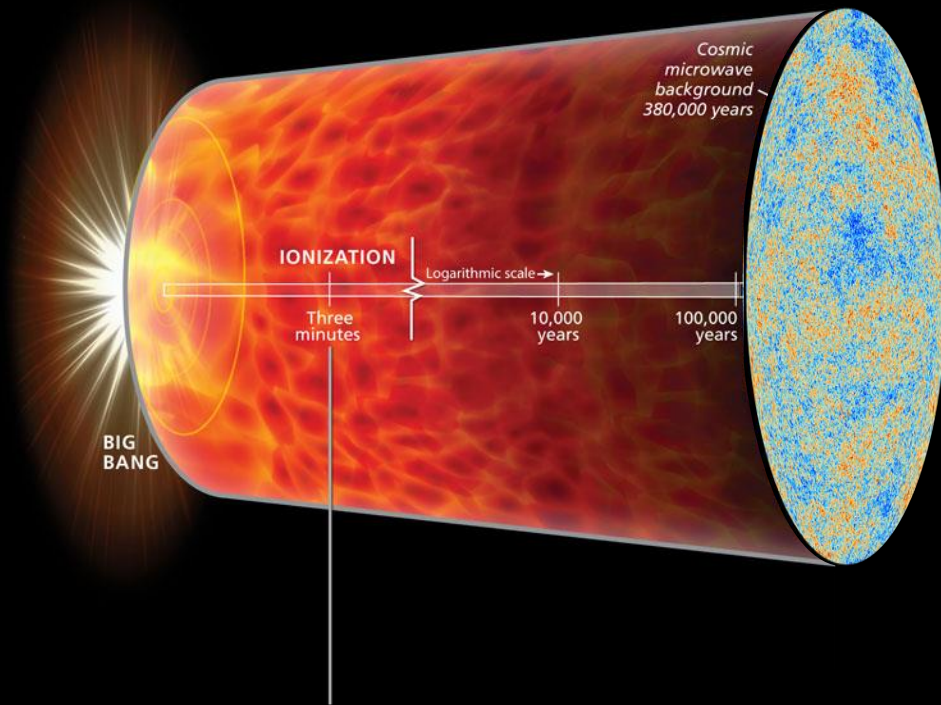


NASA/ESA & B Mobasher

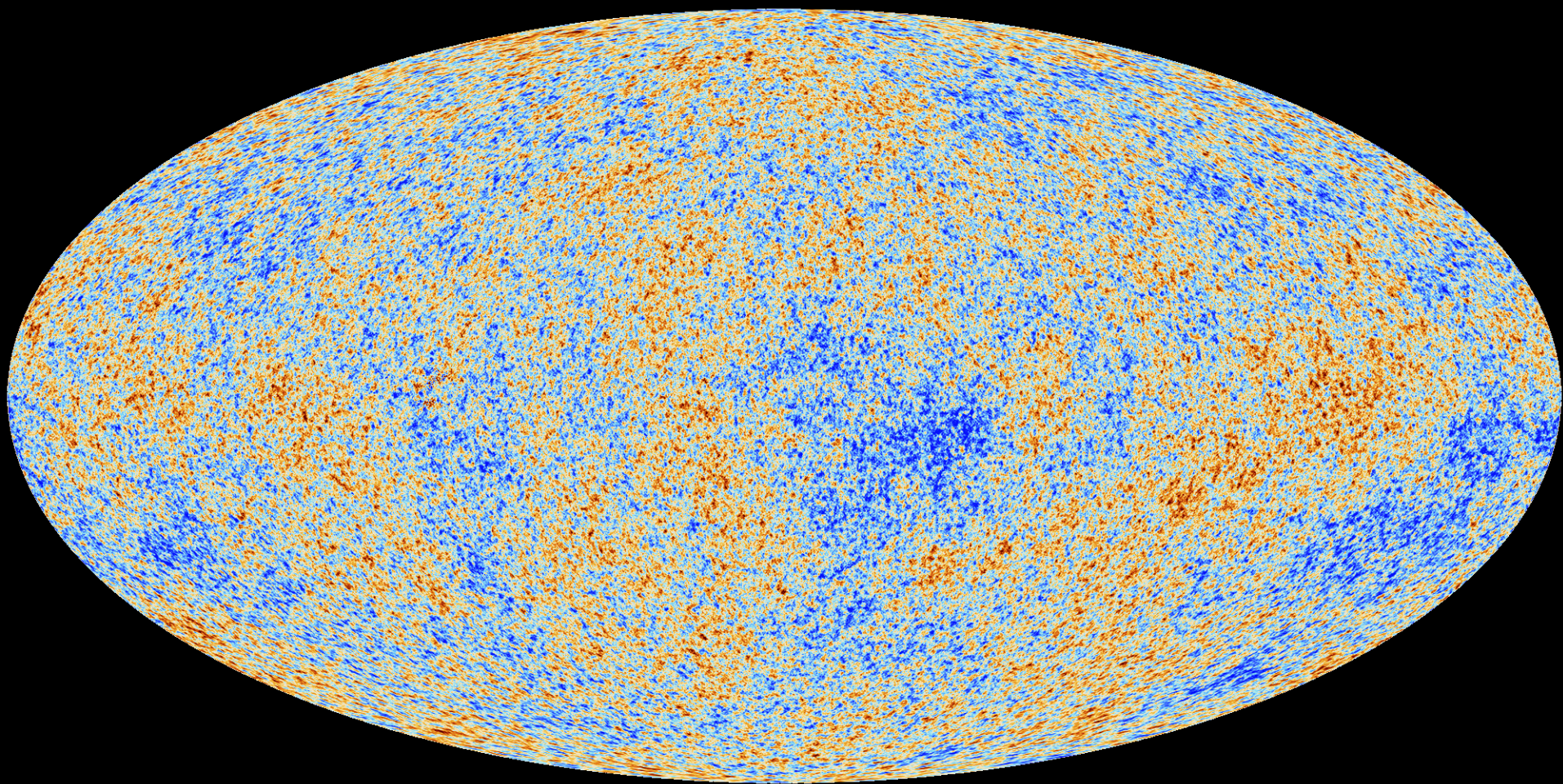


NASA/ESA/Hubble

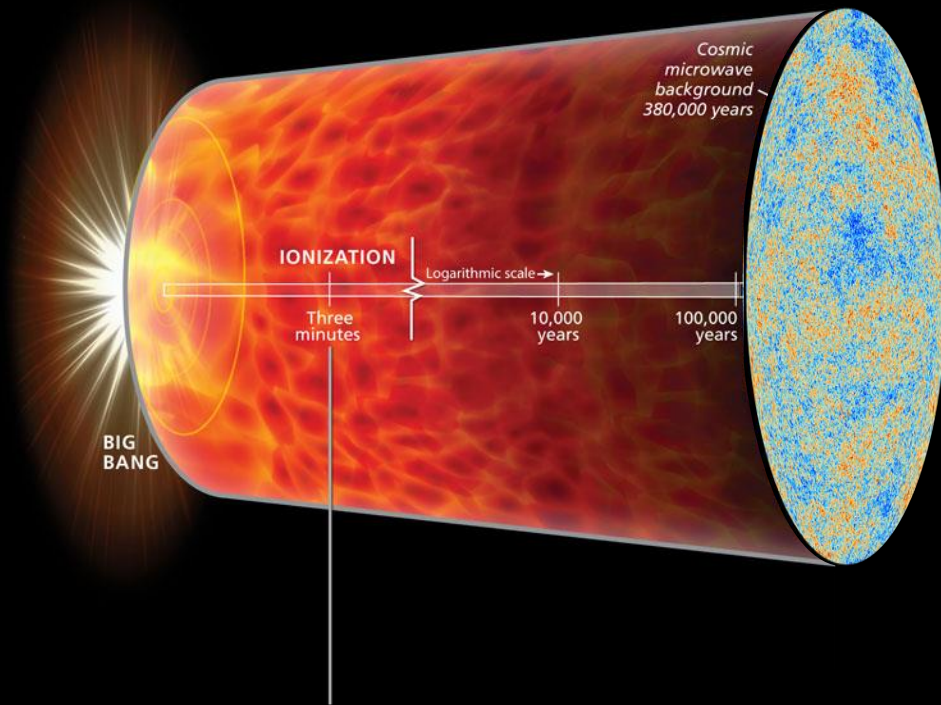
RECOMBINATION



protons and
electrons...



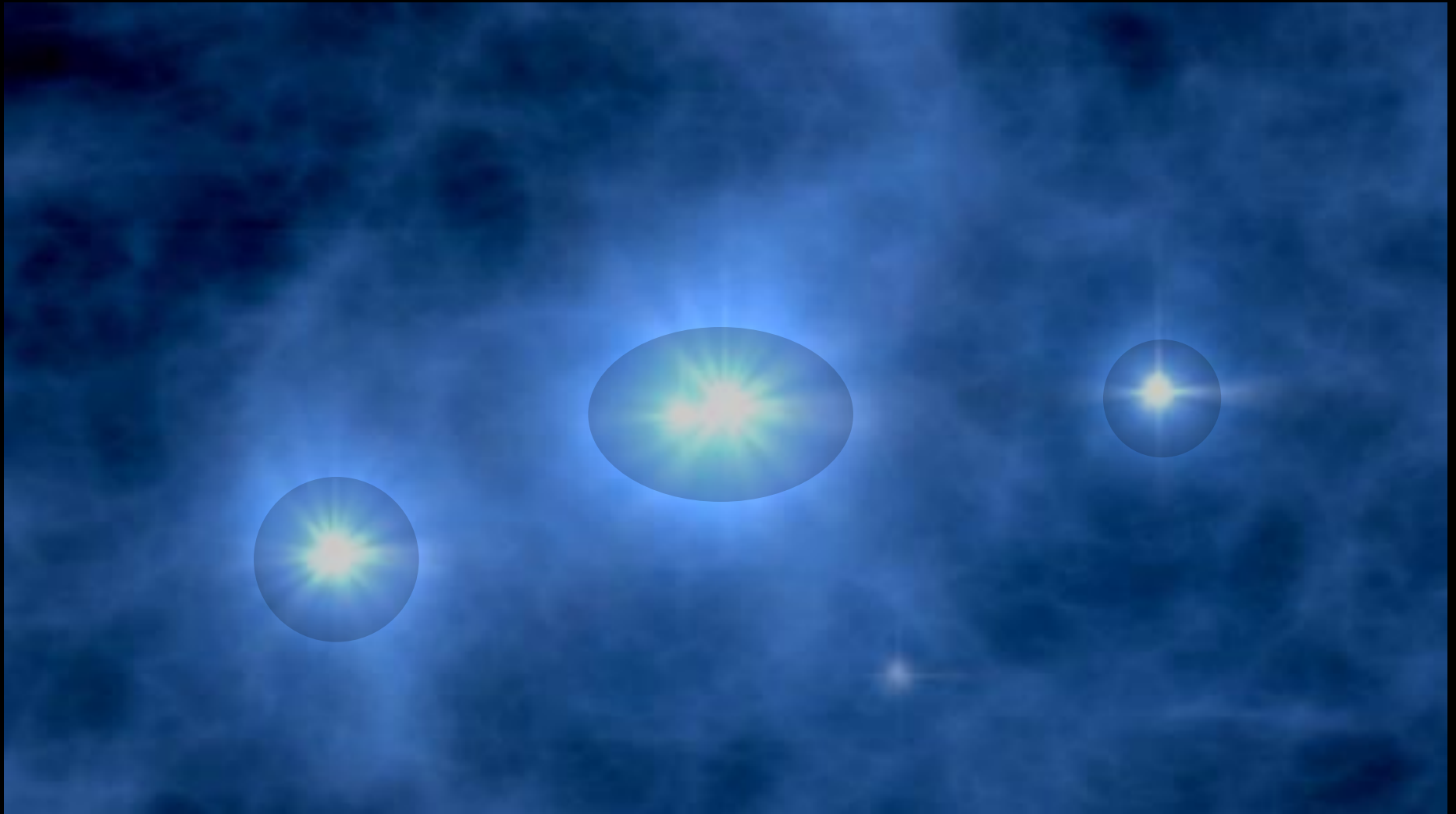
RECOMBINATION



protons and
electrons...

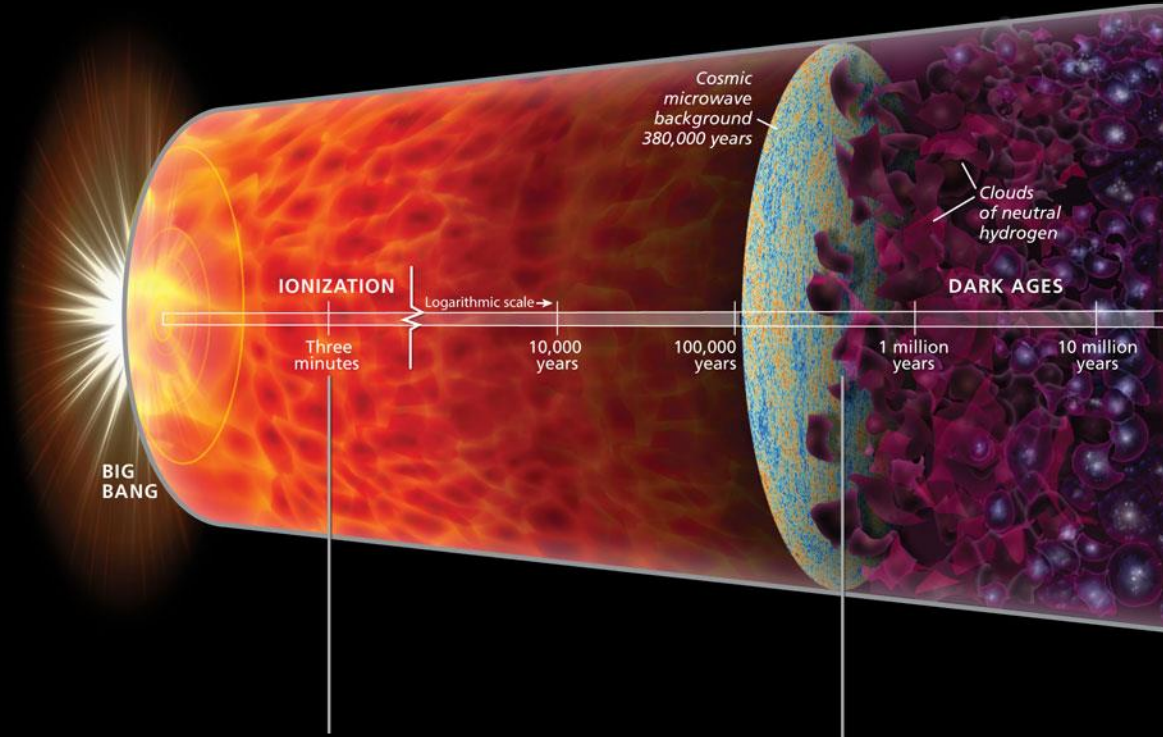
...combine
to form
neutral
atoms







DARK AGES REIONISATION



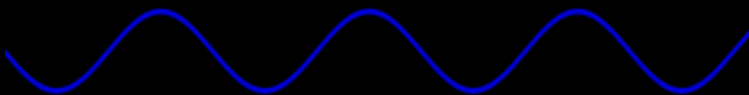
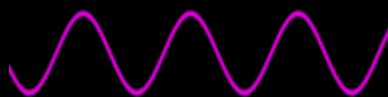
protons and
electrons...

