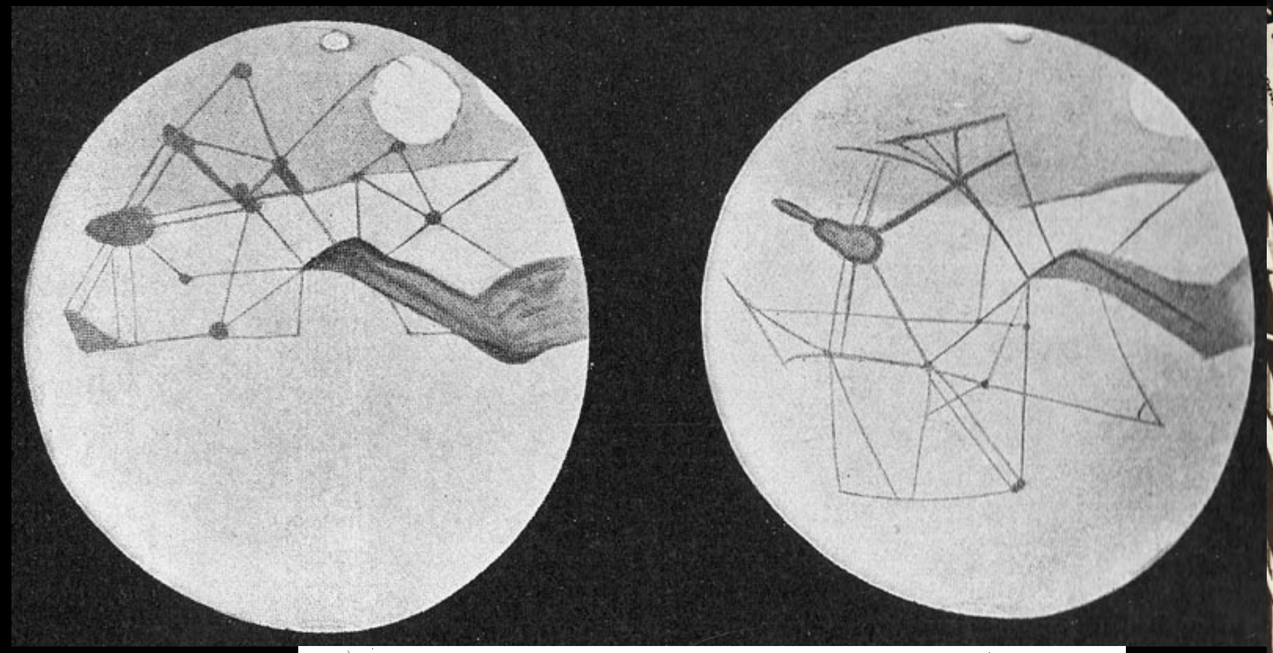
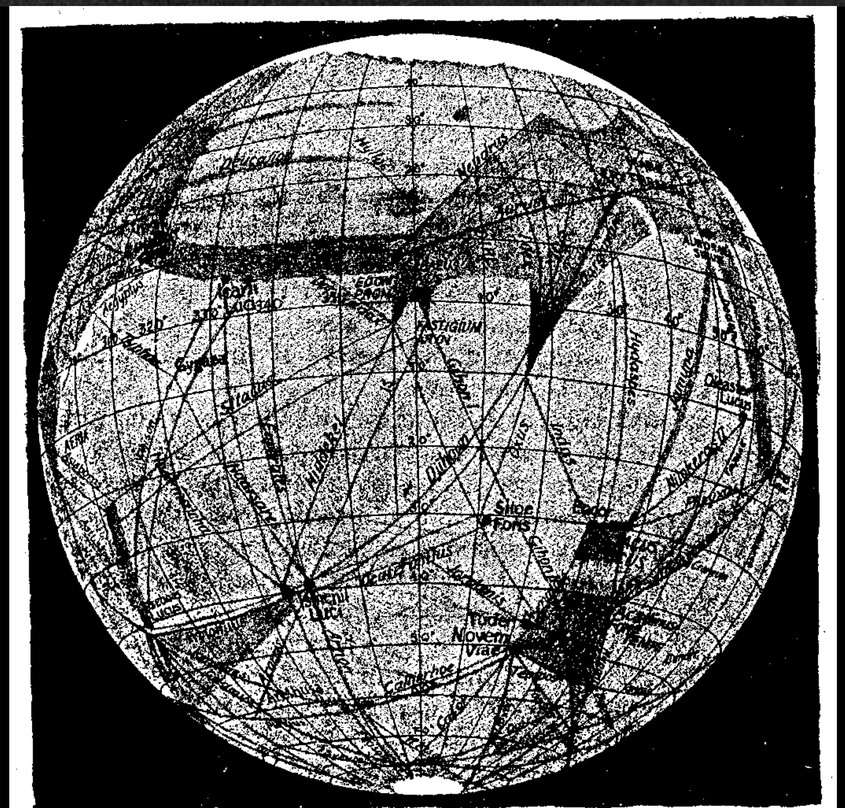
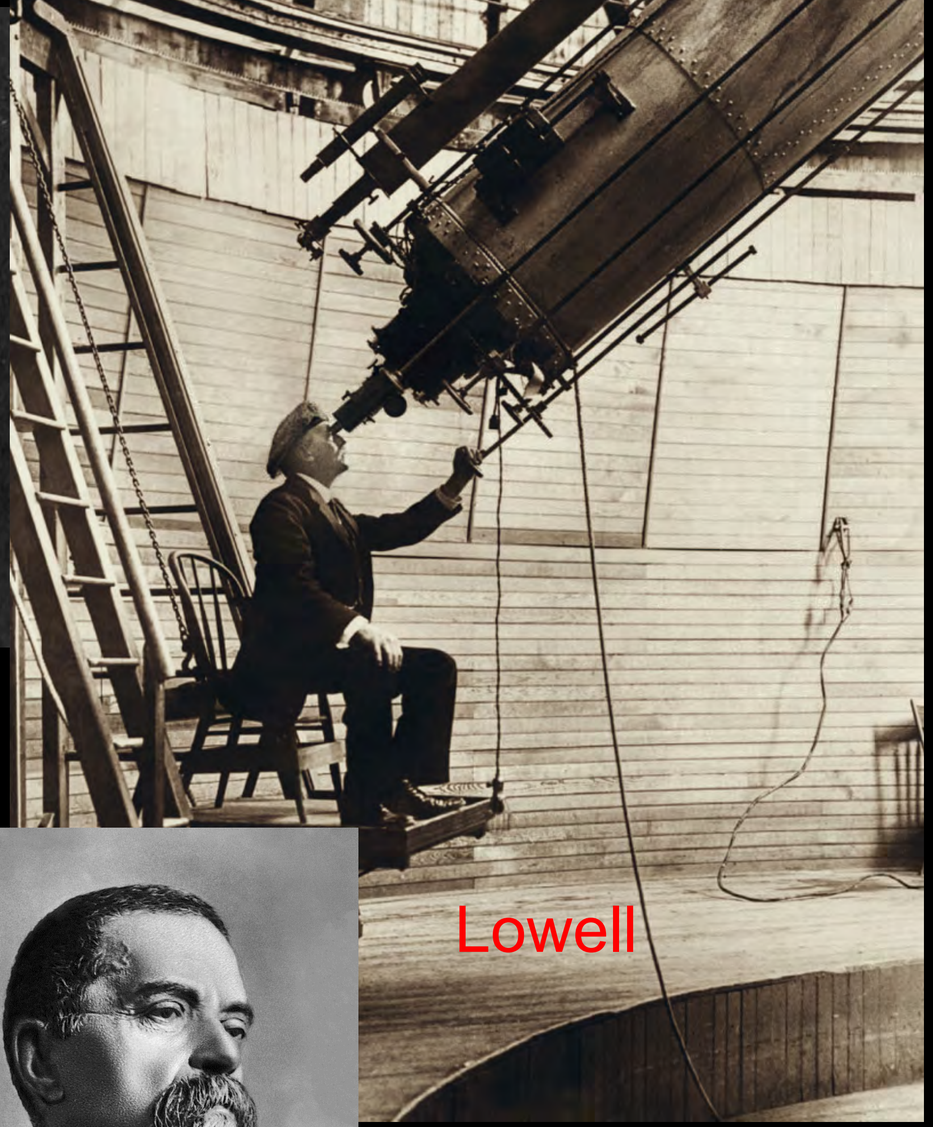
NUOVE FRONTIERE DELL'ASTRONOMIA

dal BIG-BANG alla vita

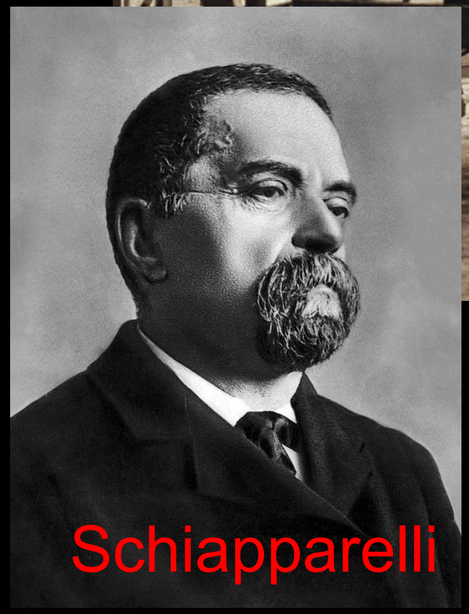
Massimo Tarenghi







Lowell



Schiapparelli

1900

Deuxième année. — N° 8. Huit pages : CINQ centimes Dimanche 19 Février 1899

LE PETIT MÉRIDIONAL

Supplément Illustré du Dimanche

ABONNEMENTS

	SIX MOIS	UN AN
France, Algérie, Tunisie	2 fr. »	3 fr. 50
L'étranger (Union postale)	2 fr. 50	5 fr. »

Direction, Rédaction, Administration : Rue Henri-Guinier, MONTPELLIER

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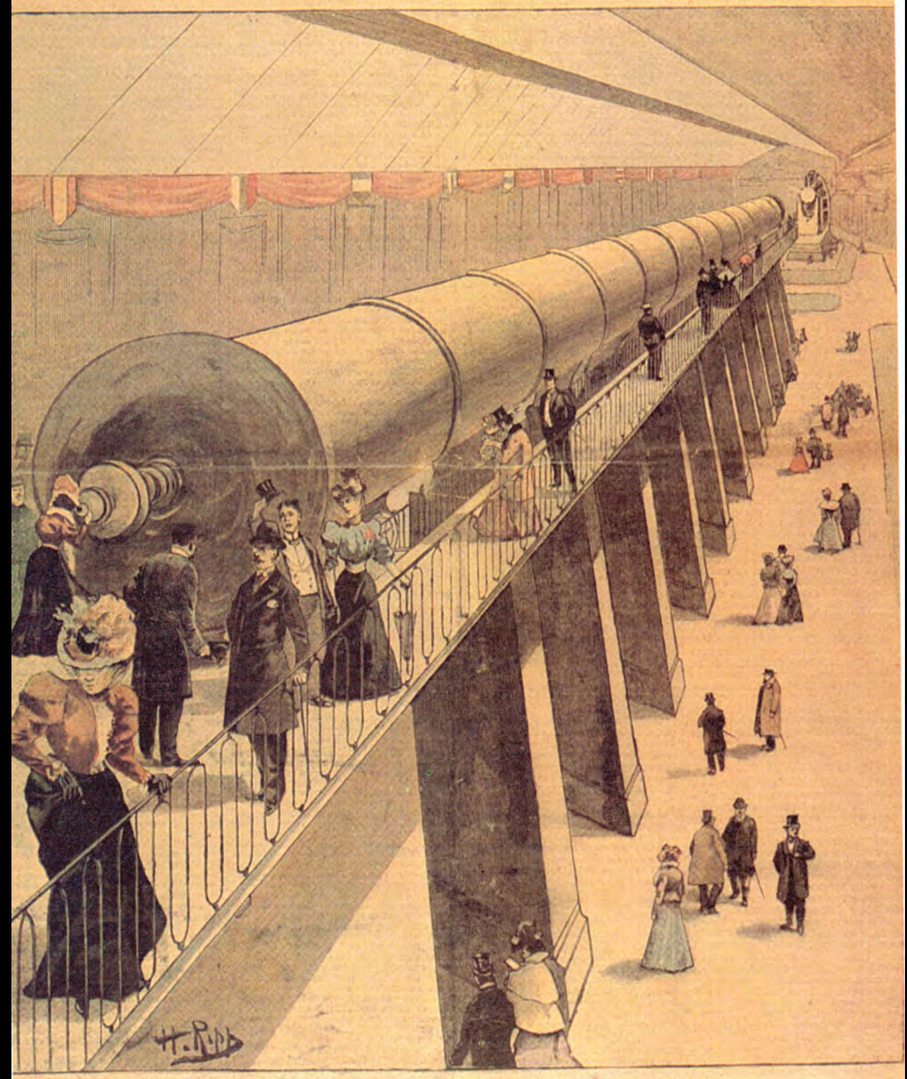


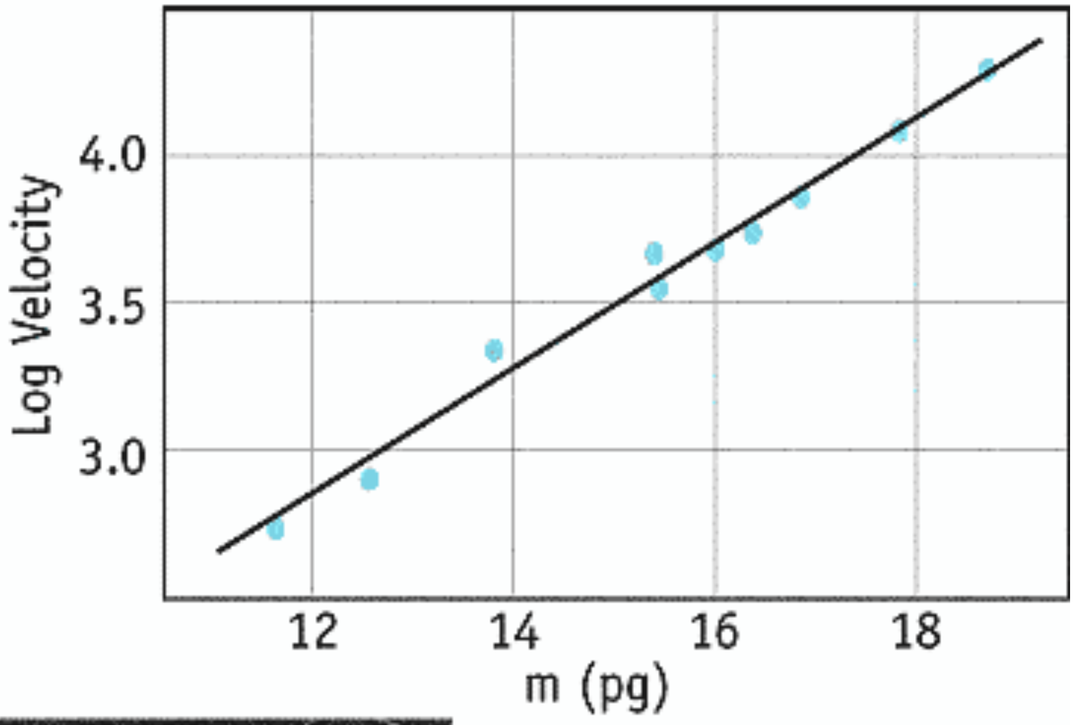
Une des merveilles de l'exposition de 1900.

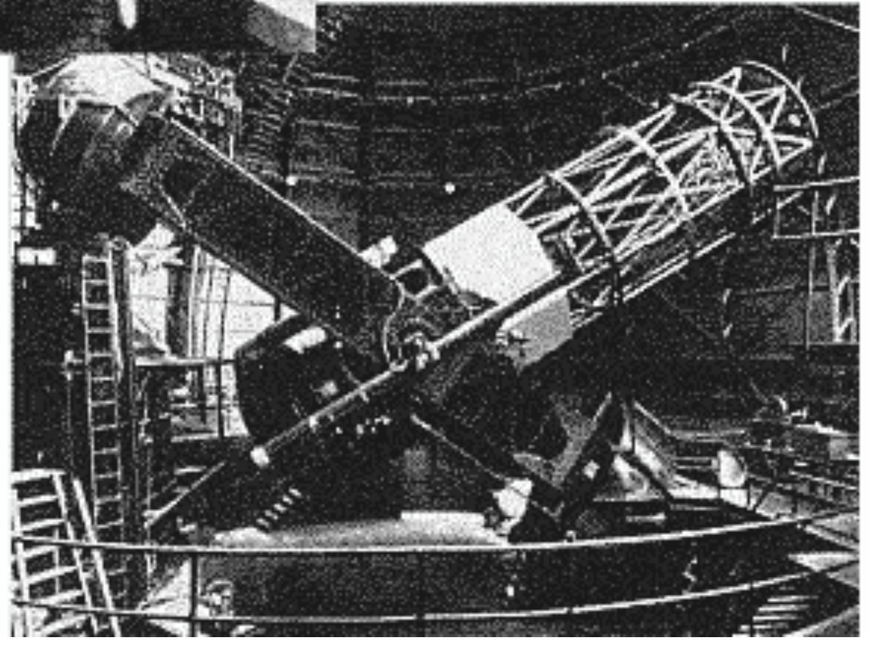
La lunette monstre qui mettra la Lune à quelques lieues de la Terre.

1915 Einstein

$$R_{\mu\nu} - \frac{1}{2} g_{\mu\nu} R + g_{\mu\nu} \Lambda = \frac{8\pi G}{c^4} T_{\mu\nu}$$

Edwin Hubble





Mt. Wilson
100 Inch
Telescope

1924 un sogno
un Telescopio di 8m

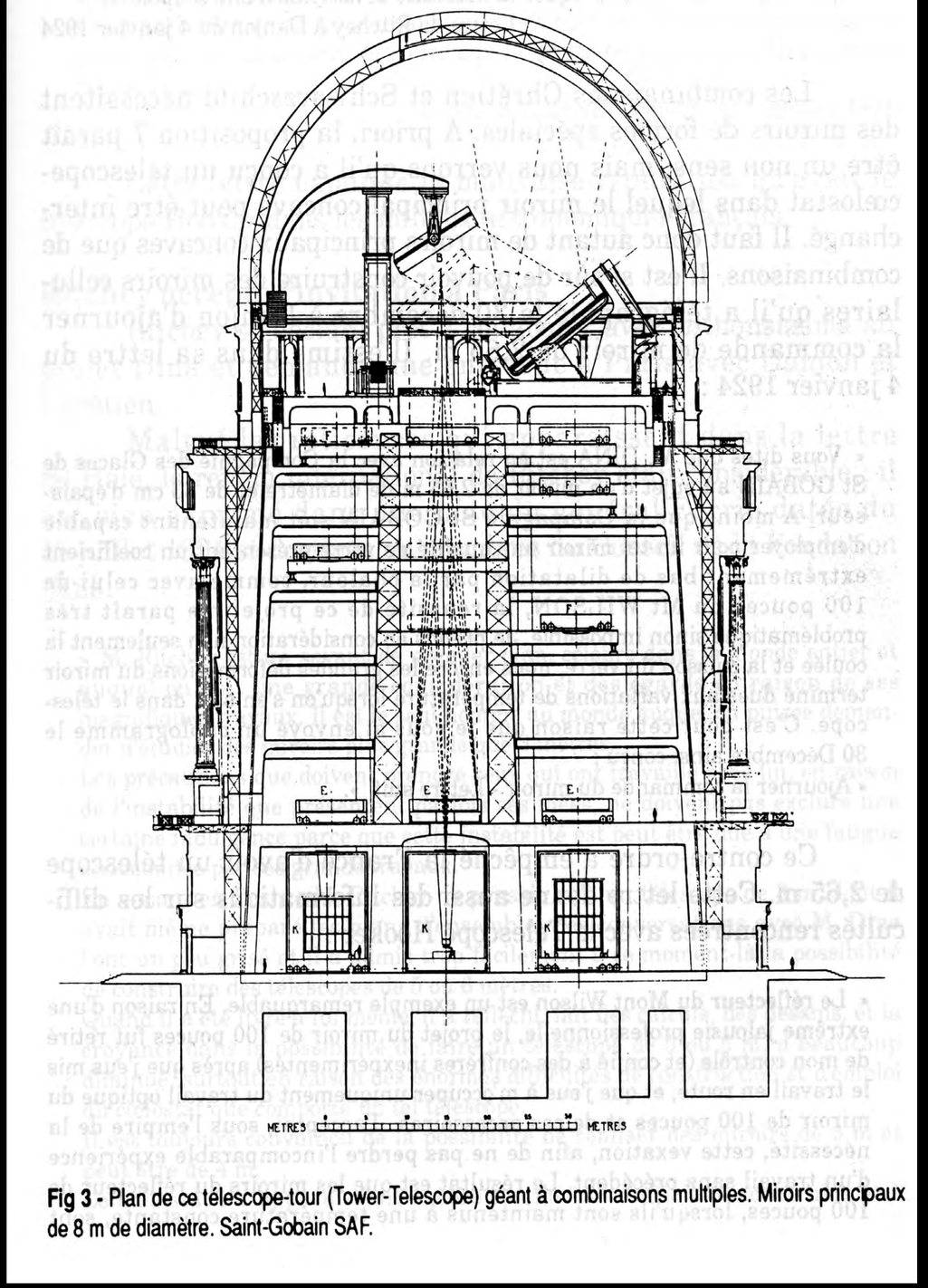


Fig 3 - Plan de ce télescope-tour (Tower-Telescope) géant à combinaisons multiples. Miroirs principaux de 8 m de diamètre. Saint-Gobain SAF.

