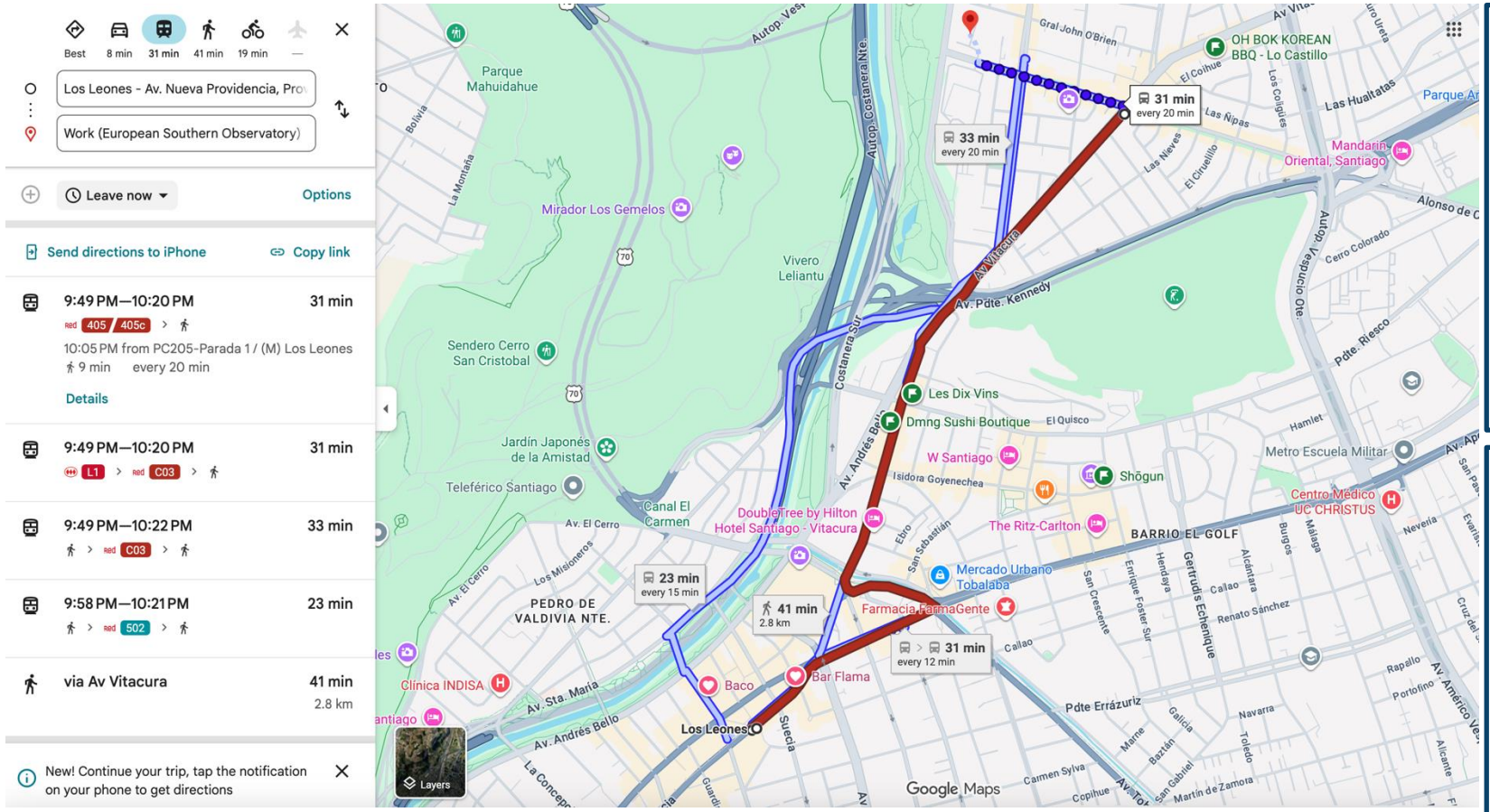
Welcome to the La Silla Observing School 2026!

Elyar Sedaghati

ESO Chile

Practical information:



- Bus 405/405c
- Bus 502 from across the river
- Walking about 35 mins
- Uber/Cabify (reliable/safe)
- Rental bikes

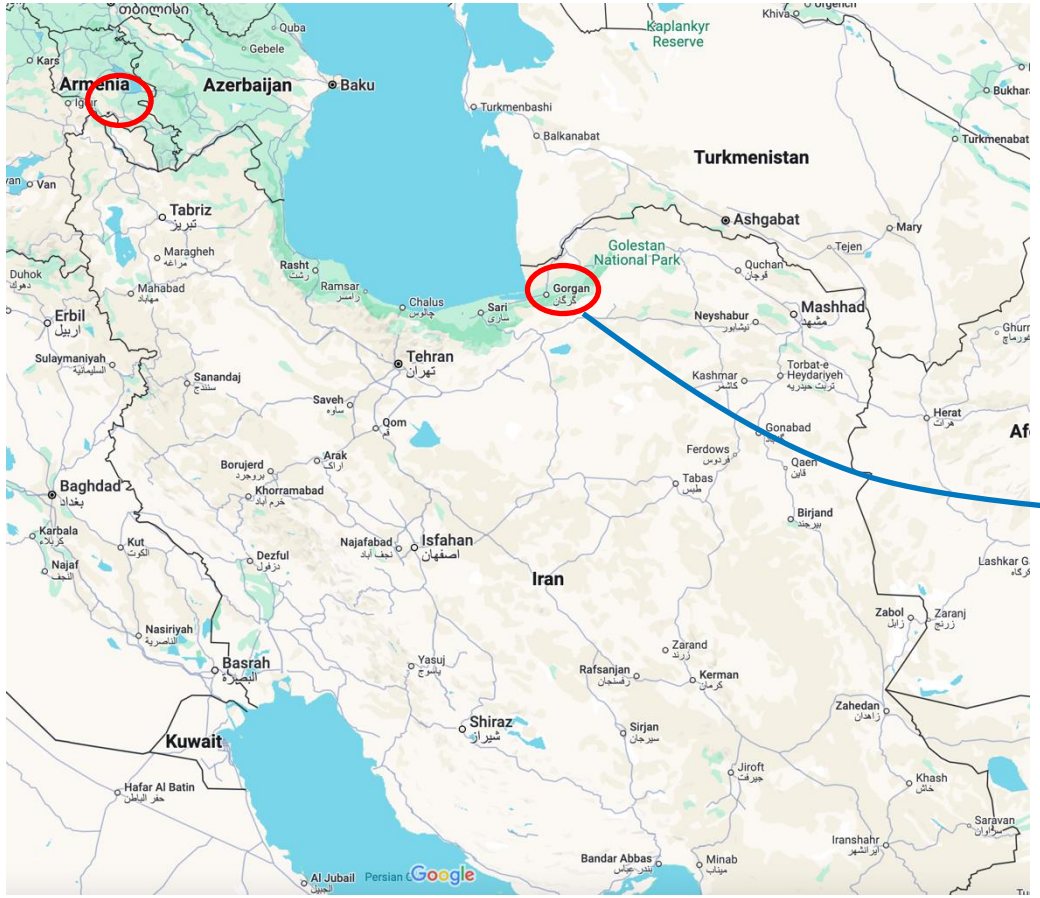
- Restaurants/Bars:
  - Bar Flama (pizza)
  - Many on Manuel Montt
  - Oculto BeerGarden
  - Barrio Lastarria
  - Bellavista

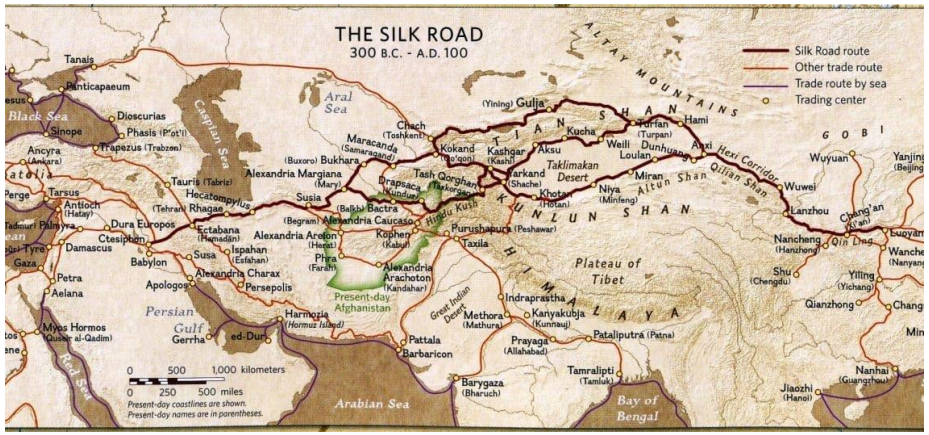
- Museo derechos humanos
- Museo precolombino