...combine
to form
neutral
atoms

....which
are then
ionised
again

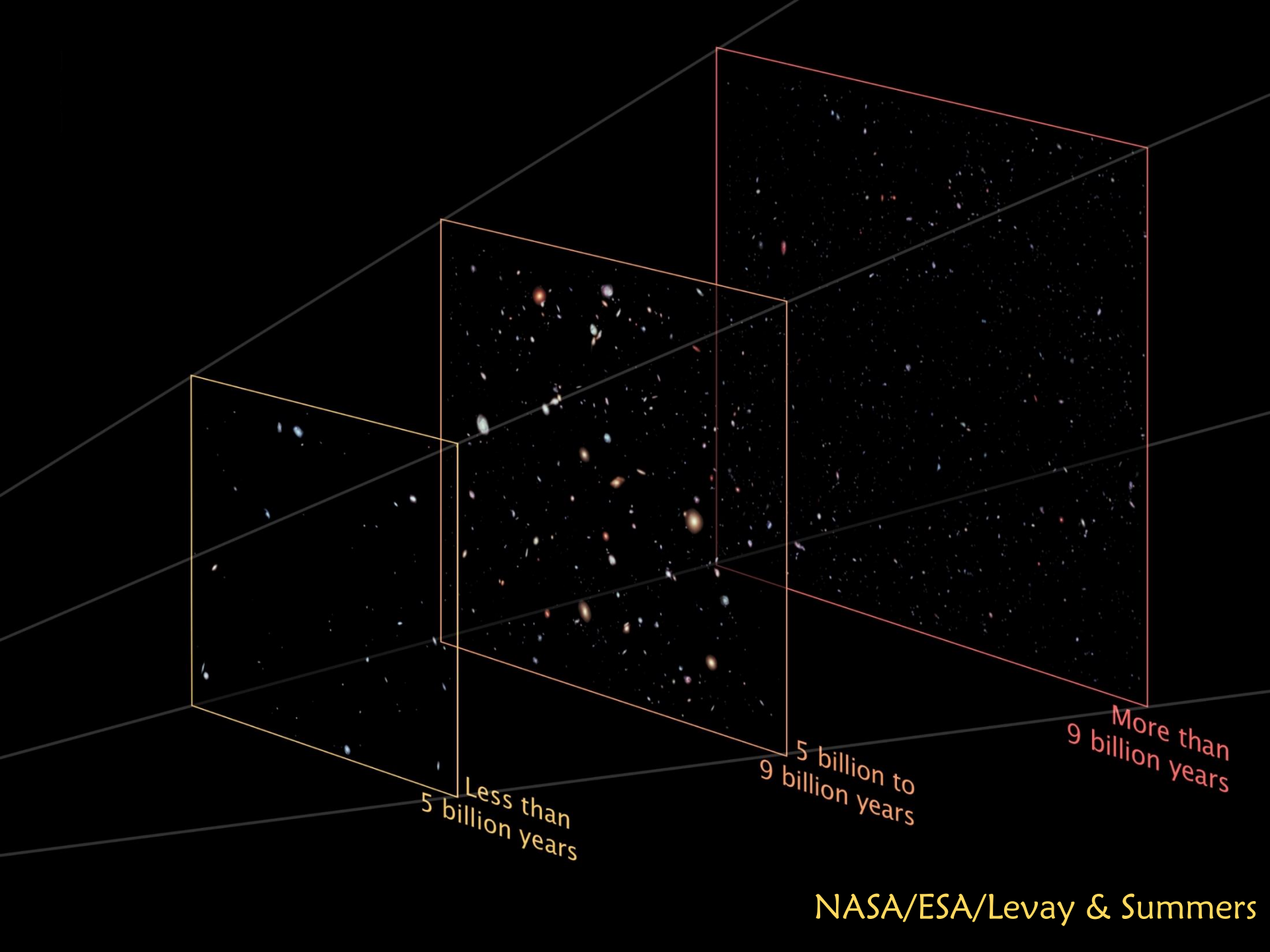


NASA/ESA/Reiss & Rodney





NASA/ESA/Reiss & Rodney

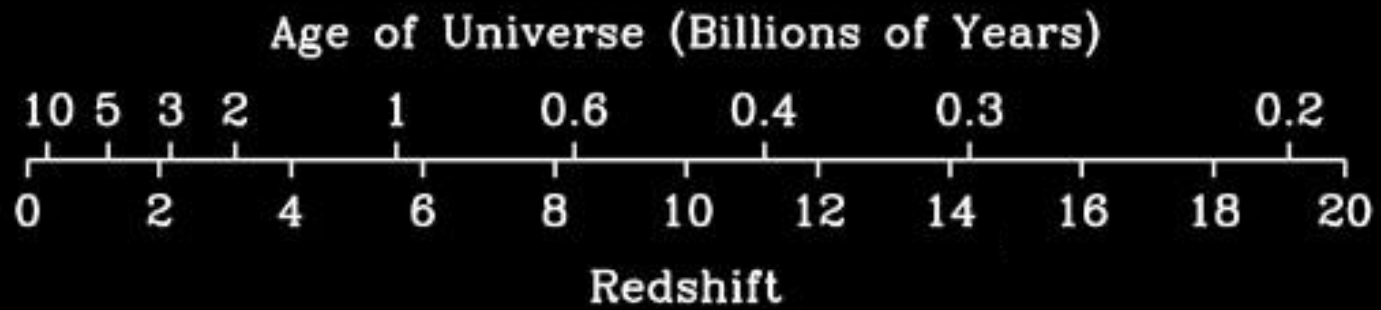


Less than
5 billion years

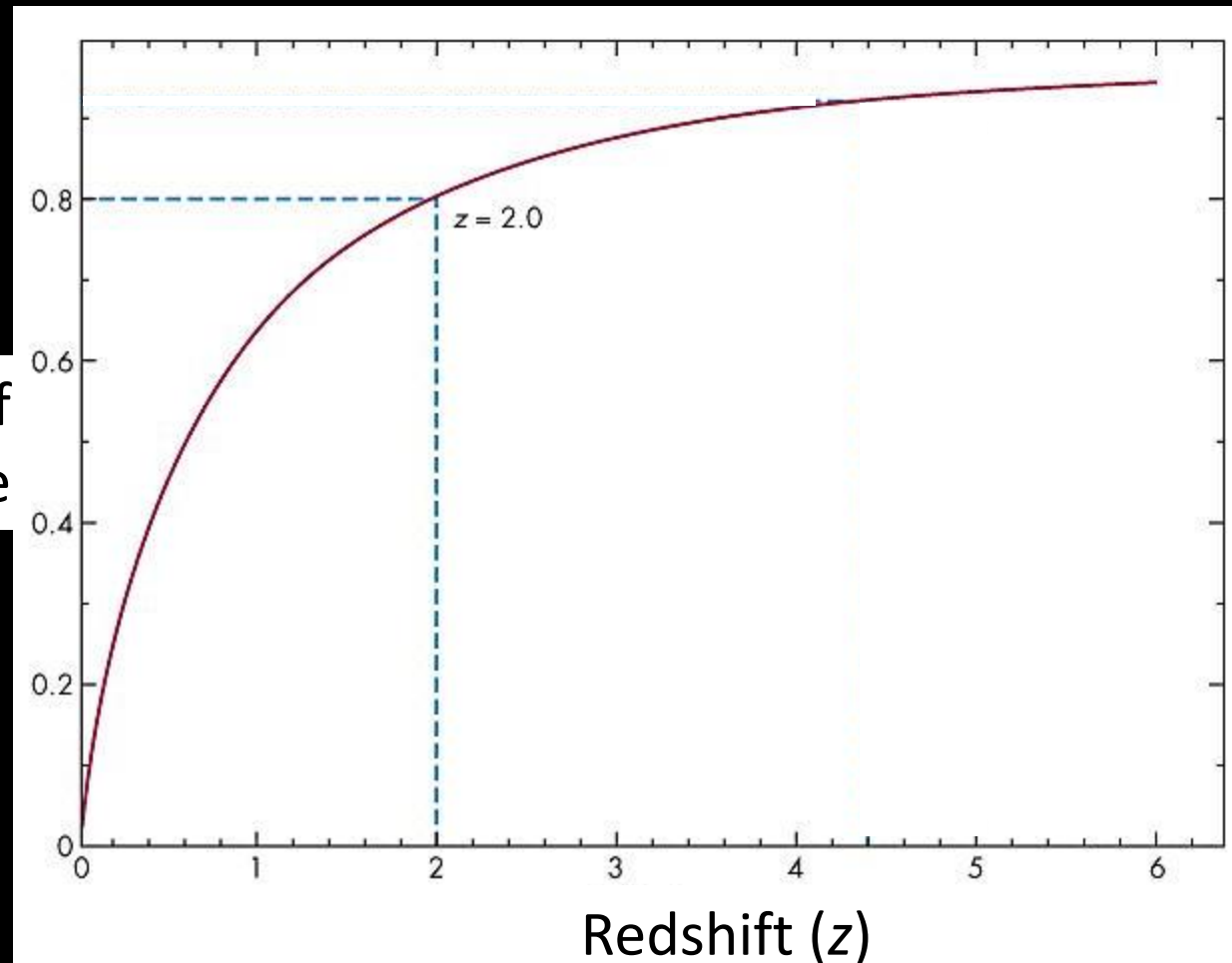
5 billion to
9 billion years

More than
9 billion years

NASA/ESA/Levay & Summers



Fractional age of
the Universe







HDF



NASA/Williams et al

HDF-S

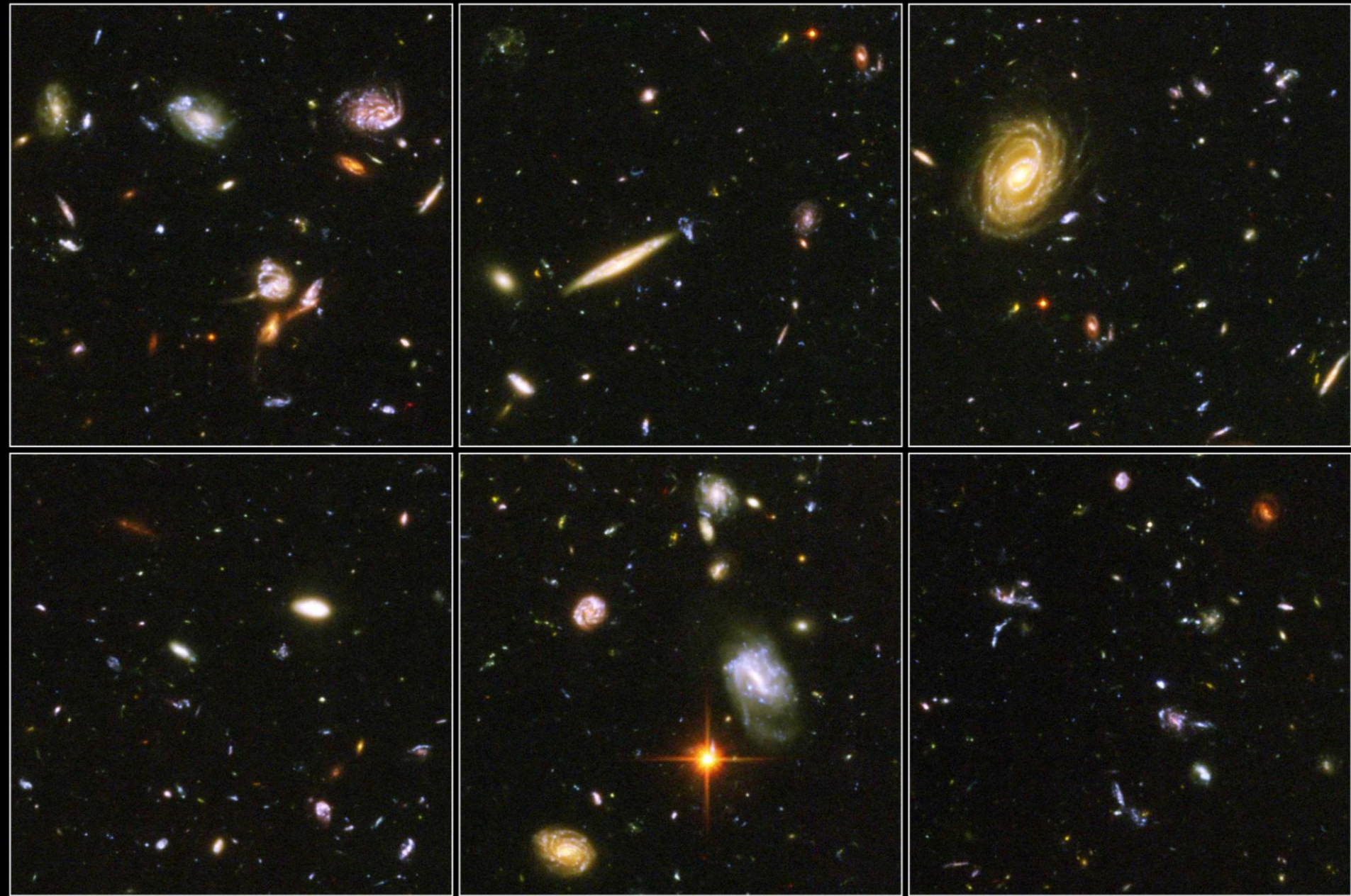


NASA/Williams et al



HUDF

NASA/ESA/Beckwith et al

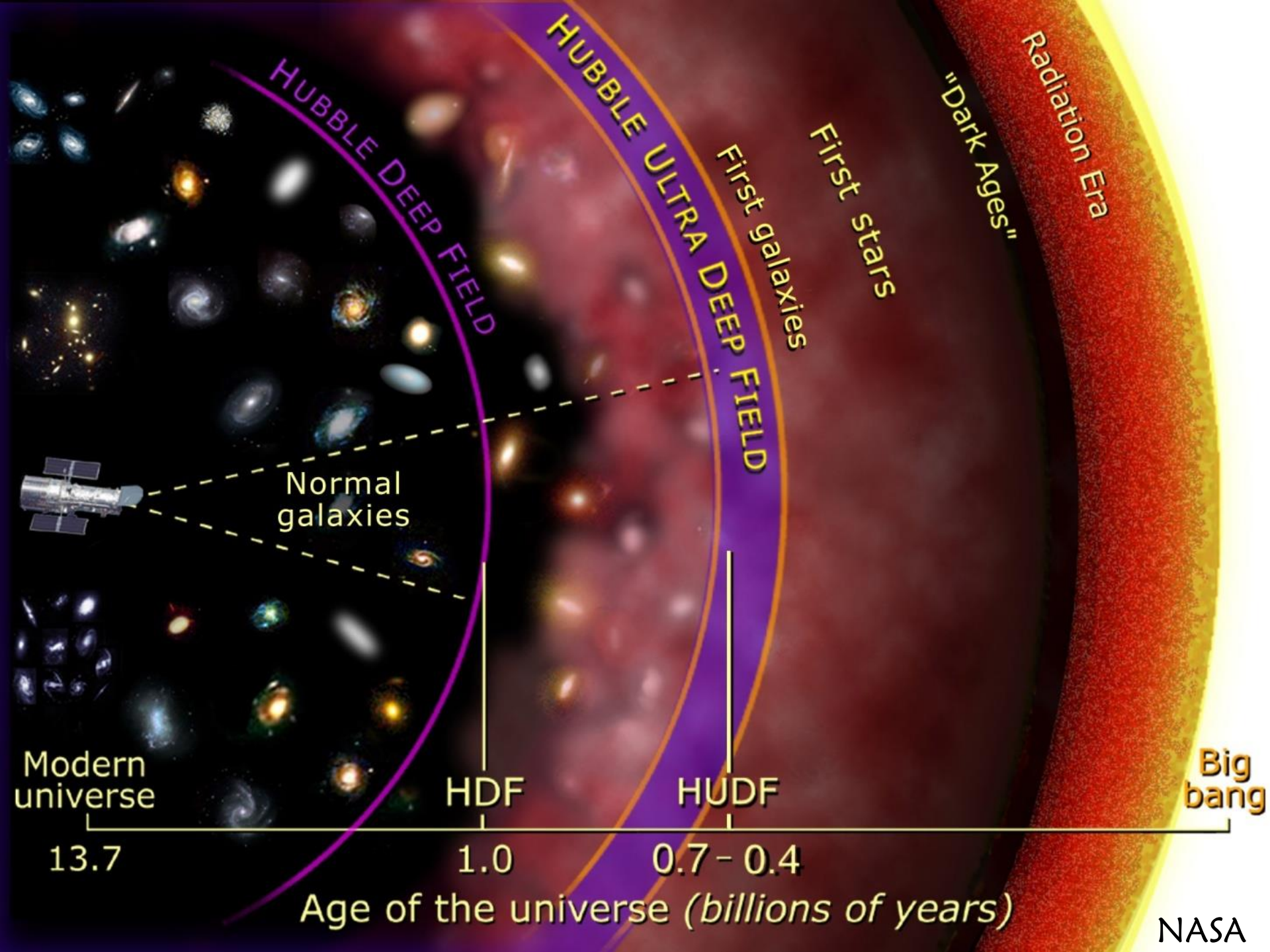




NASA/ESA/Bouwens & Illingworth



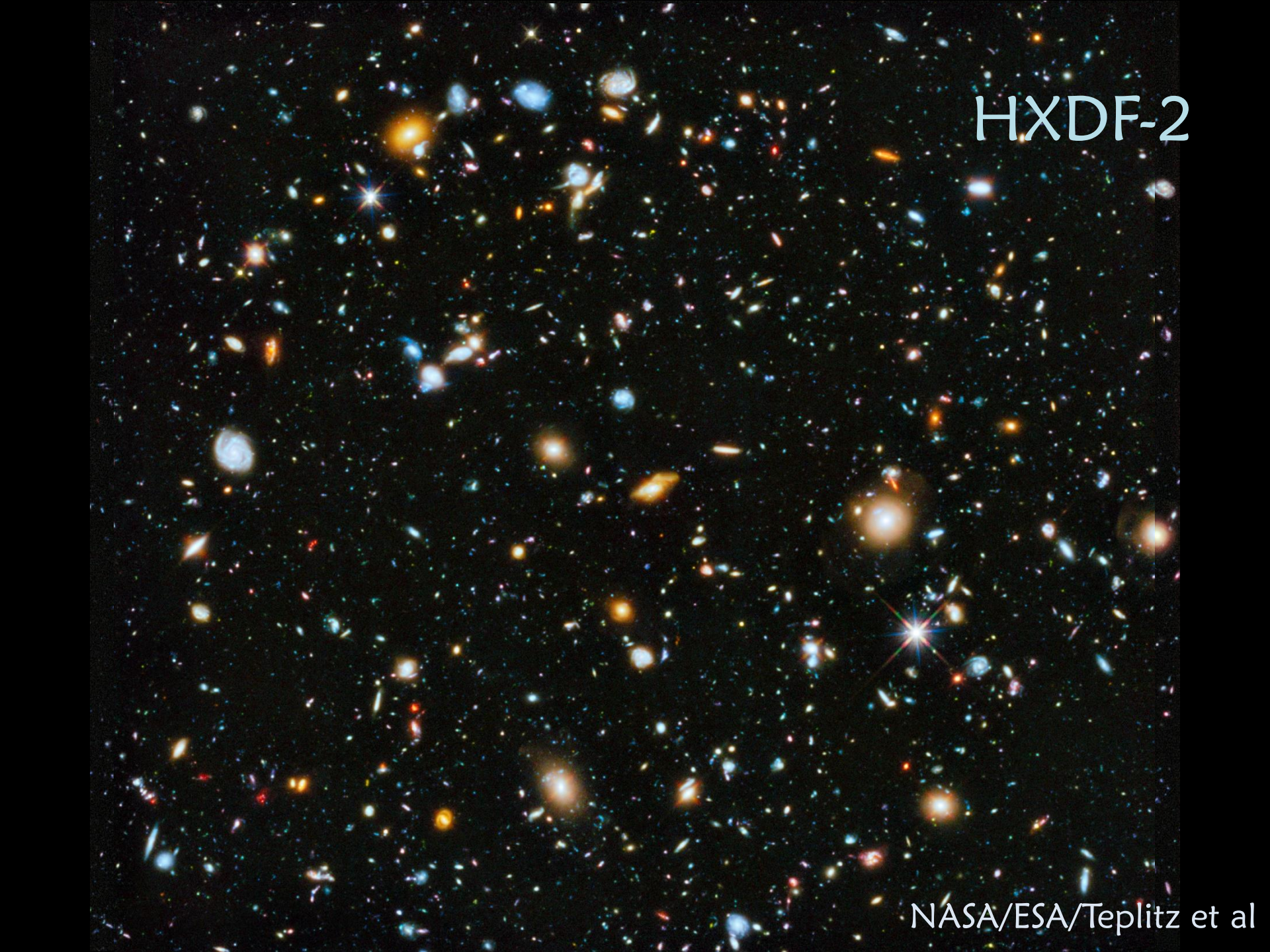
NASA/ESA/Bouwens & Illingworth



This is a deep-field astronomical image showing a vast number of galaxies in various shapes, sizes, and colors (red, blue, orange, white) against a black background. The galaxies are distributed across the entire frame, with some appearing as bright, distinct objects and others as faint, distant specks. The colors likely represent different wavelengths of light captured by the Hubble Space Telescope.

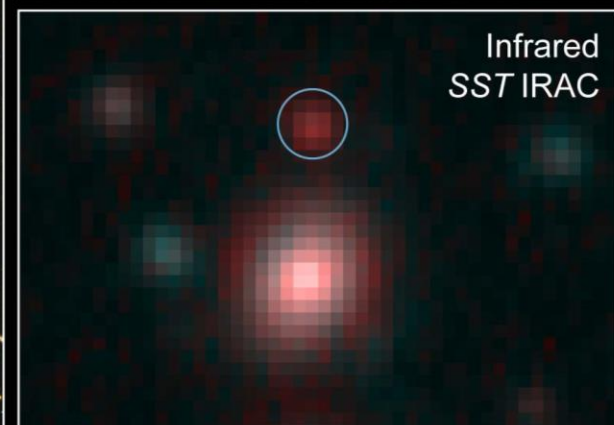
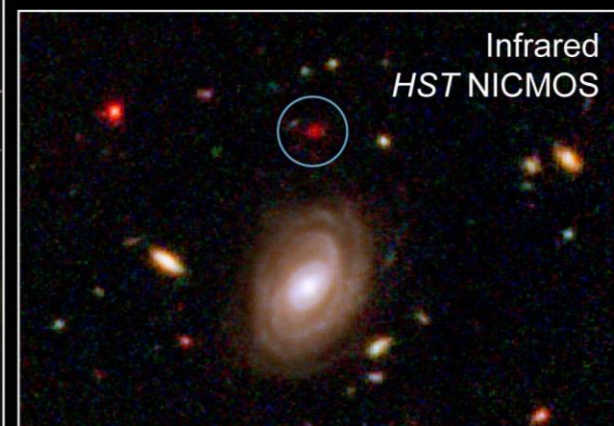
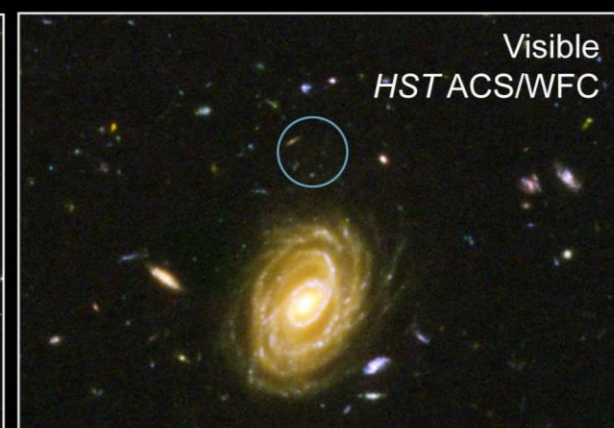
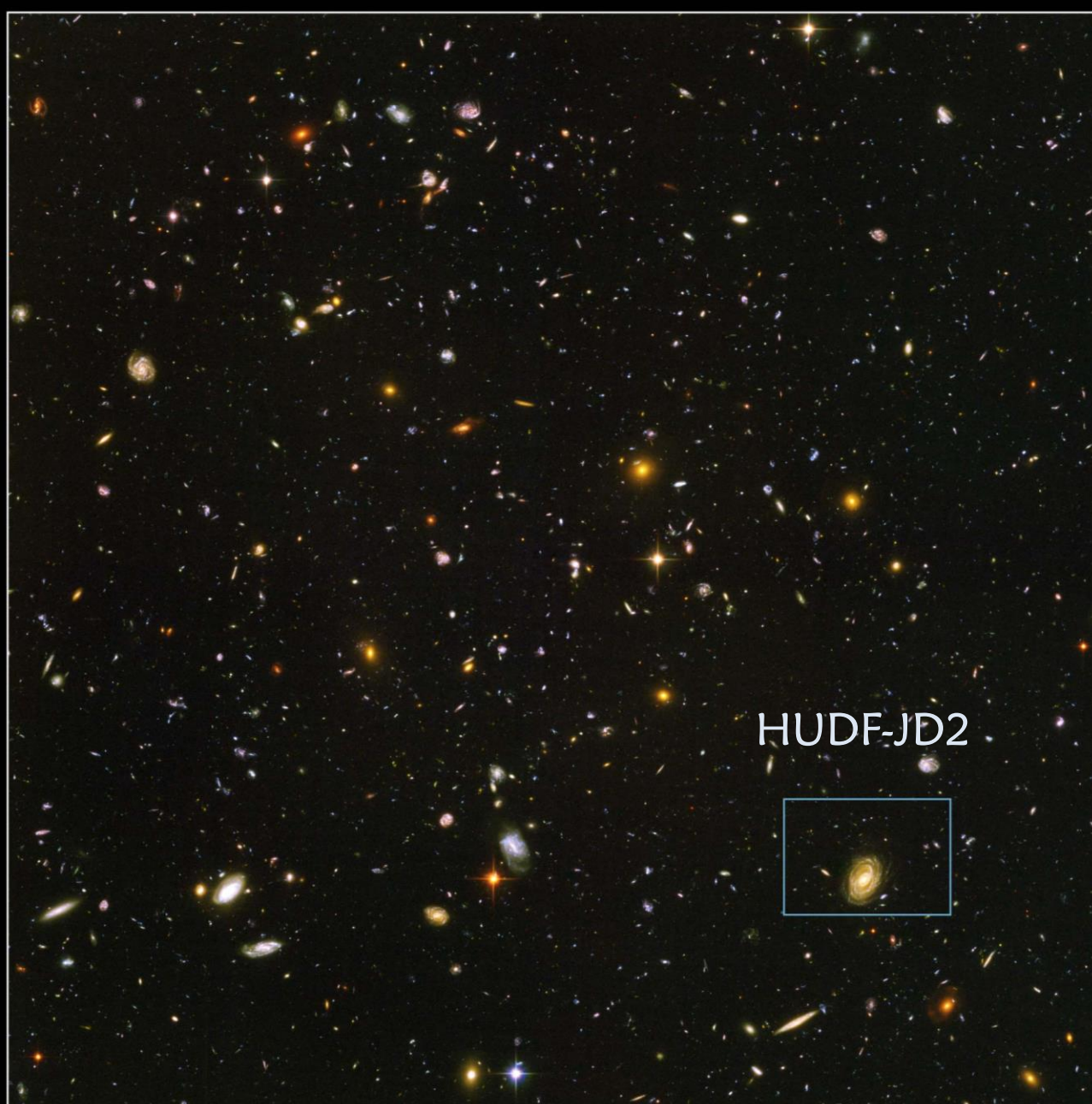
HXDF