1932

Specchio a tasselli

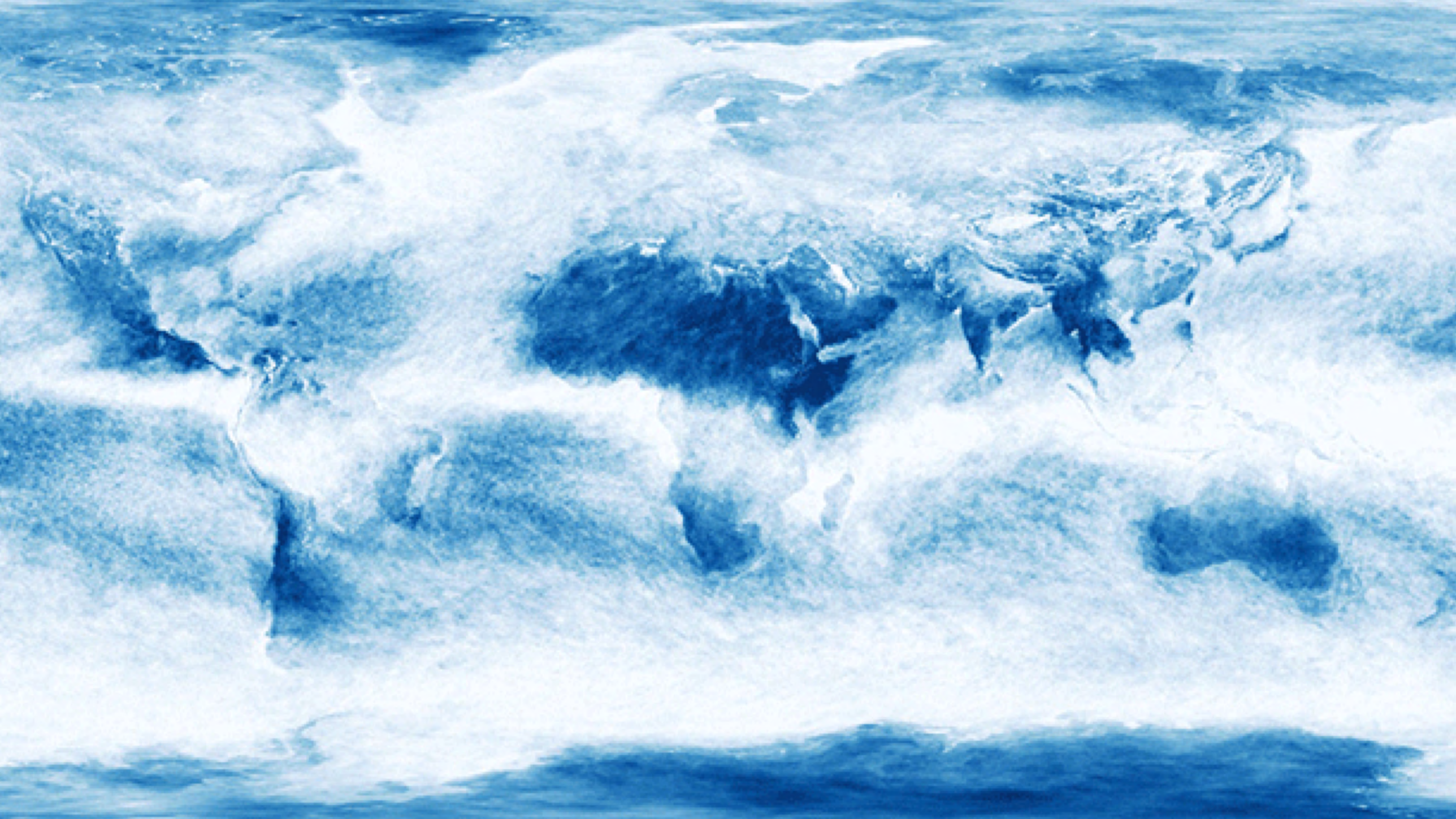
“Telescopi dell’avvenire e specchi a tasselli”

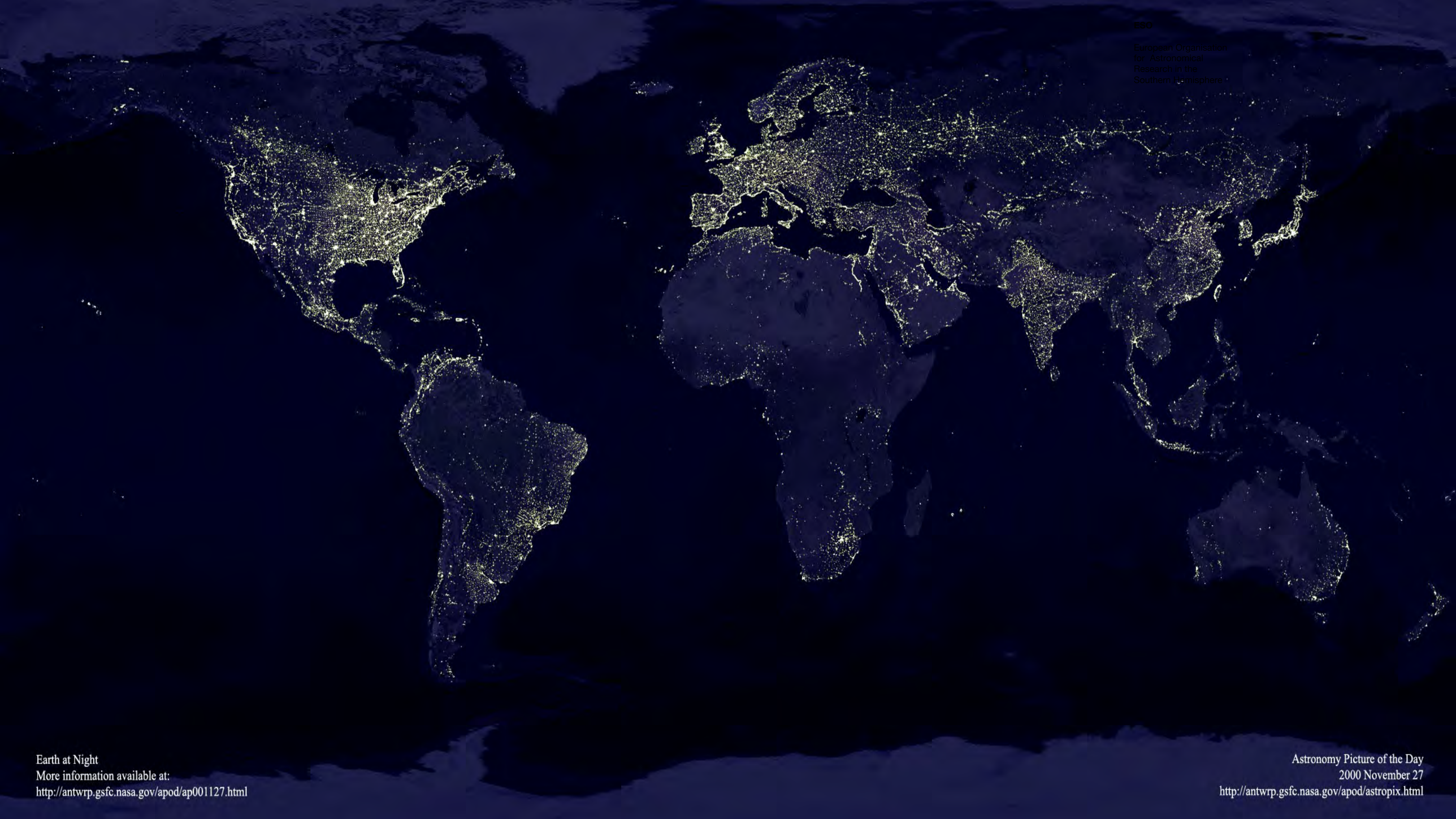
Coelum 1932, p120

PALOMAR 5m

1949

BTA 6m
1975



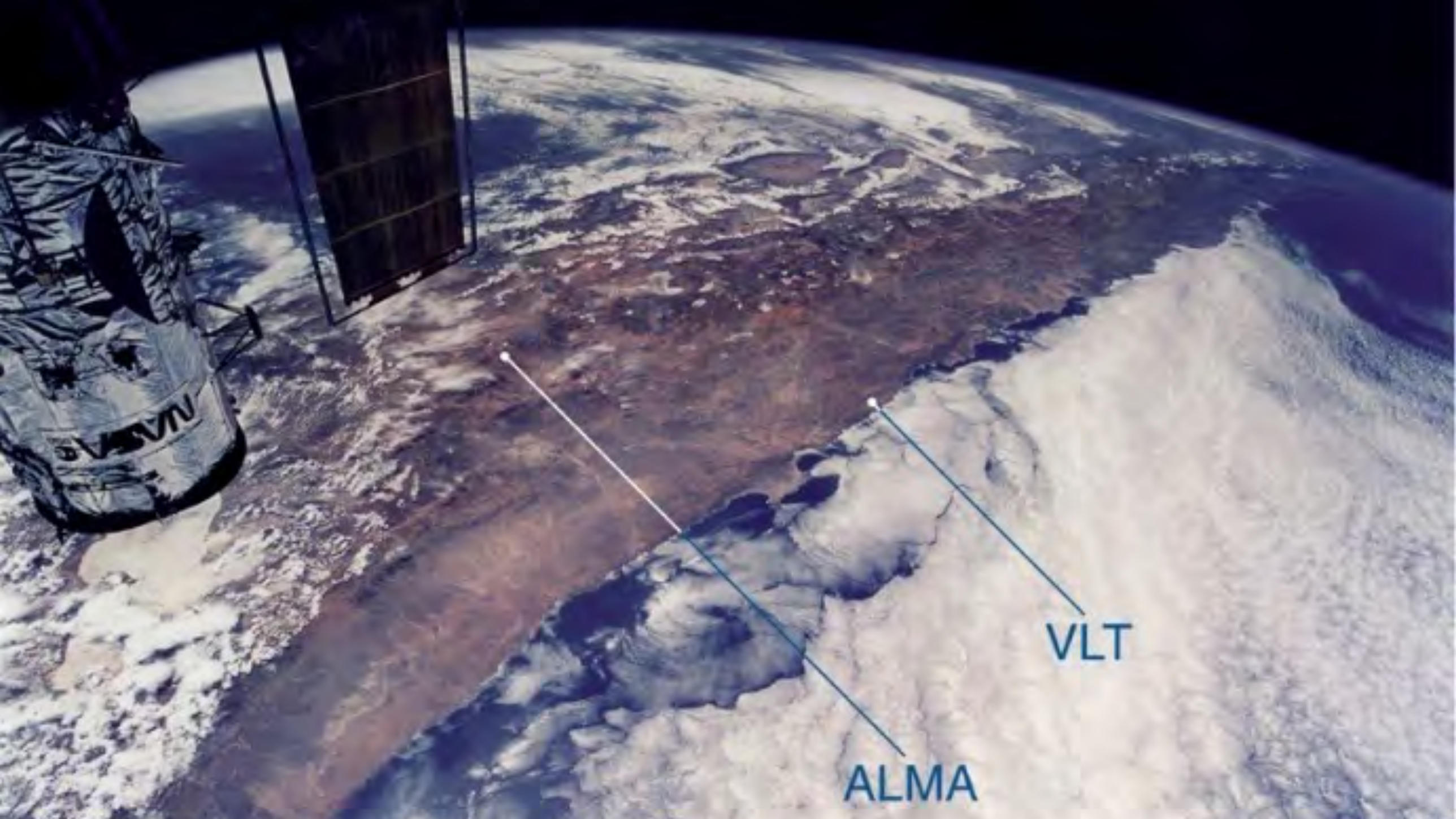


Earth at Night
More information available at:
http://antwrp.gsfc.nasa.gov/apod/ap001127.html

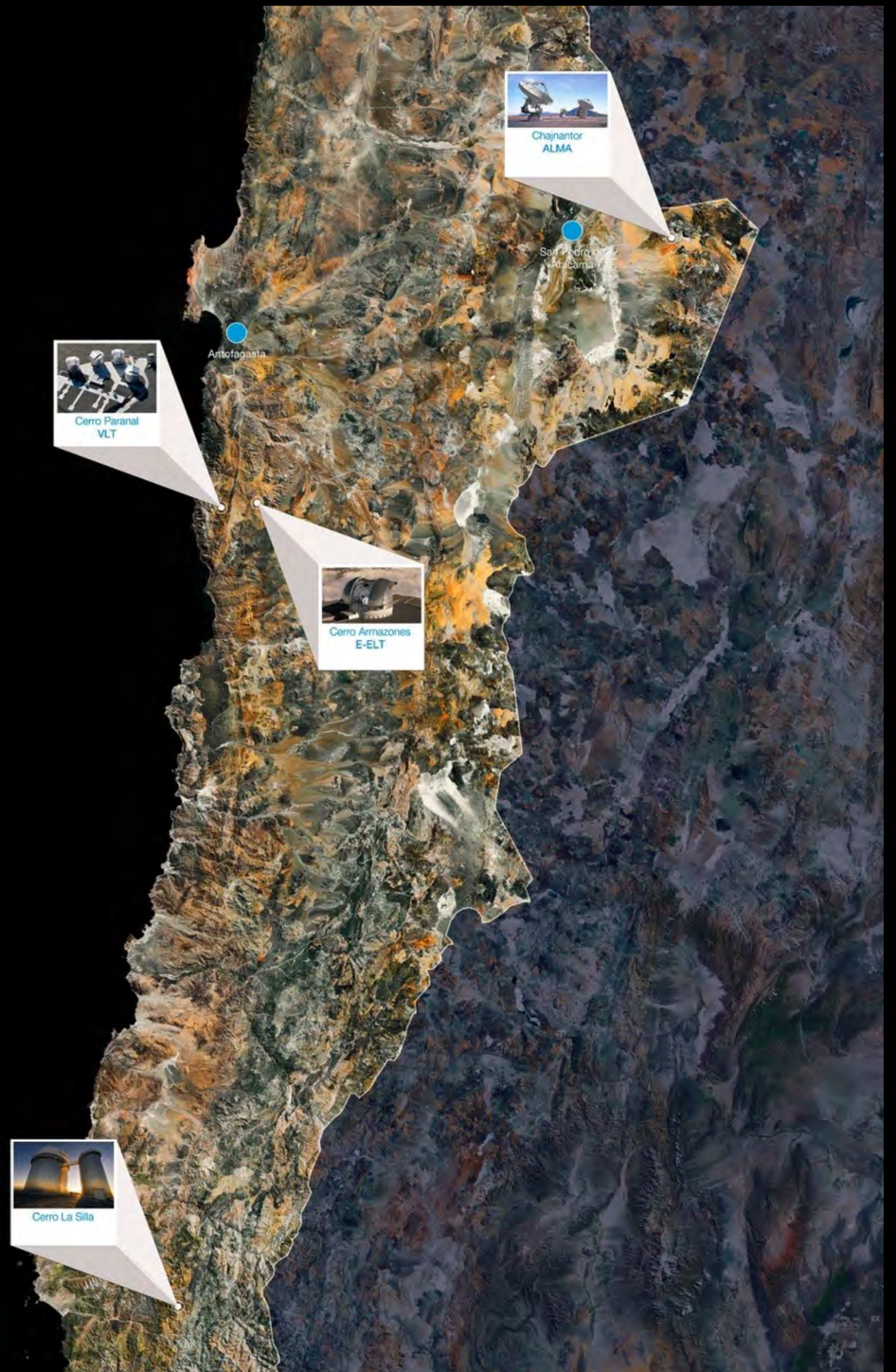
Astronomy Picture of the Day
2000 November 27
http://antwrp.gsfc.nasa.gov/apod/astropix.html


Cerca su Google Maps
Alberto
7
CHILE
about 4300km long
Mappa
Google
Immagini ©2015 Data SIO, NOAA, U.S. Navy, NGA, GEBCO,Landsat,U.S. Geological Survey,PGC/NASA,Dati cartografici ©2015 Google,INEGI
Termini
Privacy
Invia feedback
500 km

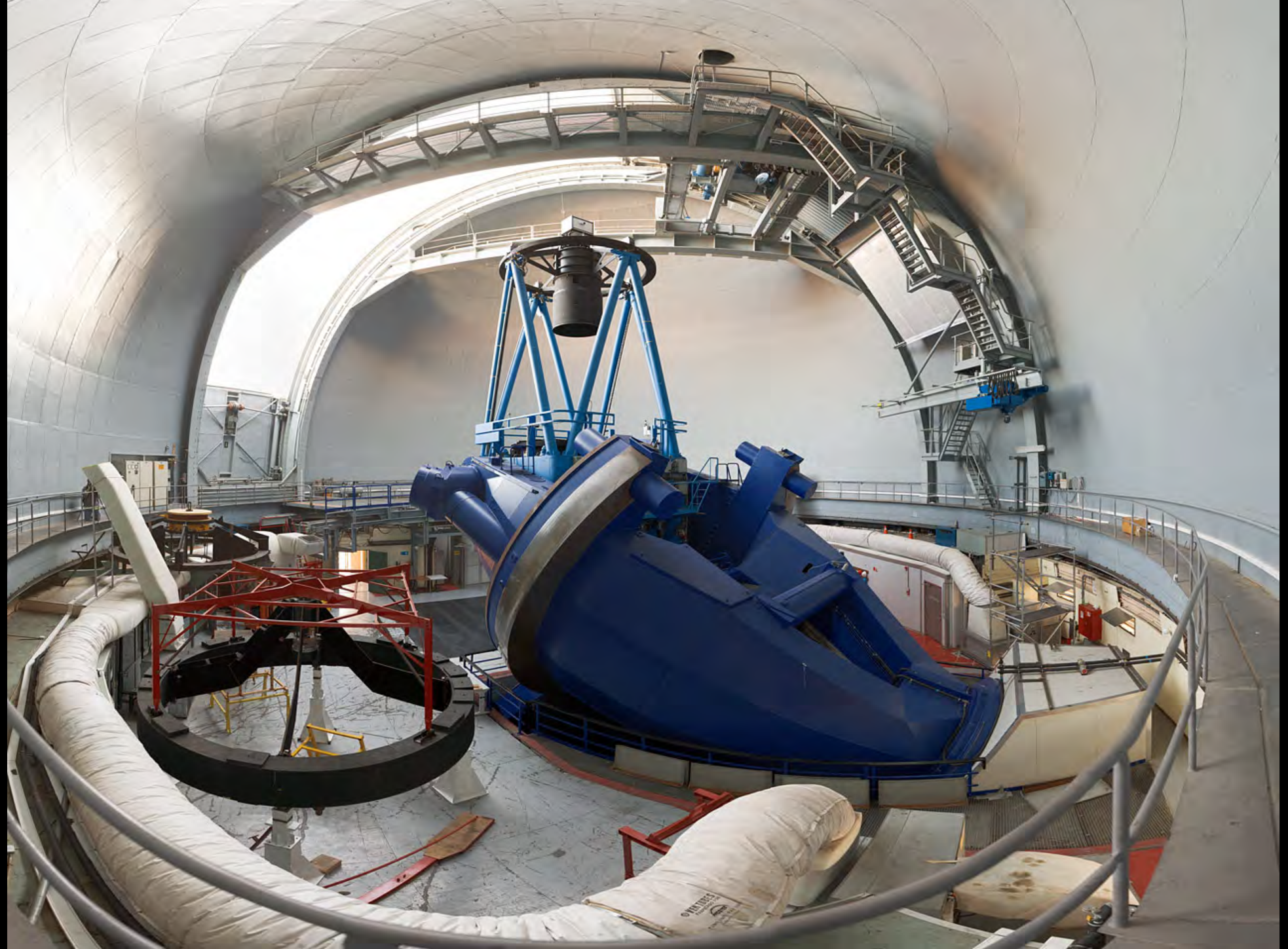

google.it
Google Maps
Screenshot dello schermo del Mac e opzioni di cattura [Guide SlideToMac] - SlideToMac Blog
Cerca su Google Maps
DESERTO DI ATACAMA
LE MIGLIORI CONDIZIONI DEL MONDO.....
...PER COSTRURE UN OSSERVATORIO....
MA NON PER VIVERCI
IL PIU SECCO DESERTO DEL MONDO
Calama
Eduardo Avaroa National Reserve of...
Alberto
Hornitos
Sierra Gorda
San Pedro de Atacama
Mejillones
Toconao
Reserva Nacional Los Flamencos
Antofagasta
Zorras
Paposo
Toro
Taltal
Diego de Almagro
El Salvador
Chañaral
2015 Google


VLT
ALMA

ESO in Chile

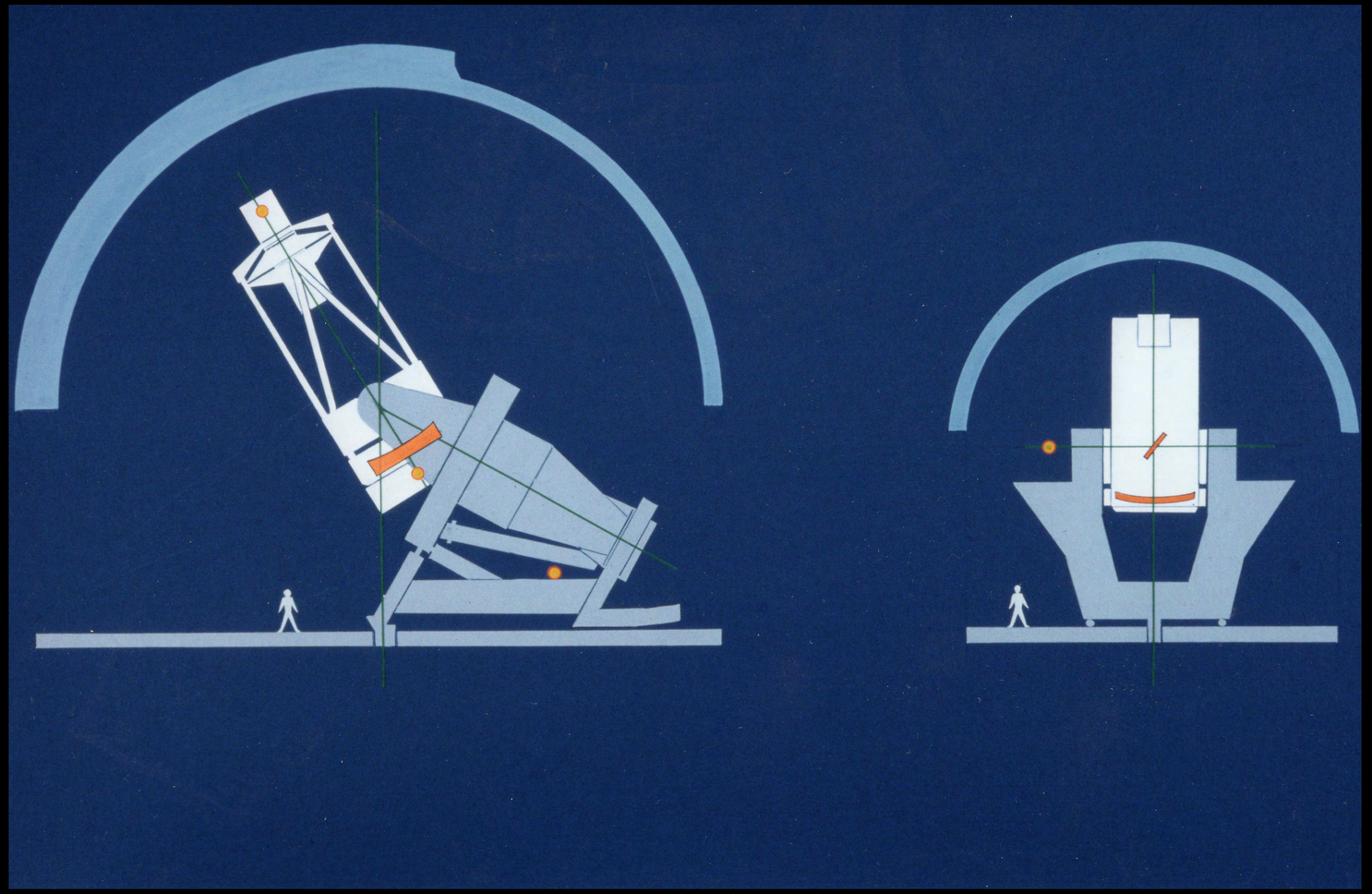

Chajnantor
ALMA
Antofagasta
Cerro Paranal
VLT
Cerro Armazones
E-ELT
Cerro La Silla