- Mercado Central
- Mercado La Vega

ESO PUBLIC

Where I come from





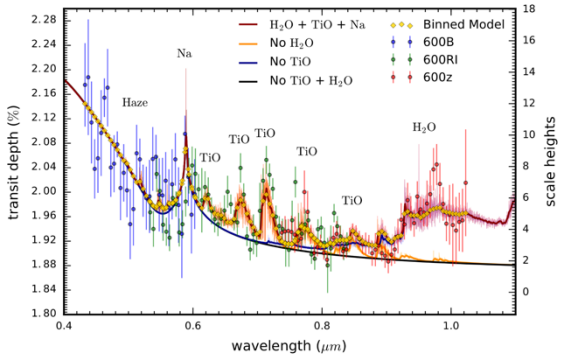
Taghavi Historical House in Gorgan

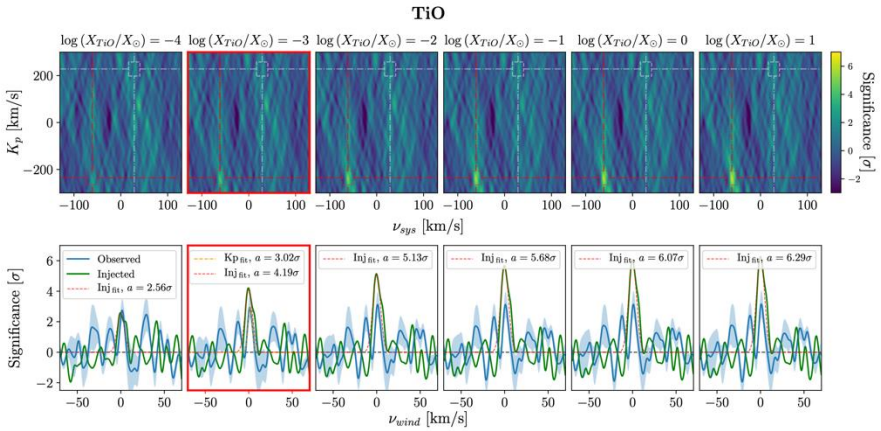
Trajectory

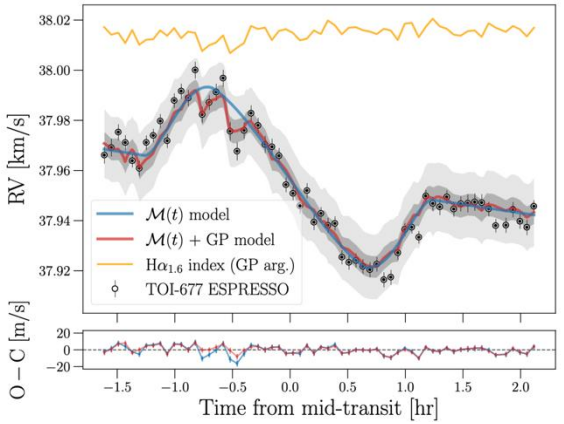
- ESO Staff Astronomer since 2022
  with duties at Paranal Observatory
- before: Fellowship at Paranal, postdocs in Chile & Spain
- PhD 2017 German Space Agency (Berlin) & ESO (Chile)
  Thesis topic: Exoplanet atmosphere detection

Why ESO?

- Interest in technical aspects of telescopes & instruments
- Community support
- Training of students and postdocs





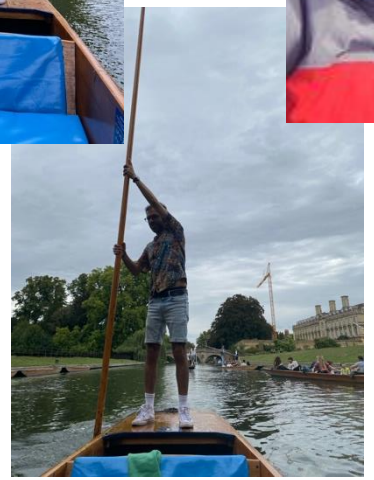


ESO PUBLIC

Hobbies & Interests

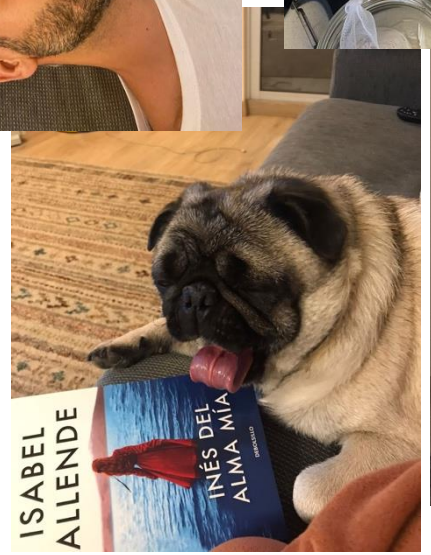
Surfing along the Chilean coast

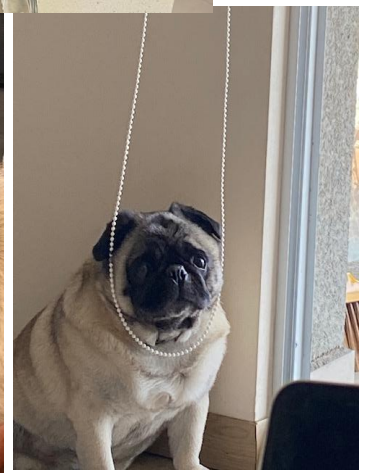
Professional punter



Skiing the Alps & the Andes

Football





LS26 Overview

Mon 2nd – Tue 3rd:

Workshop at ESO Chile
from 9:30 to ~18:00

Coffee breaks and lunch will be provided by ESO

Wed 4th – Tue 10th:

Trip to La Silla
Departure Wednesday 9:00
Arrival Wednesday ~17:00

Observations on
Friday: NTT, 3p6, 1p5
Saturday: NTT, 1p5
Sunday: NTT, 3p6, 1p5
Monday: NTT (partial), 3p6

Departure Tuesday ~09:30

Wed 11th – Fri 13th:

Data analysis at ESO Chile

Thursday: school dinner

Group presentations on
Friday afternoon

The LS26 Team

Paulina Jiron

Henri Boffin

Anna Pala

Camila de Sá Freitas

Elyar Sedaghati

Leslie Kiefer

Maria Jose (Cote) Rain

Linda Schmidtobreick

Thallis Pessi

The European Southern Observatory

Some Facts about ESO

Intergovernmental research institution of **16 member states*** along with the host state of Chile and with Australia as a strategic partner.

(*Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Ireland, Italy, The Netherlands, Poland, Portugal, Spain, Sweden, Switzerland, UK)

ESO's Vision ("Why?")

ESO's Vision is to advance humanity's understanding of the Universe by working with and for the astronomy community, providing it with world-leading facilities.

ESO's Mission ("What?")

ESO's Mission is to design, build and operate advanced ground-based observatories, and to foster international collaboration for astronomy.

Some Facts about ESO

Headquarters in Garching bei München, Munich
~550 staff (incl. 20 students + 18 fellows)

ESO Chile campus in Vitacura, Santiago de Chile
+ **observatories**: ~210 staff
(incl. 10 students + 19 fellows)

ESO Observatories

La Silla

ESO operated:
NTT 3.58 m
3.6-metre telescope

Hosted telescopes currently in operation: **14**

Paranal

ESO operated:
VLT and VLTI
4 x 8.2 m, 4 x 1.8 m
VISTA 4.1 m

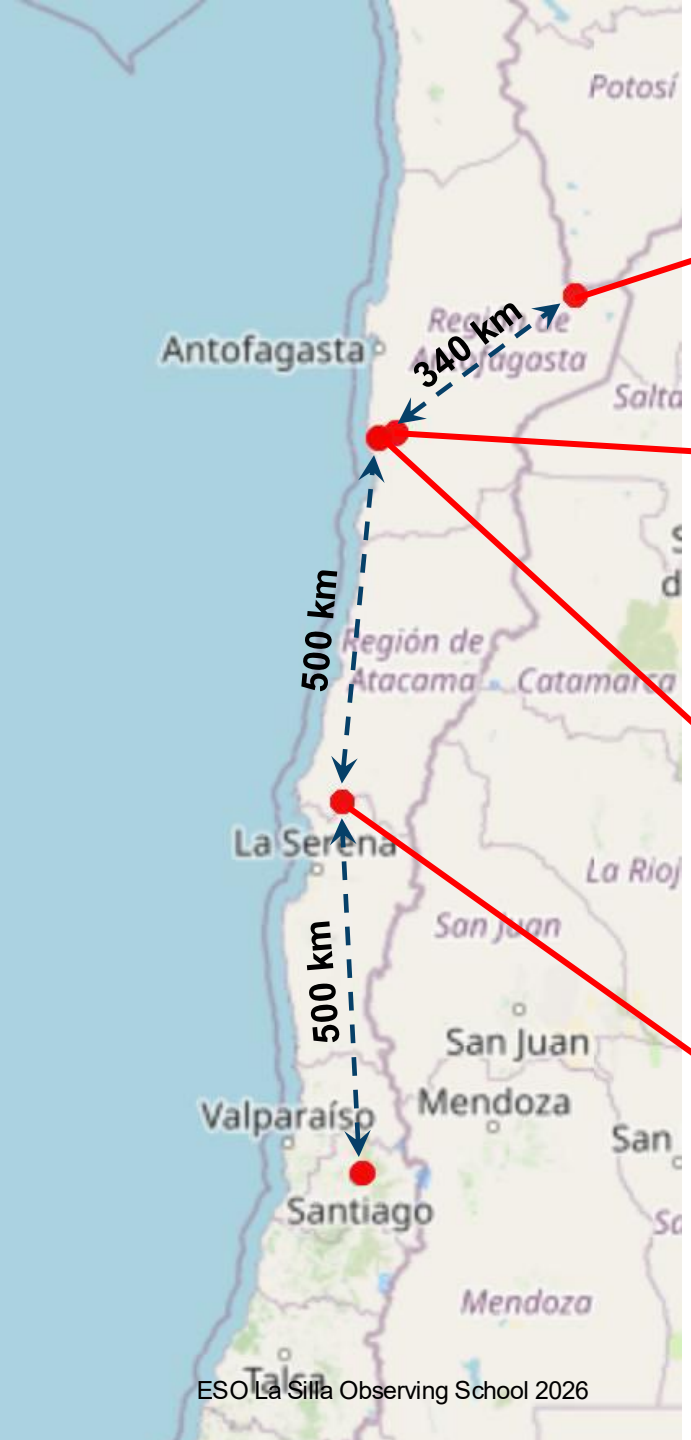
Hosted telescopes currently in operation:
VST, NGTS, SPECULOOS

Armazones

Under construction:
ELT 39.3 m

Chajnantor

ALMA
54 x 12 m and
12 x 7 m antennas


Potosí
Antofagasta
340 km
Salta
500 km
Región de Atacama
Catamarca
La Serena
La Rioj
San Juan
500 km
San Juan
Mendoza
Valparaíso
San
Santiago
Mendoza
Talca