NASA/ESA/Illingworth et al

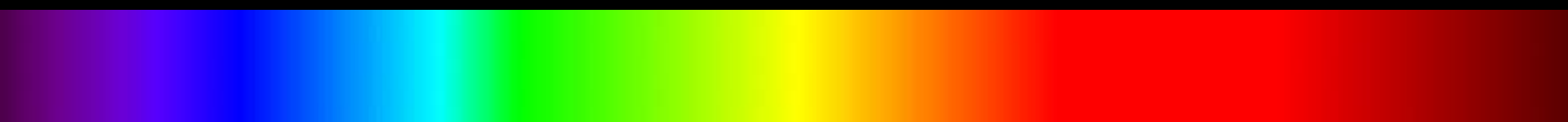
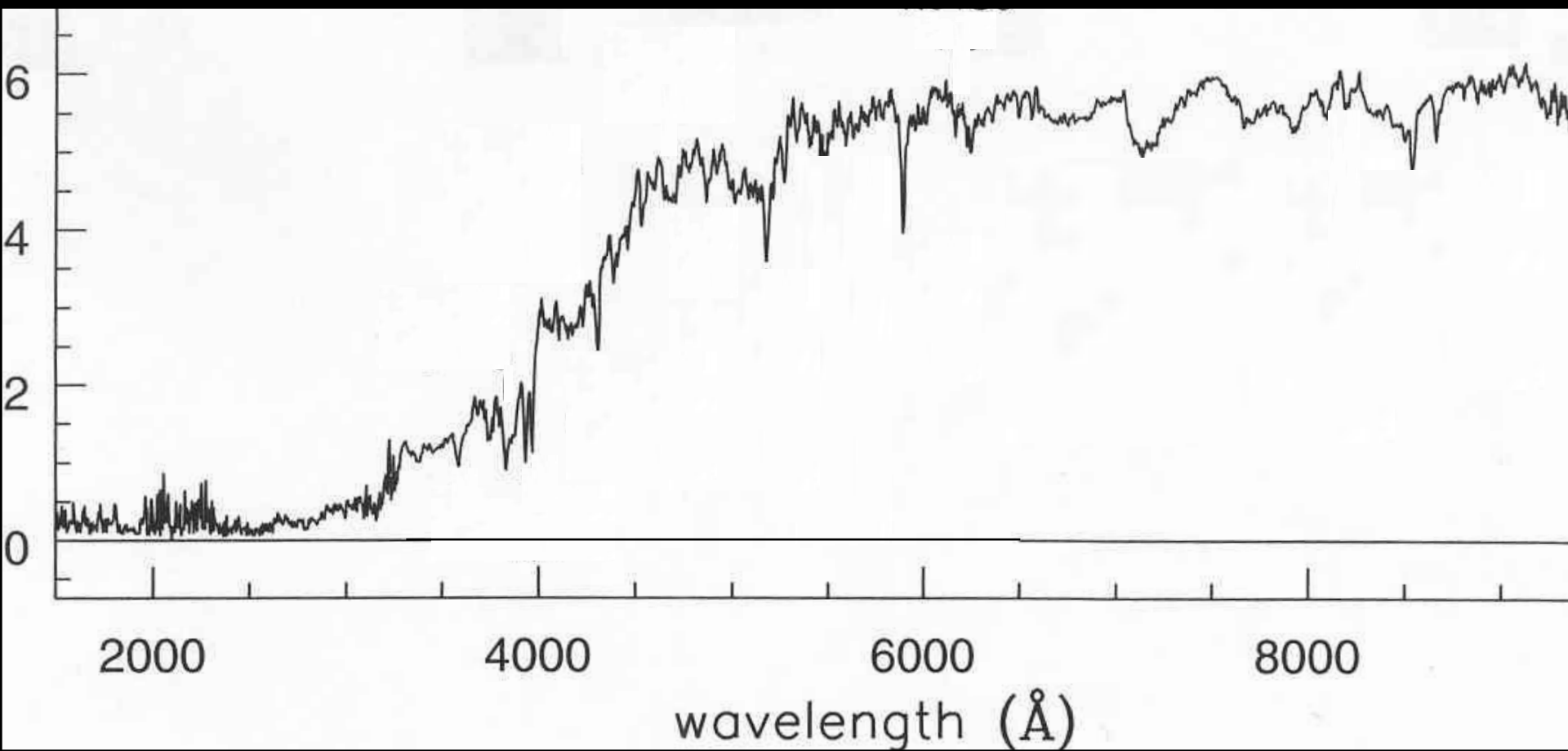


HXDF-2

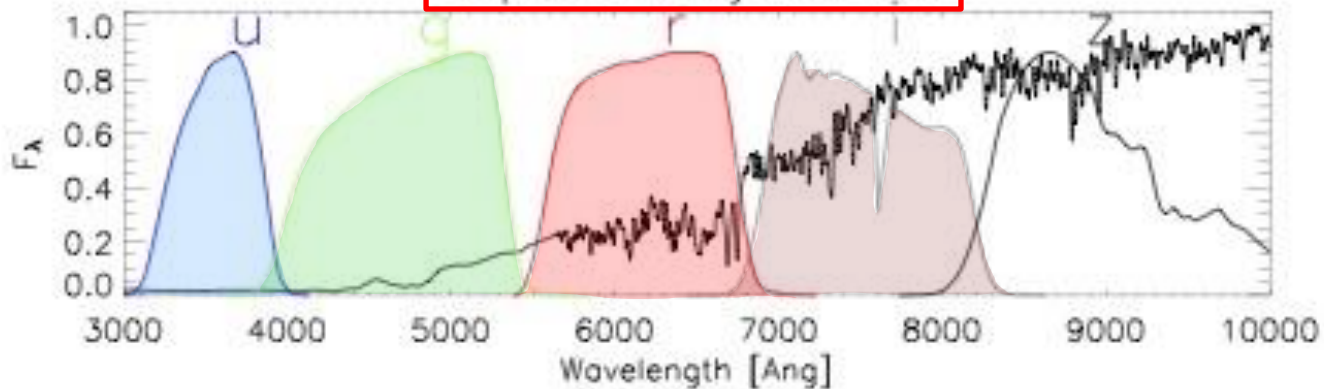
NASA/ESA/Teplitz et al



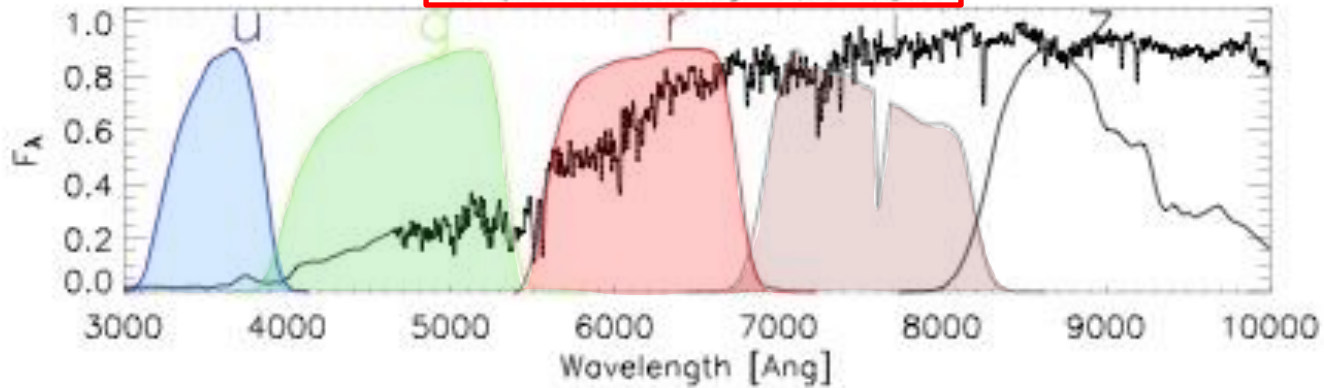




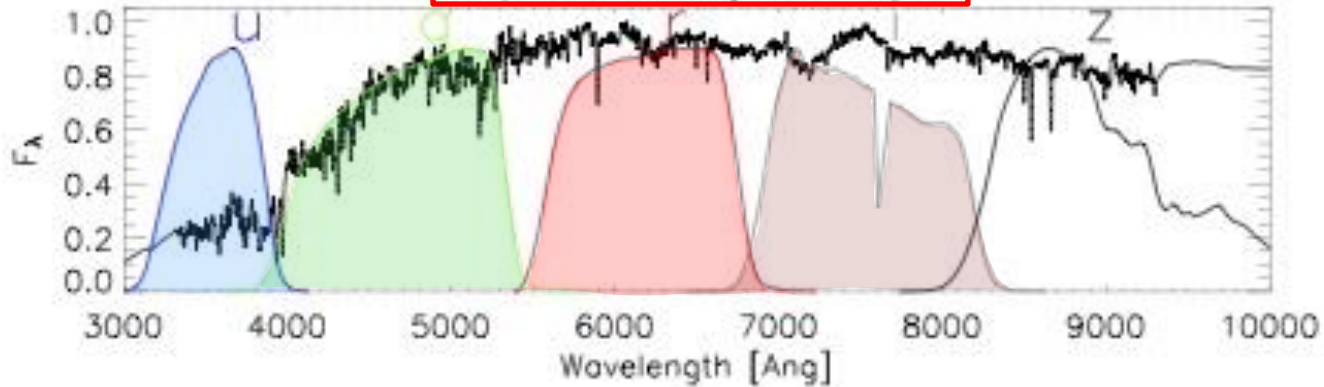
Elliptical Galaxy at $z=0.7$

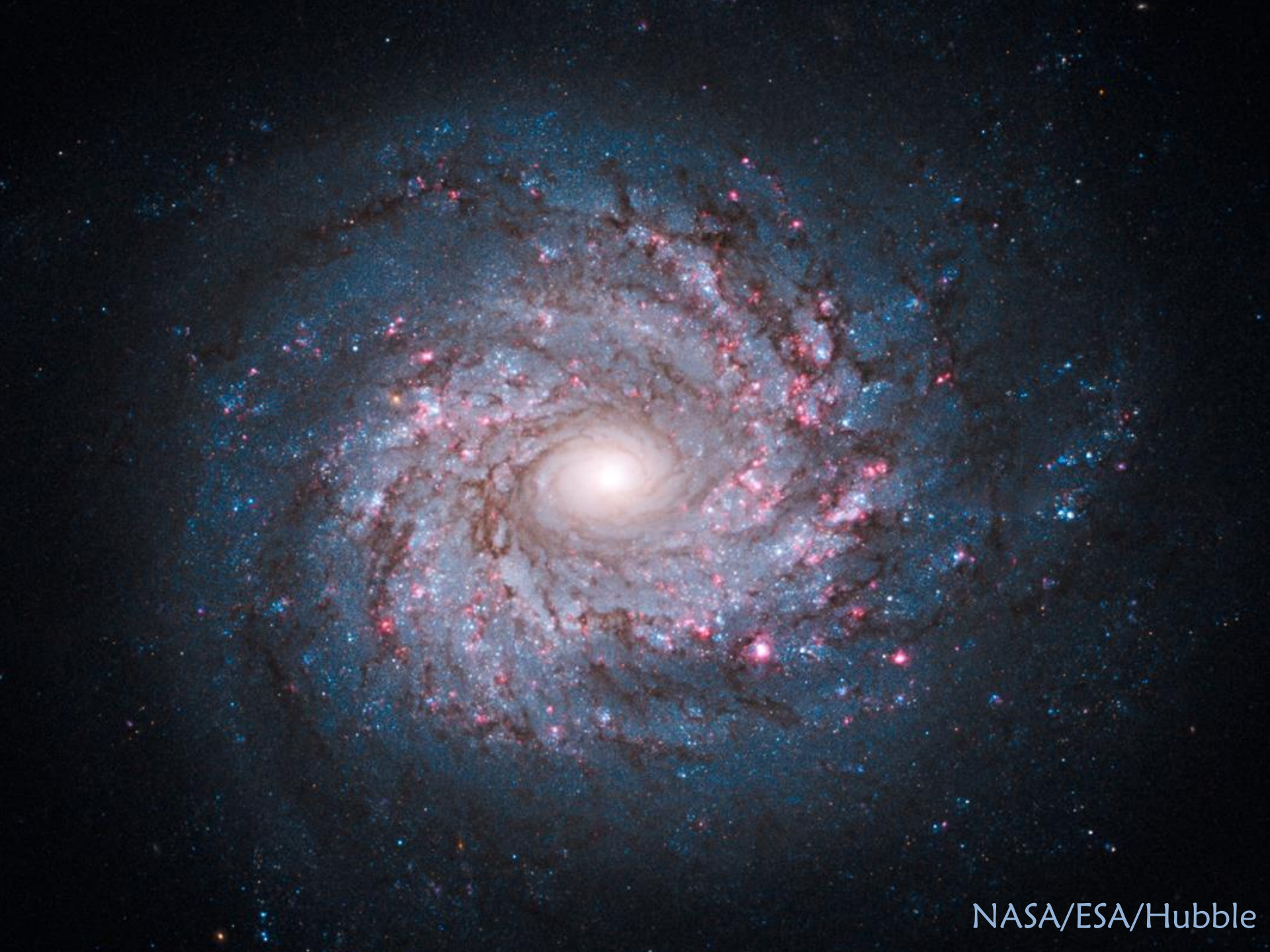


Elliptical Galaxy at $z=0.4$

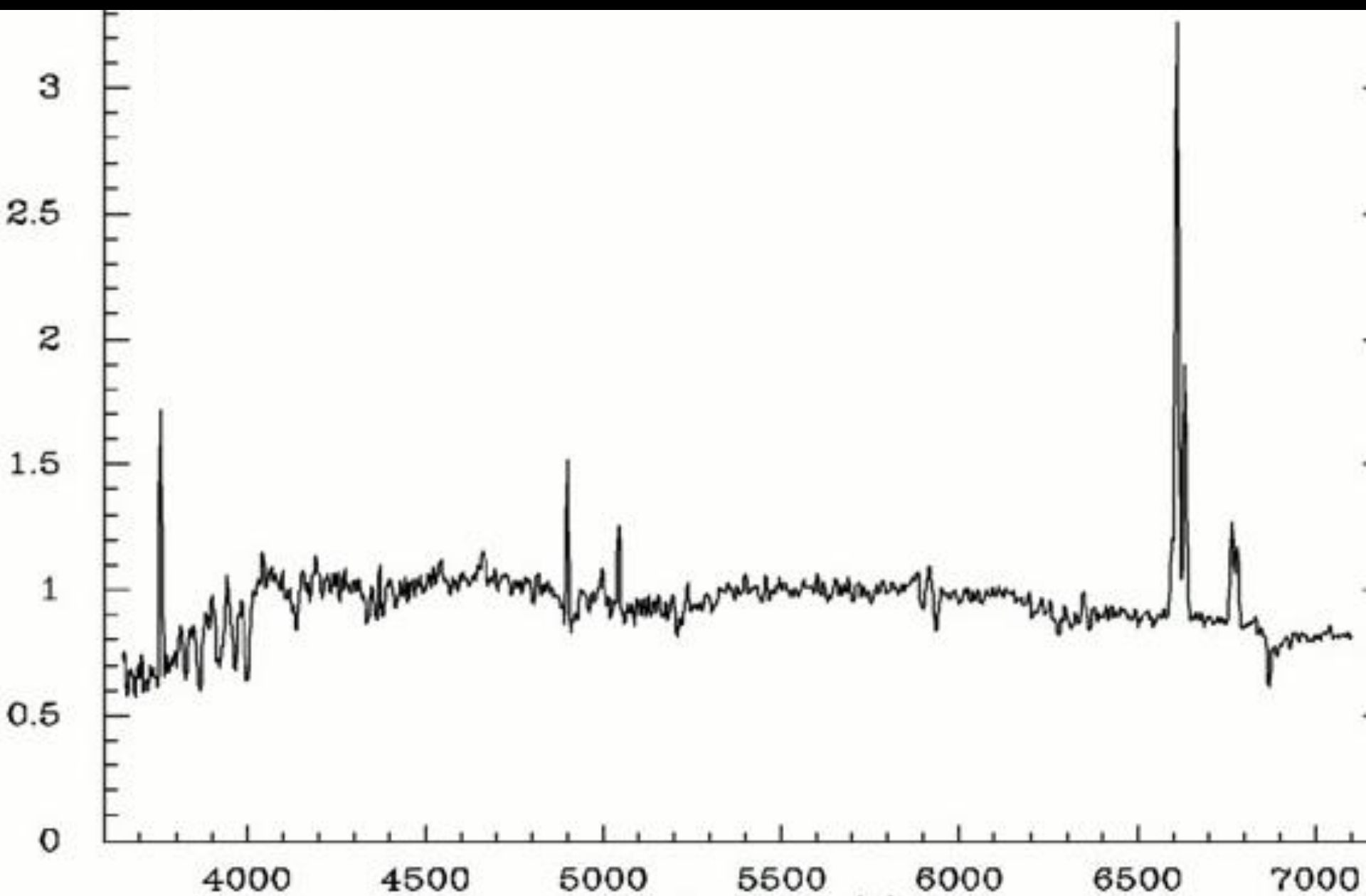


Elliptical Galaxy at $z=0.0$

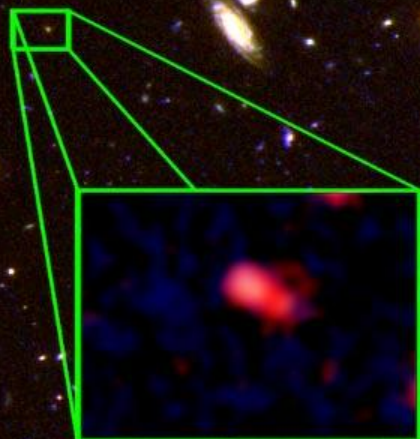




NASA/ESA/Hubble



Kennicutt 1992



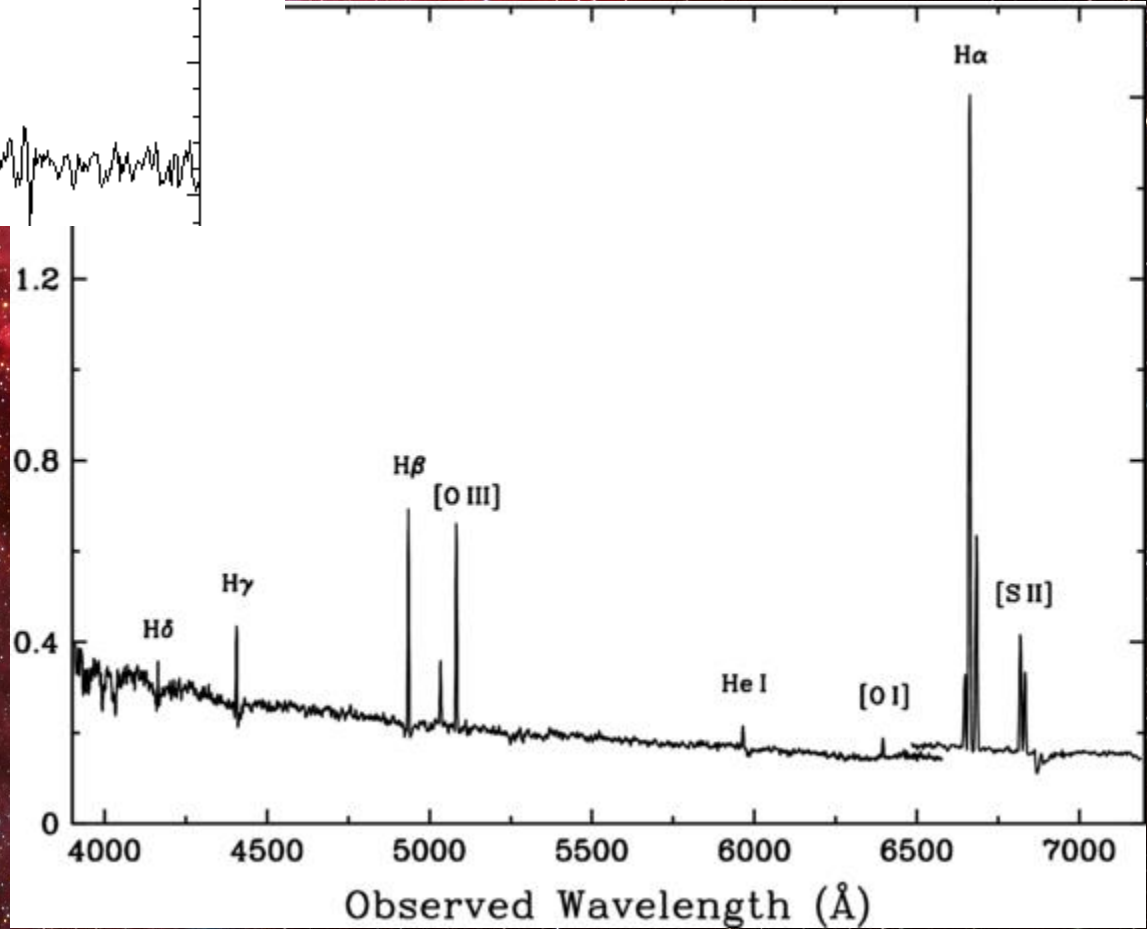
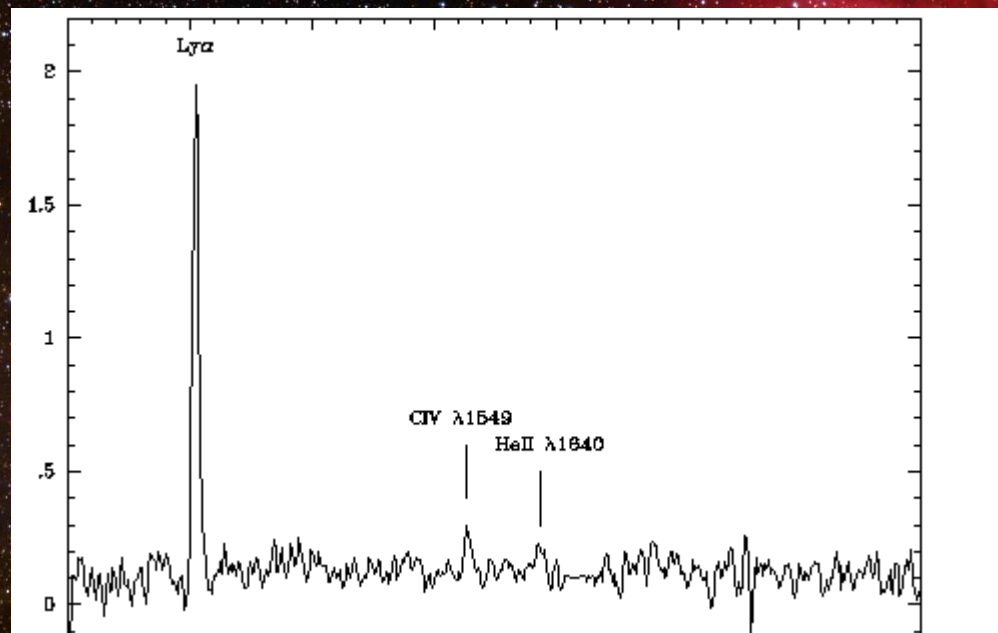
Z8-GND-5296