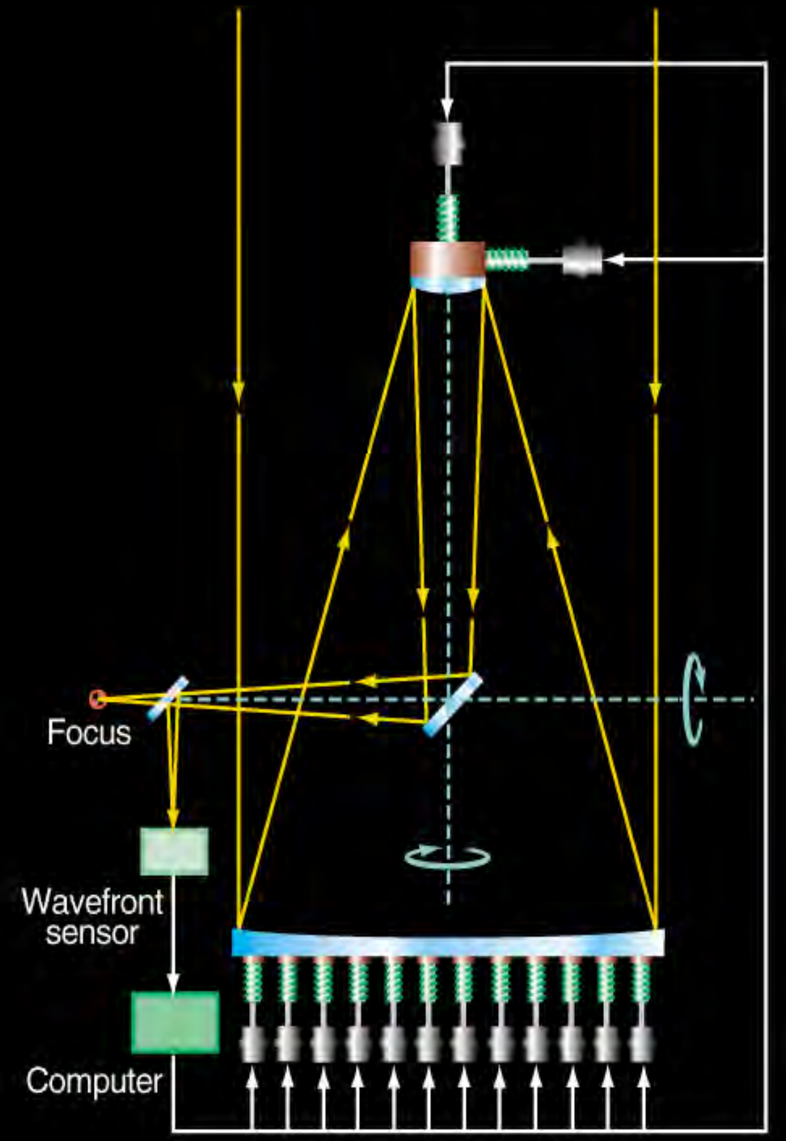

THE 3.6




PARE


ITALIAN BLANK



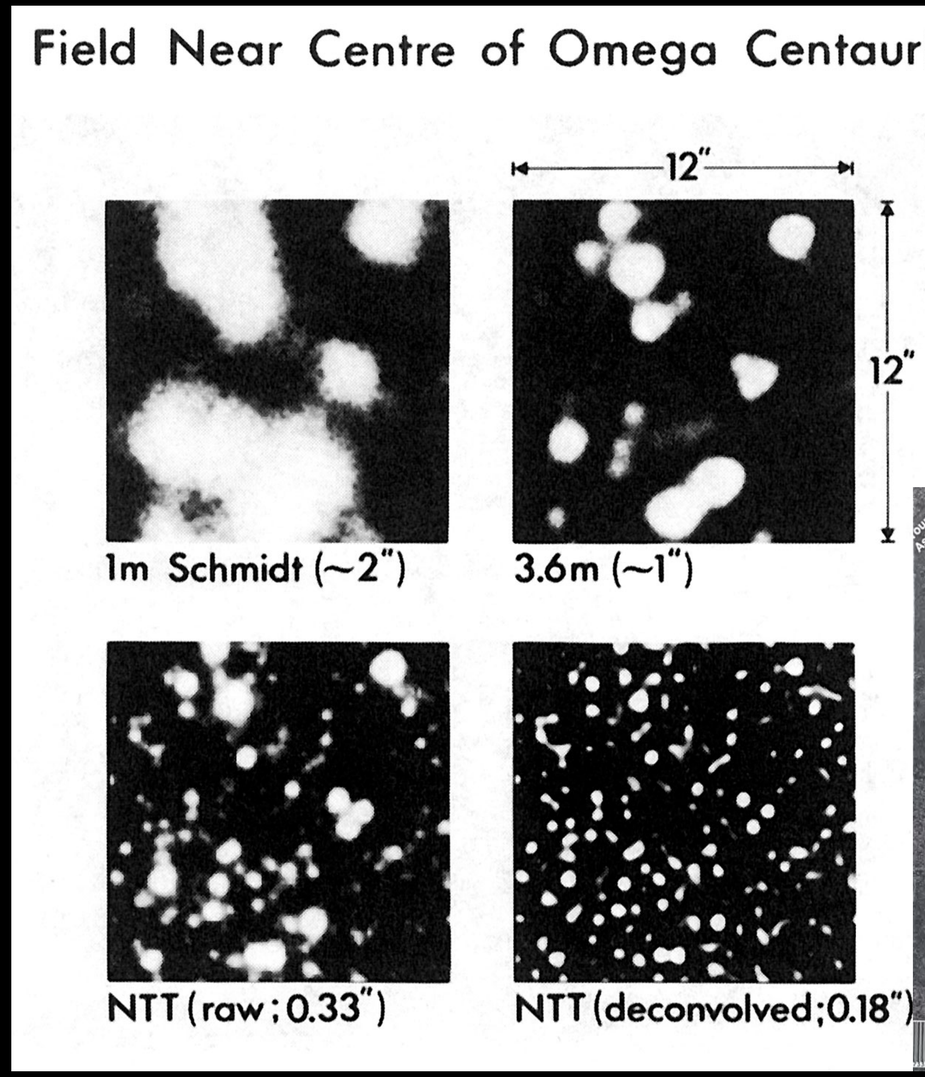


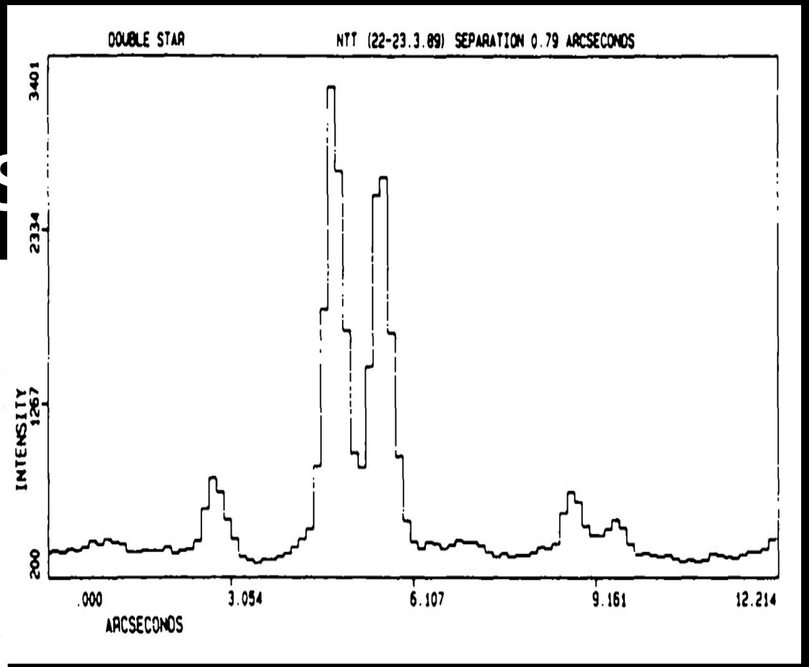
VLT Active Optics System

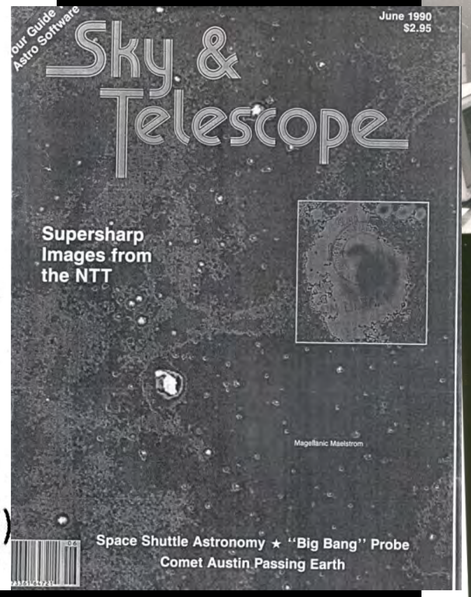
ESO PR Photo 34b/99 (13 August 1999)

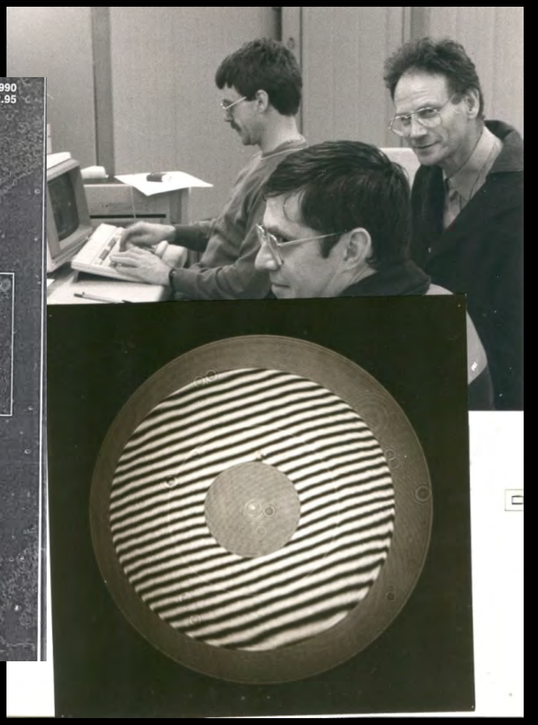

ESO NTT
INNSE

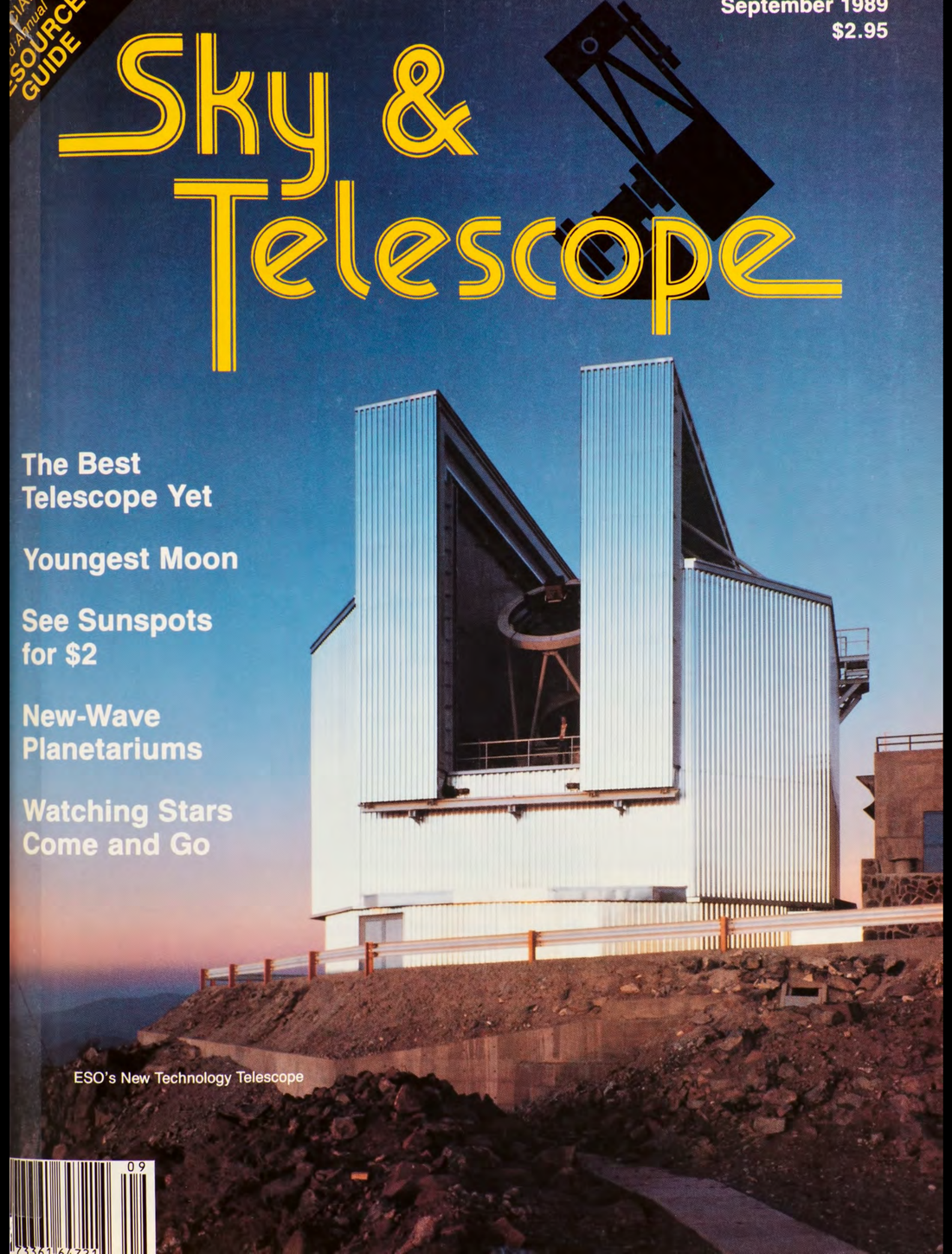
NTT Firs


Field Near Centre of Omega Centauri
12"
12"
1m Schmidt (~2")
3.6m (~1")
NTT (raw; 0.33")
NTT (deconvolved; 0.18")

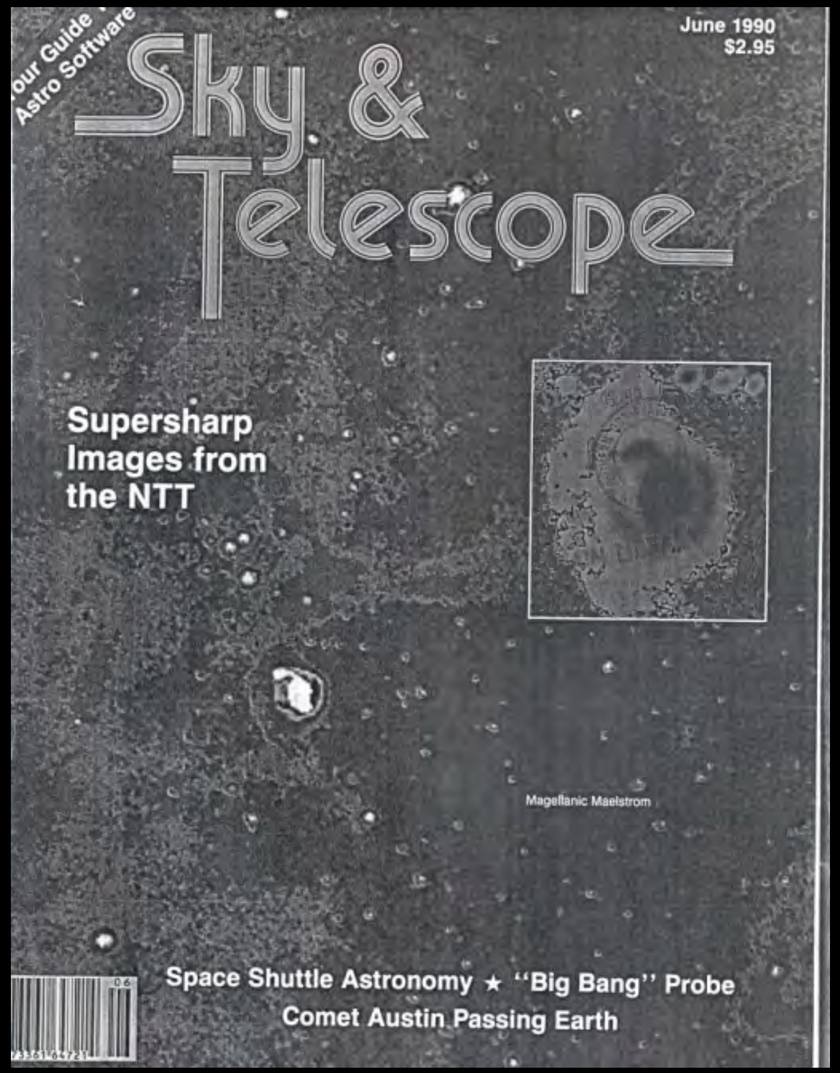

DOUBLE STAR
NTT (22-23.3.89) SEPARATION 0.79 ARCSECONDS
INTENSITY
3401
2334
1267
200
.000
3.054
6.107
9.161
12.214
ARCSECONDS


June 1990
$2.95
Sky & Telescope
Supersharp Images from the NTT
Magellanic Maelstrom
Space Shuttle Astronomy ★ "Big Bang" Probe
Comet Austin Passing Earth

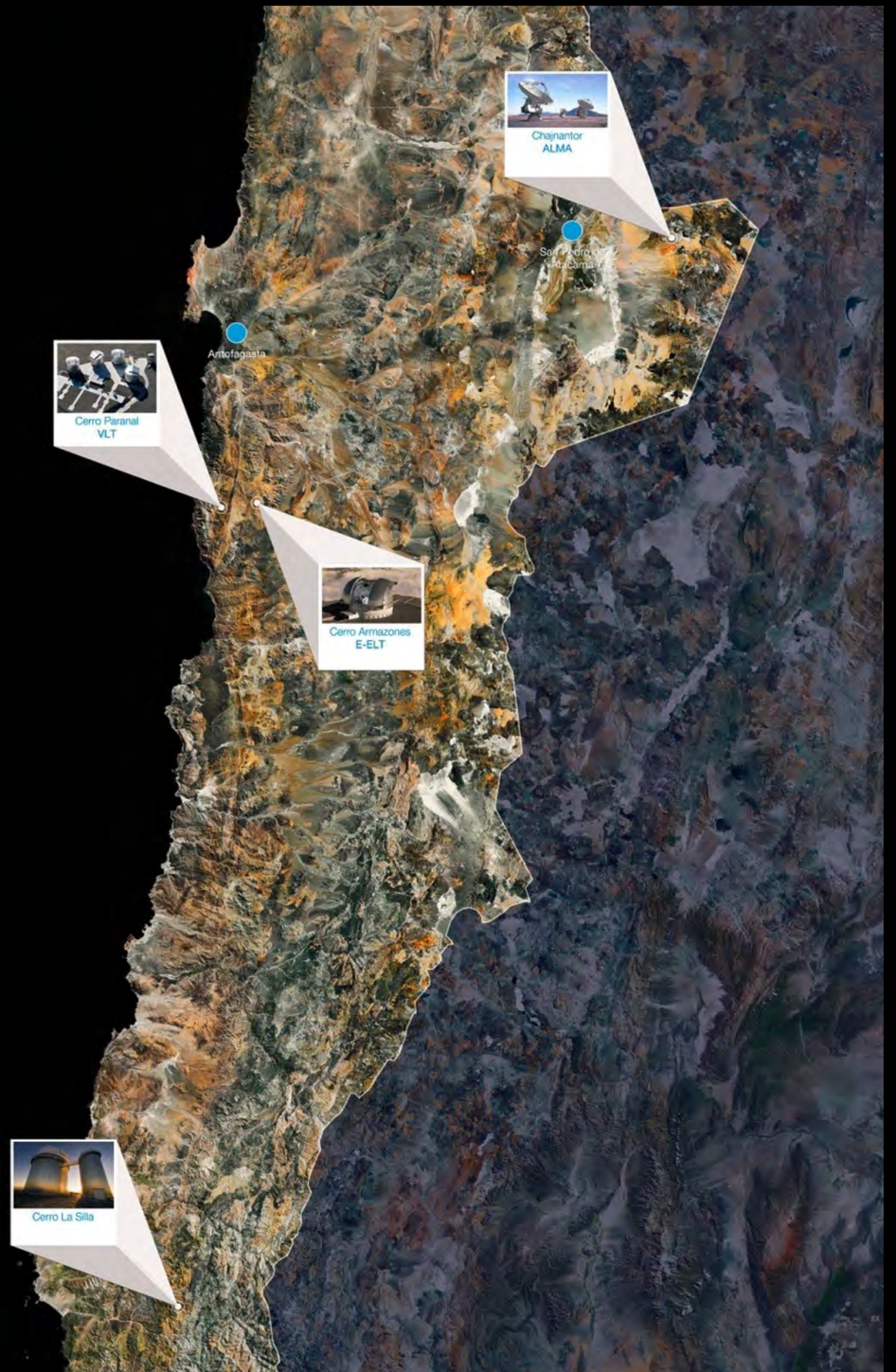




THE BEST TELESCOPE YET

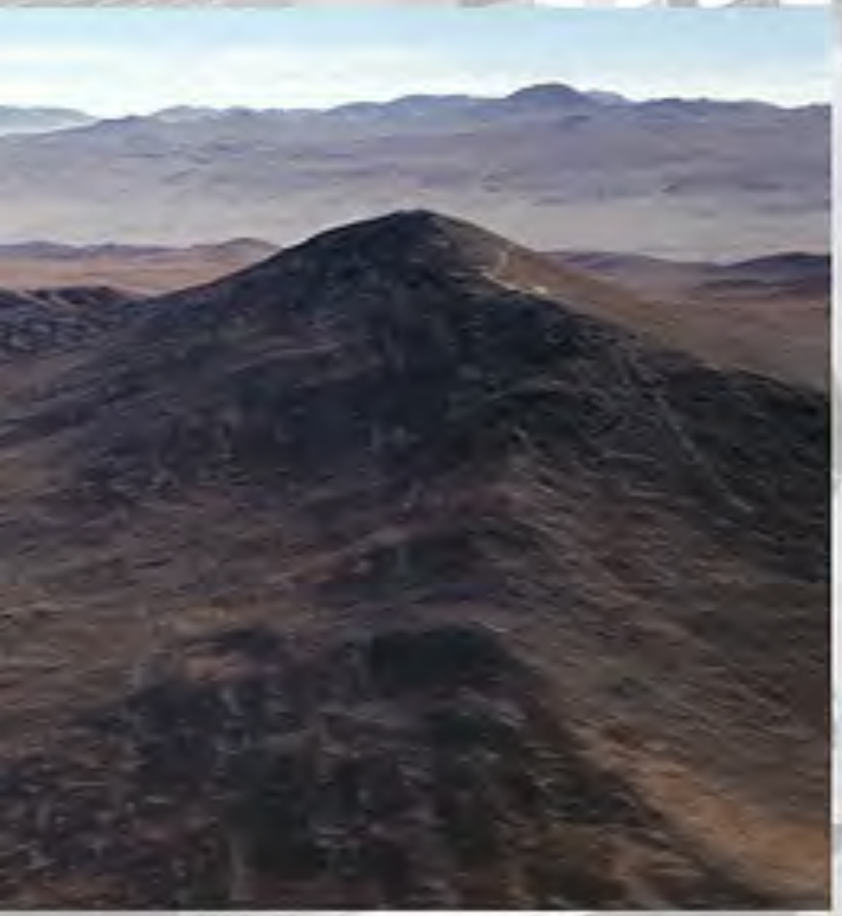


ESO in Chile


Chajnantor
ALMA
Antofagasta
Cerro Paranal
VLT
Cerro Armazones
E-ELT
Cerro La Silla