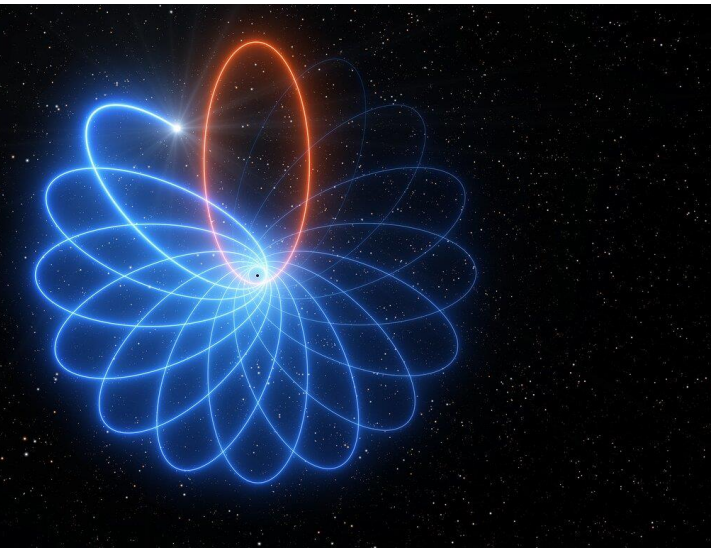

ALMA


Paranal


ELT


La Silla

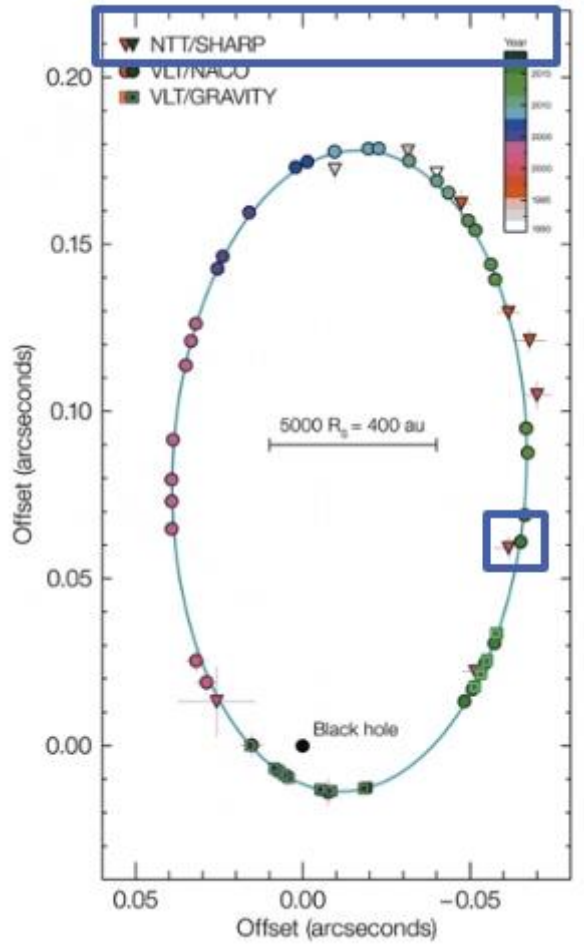
Top 10 Discoveries with ESO Telescopes



1. **Stars orbiting the Milky Way supermassive black hole**
   The observations made with NTT and VLT have for the first time revealed the effects predicted by Einstein's general relativity on the motion of a star passing through an extreme gravitational field.

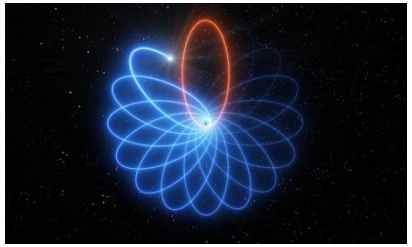
   A&A, 2020, vol. 636, p. L5

   Nobel prize in Physics in 2020



https://www.eso.org/public/science/top10/

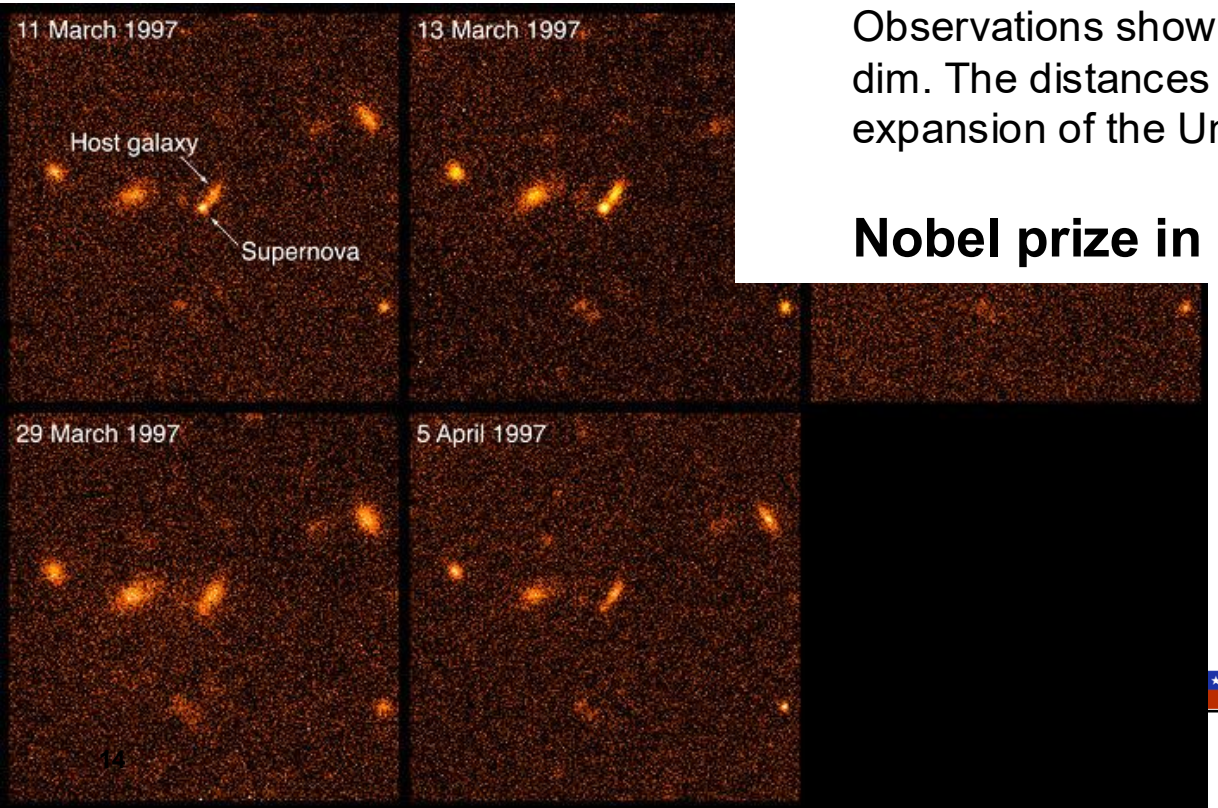
Top 10 Discoveries with ESO Telescopes



1. **Stars orbiting the Milky Way supermassive black hole**
   The observations made with NTT and VLT have for the first time revealed the effects predicted by Einstein's general relativity on the motion of a star passing through an extreme gravitational field.

2. **Accelerating Universe**
   Observations show that, compared to their nearby twins, distant supernovae appear too dim. The distances to the supernovae must have increased, suggesting that the rate of expansion of the Universe must increase with time. Observations with NTT.

Nobel prize in Physics in 2011



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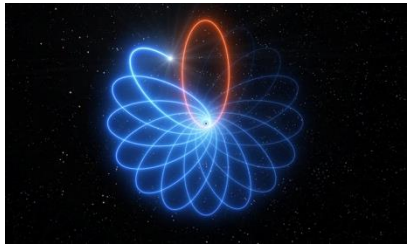
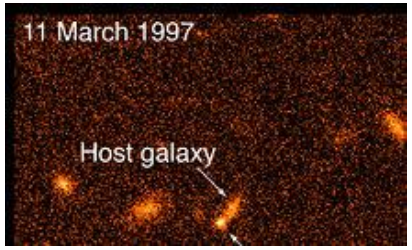
Top 10 Discoveries with ESO Telescopes





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3. **Planet Found in Habitable Zone Around Nearest Star, Proxima**
   Proxima b, orbits its cool red parent star every 11 days and has a temperature suitable for liquid water to exist on its surface. This rocky world is a little more massive than the Earth and is the closest exoplanet to us. Observations with 3.6m.

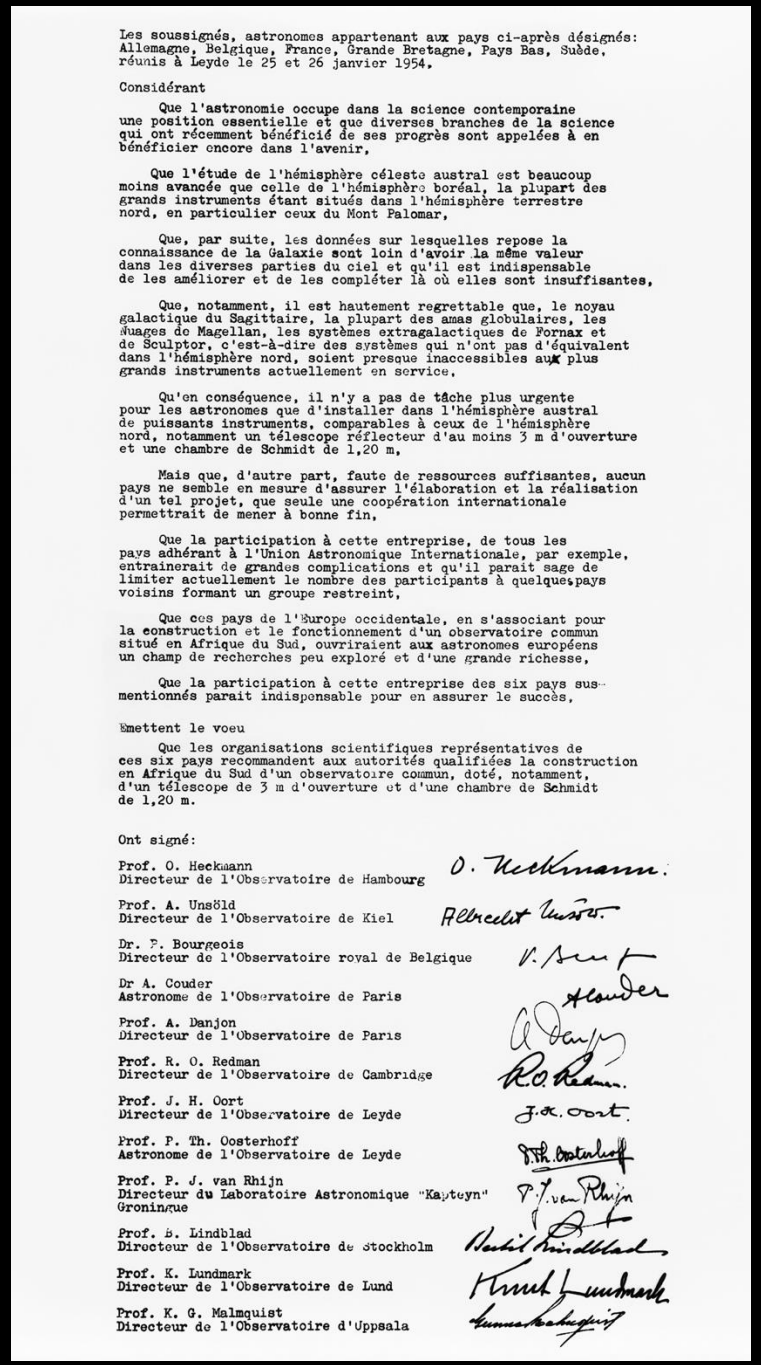
https://www.eso.org/public/science/top10/