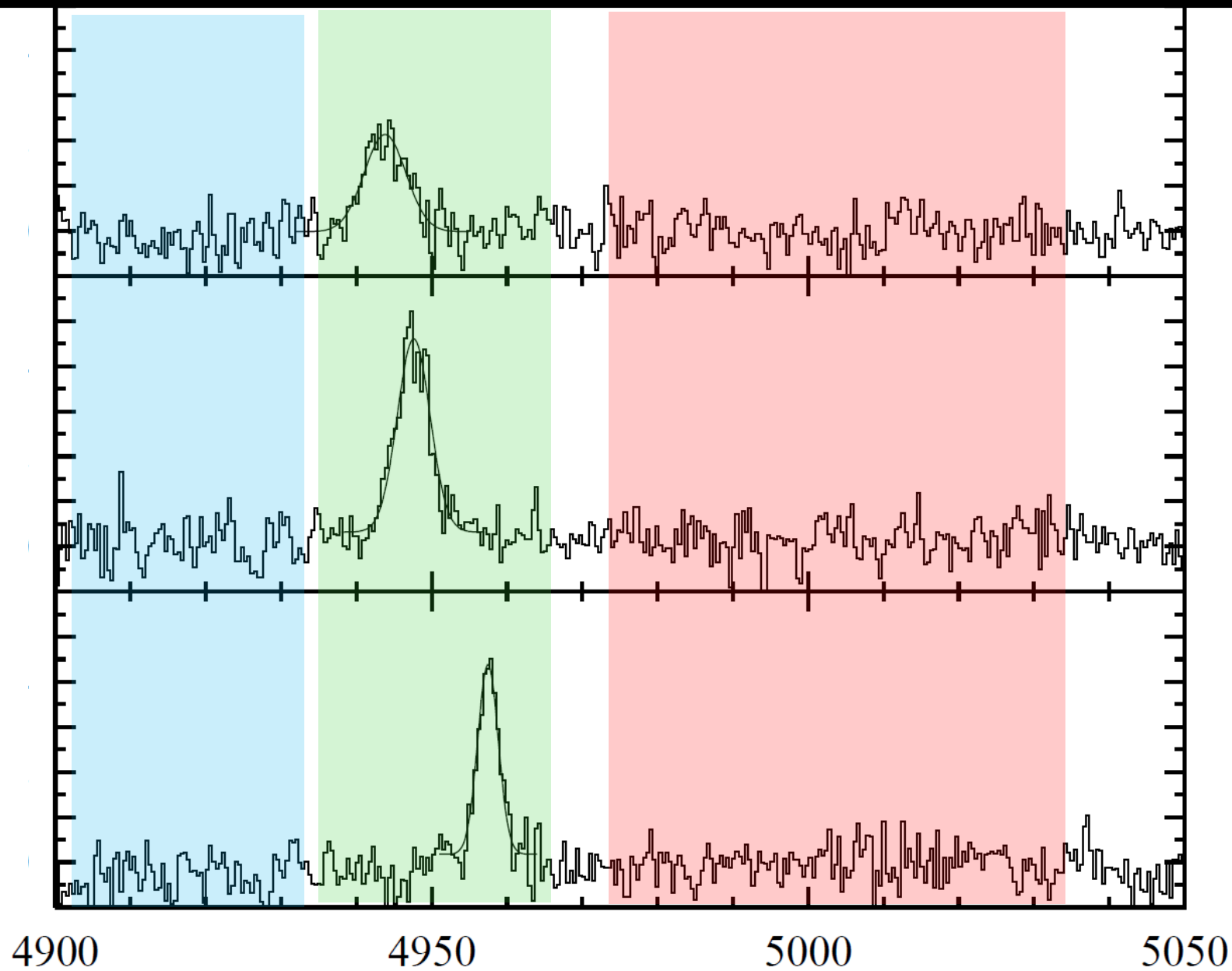


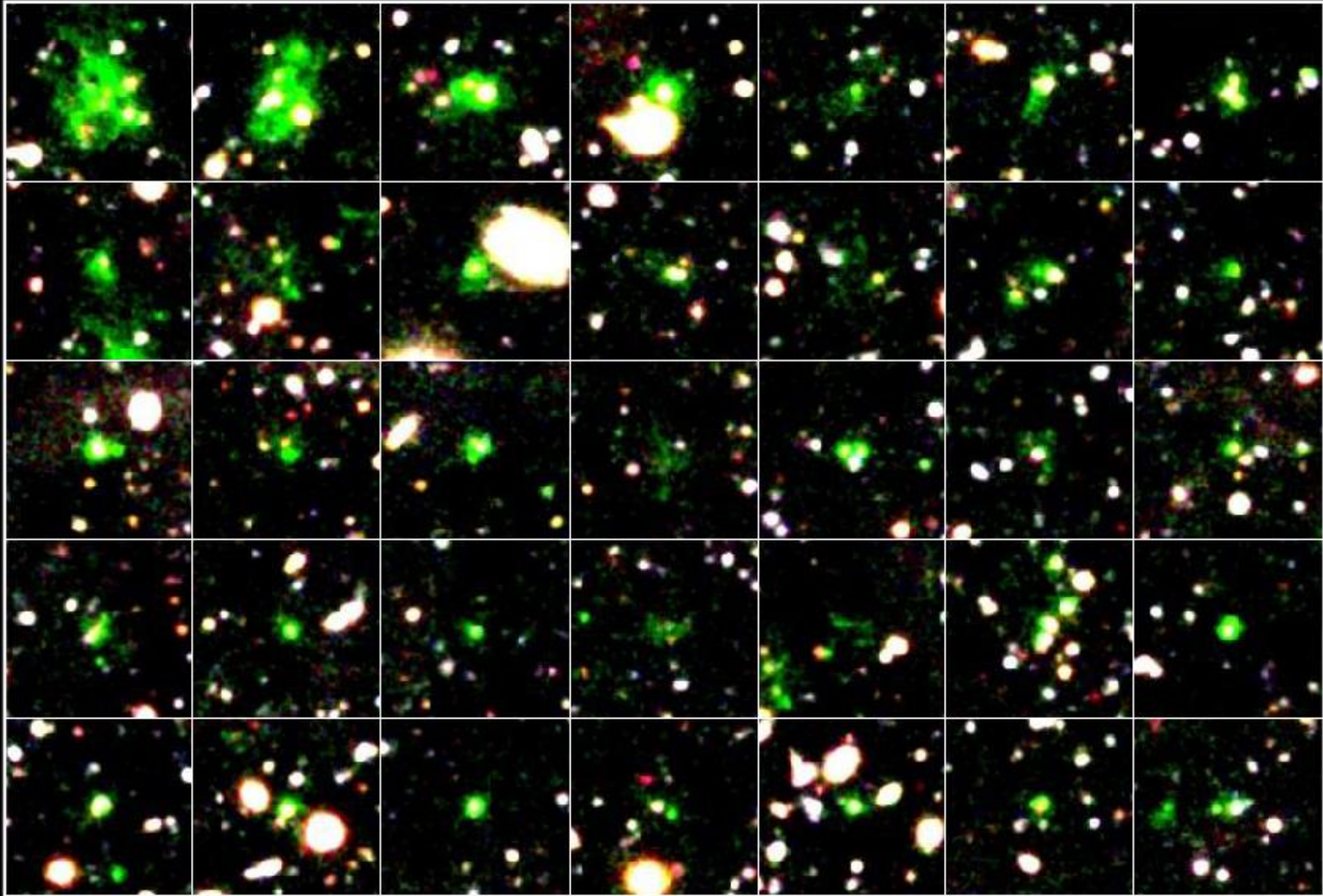
Tilvi, Finkelstein, Papovich et al



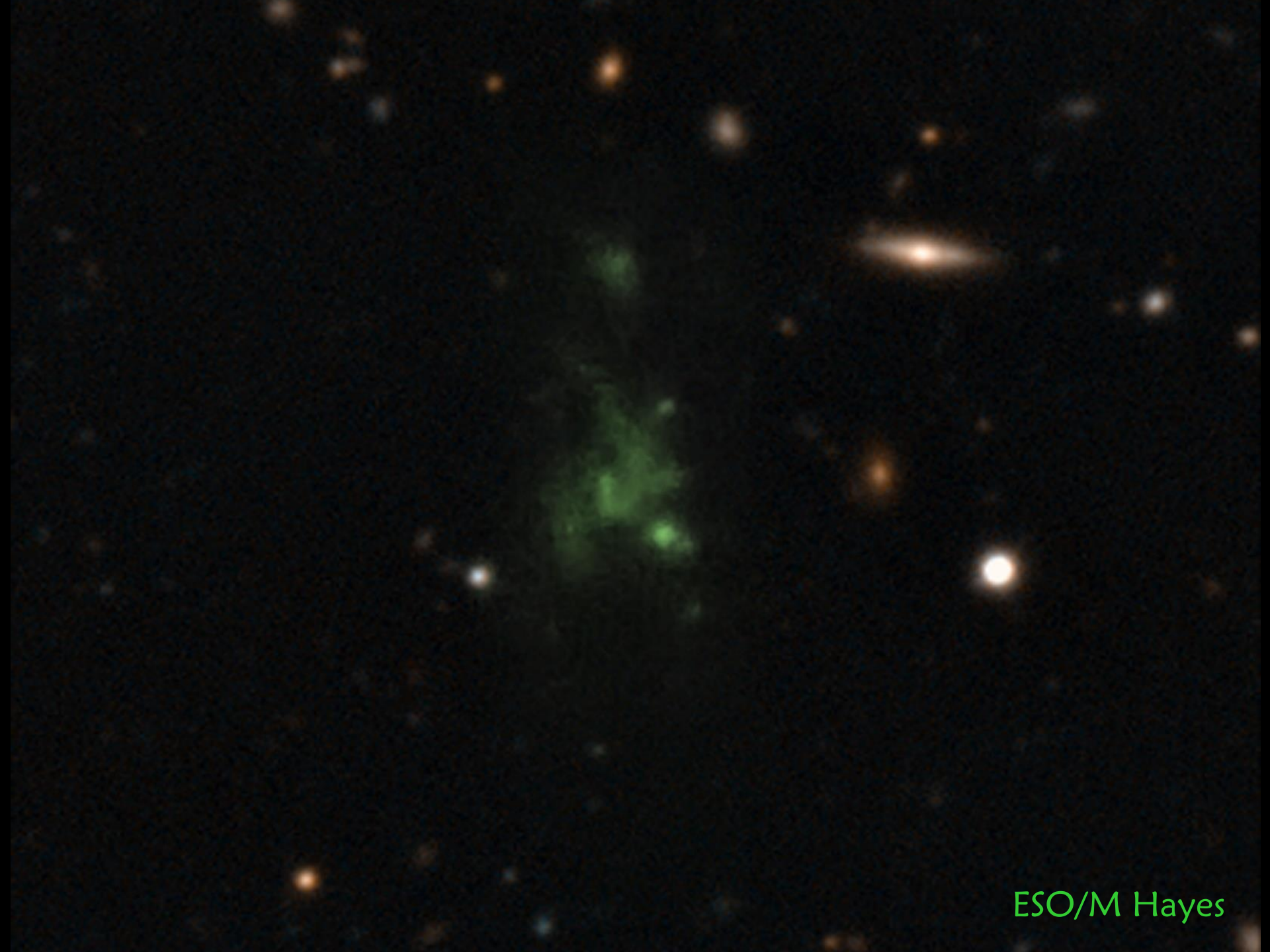
A Block (Caelum Observatory) & T Puckett