1987

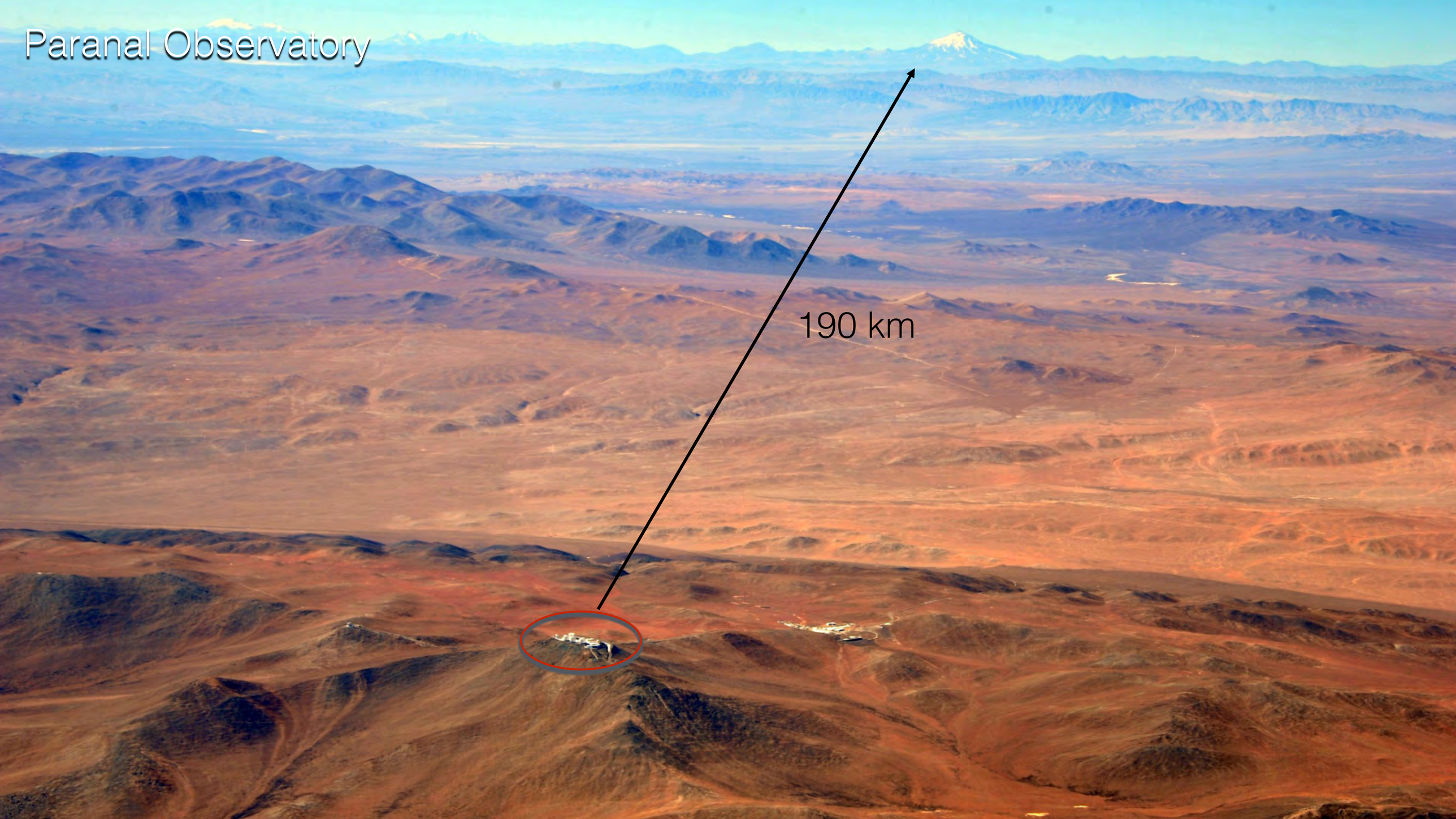
CERRO PARANAL 1991



1994

1999 PARANAL OBSERVATORY

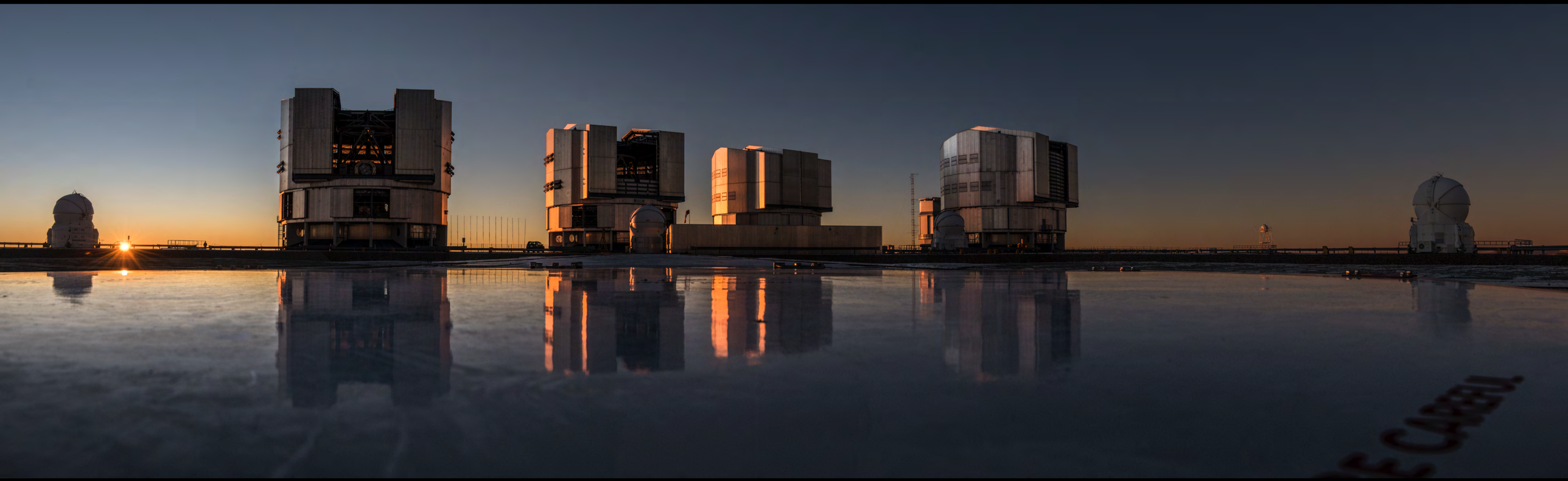
ESO PR PHOTO 36/00 (20 DECEMBER 2000)

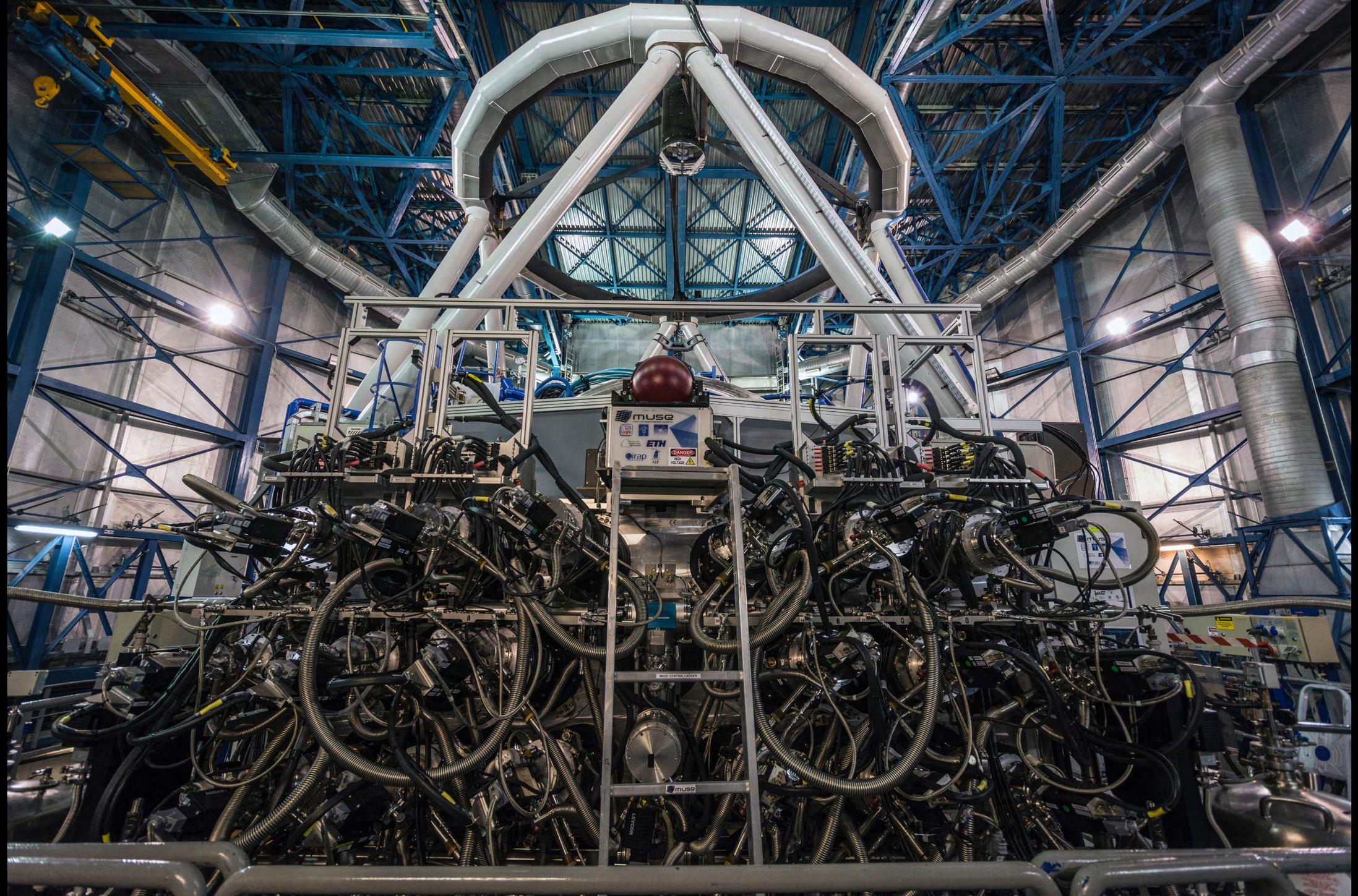

Paranal Observatory
190 km

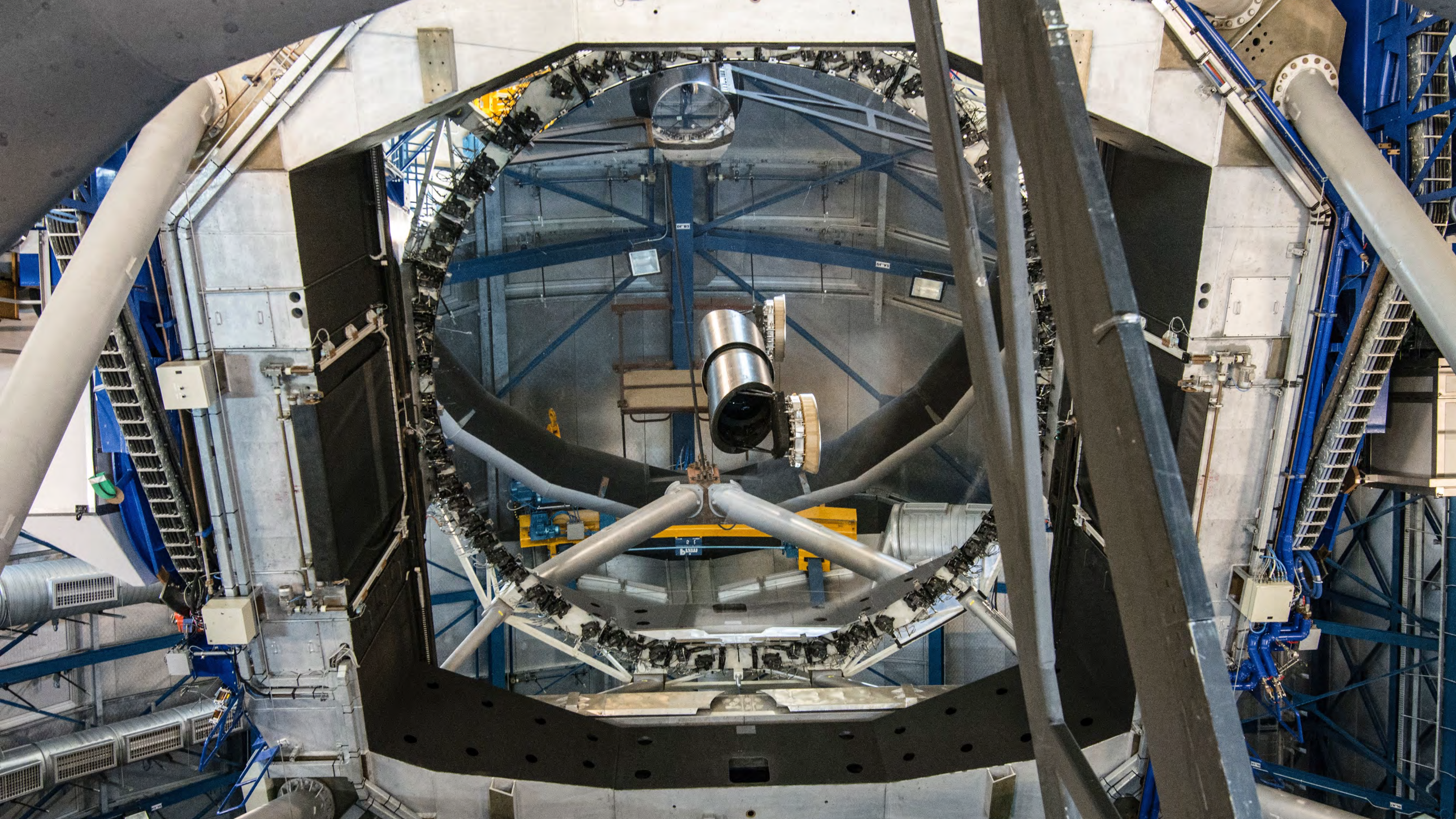
Paranal - Telescopes & facilities


!!! BE CAREFUL
TO YOUR FEET !!!
!!! MOVE THIS WAY ONLY !!!
!!! MOVE THIS WAY ONLY !!!

4 main telescopes (8.2 m) and 4 auxiliary telescopes (1.8m)




musq
ETH
irap
DANGER
HIGH VOLTAGE
MUSE CENTRAL LADDER
musq
LEYCON

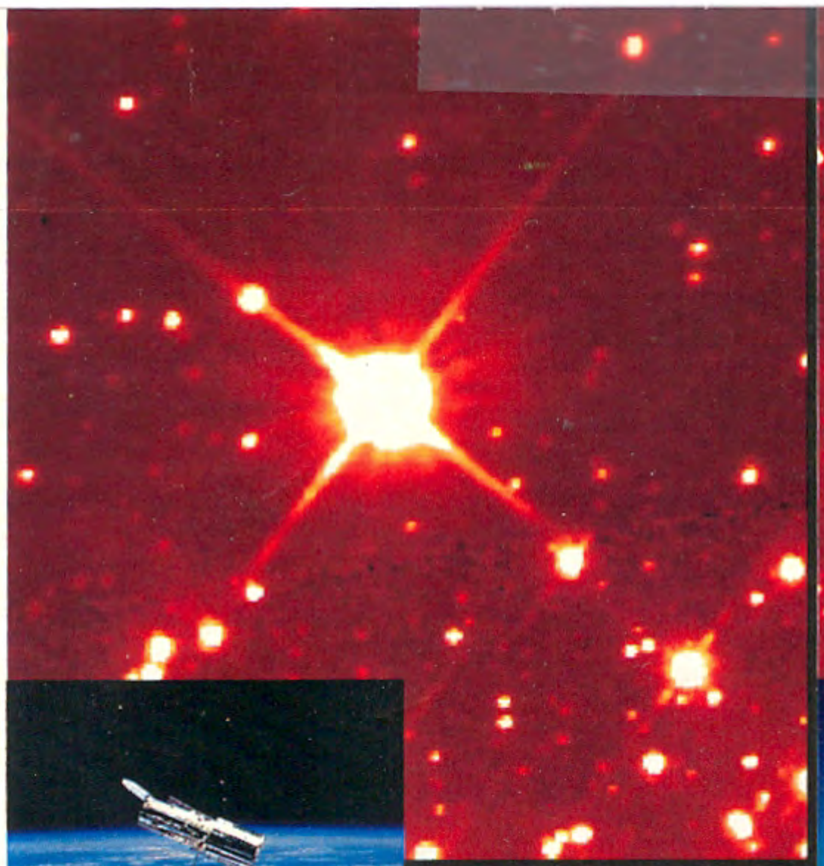



INNSE

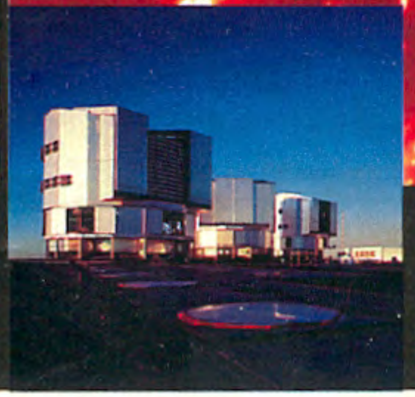

TARPON SANTIAGO


VERY
LARGE
TELESCOPE
REOSC
Ø 8.2m PRIMARY MIRROR of the
ESO
Very Large Telescope
MAN
PY-9922


VERY
LARGE
TELESCOPE
GONDRAND
REOSC
GONDRAND
GONDRAND

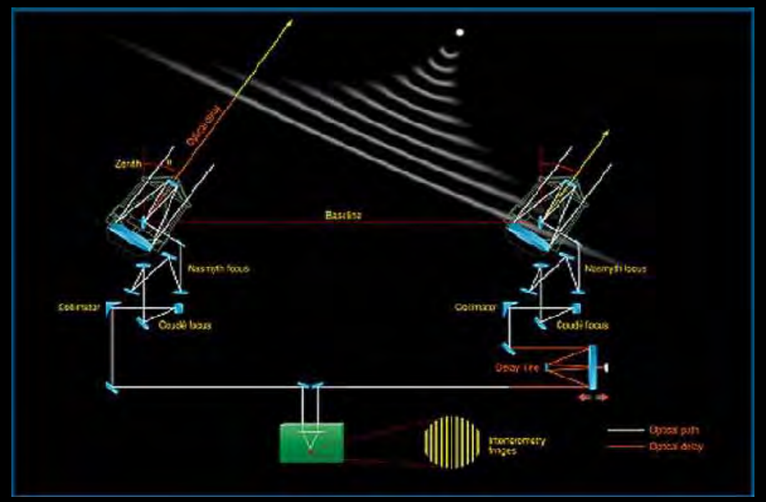


Teleskop „Hubble“ sieht den Sternhaufen NGC 3604 verschwommen



Eine Sternwarte in Chile lieferte jetzt weit detailreichere Aufnahmen

VLTI (Líneas de Retardo)



Successful First Light for the VLT Interferometer

C. CESARSKY, ESO Director General

Another momentous event took plac
Interferometer, more than two weeks in
tremely well and it was possible to do ri
scientists and the public of the effectiv
Release 06/01.)

In fact, it seems that we have becom
start-up of the four Unit Telescopes dur
means to enter into an entirely new wo
limits. I doubt that many people outside
to reach that momentous event when,
through the complex VLTI optics to the
been possible without the enormous de
cal institutes and, not least, within Europ
led to the beautiful performance of all e
of VLTI First Light.