Top 10 Discoveries with ESO Telescopes

1. Stars orbiting the Milky Way supermassive black hole (LS+VLT)
2. Accelerating Universe (LS)
3. Planet Found in Habitable Zone Around Nearest Star, Proxima (LS)
4. Astronomers Capture First Image of a Black Hole (ALMA)
5. Revolutionary ALMA image reveals planetary genesis (ALMA)
6. First image of an exoplanet (VLT)
7. First light from gravitational wave source
8. First Super-Earth Atmosphere Analysed
9. Cosmic temperature independently measured
10. Record-breaking planetary system (Trappist-1)

https://www.eso.org/public/science/top10/

Milestones



Les soussignés, astronomes appartenant aux pays ci-après désignés: Allemagne, Belgique, France, Grande Bretagne, Pays Bas, Suède, réunis à Leyde le 25 et 26 janvier 1954,

Considérant

Que l'astronomie occupe dans la science contemporaine une position essentielle et que diverses branches de la science qui ont récemment bénéficié de ses progrès sont appelées à en bénéficier encore dans l'avenir,

Que l'étude de l'hémisphère céleste austral est beaucoup moins avancée que celle de l'hémisphère boréal, la plupart des grands instruments étant situés dans l'hémisphère terrestre nord, en particulier ceux du Mont Palomar,

Que, par suite, les données sur lesquelles repose la connaissance de la Galaxie sont loin d'avoir la même valeur dans les diverses parties du ciel et qu'il est indispensable de les améliorer et de les compléter là où elles sont insuffisantes,

Que, notamment, il est hautement regrettable que, le noyau galactique du Sagittaire, la plupart des amas globulaires, les Nuages de Magellan, les systèmes extragalactiques de Fornax et de Sculptor, c'est-à-dire des systèmes qui n'ont pas d'équivalent dans l'hémisphère nord, soient presque inaccessibles aux plus grands instruments actuellement en service,

Qu'en conséquence, il n'y a pas de tâche plus urgente pour les astronomes que d'installer dans l'hémisphère austral de puissants instruments, comparables à ceux de l'hémisphère nord, notamment un télescope réflecteur d'au moins 3 m d'ouverture et une chambre de Schmidt de 1,20 m,

Mais que, d'autre part, faute de ressources suffisantes, aucun pays ne semble en mesure d'assurer l'élaboration et la réalisation d'un tel projet, que seule une coopération internationale permettrait de mener à bonne fin,

Que la participation à cette entreprise, de tous les pays adhérant à l'Union Astronomique Internationale, par exemple, entrainerait de grandes complications et qu'il parait sage de limiter actuellement le nombre des participants à quelques pays voisins formant un groupe restreint,

Que ces pays de l'Europe occidentale, en s'associant pour la construction et le fonctionnement d'un observatoire commun situé en Afrique du Sud, ouvriraient aux astronomes européens un champ de recherches peu exploré et d'une grande richesse,

Que la participation à cette entreprise des six pays susmentionnés parait indispensable pour en assurer le succès,

Emettent le voeu

Que les organisations scientifiques représentatives de ces six pays recommandent aux autorités qualifiées la construction en Afrique du Sud d'un observatoire commun, doté, notamment, d'un télescope de 3 m d'ouverture et d'une chambre de Schmidt de 1,20 m.

Ont signé:

Prof. O. Heckmann
Directeur de l'Observatoire de Hambourg

Prof. A. Unsöld
Directeur de l'Observatoire de Kiel

Dr. P. Bourgeois
Directeur de l'Observatoire roval de Belgique

Dr A. Couder
Astronome de l'Observatoire de Paris

Prof. A. Danjon
Directeur de l'Observatoire de Paris

Prof. R. O. Redman
Directeur de l'Observatoire de Cambridge

Prof. J. H. Oort
Directeur de l'Observatoire de Leyde

Prof. P. Th. Oosterhoff
Astronome de l'Observatoire de Leyde

Prof. P. J. van Rhijn
Directeur du Laboratoire Astronomique "Kapteyn" Groningue

Prof. B. Lindblad
Directeur de l'Observatoire de Stockholm

Prof. K. Lundmark
Directeur de l'Observatoire de Lund

Prof. K. G. Malmquist
Directeur de l'Observatoire d'Uppsala

26 January 1954

Astronomers from six European countries signed a statement with the aim of establishing a joint observatory.

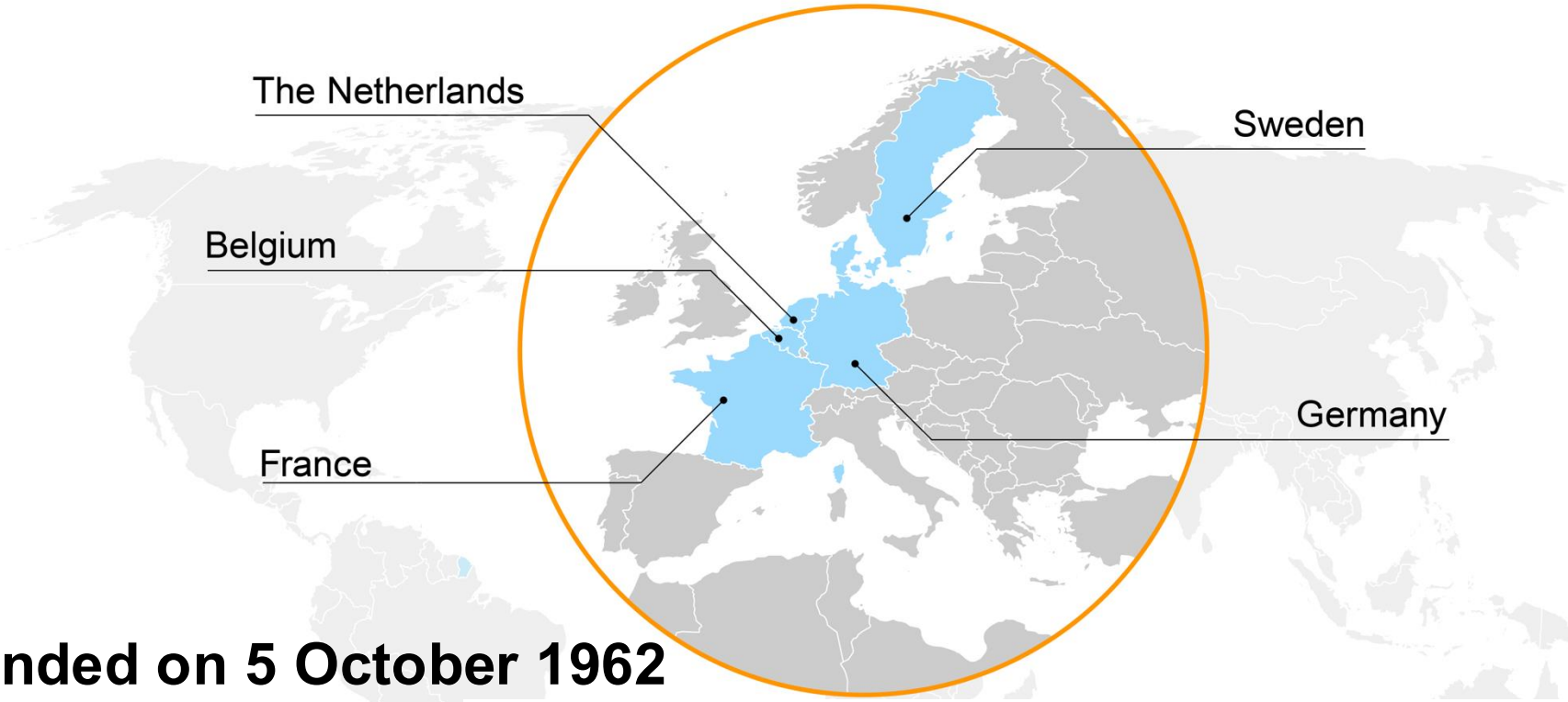
The observatory should house two modern telescopes with an initial staffing of 14 people.

André Danjon, one of ESO's founding persons, signs the statement.

1956

Site testing in South Africa, later in Chile

Founding Member States



ESO, **founded on 5 October 1962**
by five Member States

1962

In October 1959 the Ford Foundation of New York promised a donation of 1 000 000 U.S. dollars under the condition that four European countries join the ESO project. Without any doubt this promise has played an essential rôle in stimulating the countries concerned to reach an agreement. On 21 September 1964 the Ford Foundation transferred the above mentioned sum to the ESO account.