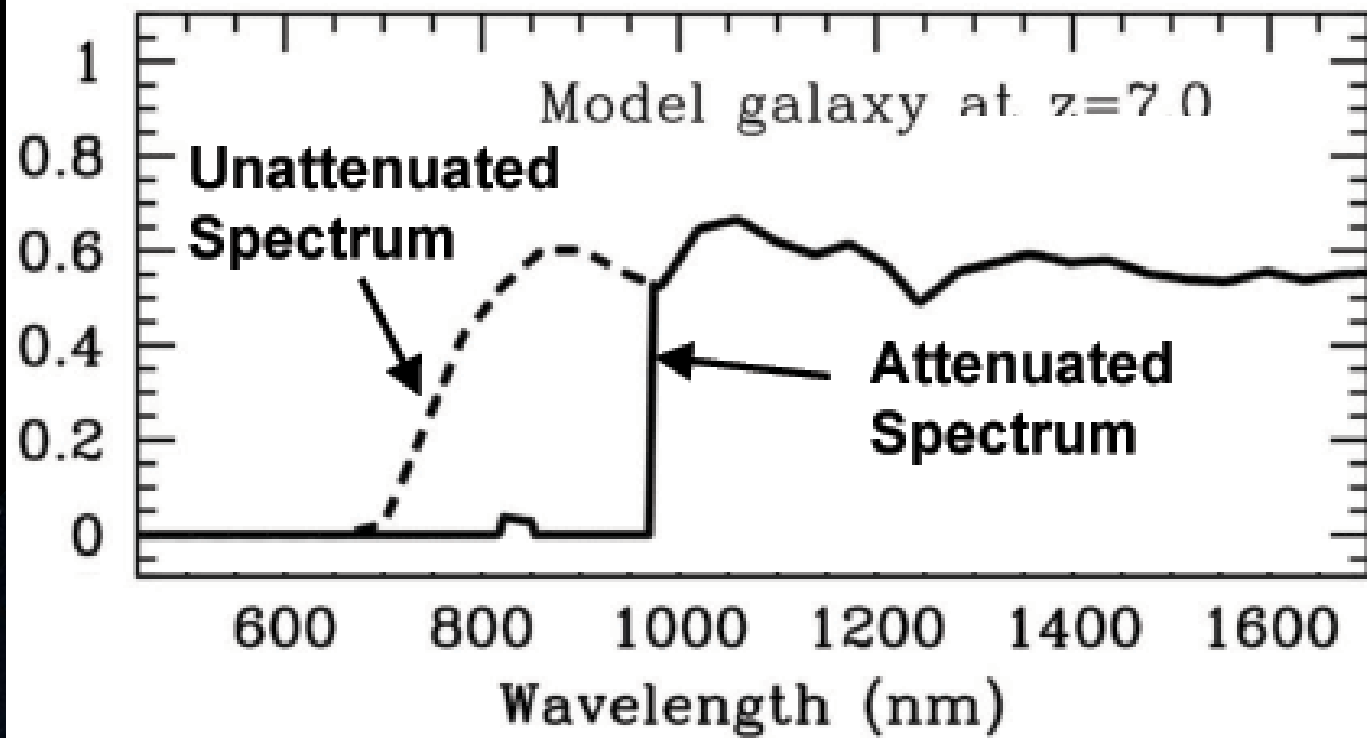


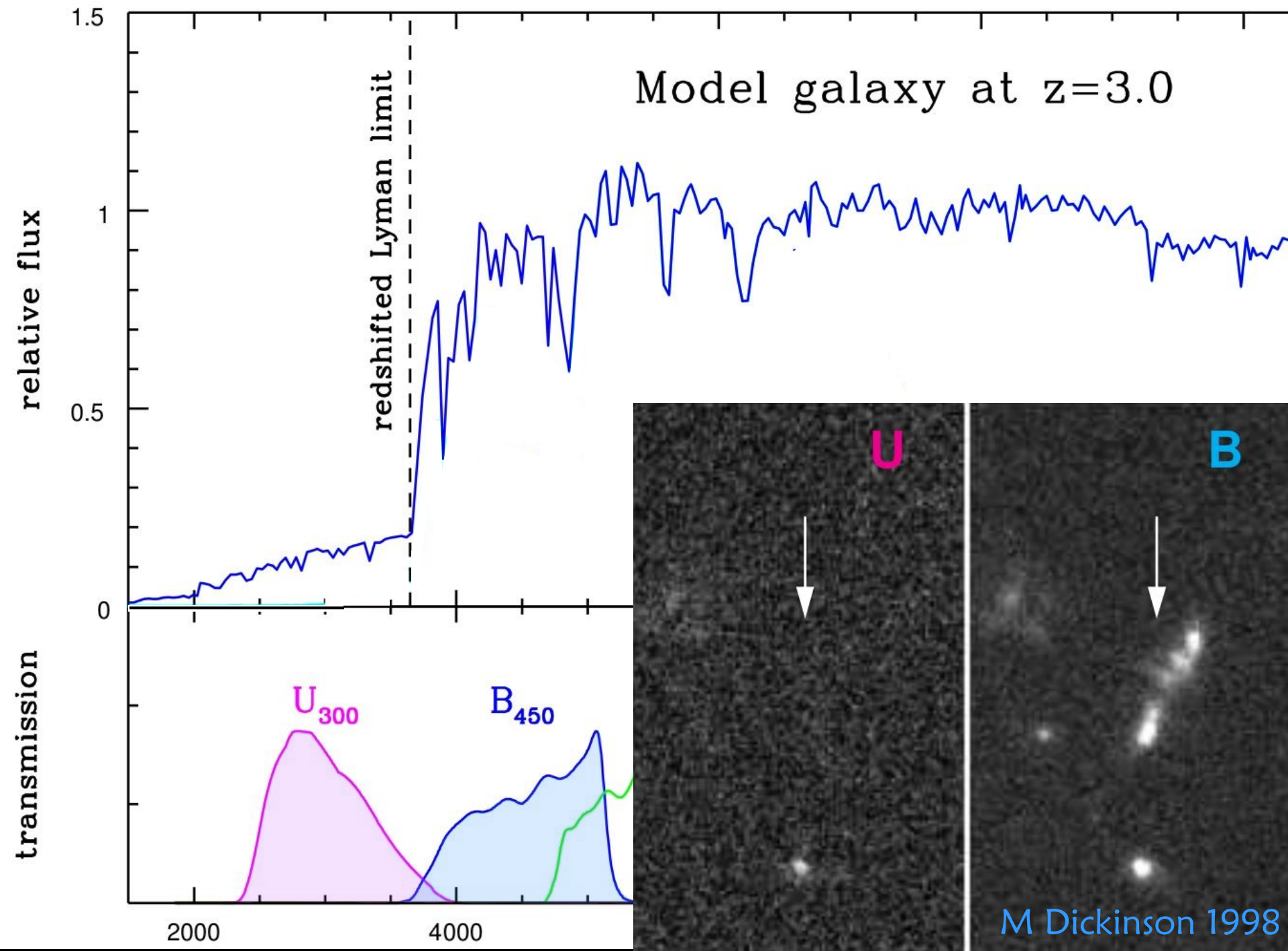


Subaru Telescope/NAOJ



ESO/M Hayes





Filters

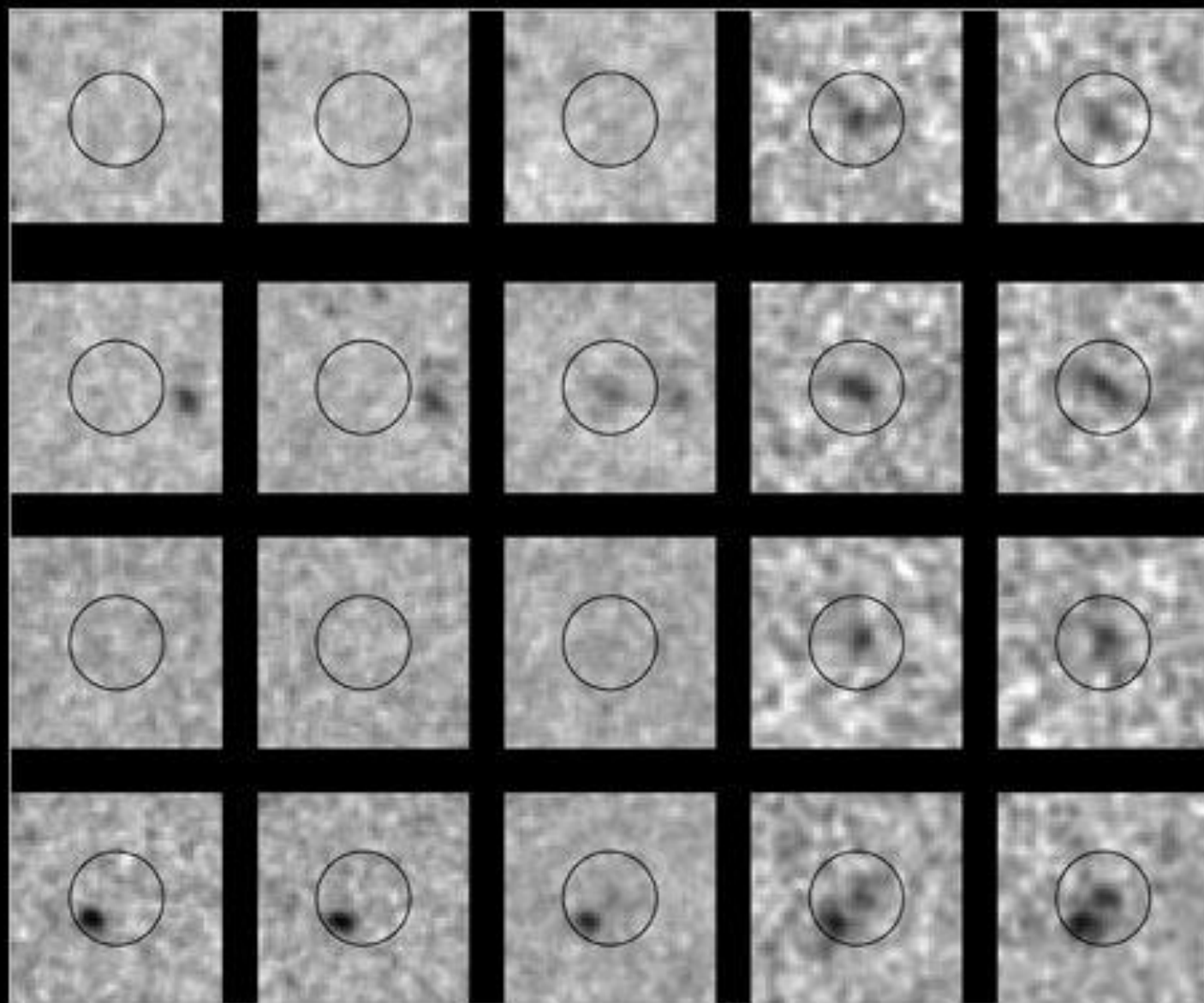
V

i

z

J

H



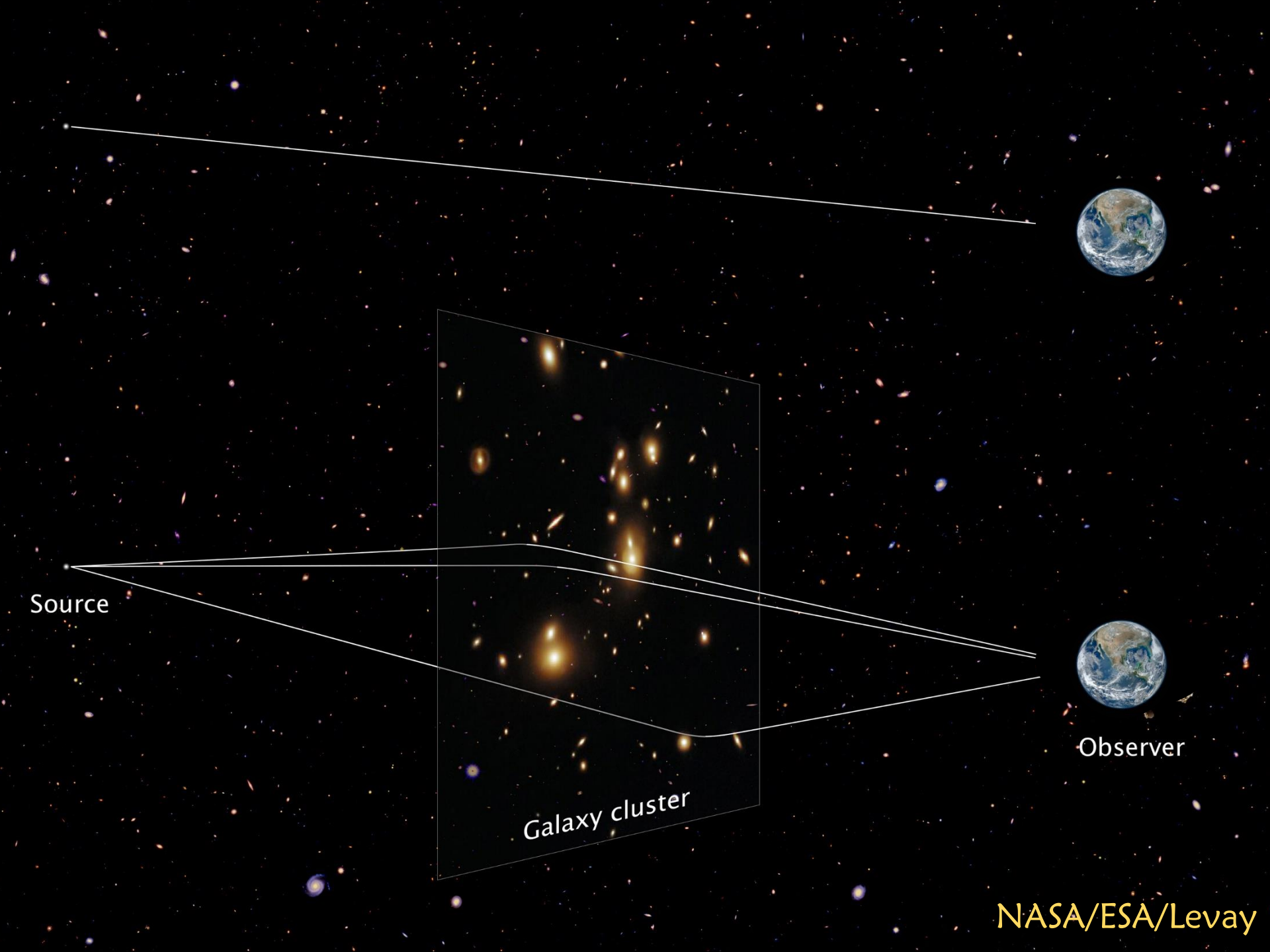
$z \sim 7.4$

$z \sim 6.8$

$z \sim 6.8$

$z \sim 6.8$

Rychard Bouwens



Source

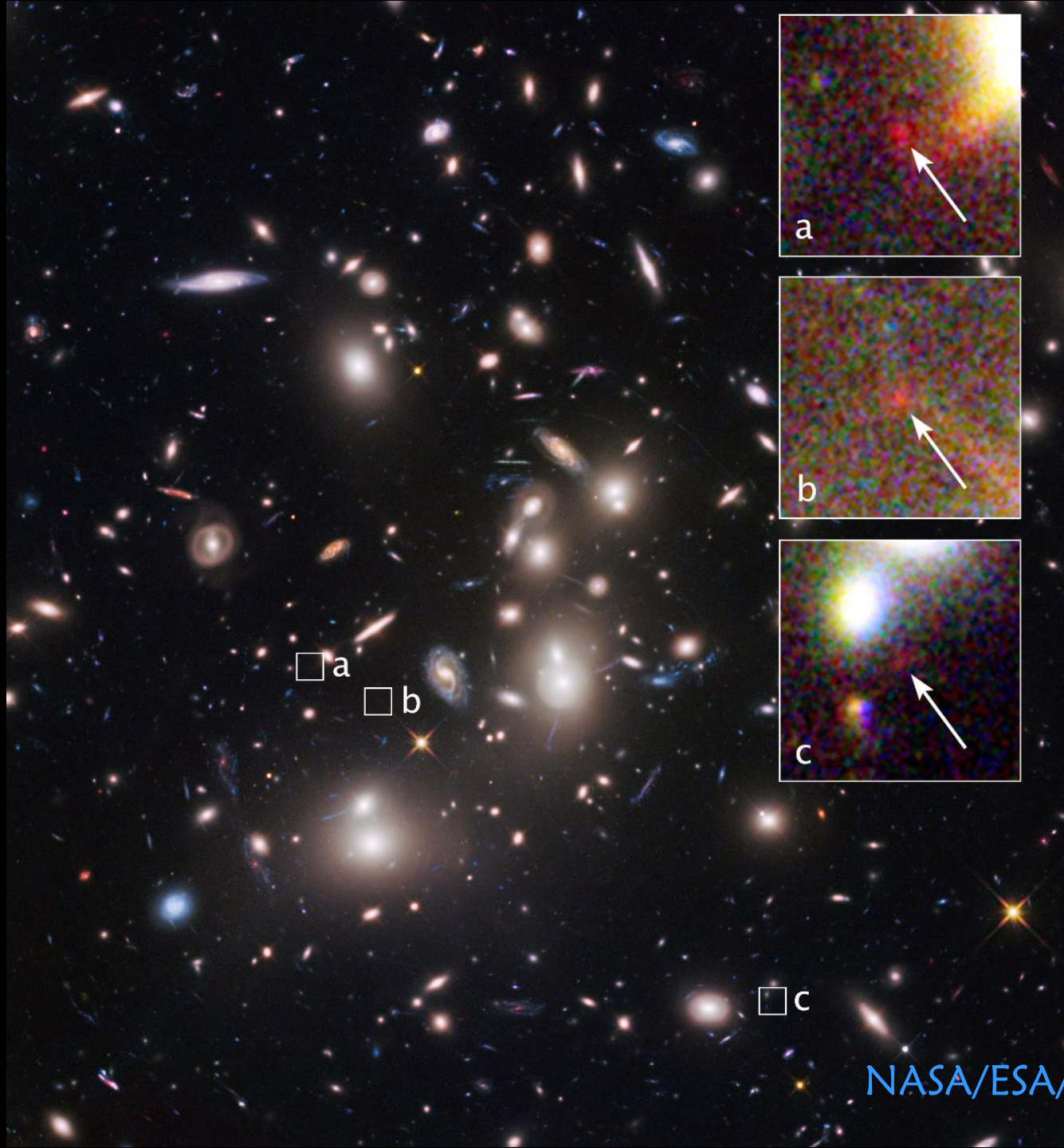


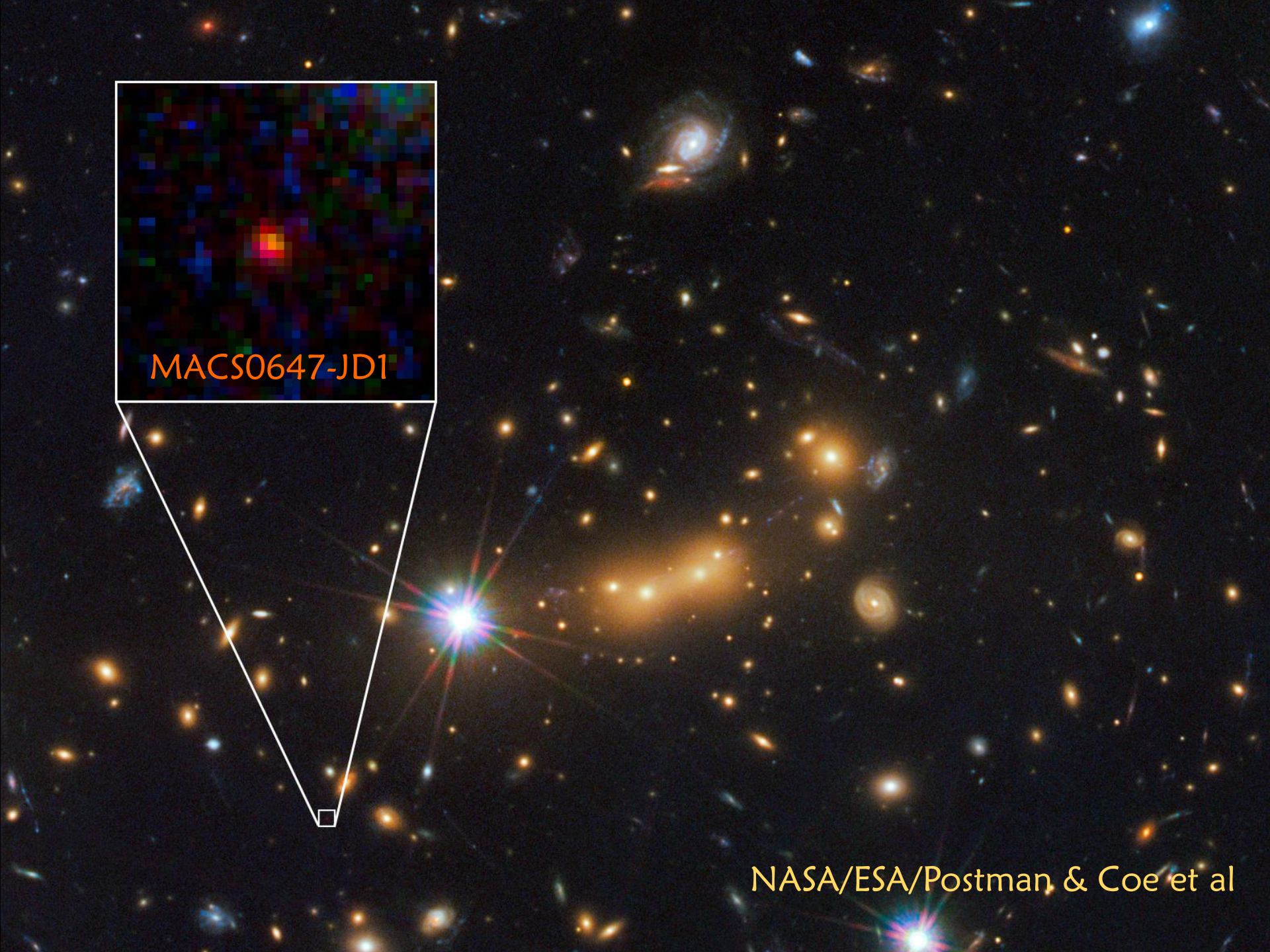
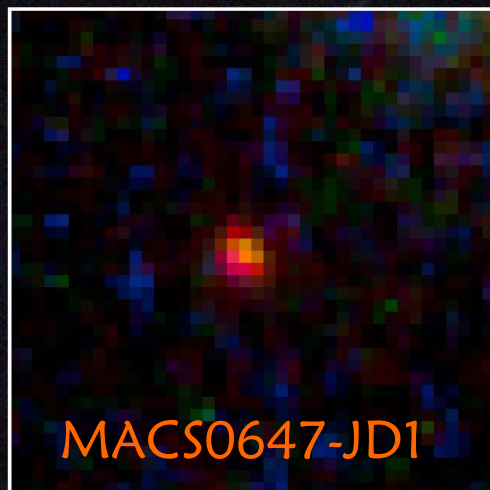
Observer