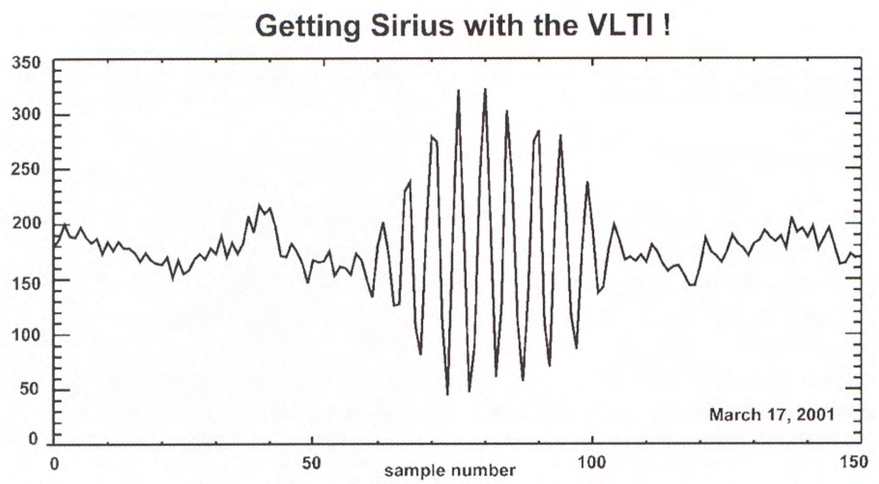
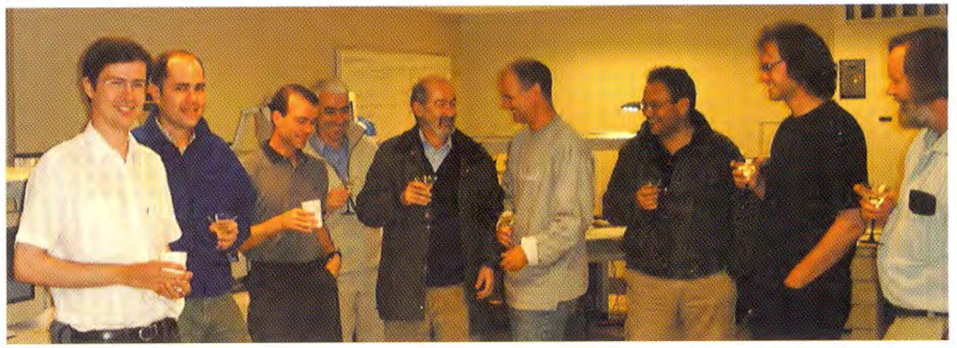


Figure 1: The very first fringe pattern of the VLTI observing Sirius.

It gives us all great confidence to see terminations of angular diameters of several other stars, including – I guess not quite by chance – for the first time ever of that of one of the stars in the Southern Cross that is depicted in the ESO logo!

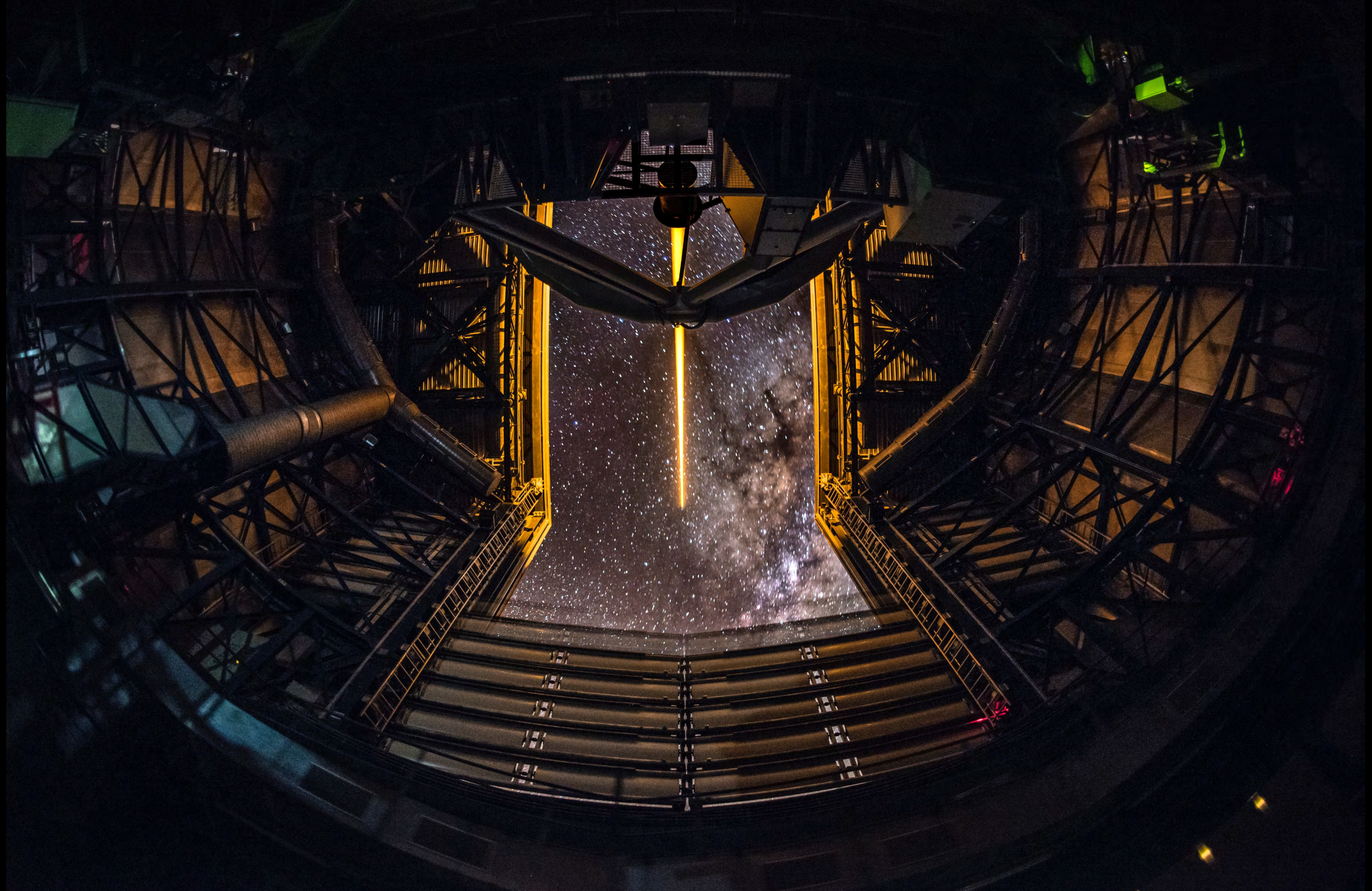
European astronomy can be proud of these early achievements and I have little doubt that interferometric observations will in due time become as common and easy to perform as normal observations are now at the VLT and other ESO telescopes, thanks in particular to the implementation of very user-friendly VLTI software. Indeed, I believe that this now opens fantastic perspectives in virtually all fields of modern astronomy and that we are now entering an era in which "stars will never be point sources anymore"!



Celebrating the moment of "First Fringes" at the VLTI. A number of people have, with their talent and determination, made this achievement possible. See the list of authors of the article on page 2 and the names in this caption. At the VLTI control console (left to right): P. Kervella, V. Coudé du Foresto, P. Gitton, A. Glindemann, M. Tarenghi, A. Wallander, R. Gilmozzi, M. Schoeller and W. Cotton. Bertrand Koehler was also present and took the photo.

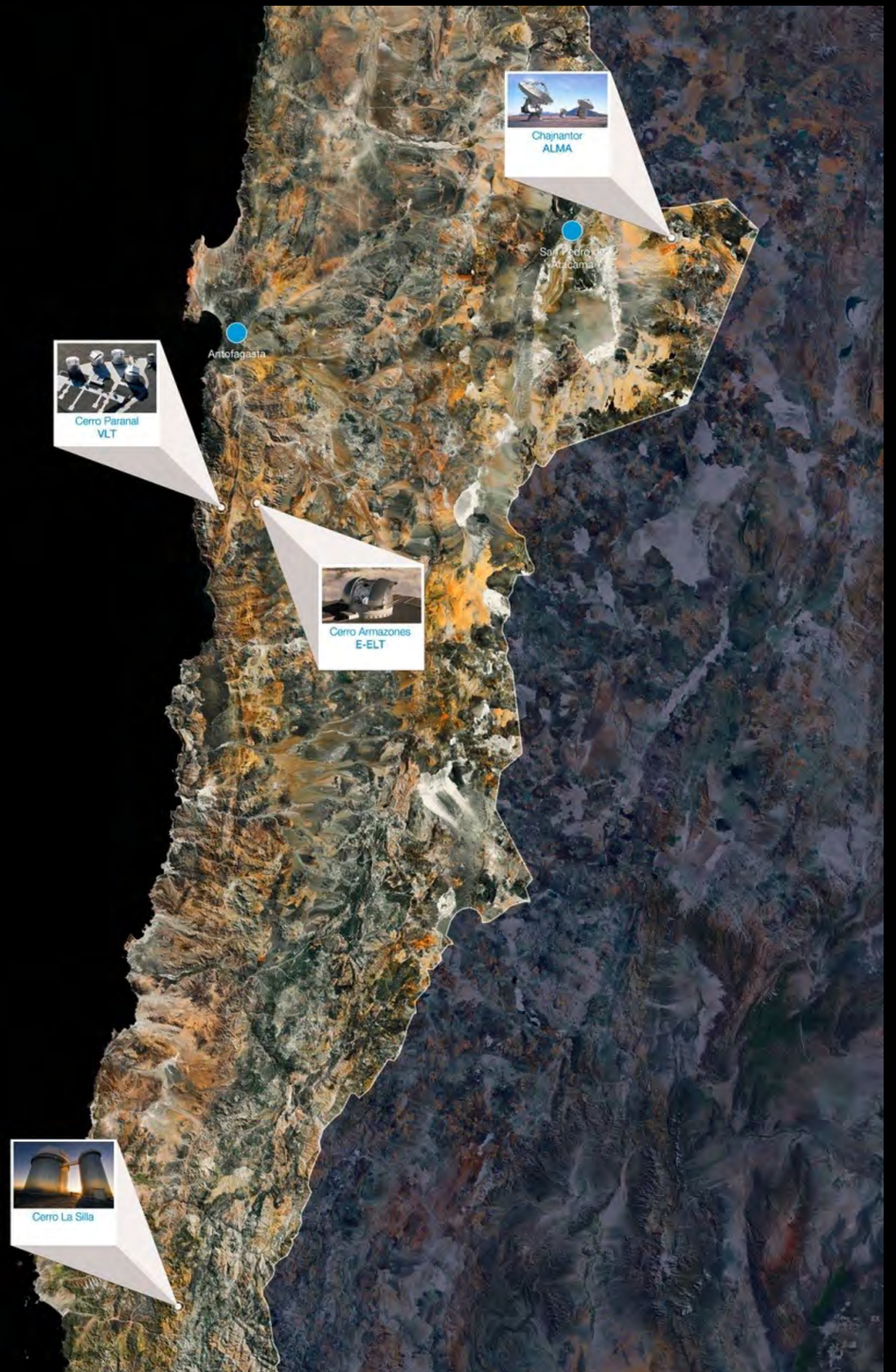

AMOS
MARCOT

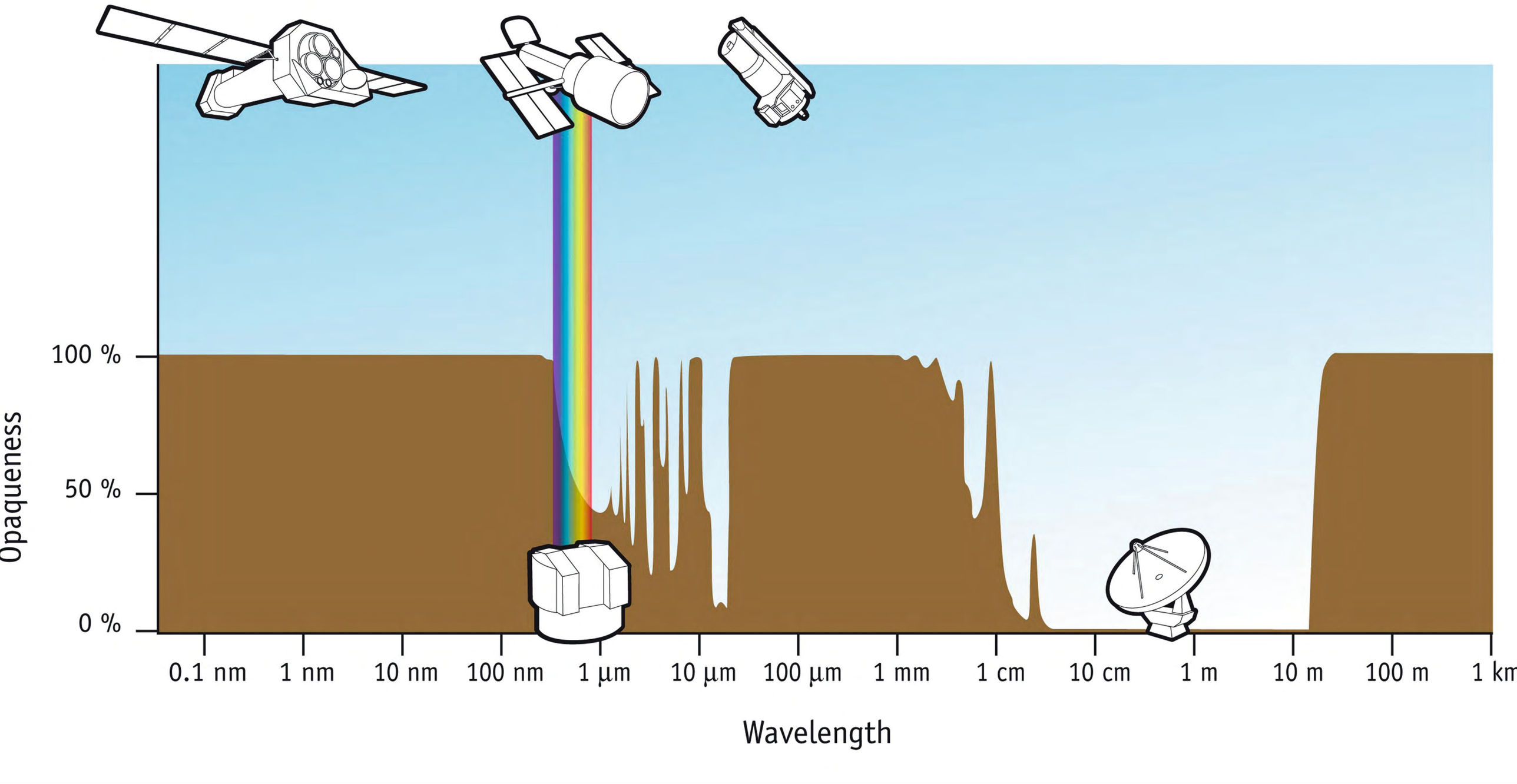

3



Paranal - The Residence

ESO in Chile


Chajnantor
ALMA
Antofagasta
Cerro Paranal
VLT
Cerro Armazones
E-ELT
Cerro La Silla


Opaqueness
100 %
50 %
0 %
0.1 nm
1 nm
10 nm
100 nm
1 µm
10 µm
100 µm
1 mm
1 cm
10 cm
1 m
10 m
100 m
1 km
Wavelength


SALAR DE ATACAMA
altitude 2.300m
water depth 1.000m

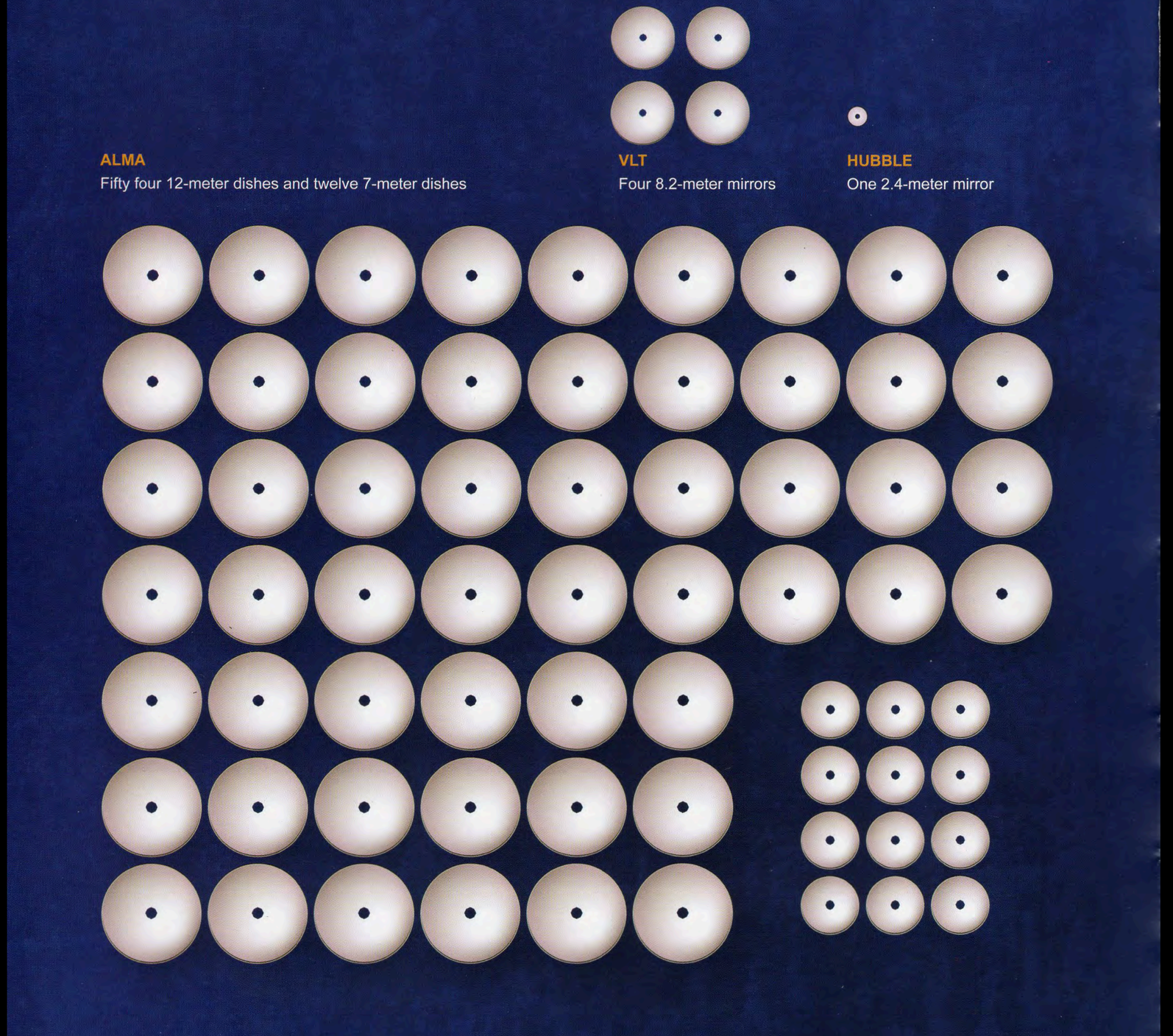

ALMA
Telescopes at 5.050m
Camp OSF 3.000m

OSF (Operation Science Facility) 3.000m


alt 5000

ALMA


PM-04
DA-41

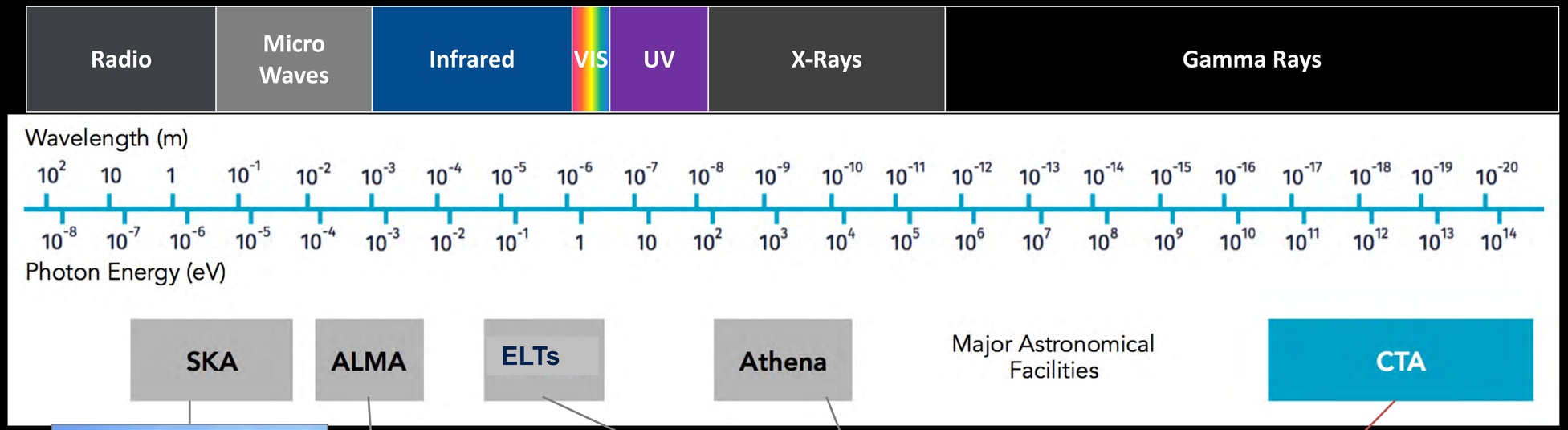


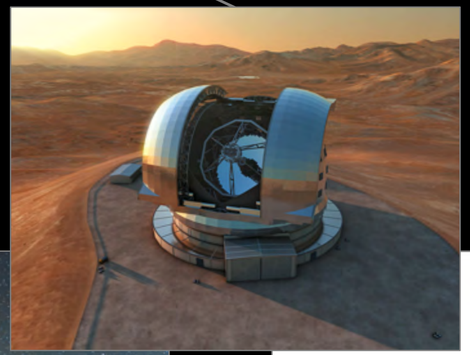
ALMA
Fifty four 12-meter dishes and twelve 7-meter dishes