Organisation Européenne pour des Recherches Astronomiques
dans l'Hémisphère Austral

EUROPEAN SOUTHERN
OBSERVATORY

ANNUAL REPORT
1964

Hamburg-Bergedorf
1965

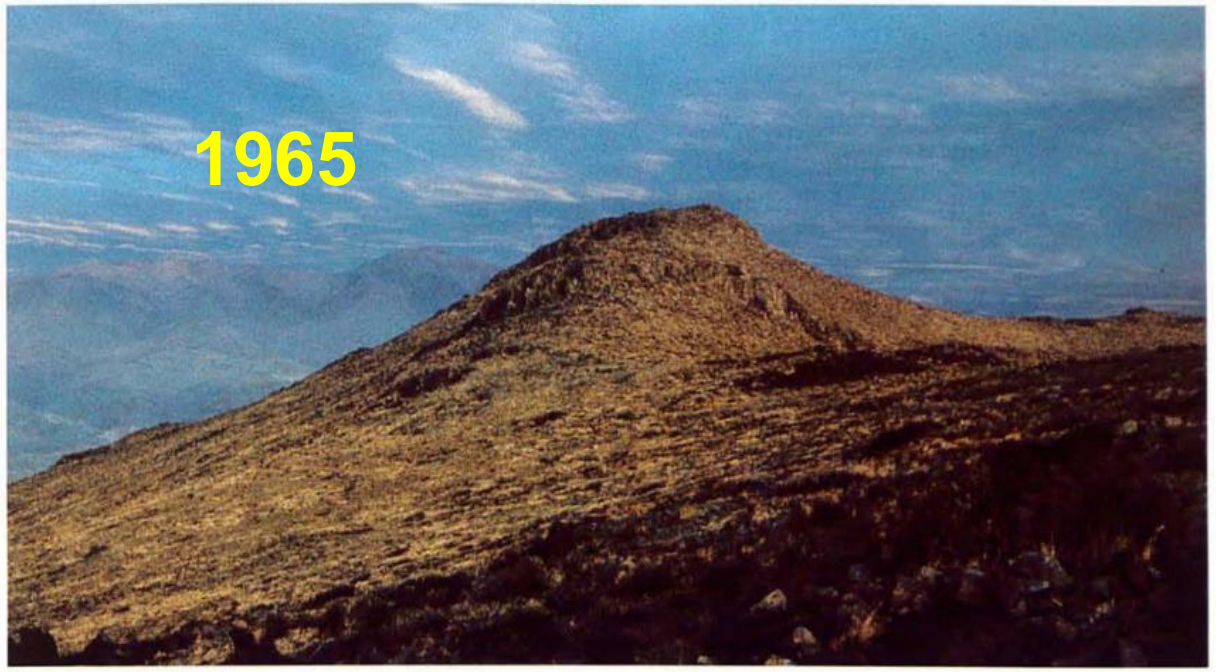
1963

3. Convention between the Chilean Government and ESO

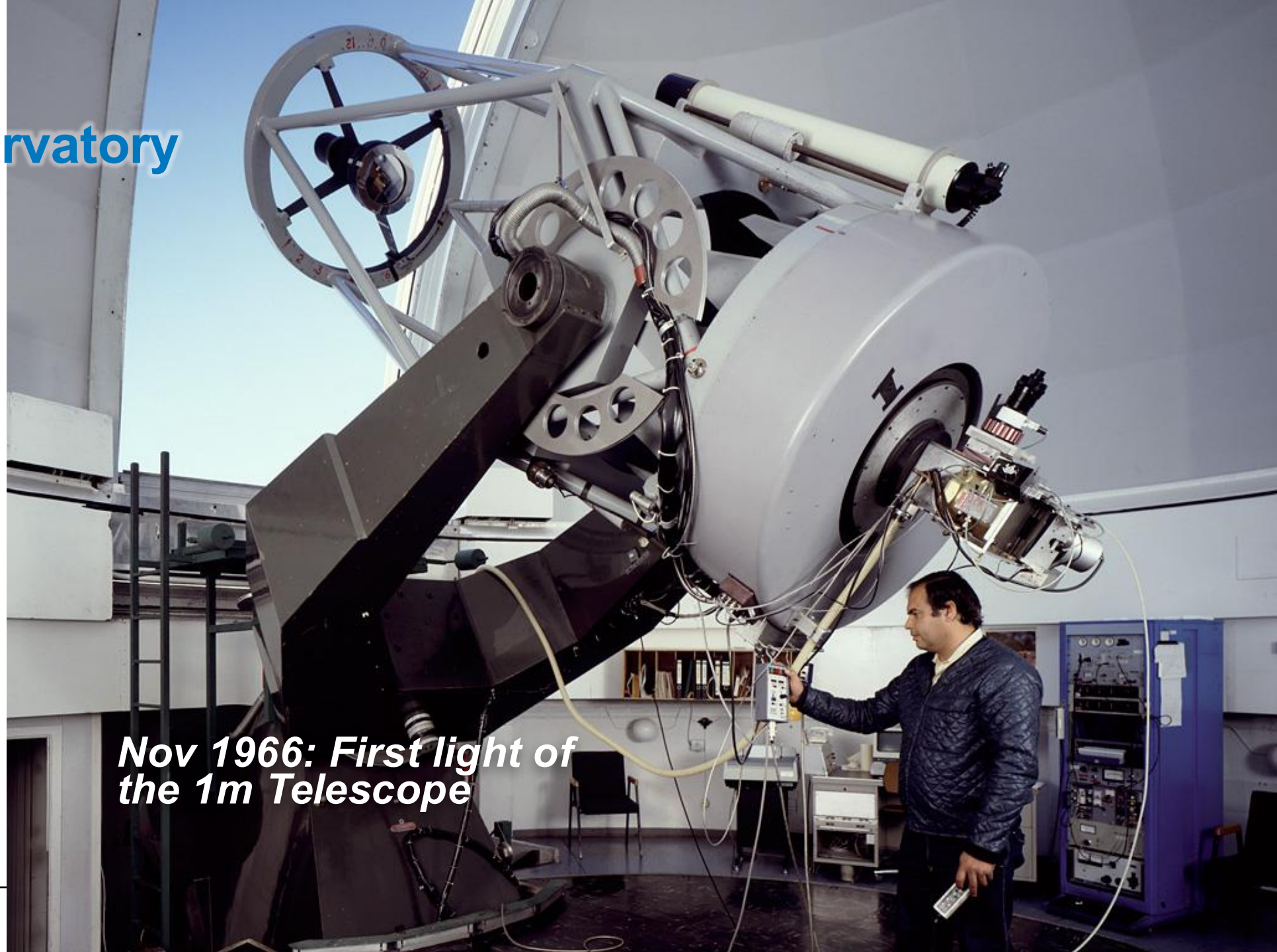
In order to facilitate international scientific activities the Swiss Government has granted to the European Organization for Nuclear Research / Organisation Européenne pour la Recherche Nucléaire (CERN) / certain immunities, preferences, and priorities in a special convention. ESO decided to aim at a similar Convention with the Chilean Government. Discussions were arranged in which the representatives of the Chilean Government fully agreed to ESO's request. The resulting Convention was signed in November 1963. It gives to ESO very much the same rights as had been granted to the Comisión Económica para América Latina (CEPAL) of the United Nations. The Convention was ratified by the Chilean Parliament and approved by the ESO Council early in 1964*).