Galaxy cluster

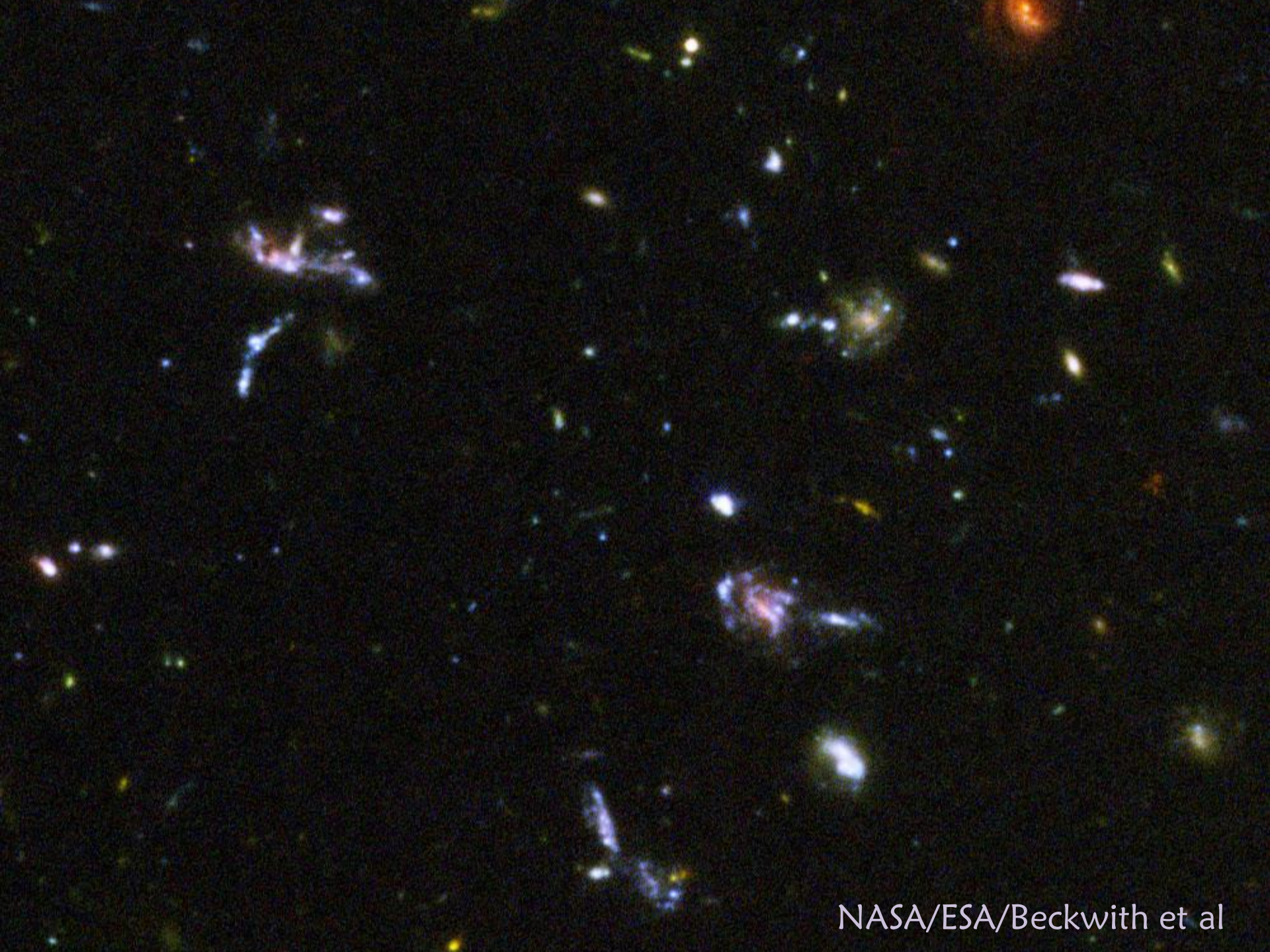


NASA/ESA/Zitrin et al

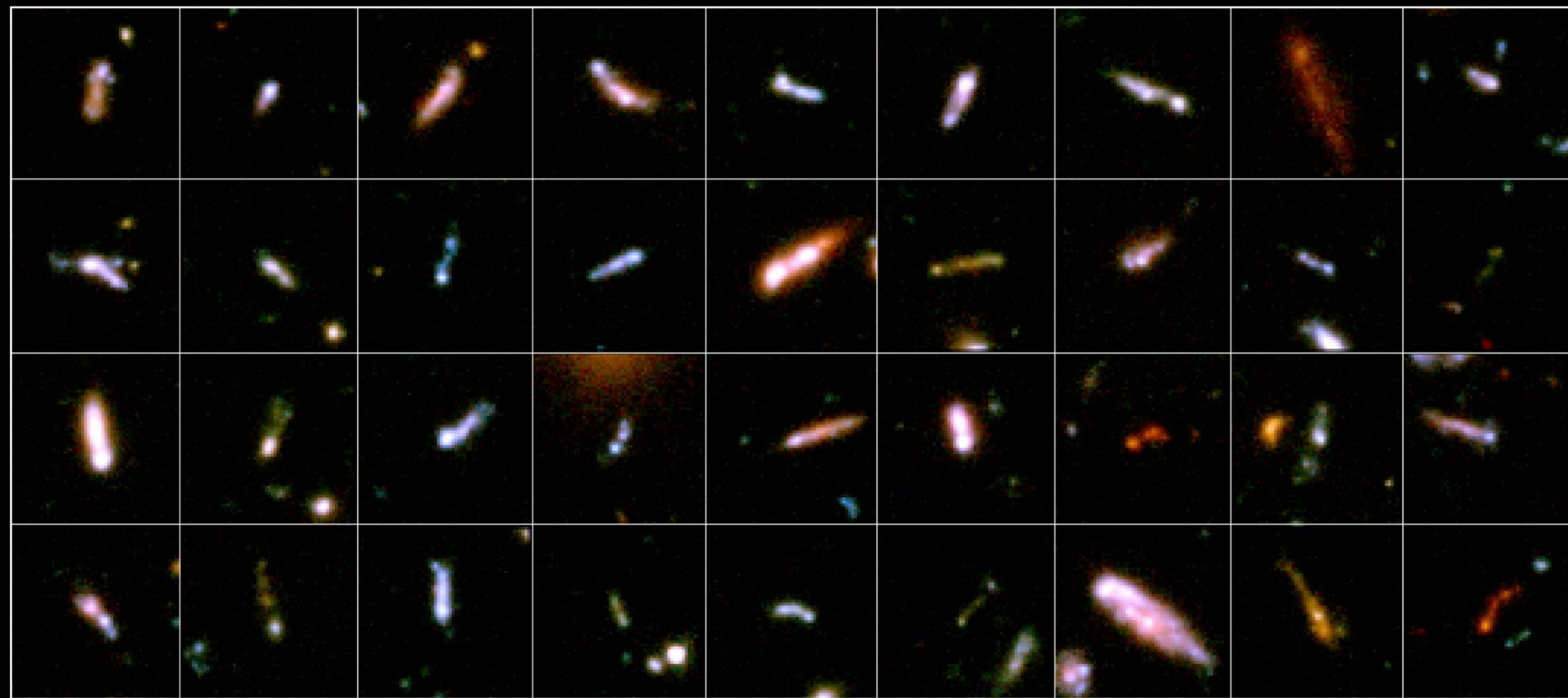




NASA/ESA/Postman & Coe et al

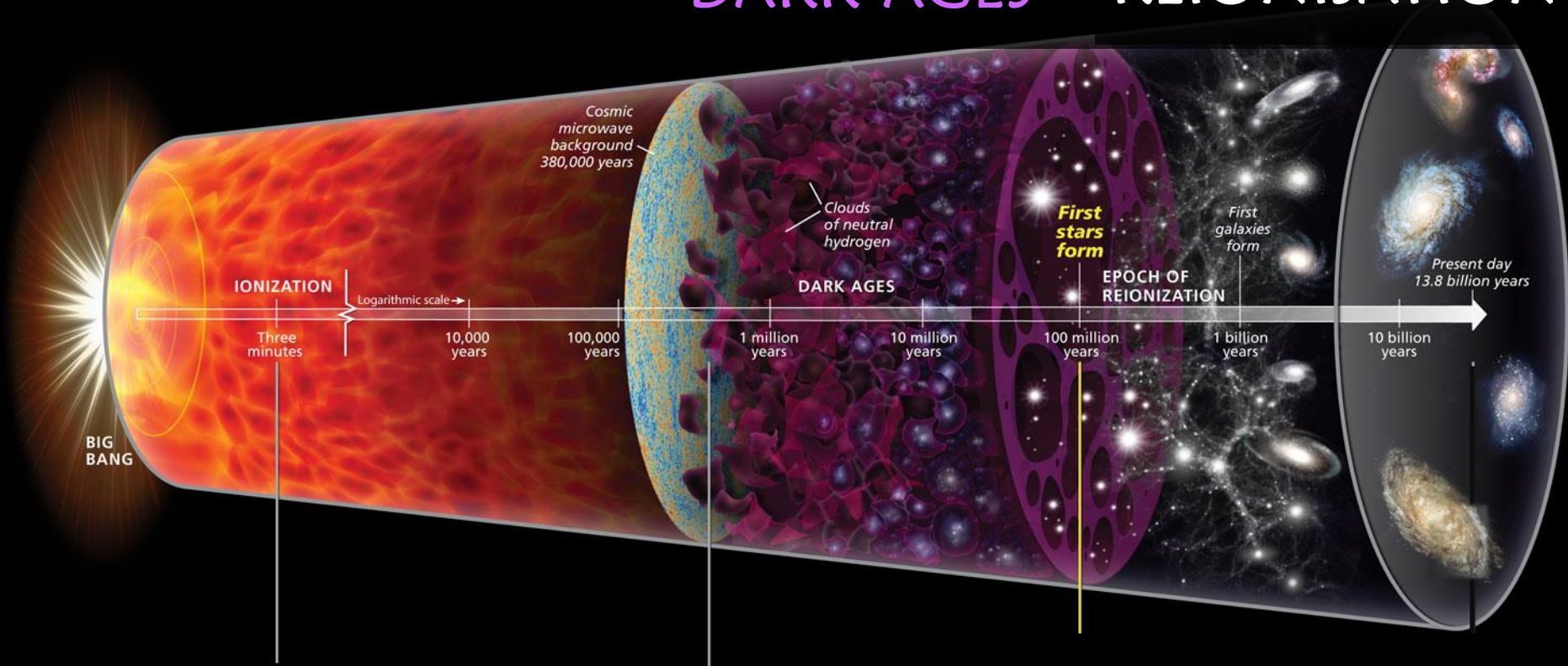


NASA/ESA/Beckwith et al



DARK AGES

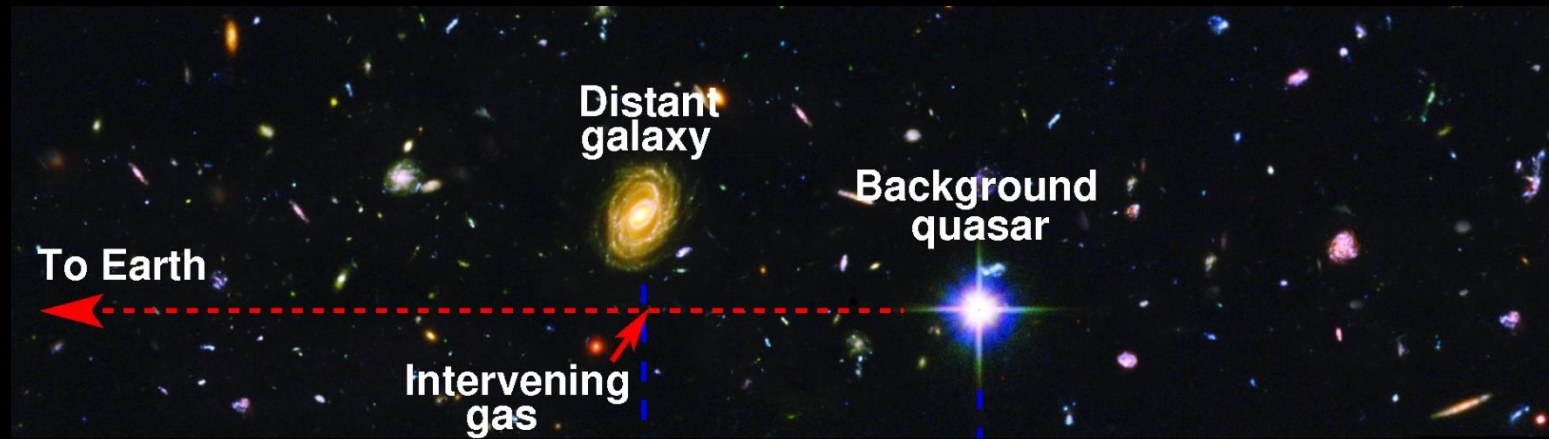
REIONISATION

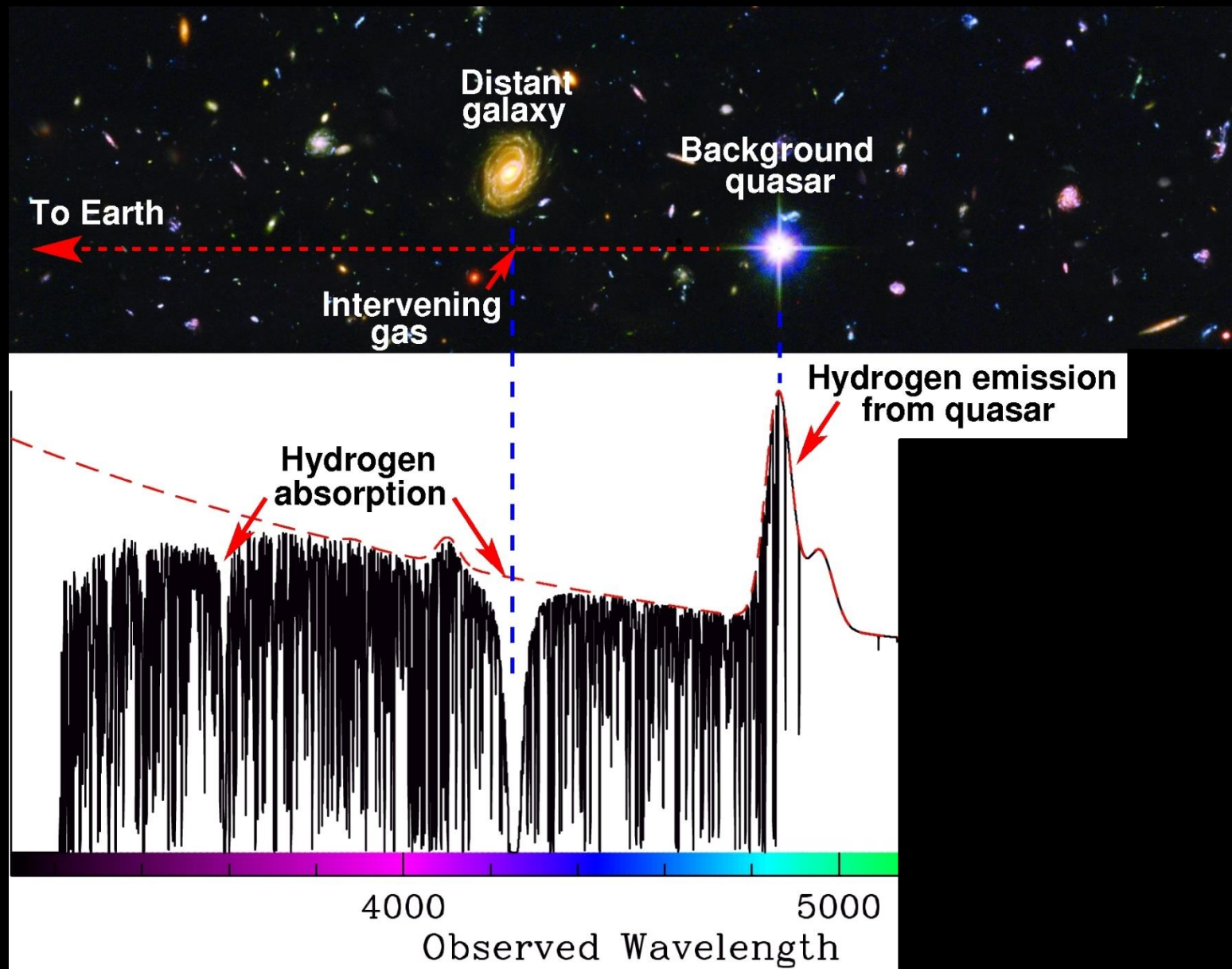


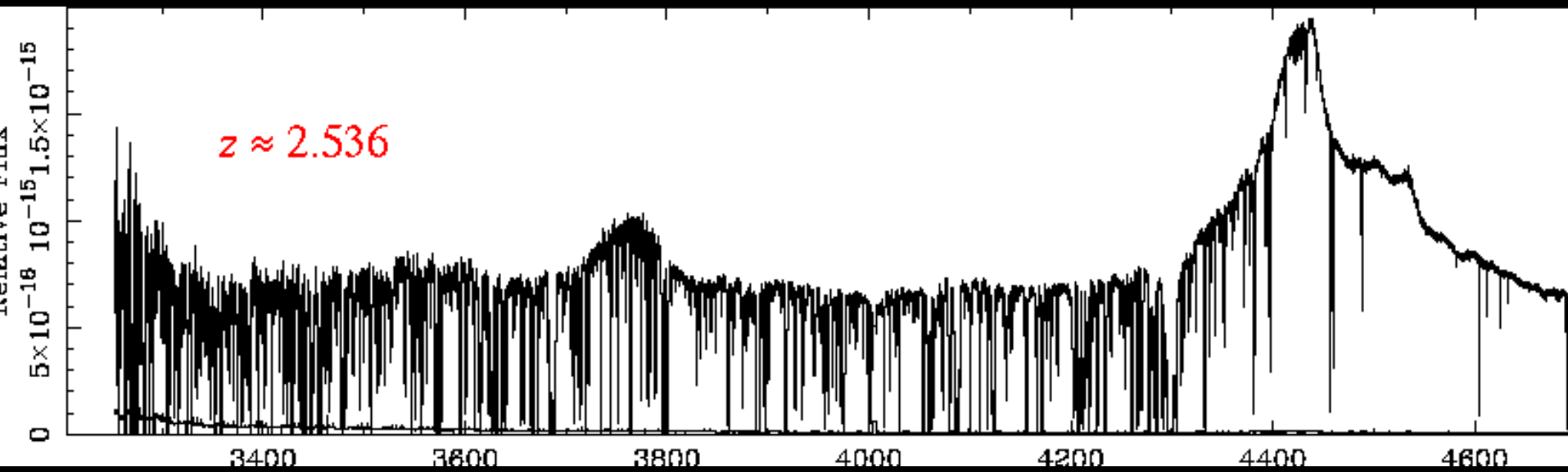
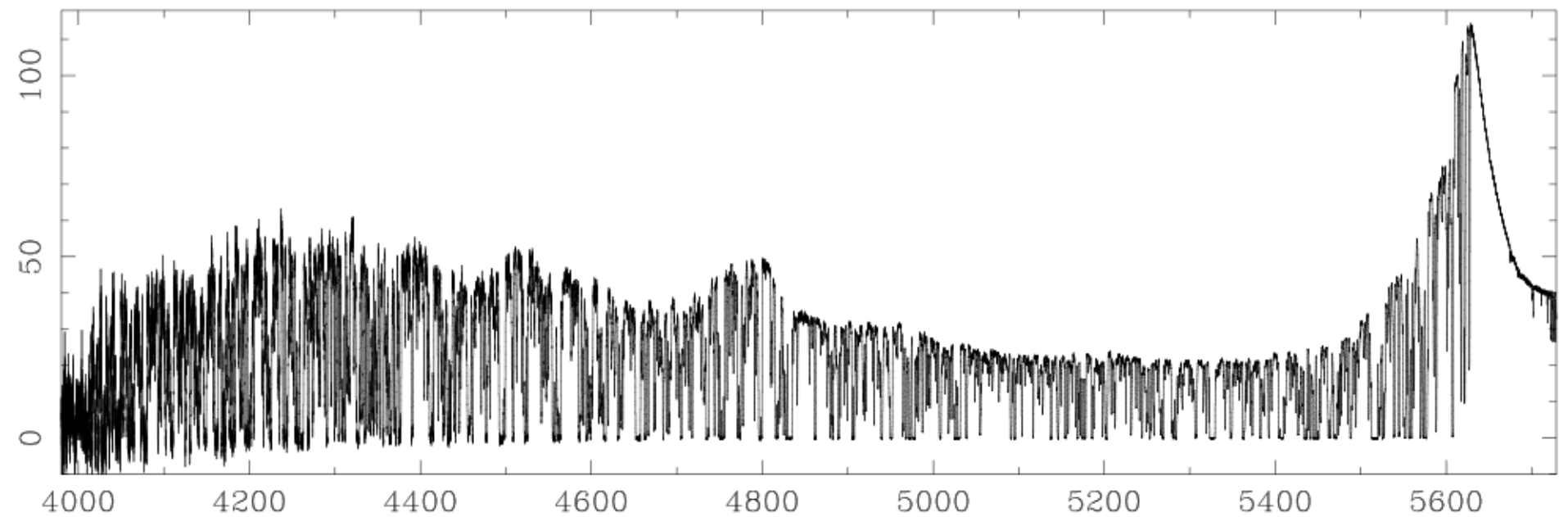
protons and
electrons...