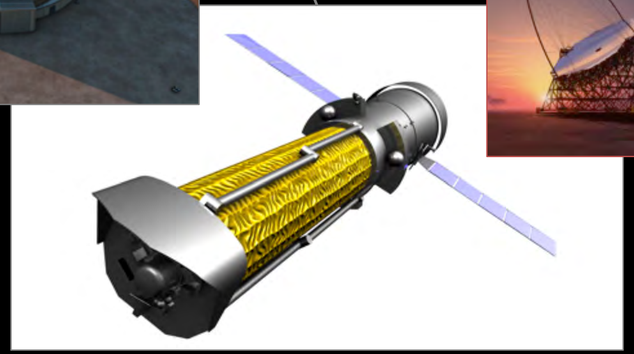
VLT
Four 8.2-meter mirrors

HUBBLE
One 2.4-meter mirror

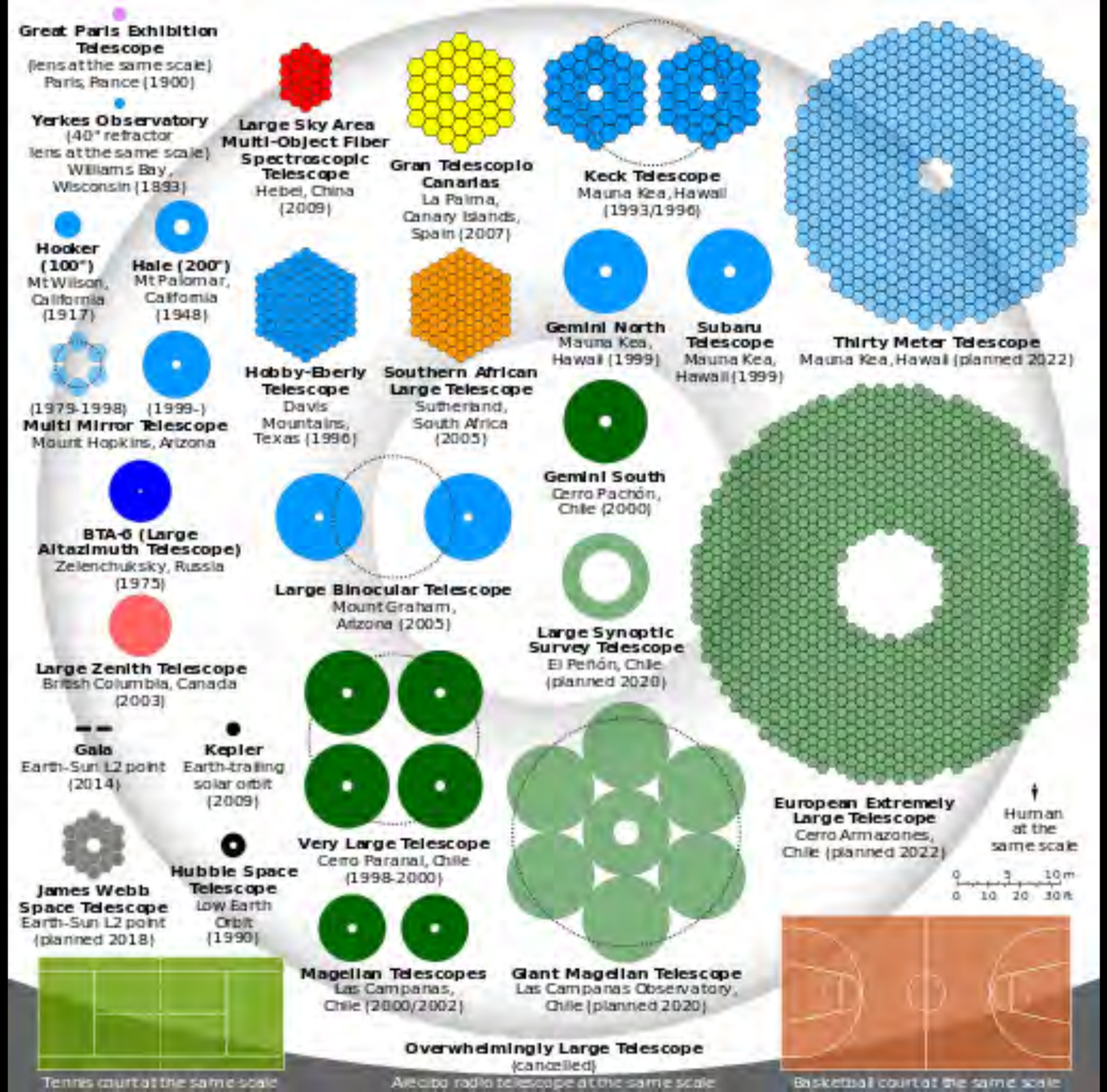
Waveband coverage

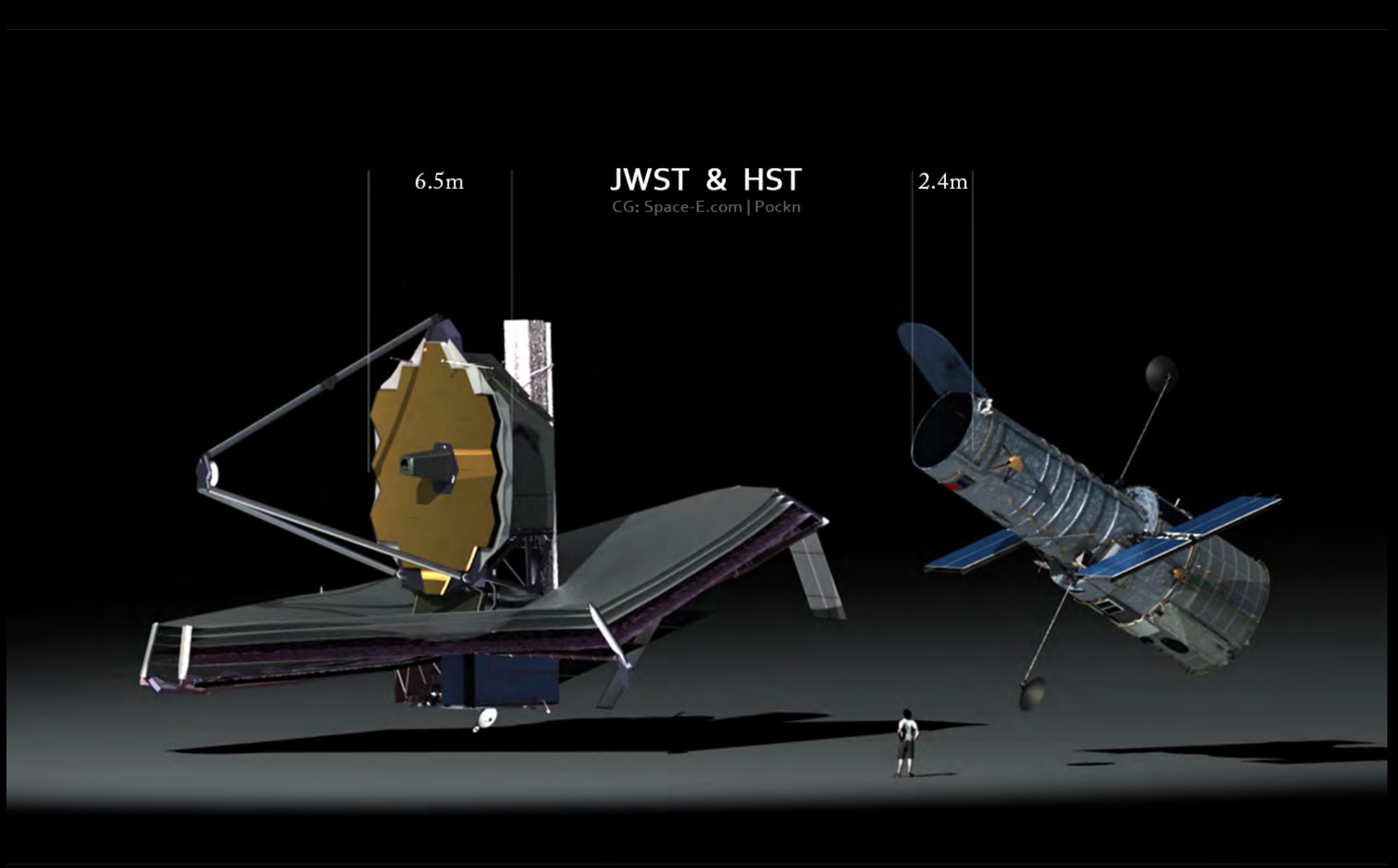


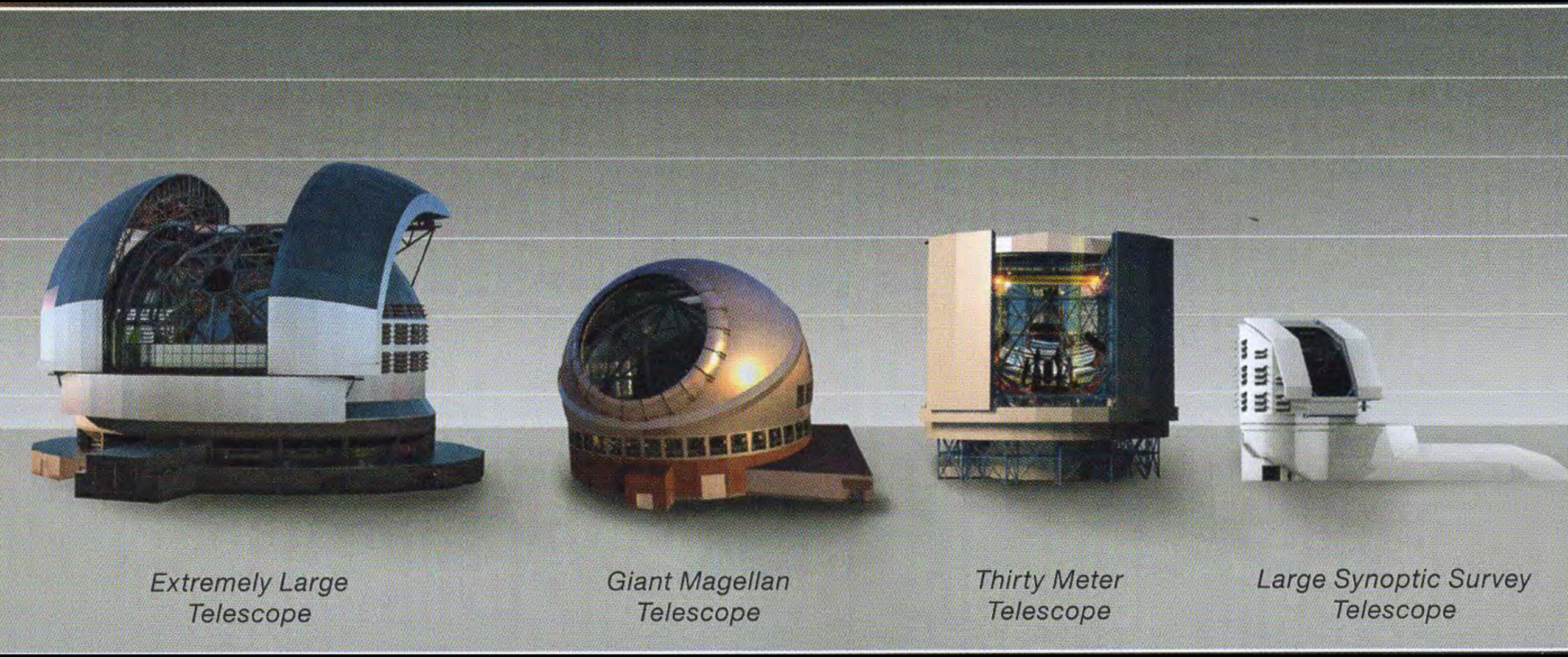




CTA raggi gamma


Great Paris Exhibition Telescope
(lens at the same scale)
Paris, France (1900)
Yerkes Observatory
(40" refractor lens at the same scale)
Williams Bay, Wisconsin (1893)
Hooker (100")
Mt Wilson, California (1917)
Hale (200")
Mt Palomar, California (1948)
(1979-1998)
(1998-)
Multi Mirror Telescope
Mount Hopkins, Arizona
BTA-6 (Large Altazimuth Telescope)
Zelenchuksky, Russia (1975)
Large Zenith Telescope
British Columbia, Canada (2003)
Gaia
Earth-Sun L2 point (2014)
Kepler
Earth-trailing solar orbit (2009)
James Webb Space Telescope
Earth-Sun L2 point (planned 2018)
Hubble Space Telescope
Low Earth Orbit (1990)
Large Sky Area Multi-Object Fiber Spectroscopic Telescope
Hebei, China (2009)
Hobby-Eberly Telescope
Davis Mountains, Texas (1996)
Large Binocular Telescope
Mount Graham, Arizona (2005)
Very Large Telescope
Cerro Paranal, Chile (1998-2000)
Magellan Telescopes
Las Campanas, Chile (2000/2002)
Gran Telescopio Canarias
La Palma, Canary Islands, Spain (2007)
Southern African Large Telescope
Sutherland, South Africa (2005)
Keck Telescope
Mauna Kea, Hawaii (1993/1996)
Gemini North
Mauna Kea, Hawaii (1999)
Subaru Telescope
Mauna Kea, Hawaii (1999)
Gemini South
Cerro Pachón, Chile (2000)
Large Synoptic Survey Telescope
El Peñón, Chile (planned 2020)
Giant Magellan Telescope
Las Campanas Observatory, Chile (planned 2020)
Thirty Meter Telescope
Mauna Kea, Hawaii (planned 2022)
European Extremely Large Telescope
Cerro Armazones, Chile (planned 2022)
Human at the same scale
0 5 10 m
0 10 20 30 ft
Overwhelmingly Large Telescope
(cancelled)
Tennis court at the same scale
Arecibo radio telescope at the same scale
Basketball court at the same scale