La Silla Observatory

~500 km North of Santiago de Chile,
at 2400m elevation

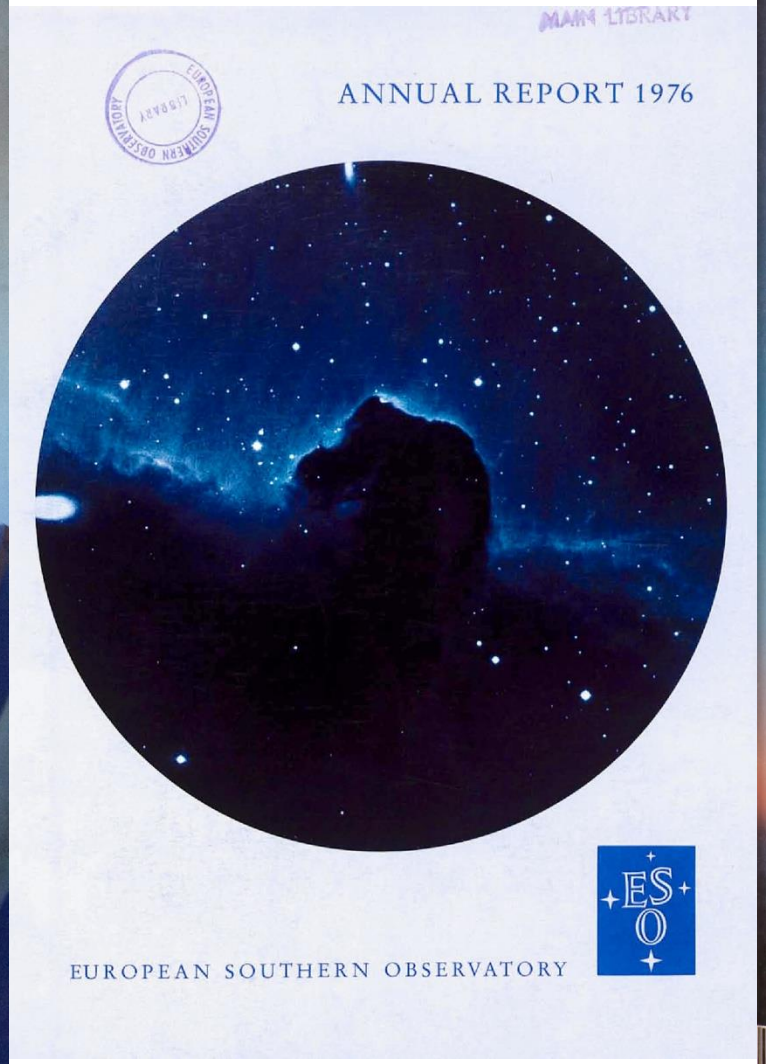


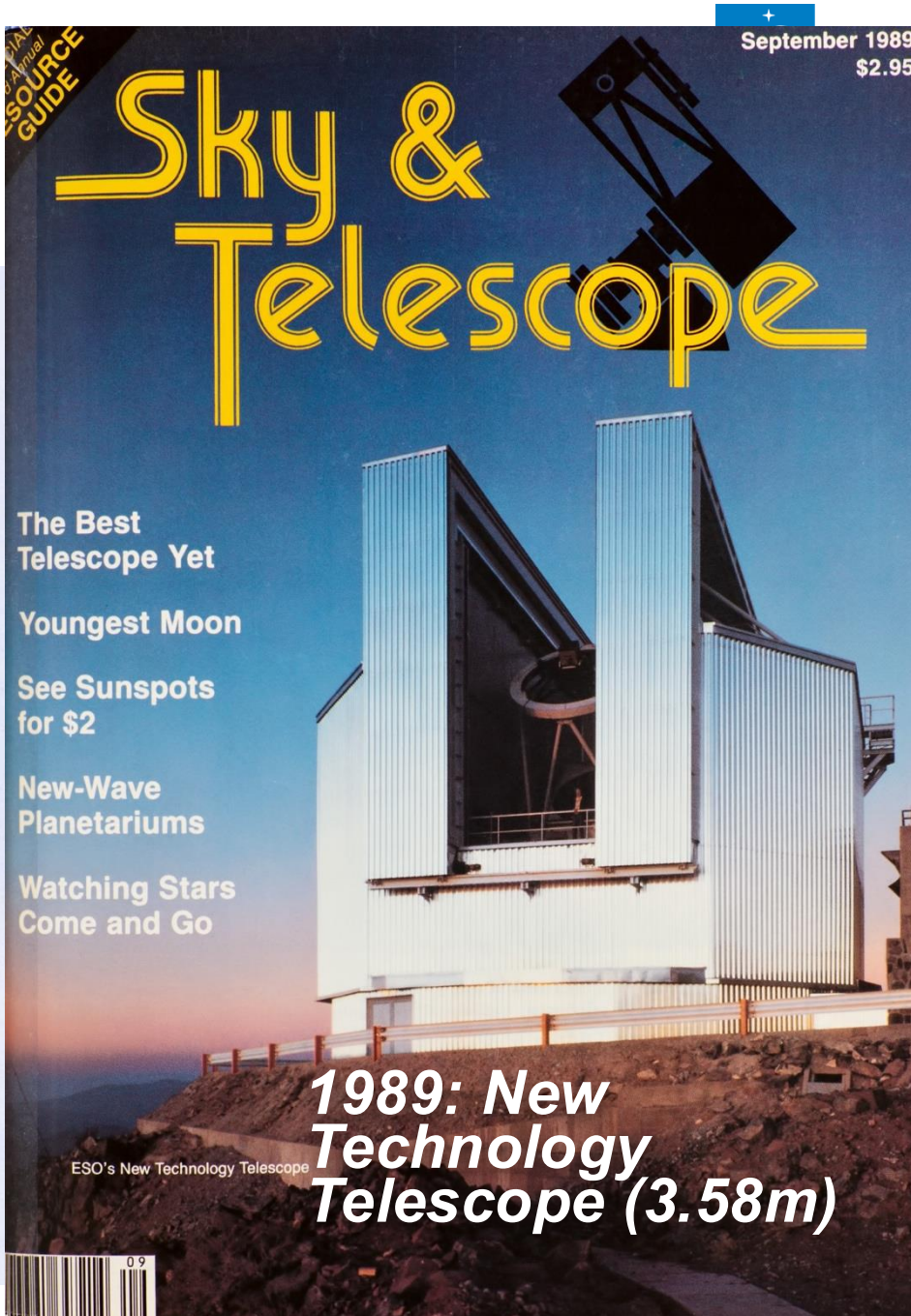
La Silla Observatory



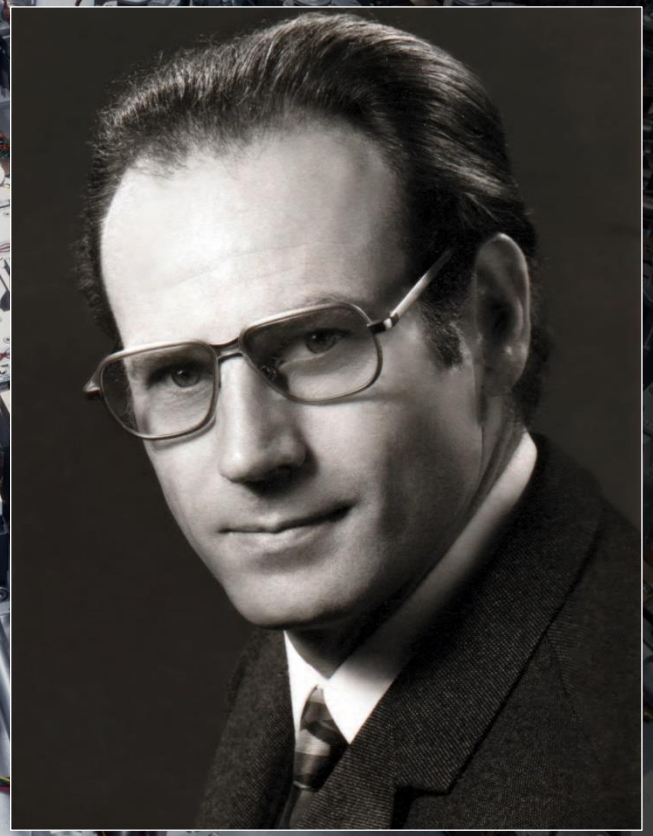
Nov 1966: First light of the 1m Telescope

La Silla Observatory





Active optics
Inventing a game changer



In the late 1980s ESO engineer **Raymond Wilson** invented a **revolutionary technology** and pioneered it at ESO's NTT.

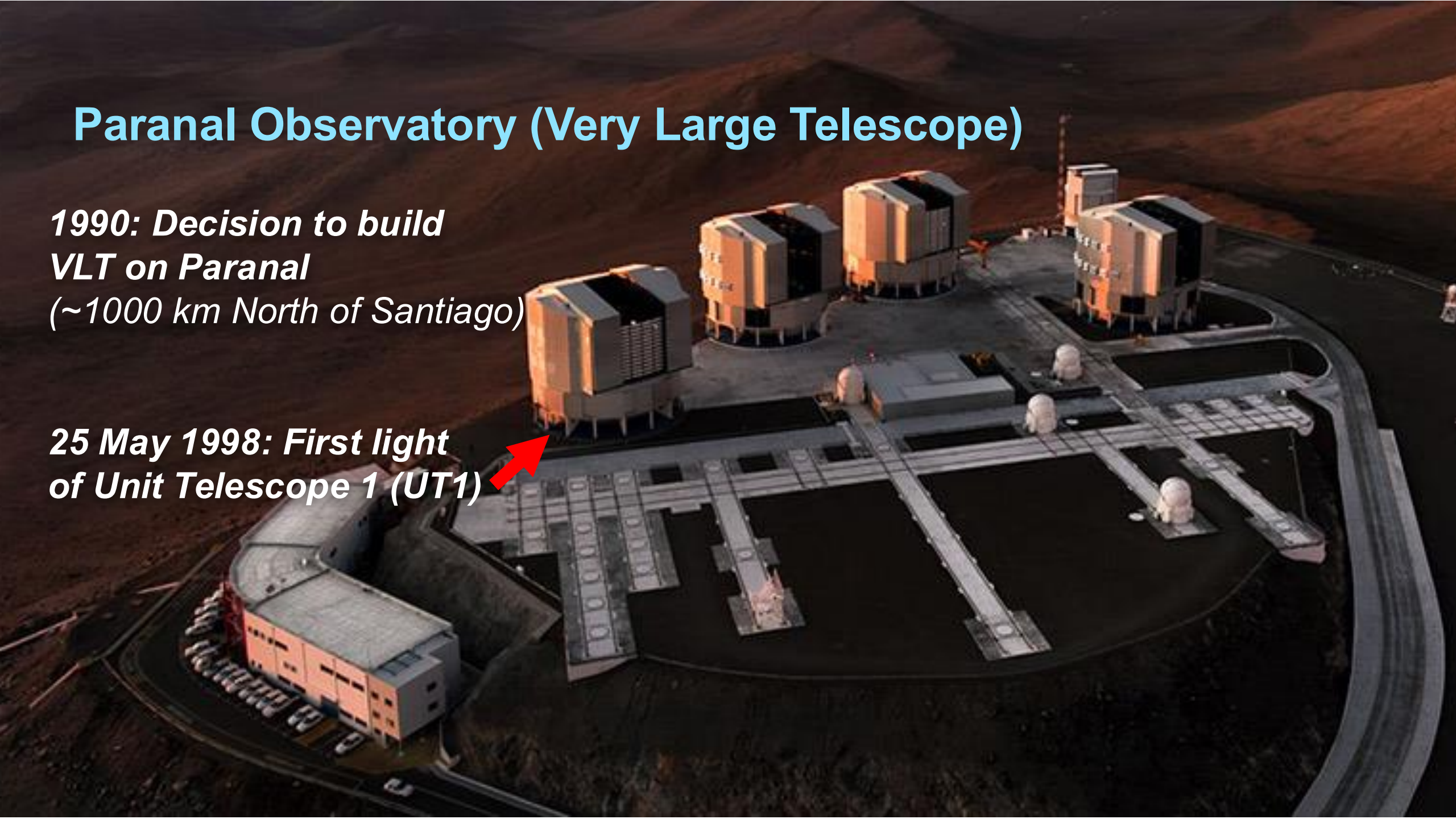
Today, **Active optics** is the backbone of large telescopes all over the world.

Active optics actuators for the NTT's primary mirror

Paranal Observatory (Very Large Telescope)

1990: Decision to build VLT on Paranal
(~1000 km North of Santiago)

25 May 1998: First light of Unit Telescope 1 (UT1)



2011: Atacama Large Millimeter Array (ALMA)