...combine
to form
neutral
atoms

....which
are then
ionised
again

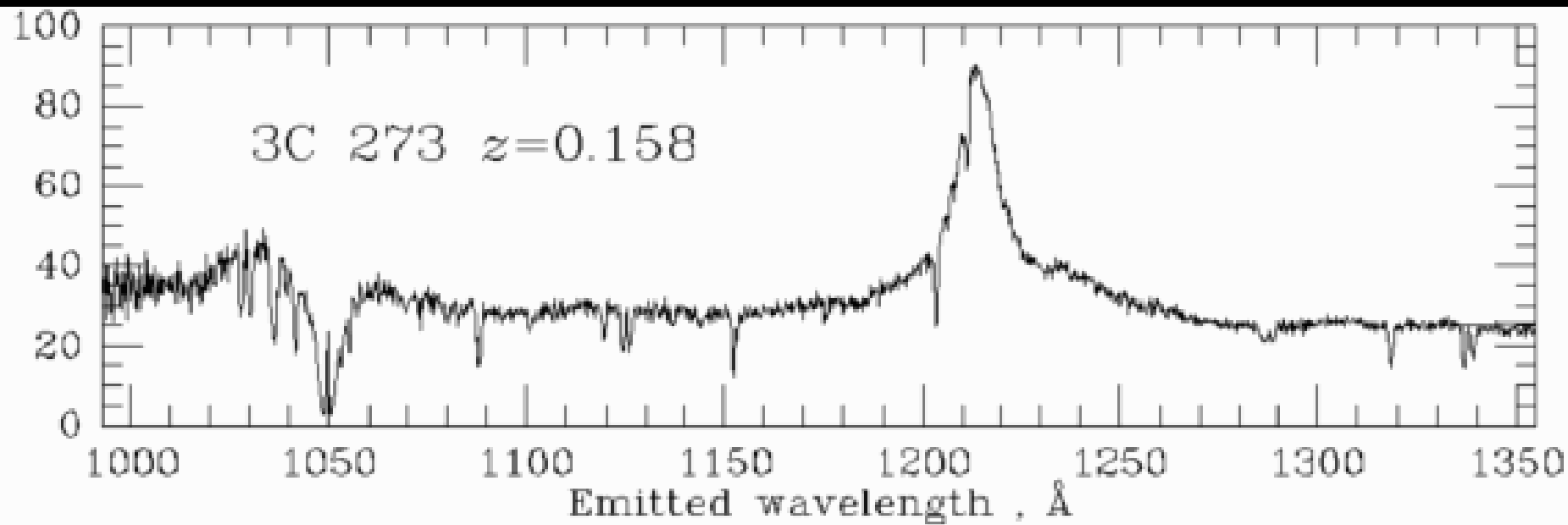




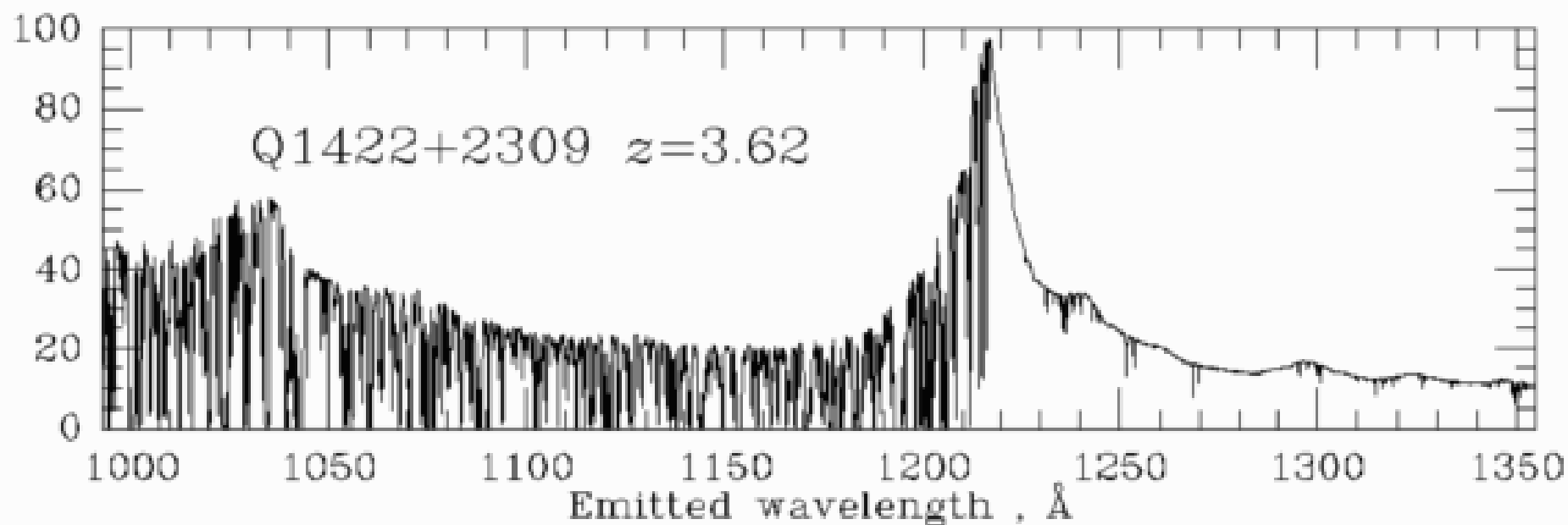


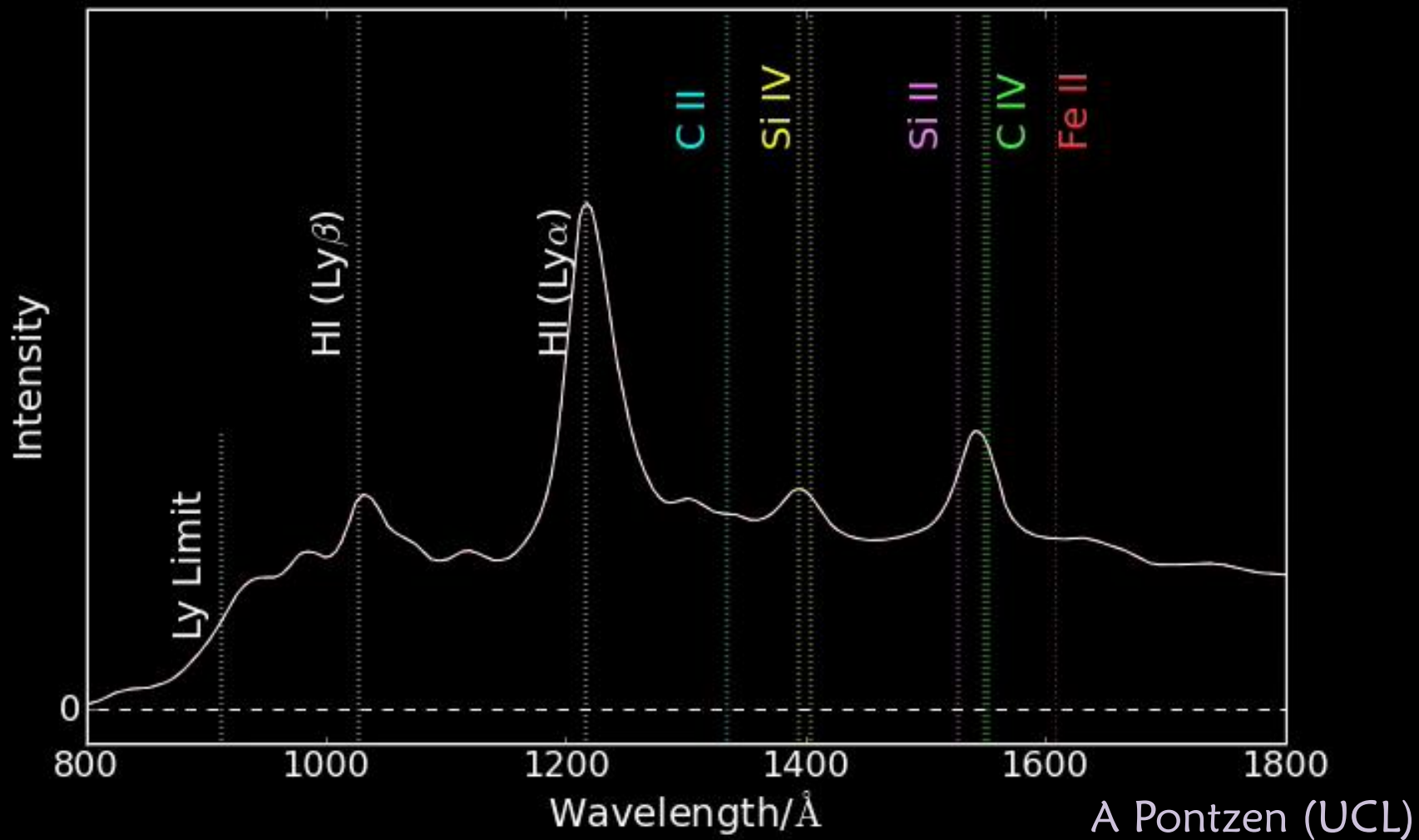
Womble et al 1996

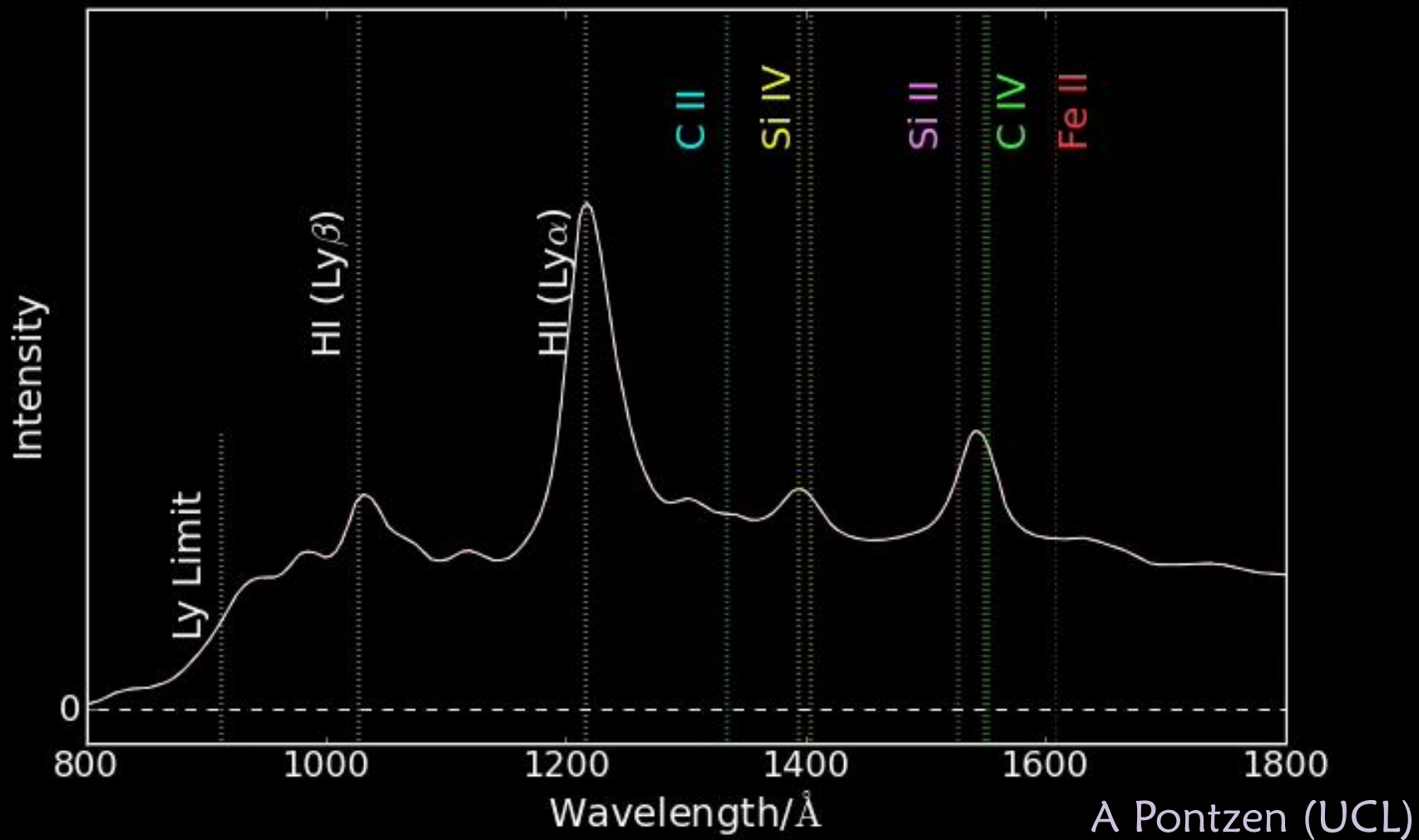
Intensity

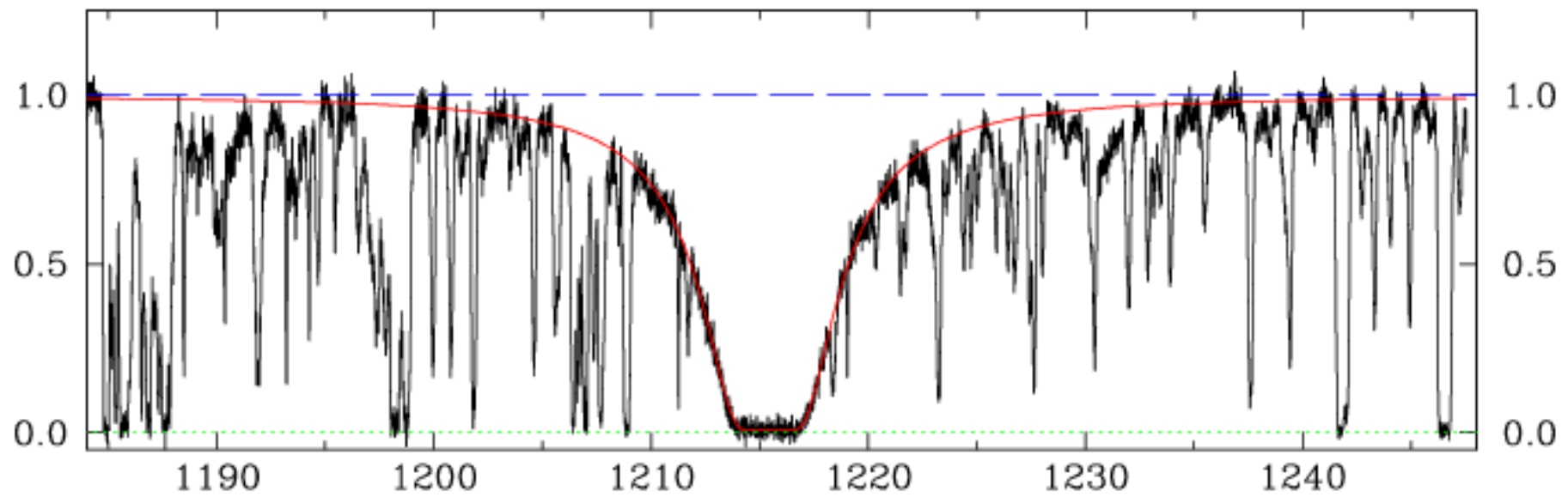
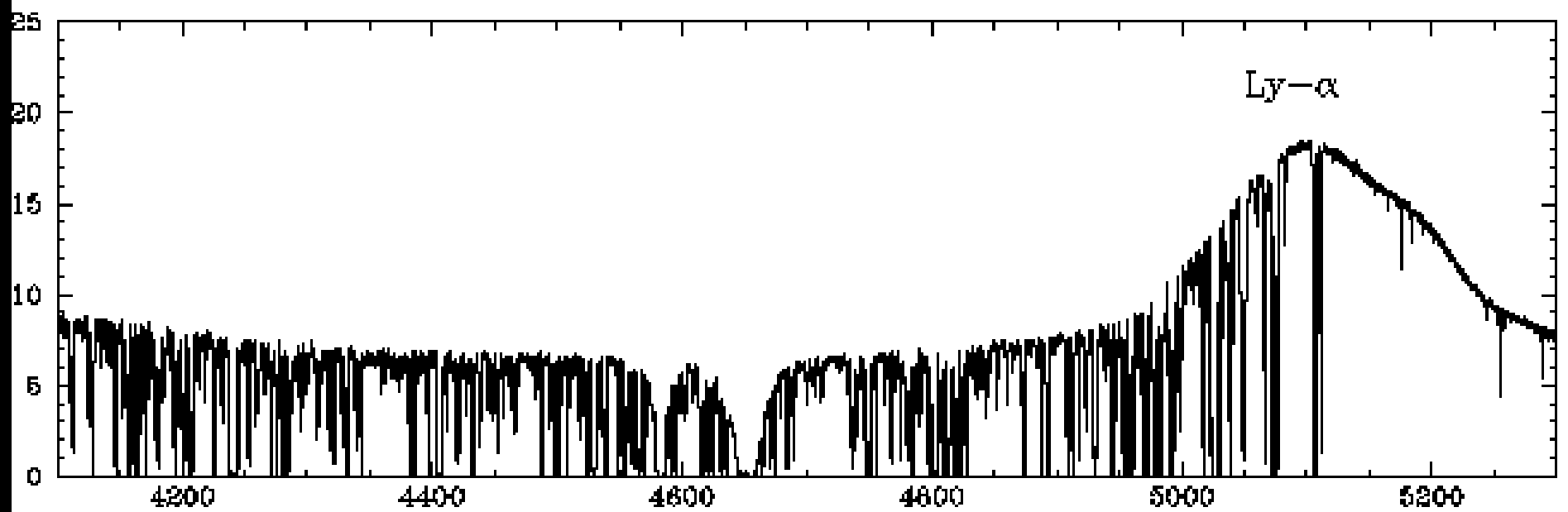