6.5m
JWST & HST
CG: Space-E.com | Pockn
2.4m



Extremely Large Telescope

Giant Magellan Telescope

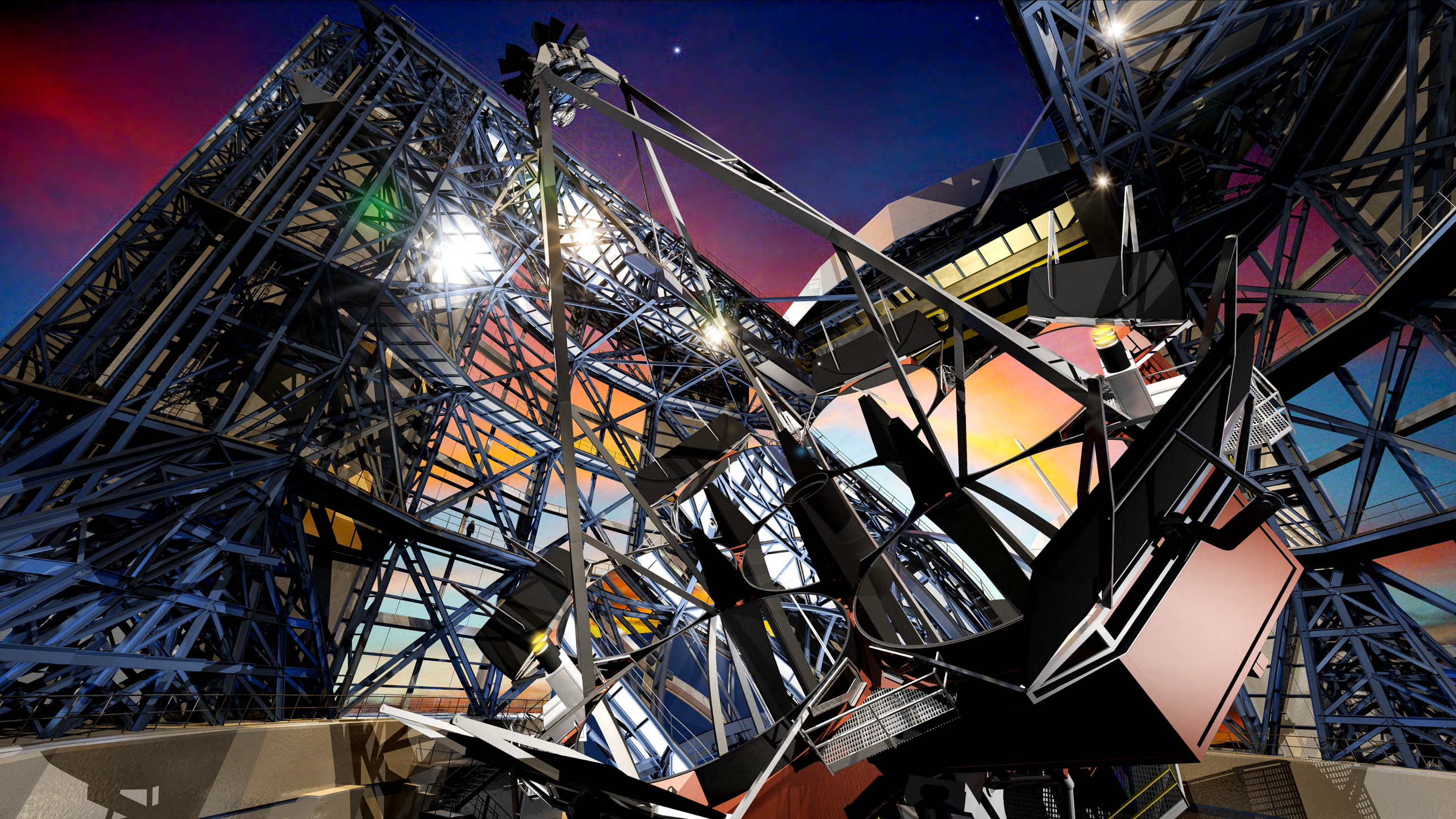
Thirty Meter Telescope

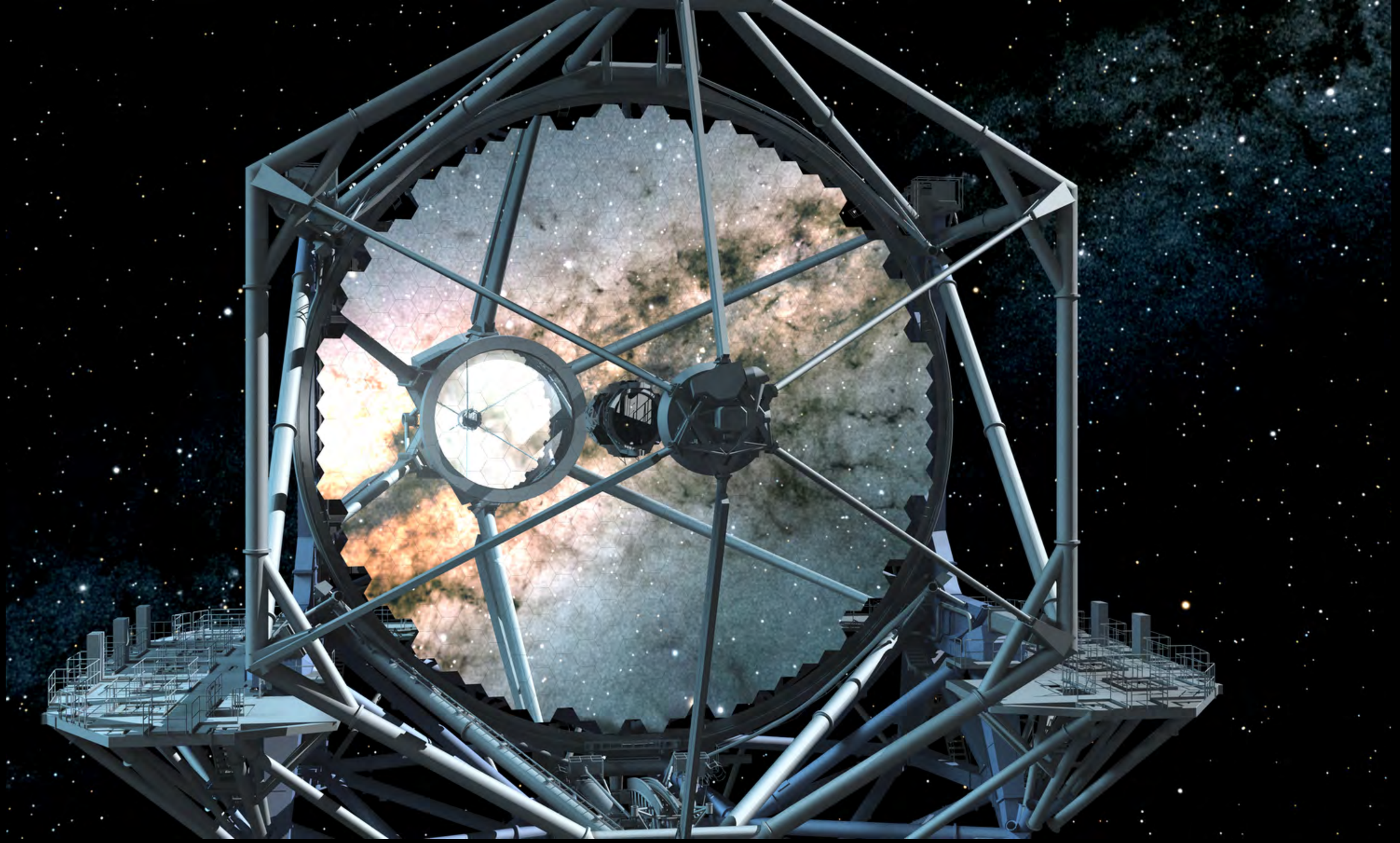
Large Synoptic Survey Telescope

biggest digital camera of the world
3200 megapixel

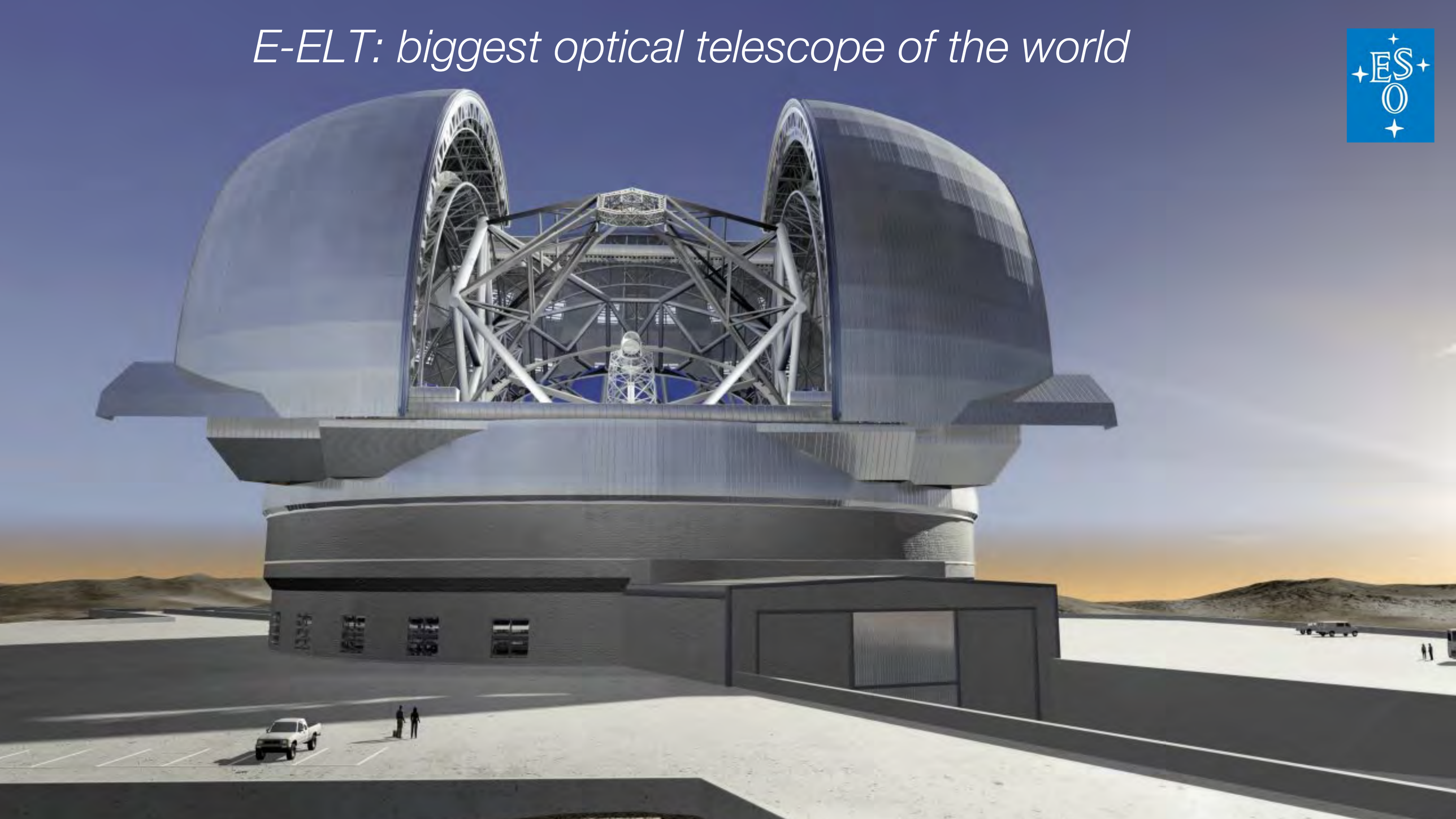
LSST

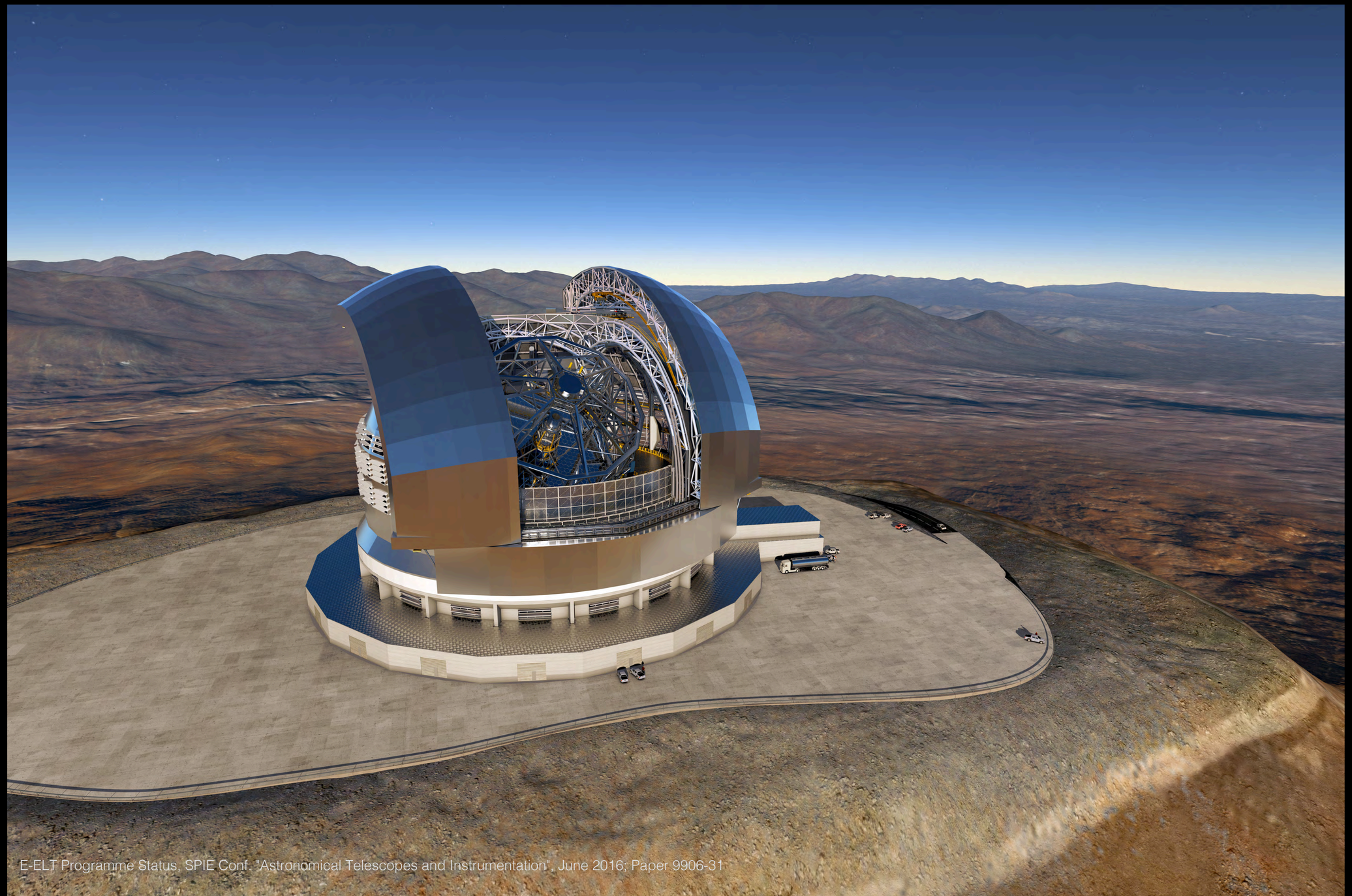

GMT





E-ELT: biggest optical telescope of the world



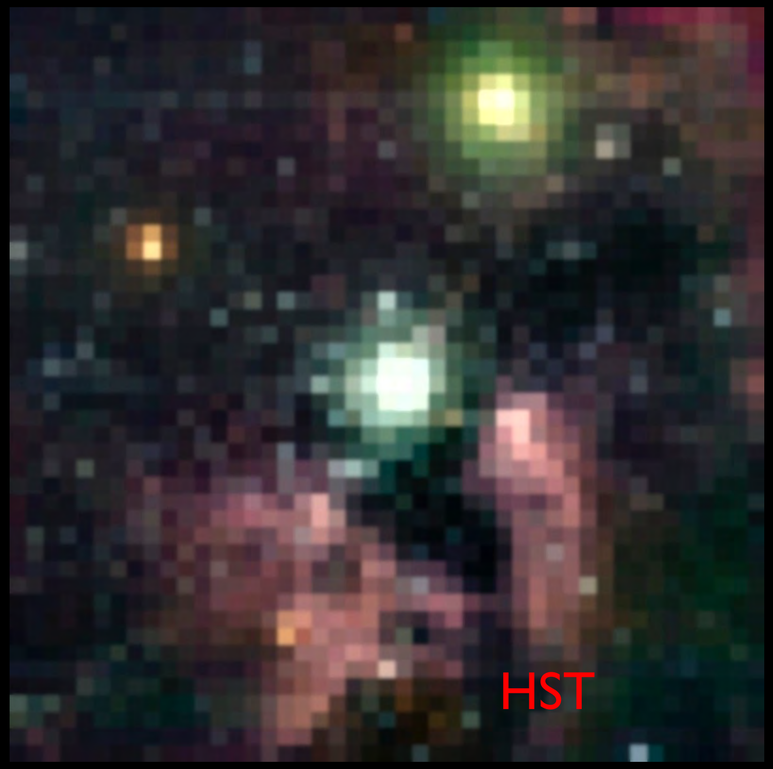


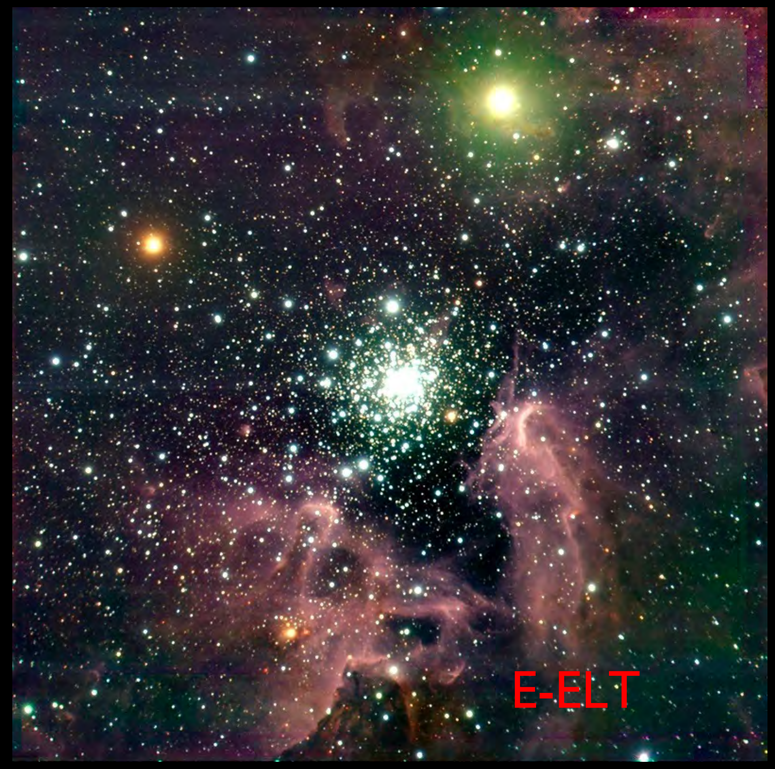
E-ELT Programme Status, SPIE Conf. "Astronomical Telescopes and Instrumentation", June 2016; Paper 9906-31


120 м
100 м
80 м
60 м
40 м
20 м


140 м
120 м
100 м
80 м
60 м
20 м

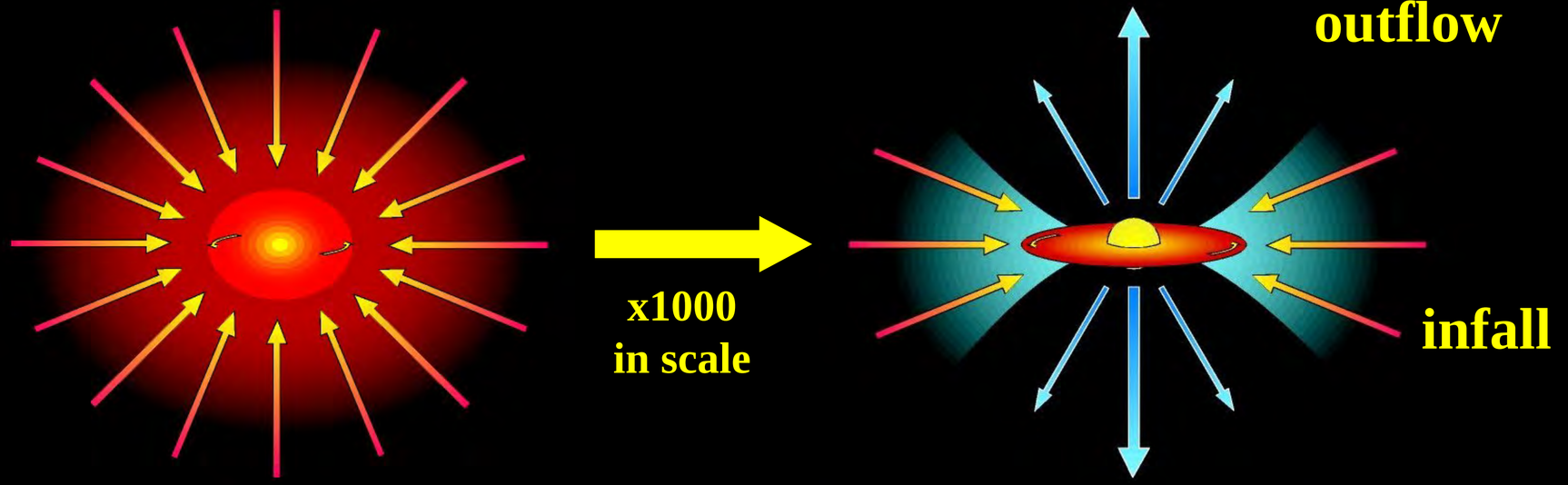
from Hubble to E-ELT





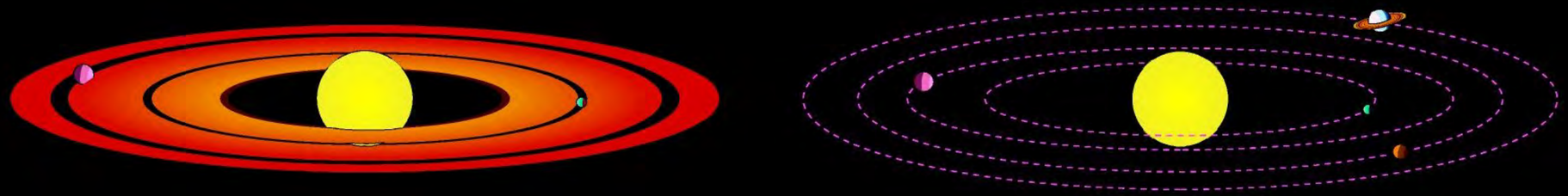

ANTOFAGASTA
Armazones

How are single stars created?



Cloud collapse

Rotating disk

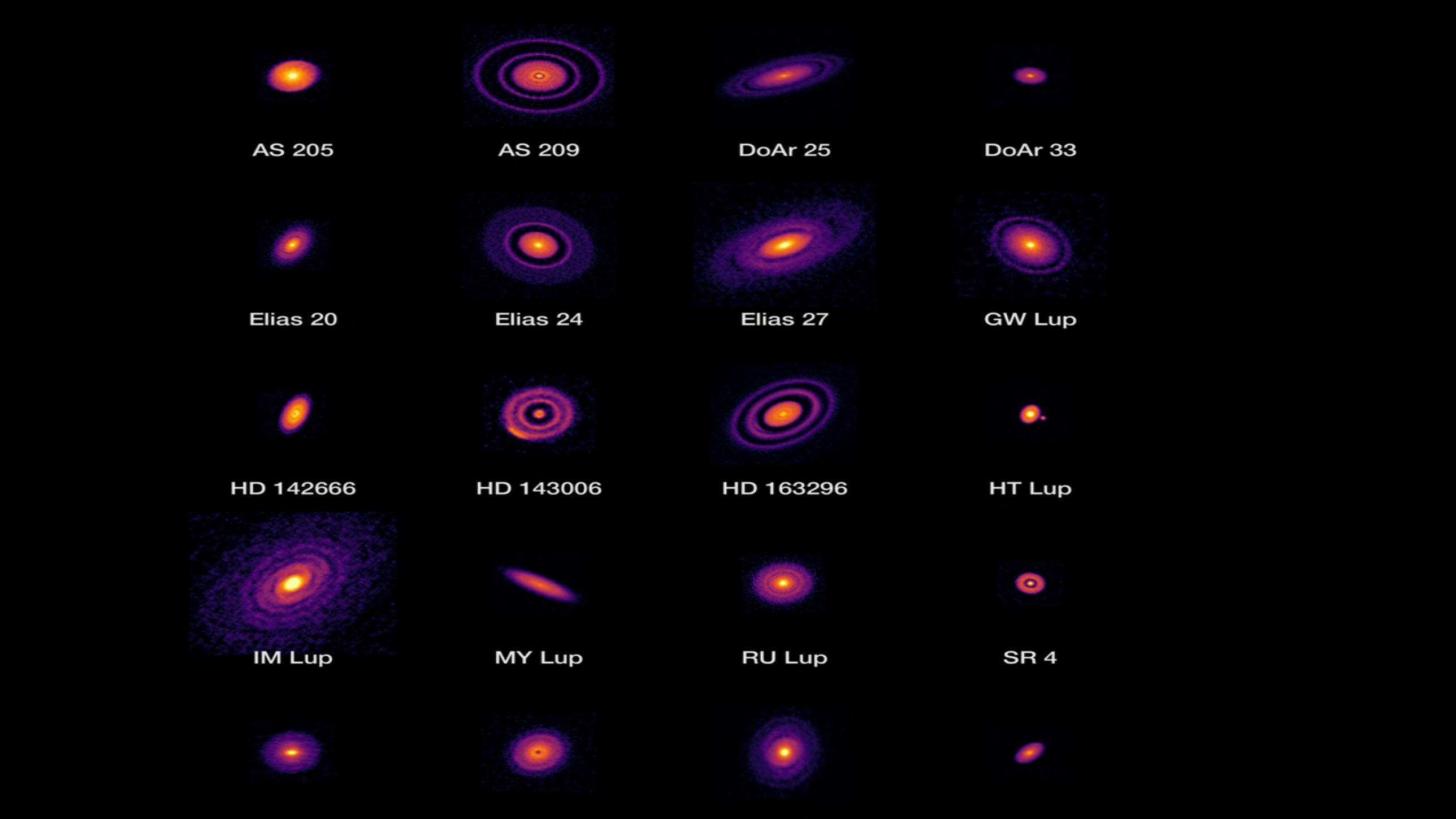


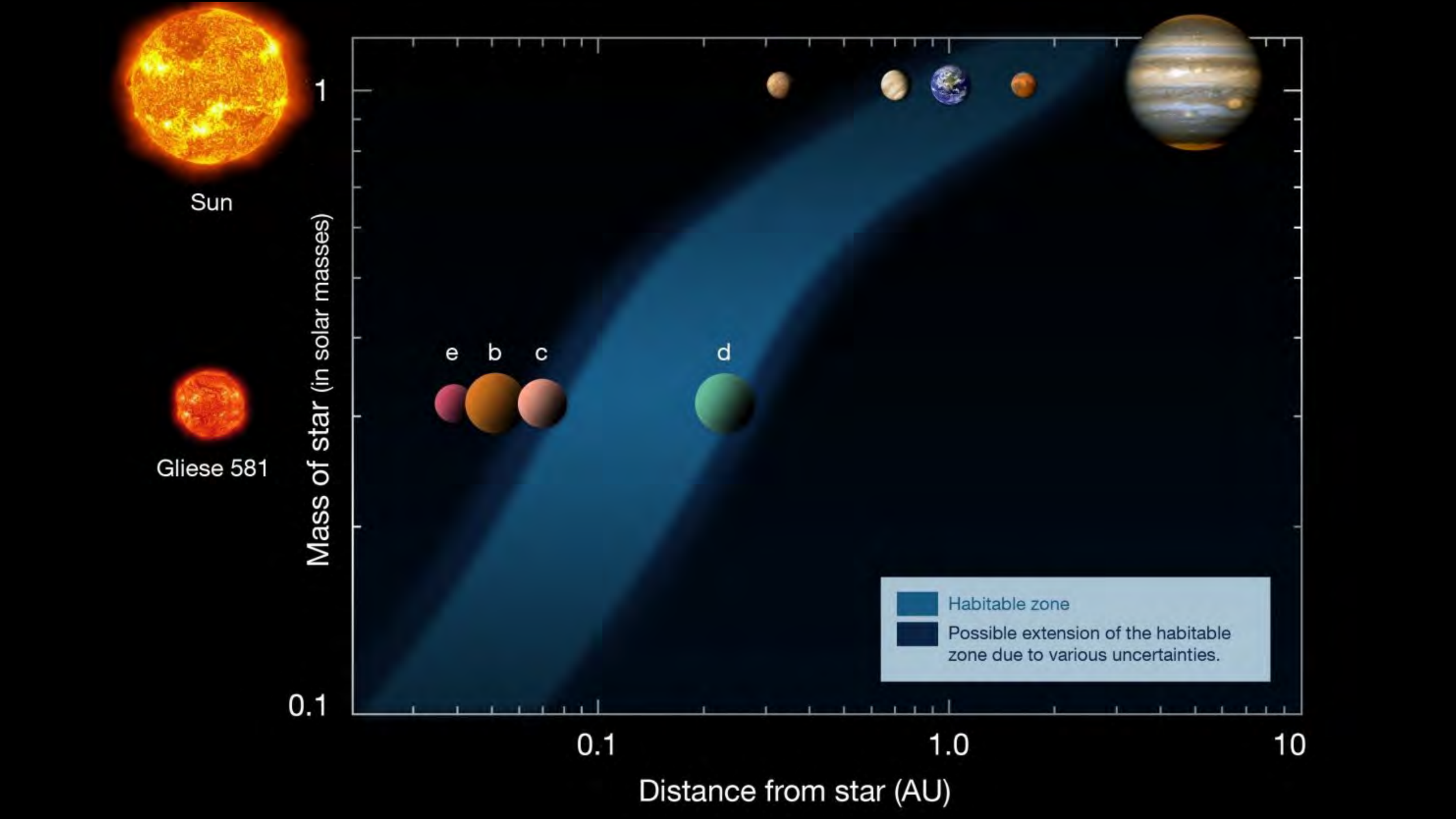
Planet formation

Mature solar system

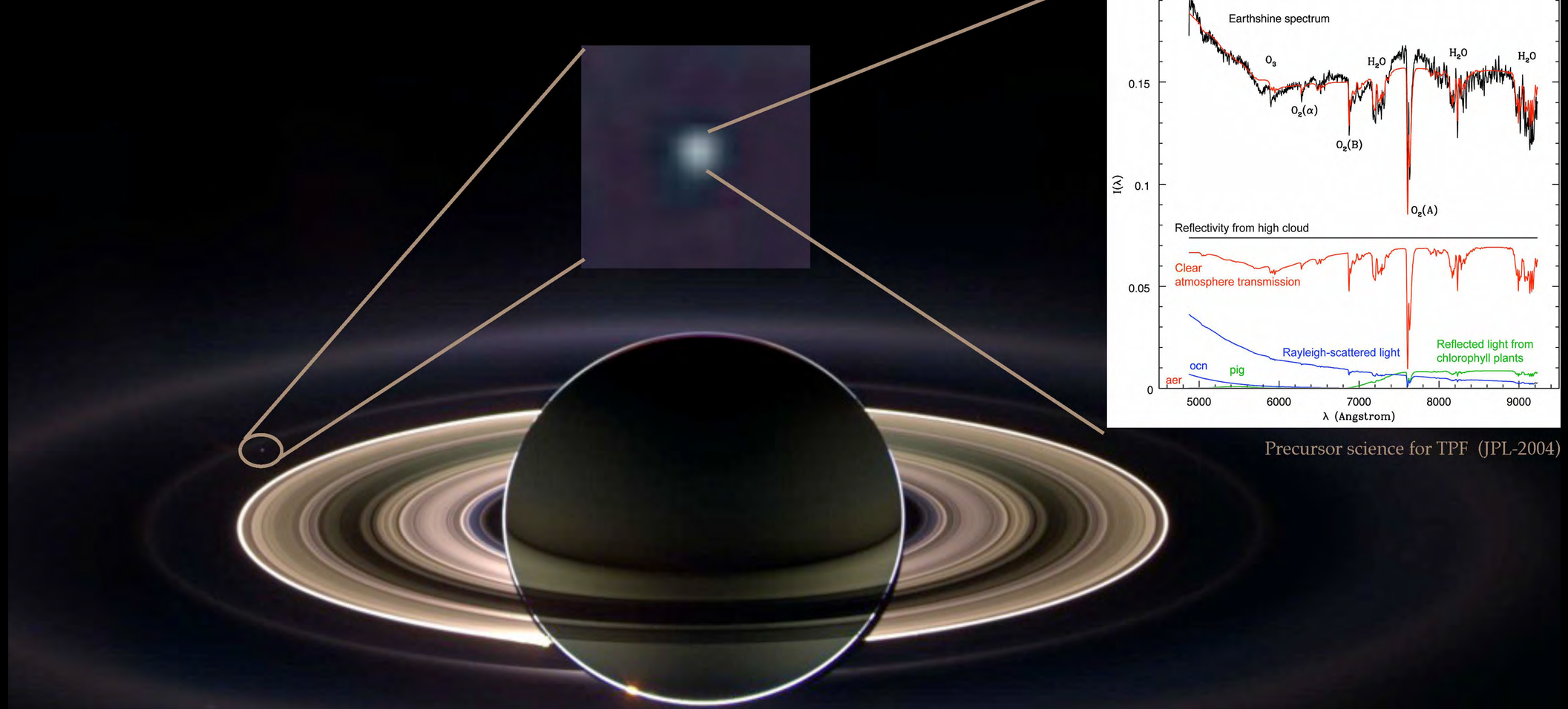
Scenario largely from indirect tracers.