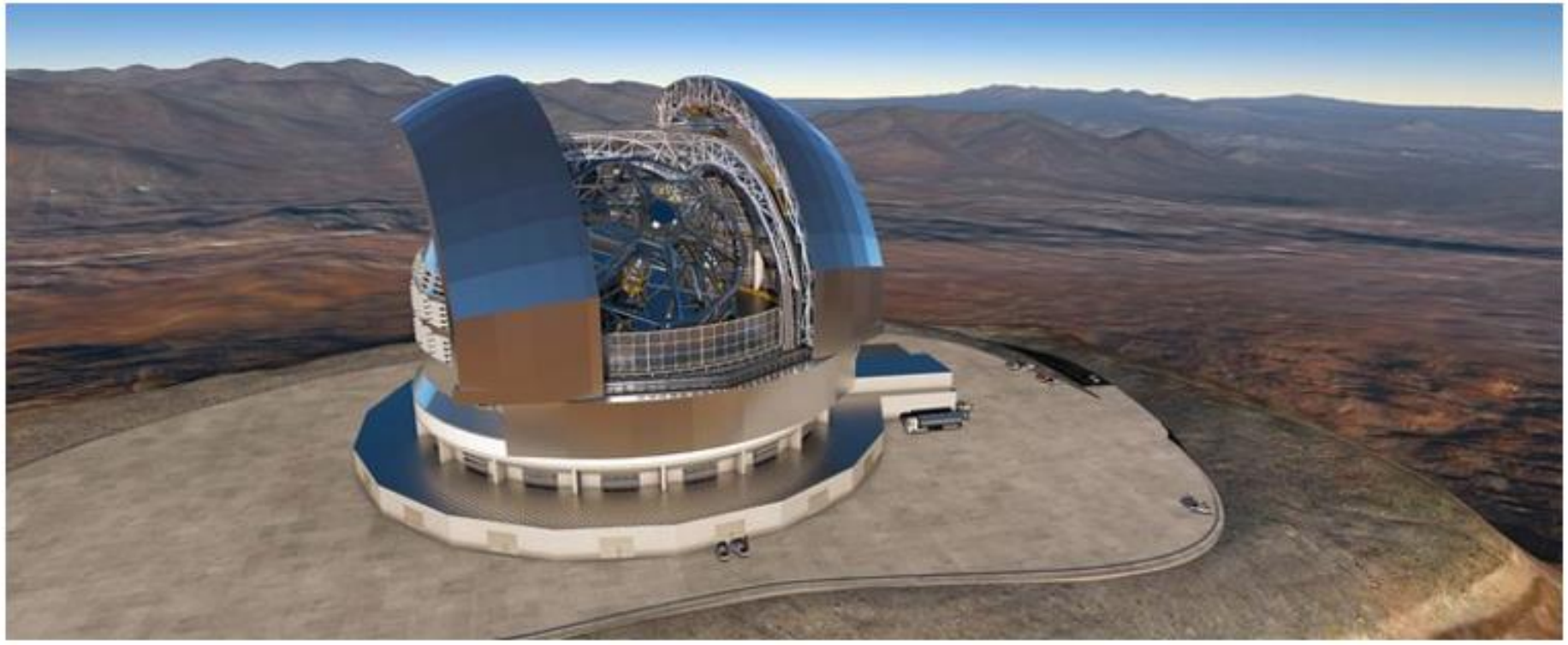
ALMA: Partnership between ESO, NSF (USA), Canada, Japan, Taiwan and Chile

66 radio telescopes on Chajnantor plateau (4800m) (San Pedro de Atacama, Chile)

2016: ELT

ESO Signs Largest Ever Ground-based Astronomy Contract for ELT Dome and Telescope Structure

25 May 2016



At a ceremony in Garching bei München, Germany on 25 May 2016, ESO signed the contract with the ACe Consortium, consisting of Astaldi, Cimolai and the nominated sub-contractor EIE Group, for the construction of the dome and telescope structure of the Extremely Large Telescope (ELT). This is the largest contract ever awarded by ESO and also the largest contract ever in ground-based astronomy. This occasion saw the unveiling of the construction design of the ELT. Construction of the dome and telescope structure will now commence.