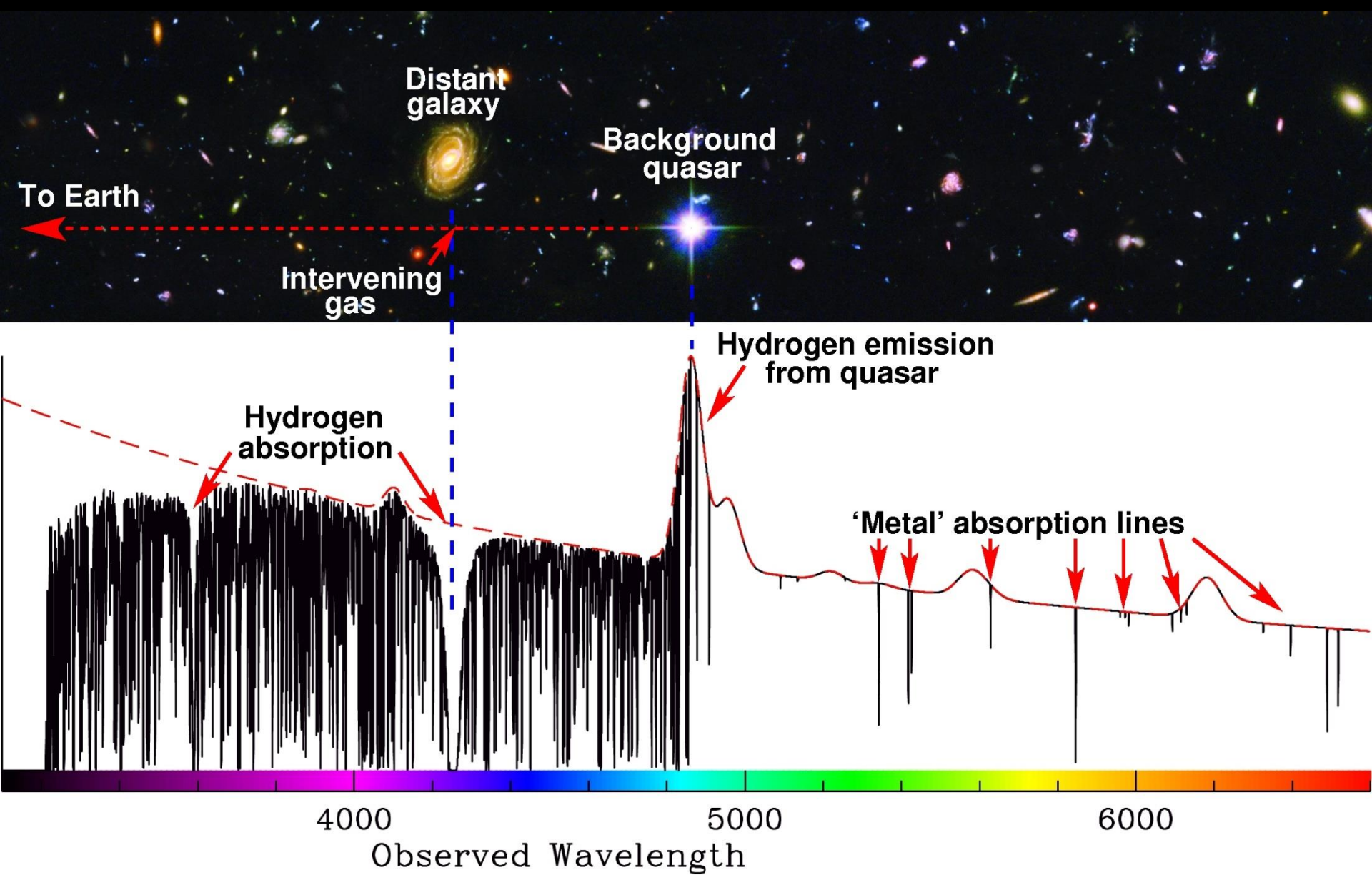
Intensity











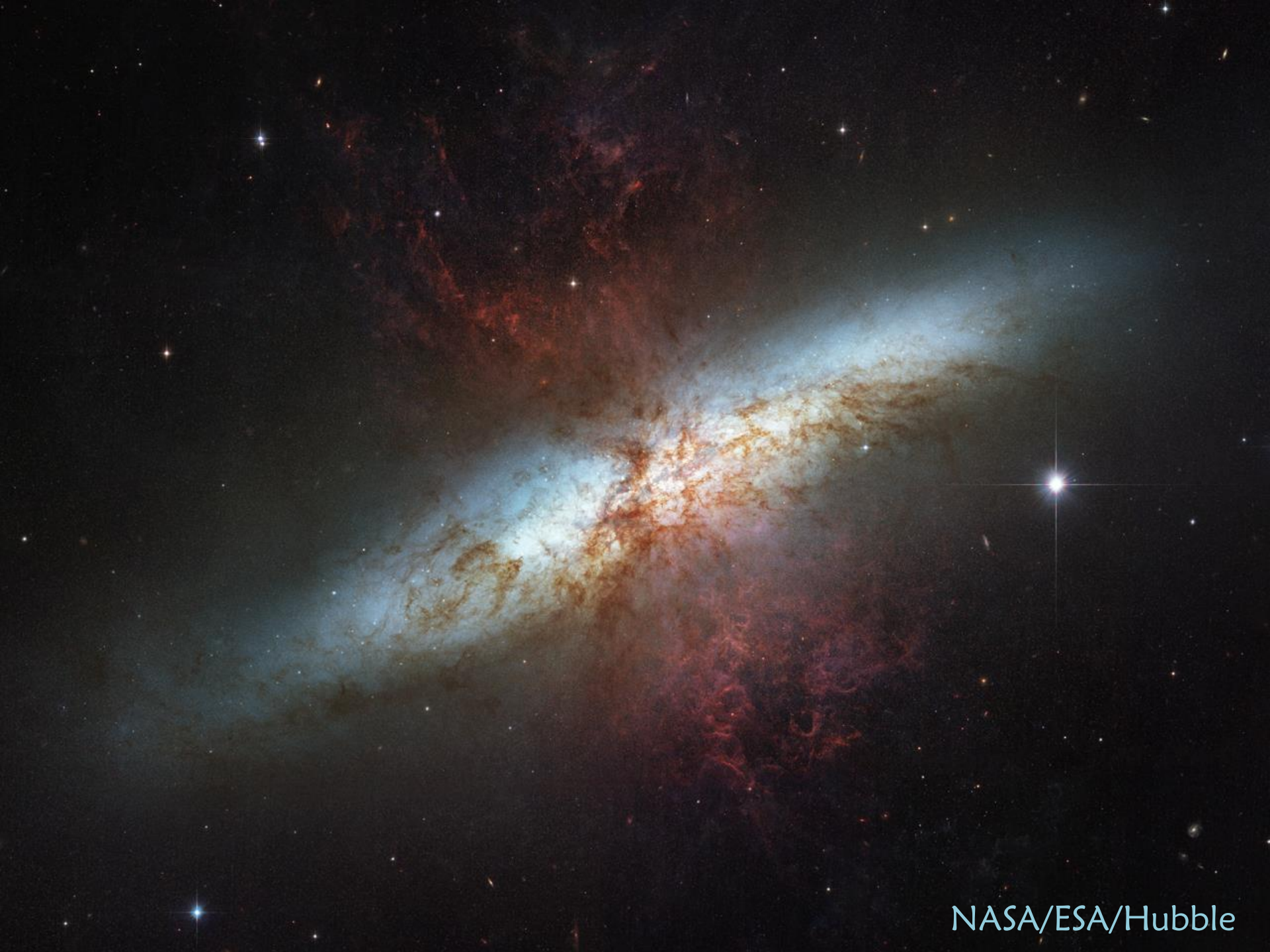


NASA/ESA/Reiss & Rodney

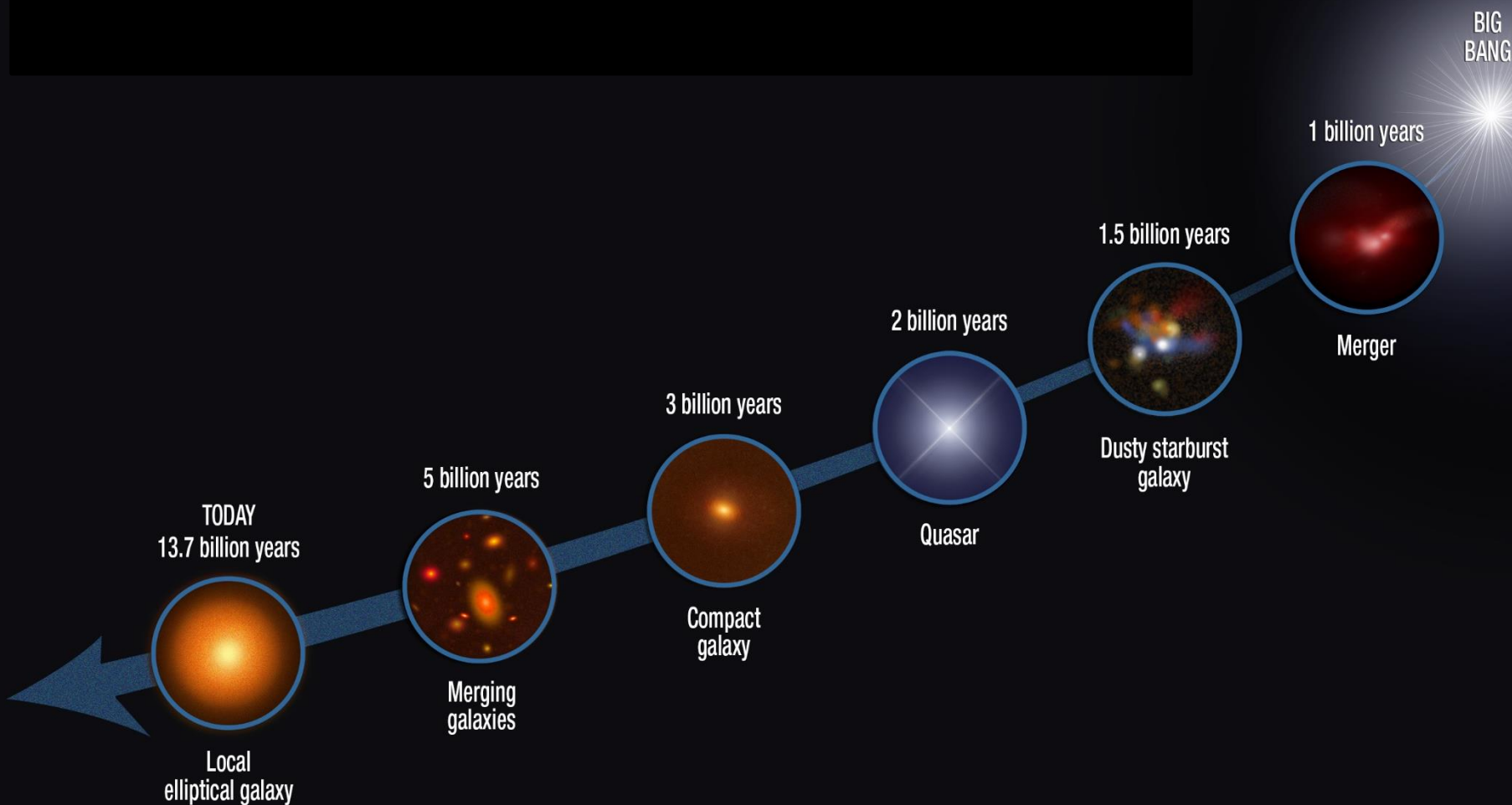


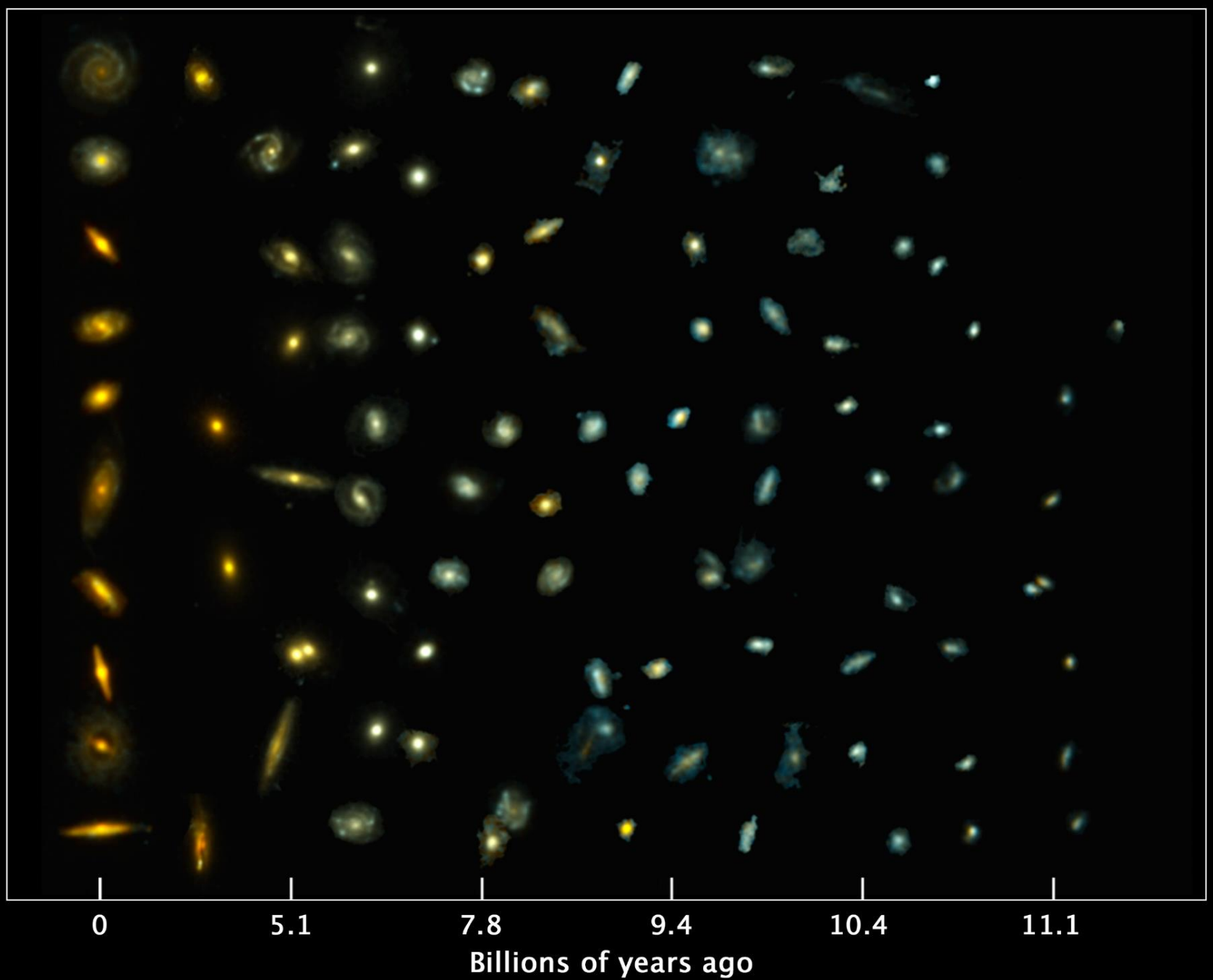
NASA/ESA/Riess



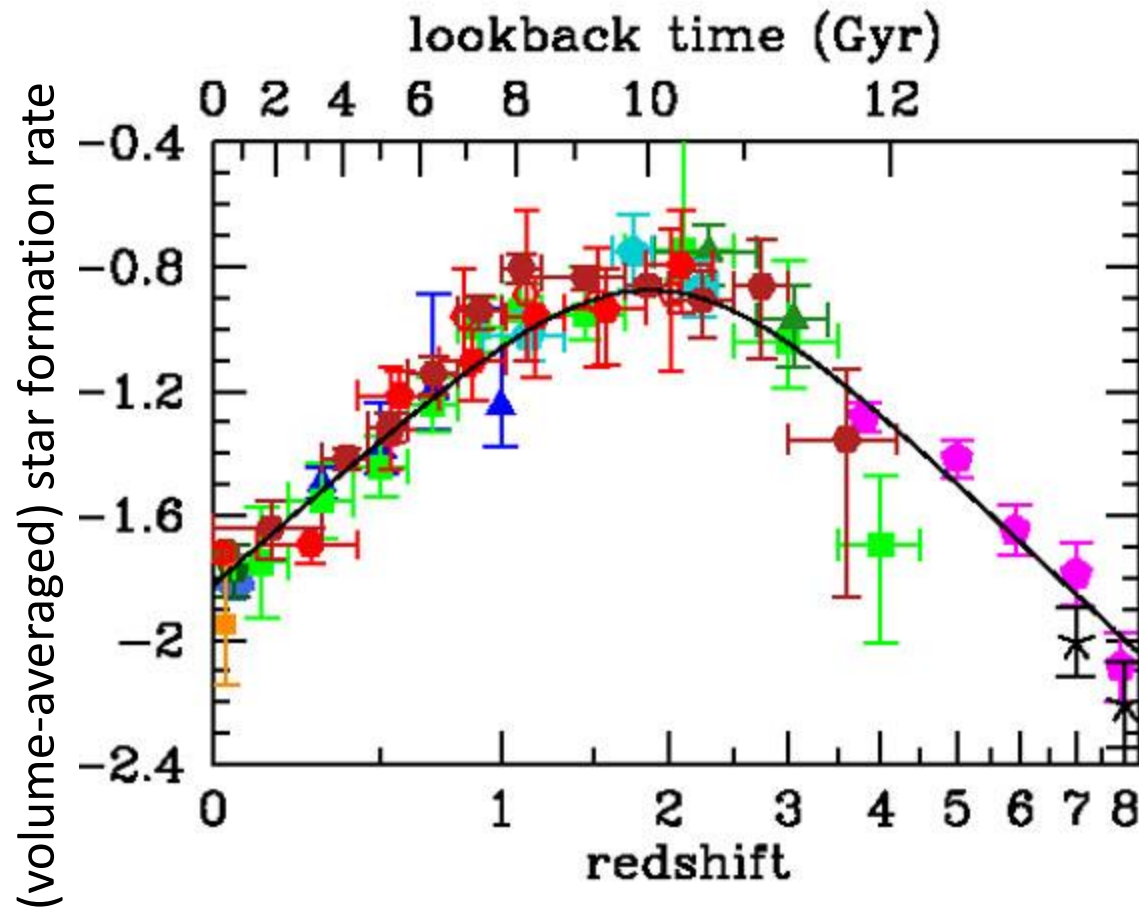


NASA/ESA/Hubble





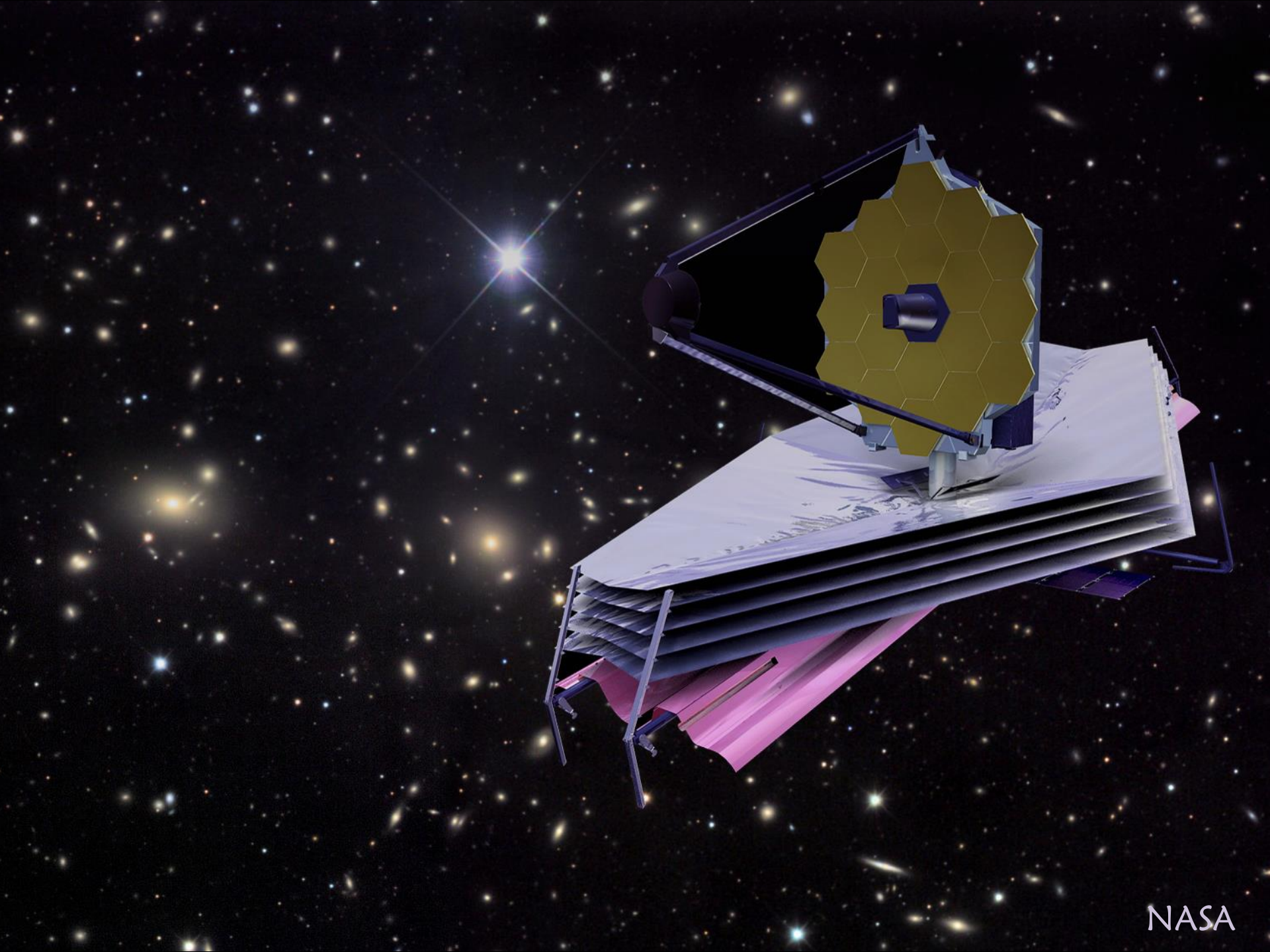
NASA/ESA/van Dokkum & Patel



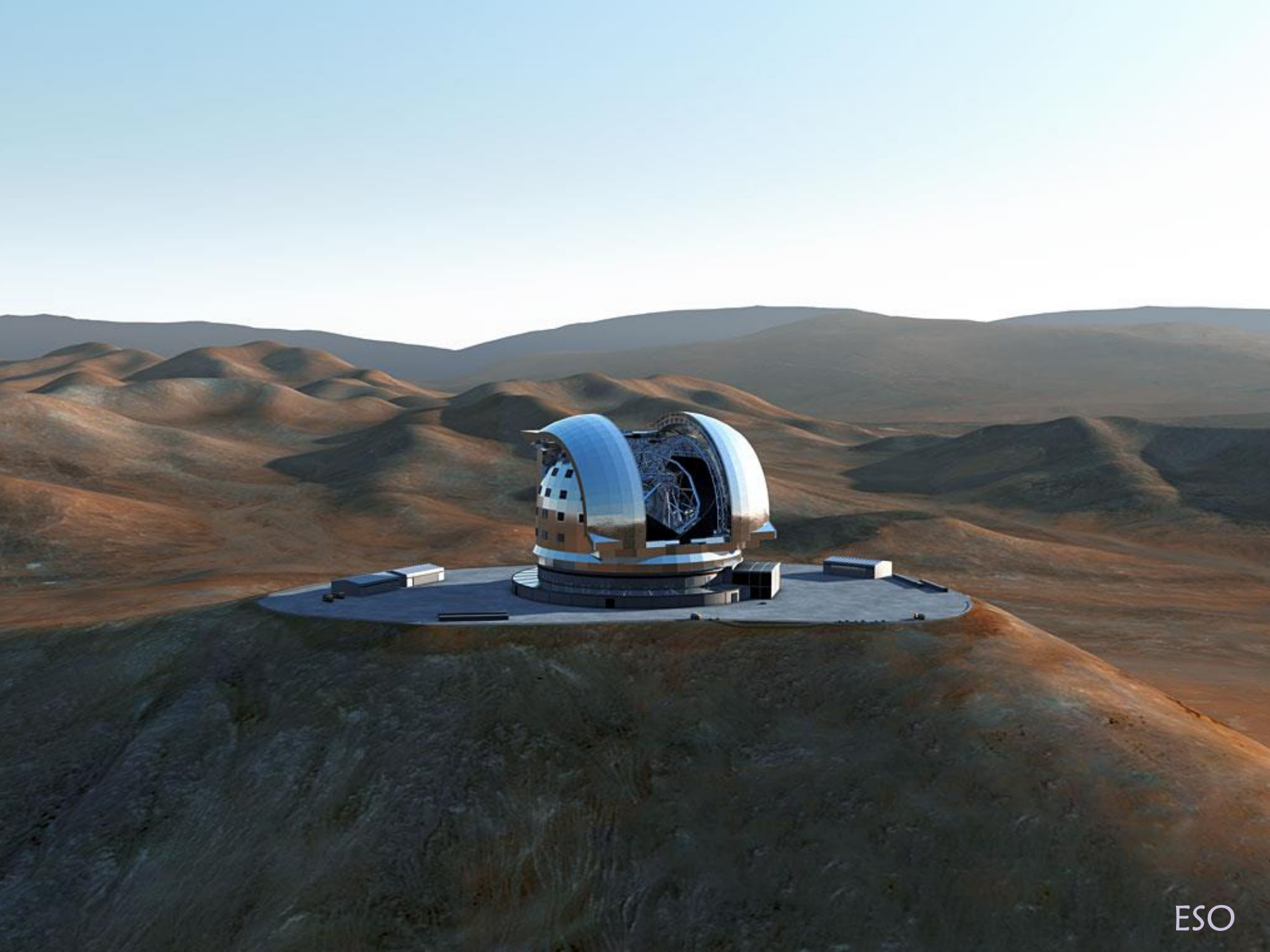




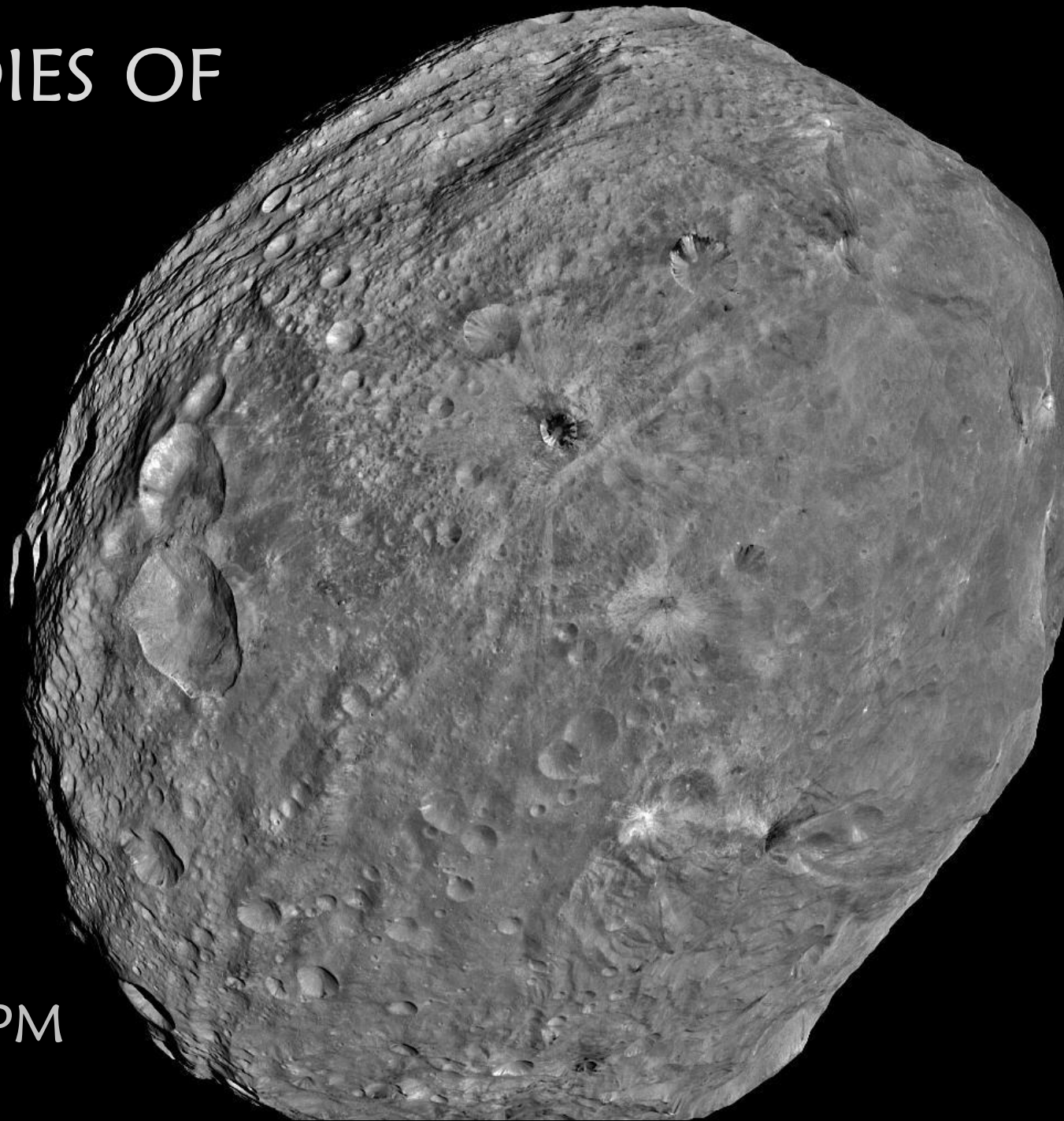
ALMA/ESO/NAOJ/NRAO



NASA



SMALL BODIES OF THE SOLAR SYSTEM



4TH MARCH 1PM