Source: G. Blake; Figure by McCaughrean


AS 205
AS 209
DoAr 25
DoAr 33
Elias 20
Elias 24
Elias 27
GW Lup
HD 142666
HD 143006
HD 163296
HT Lup
IM Lup
MY Lup
RU Lup
SR 4


Sun
Gliese 581
1
0.1
Mass of star (in solar masses)
e
b
c
d
Habitable zone
Possible extension of the habitable zone due to various uncertainties.
0.1
1.0
10
Distance from star (AU)

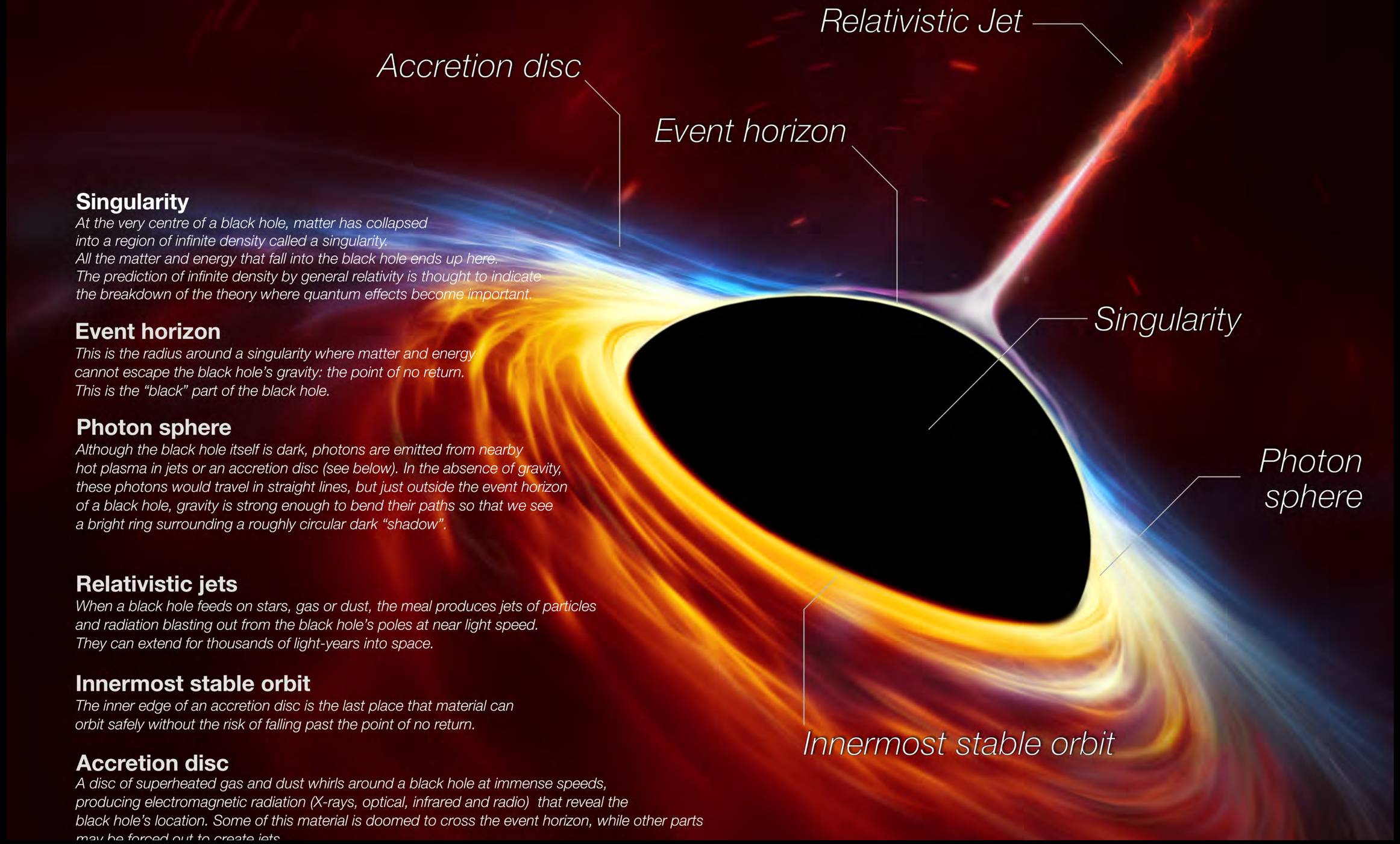
Credit: Cassini Imaging team, SSI, JPL, ESA, NASA



Precursor science for TPF (JPL-2004)

IL BUCO NERO
AL CENTRO DELLA VIA LATTEA


NGC 1232



Singularity

At the very centre of a black hole, matter has collapsed into a region of infinite density called a singularity. All the matter and energy that fall into the black hole ends up here. The prediction of infinite density by general relativity is thought to indicate the breakdown of the theory where quantum effects become important.

Event horizon

This is the radius around a singularity where matter and energy cannot escape the black hole's gravity: the point of no return. This is the "black" part of the black hole.

Photon sphere

Although the black hole itself is dark, photons are emitted from nearby hot plasma in jets or an accretion disc (see below). In the absence of gravity, these photons would travel in straight lines, but just outside the event horizon of a black hole, gravity is strong enough to bend their paths so that we see a bright ring surrounding a roughly circular dark "shadow".

Relativistic jets

When a black hole feeds on stars, gas or dust, the meal produces jets of particles and radiation blasting out from the black hole's poles at near light speed. They can extend for thousands of light-years into space.

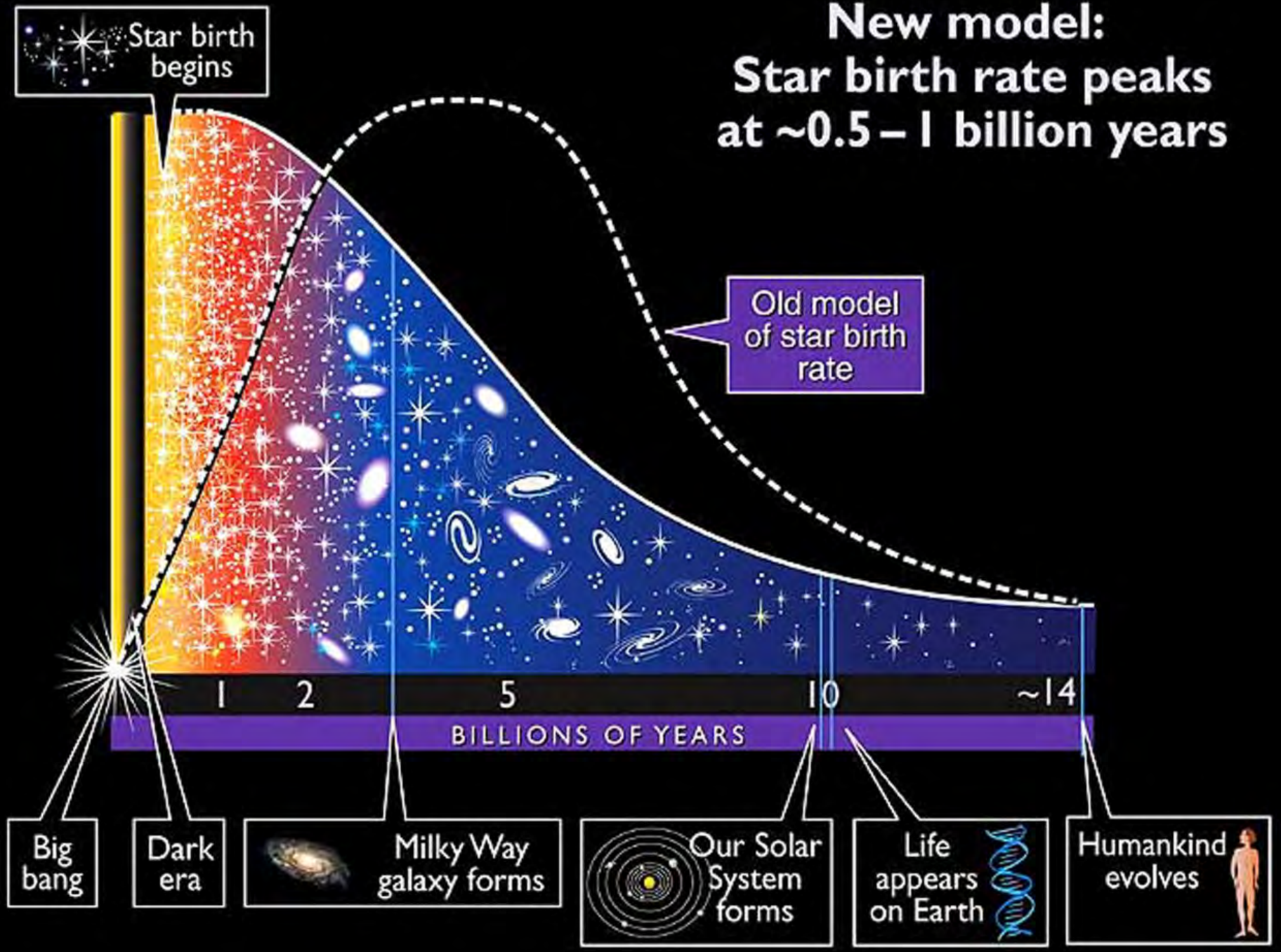
Innermost stable orbit

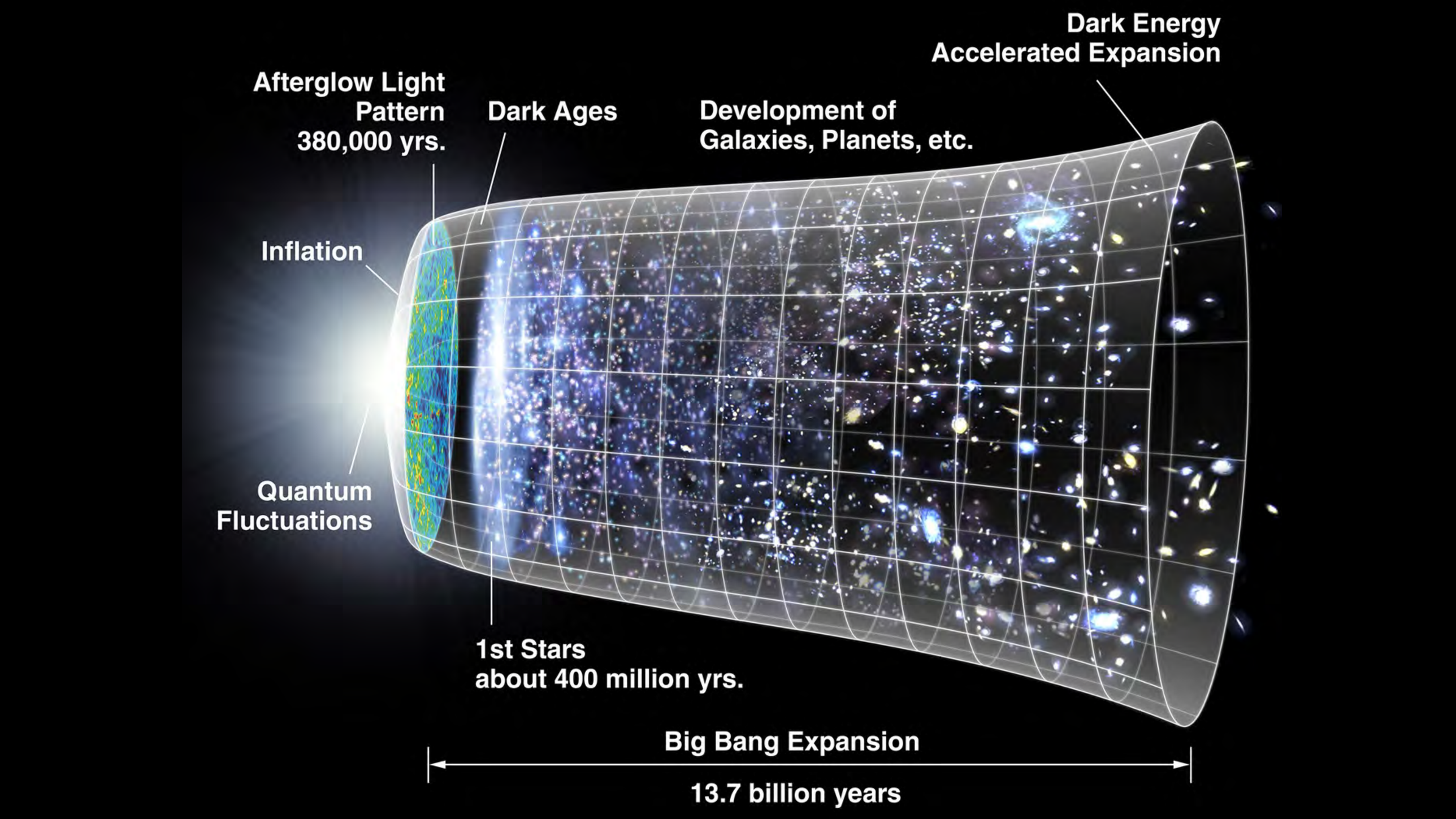
The inner edge of an accretion disc is the last place that material can orbit safely without the risk of falling past the point of no return.

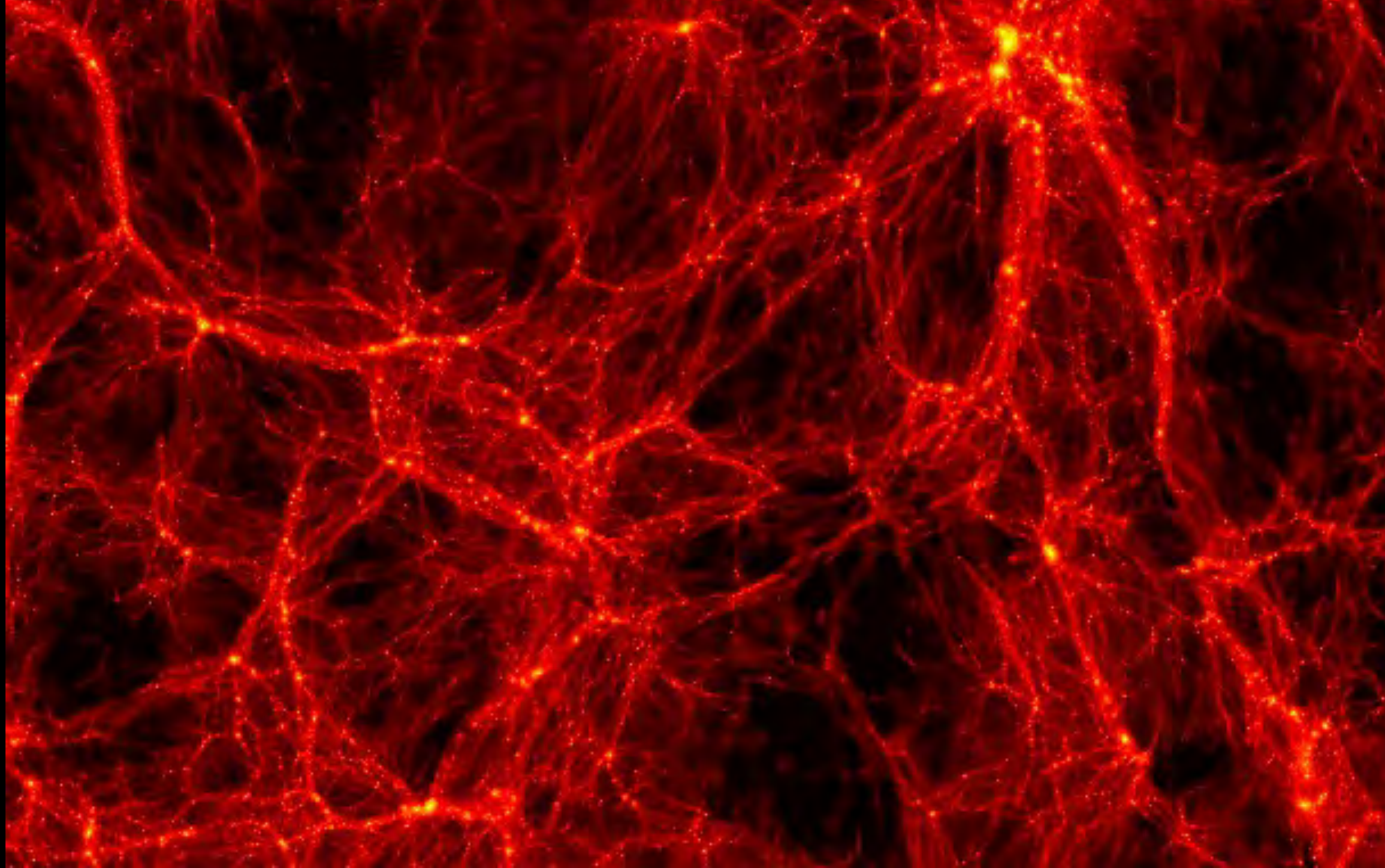
Accretion disc

A disc of superheated gas and dust whirls around a black hole at immense speeds, producing electromagnetic radiation (X-rays, optical, infrared and radio) that reveal the black hole's location. Some of this material is doomed to cross the event horizon, while other parts may be forced out to create jets.

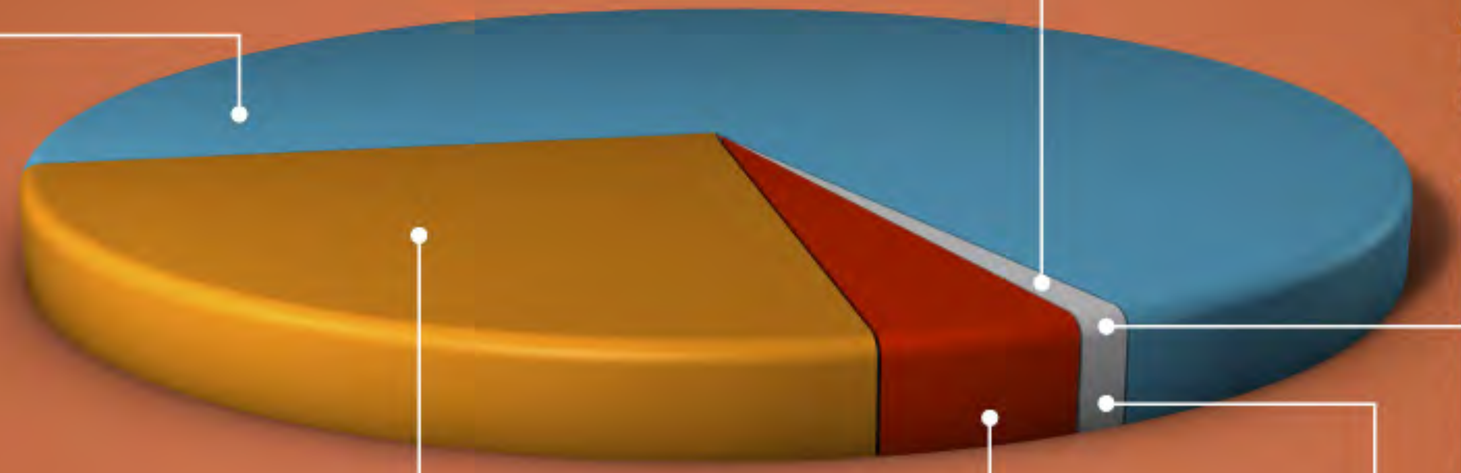
COSMOLOGIA


Star birth begins
New model:
Star birth rate peaks
at ~0.5 – 1 billion years
Old model of star birth rate
1
2
5
10
~14
BILLIONS OF YEARS
Big bang
Dark era
Milky Way galaxy forms
Our Solar System forms
Life appears on Earth
Humankind evolves


Dark Energy
Accelerated Expansion
Afterglow Light
Pattern
380,000 yrs.
Dark Ages
Development of
Galaxies, Planets, etc.
Inflation
Quantum
Fluctuations
1st Stars
about 400 million yrs.
Big Bang Expansion
13.7 billion years



Dark Energy 70%



Heavy Elements
0,03%

Neutrinos 0,3%

Dark Matter 25%

Free Hydrogen and
Helium 4%

Stars 0,5%