The Future

La Silla Observatory

La Silla Observatory - Hosted Telescopes

Optical counterparts of gravitational waves

- BlackGem
- Schmidt / LS4
- TAROT
- REM

ExoPlanets

- ESO 1.52m > PLATOSPEC
- ExTRA
- Swiss
- MASCARA
- TRAPPIST

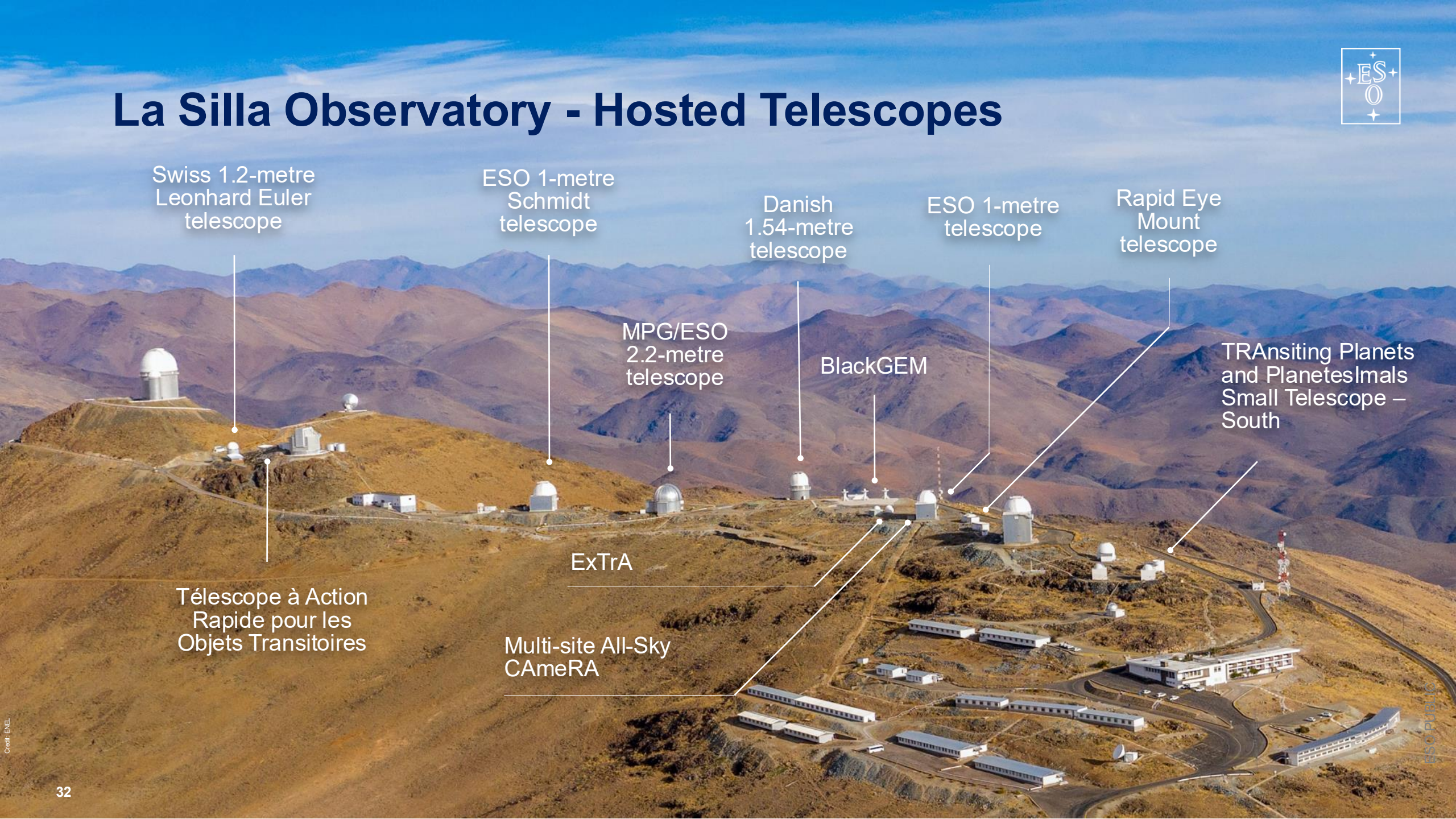
General science

- Danish 1.54m
- 2.2m MPG
- ESO 1m > UCN

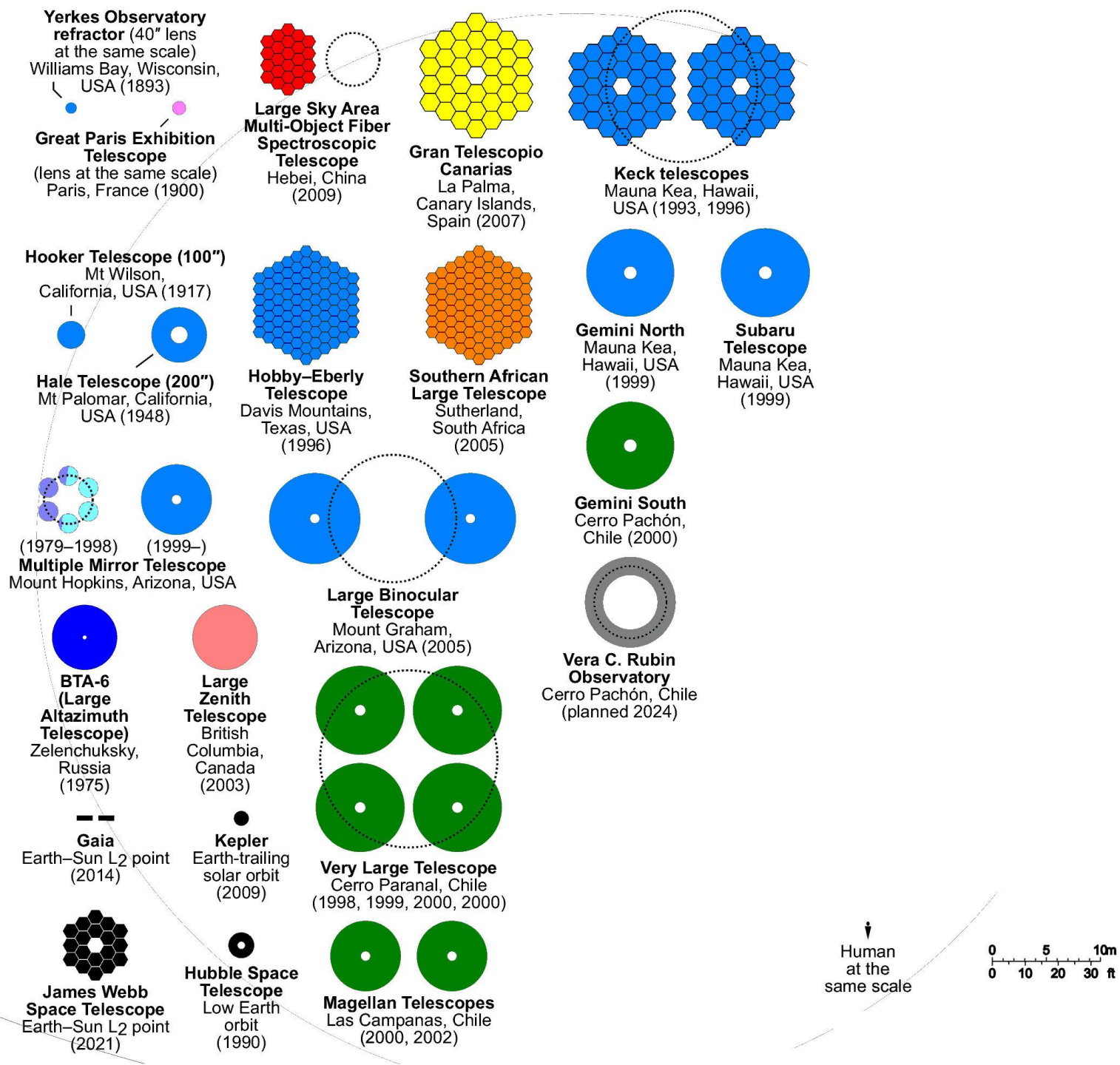
Near Earth Objects

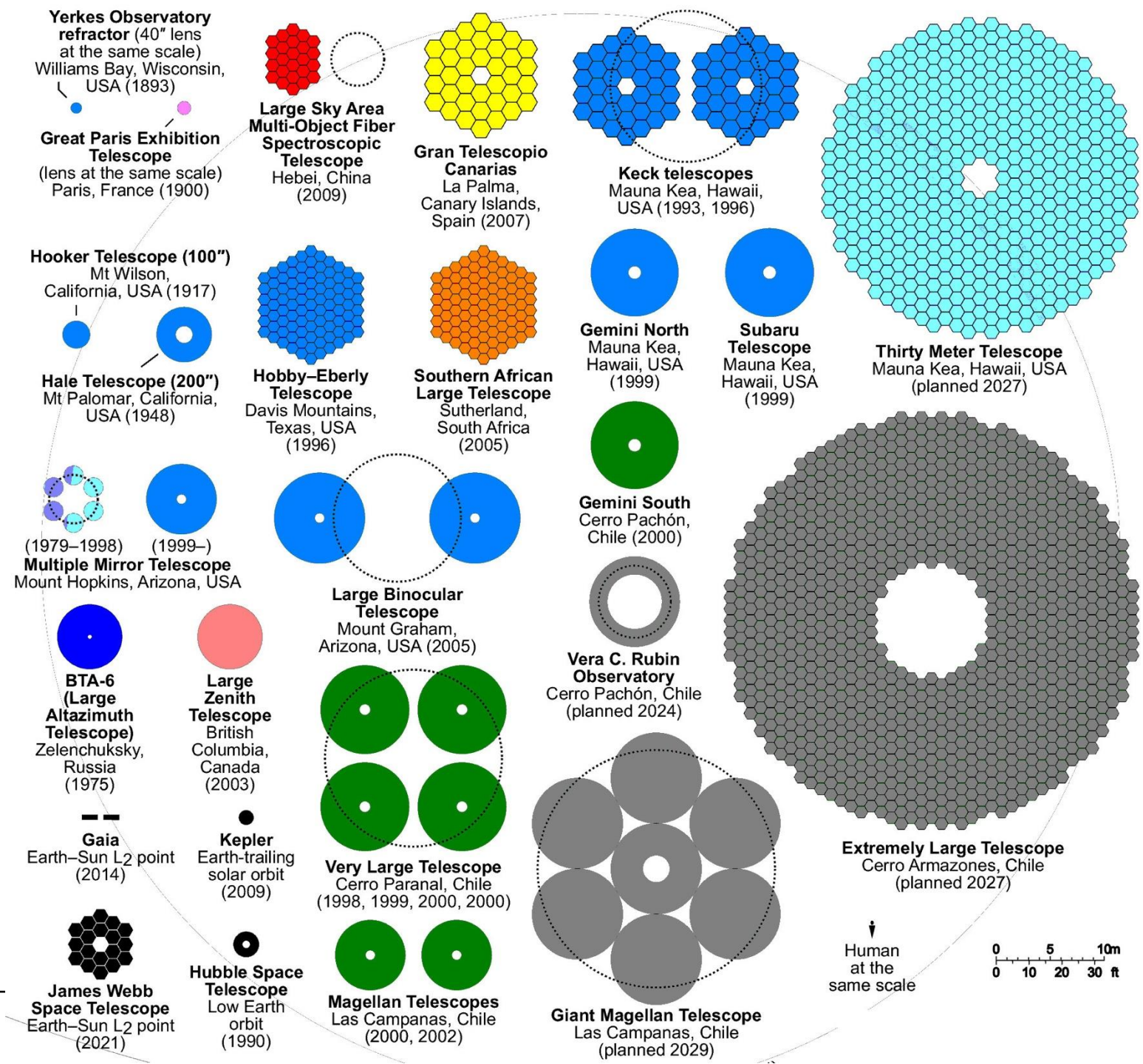
- ESA / TBT
- ESA / FlyE Eye (future)

La Silla Observatory - Hosted Telescopes



Credit: ENEL


Yerkes Observatory refractor (40″ lens at the same scale) Williams Bay, Wisconsin, USA (1893)
Great Paris Exhibition Telescope (lens at the same scale) Paris, France (1900)
Large Sky Area Multi-Object Fiber Spectroscopic Telescope Hebei, China (2009)
Gran Telescopio Canarias La Palma, Canary Islands, Spain (2007)
Keck telescopes Mauna Kea, Hawaii, USA (1993, 1996)
Hooker Telescope (100″) Mt Wilson, California, USA (1917)
Hale Telescope (200″) Mt Palomar, California, USA (1948)
Hobby–Eberly Telescope Davis Mountains, Texas, USA (1996)
Southern African Large Telescope Sutherland, South Africa (2005)
Gemini North Mauna Kea, Hawaii, USA (1999)
Subaru Telescope Mauna Kea, Hawaii, USA (1999)
(1979–1998)
(1999–)
Multiple Mirror Telescope Mount Hopkins, Arizona, USA
Large Binocular Telescope Mount Graham, Arizona, USA (2005)
Gemini South Cerro Pachón, Chile (2000)
Vera C. Rubin Observatory Cerro Pachón, Chile (planned 2024)
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)
Very Large Telescope Cerro Paranal, Chile (1998, 1999, 2000, 2000)
James Webb Space Telescope Earth–Sun L2 point (2021)
Hubble Space Telescope Low Earth orbit (1990)
Magellan Telescopes Las Campanas, Chile (2000, 2002)
Human at the same scale
0 5 10m
0 10 20 30 ft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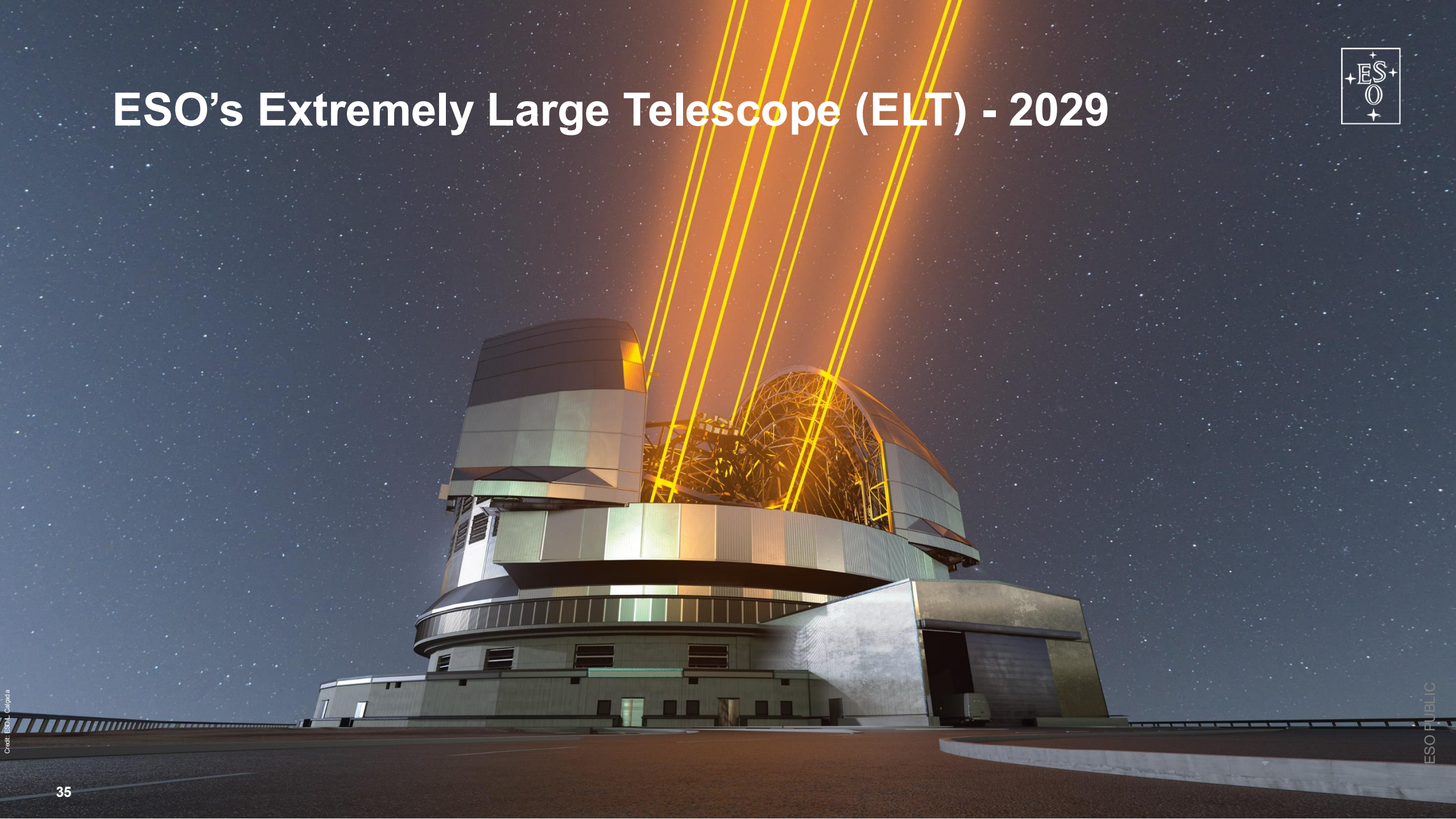
James Webb Space Telescope Earth–Sun L2 point (2021)
Hubble Space Telescope Low Earth orbit (1990)
Magellan Telescopes Las Campanas, Chile (2000, 2002)
Giant Magellan Telescope Las Campanas, Chile (planned 2029)
Human at the same scale
0 5 10m
0 10 20 30 ft

ESO’s Extremely Large Telescope (ELT) - 2029



Credit: ESO/L. Calçada

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Thank you!

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