



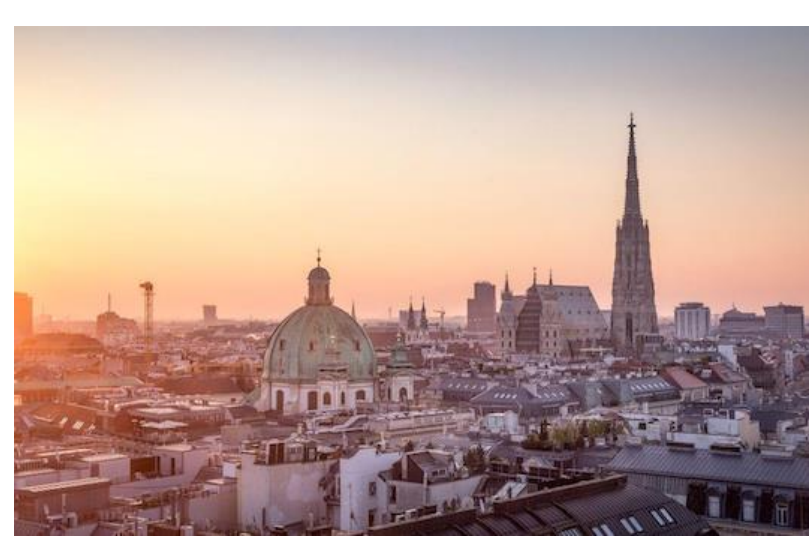
# Welcome to the La Silla Observing School!

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*Florian Rodler*

*ESO Chile*







# A few words about myself:

Florian Rodler

- ESO Staff Astronomer since 2016 with duties at Paranal Observatory
- before: postdocs in Spain, US and Germany
- PhD 2008 University of Vienna and MPIA Heidelberg
- Research: exoplanets and their atmospheres.

Why ESO Chile?

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





# LS25 Overview

## Mon 10<sup>th</sup> – Tue 11<sup>th</sup>:

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

Coffee breaks and lunch will  
be provided by ESO

Transport from hotel to ESO  
(9:00)

## Wed 12<sup>th</sup> – Tue 18<sup>th</sup>:

Trip to La Silla  
Departure Wed 9:00 (Hotel)

Observations on  
Friday: NTT, 3p6  
Saturday: NTT, 3p6  
Sunday: NTT, 3p6

Return to Santiago on  
Tuesday morning

## Wed 19<sup>th</sup> – Fri 21<sup>st</sup>:

Data analysis at ESO Chile

Group presentations on  
Friday afternoon



# The LS25 Team



**Florian Rodler**



**Paulina Jiron**



**Alejandra Rojas  
Lilayú**



**Robert de Rosa**



**Monika Petr-Gotzens**



**Leslie Kiefer**



**Ana Jiménez Gallardo**



**Michaël Marsset**





# 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. 13 students + 21 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**

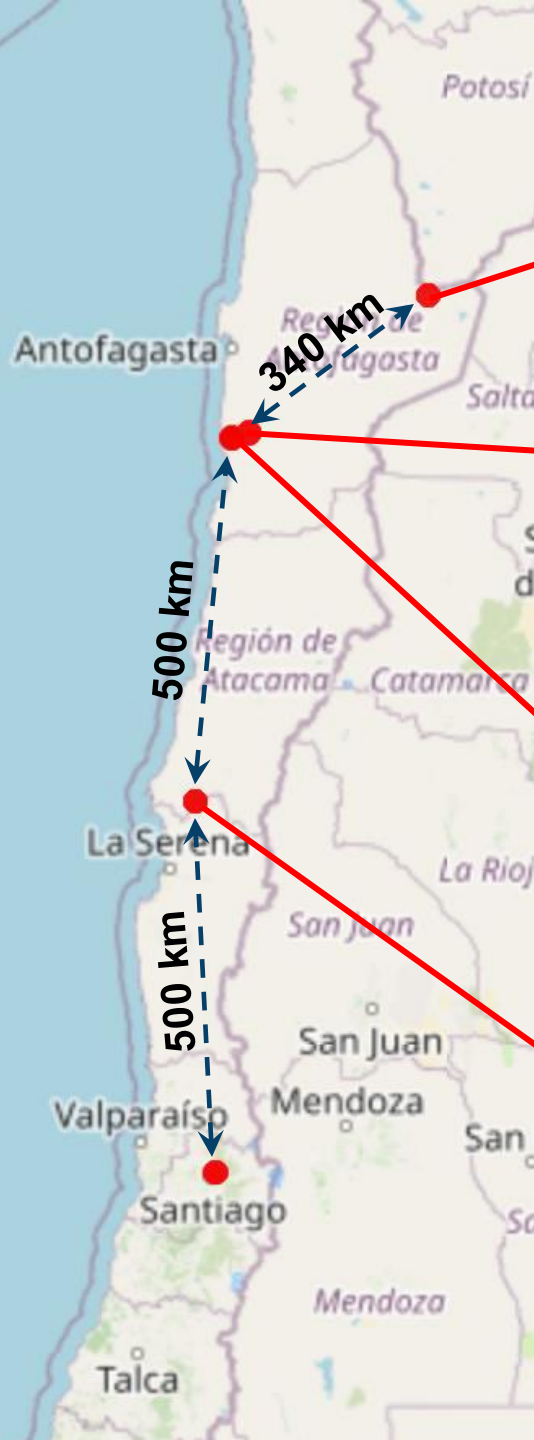
**Under construction:**  
**ELT 39.3 m**



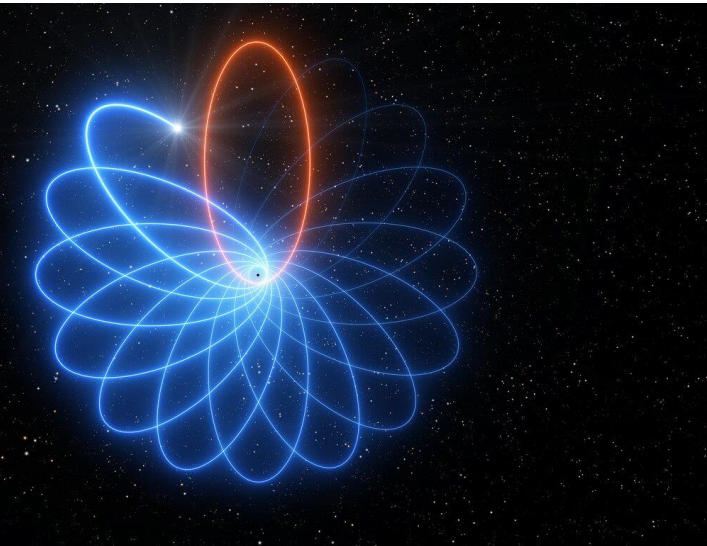
**Chajnantor**

**ALMA**  
 54 x 12 m and  
 12 x 7 m antennas





# Top 10 Discoveries with ESO Telescopes

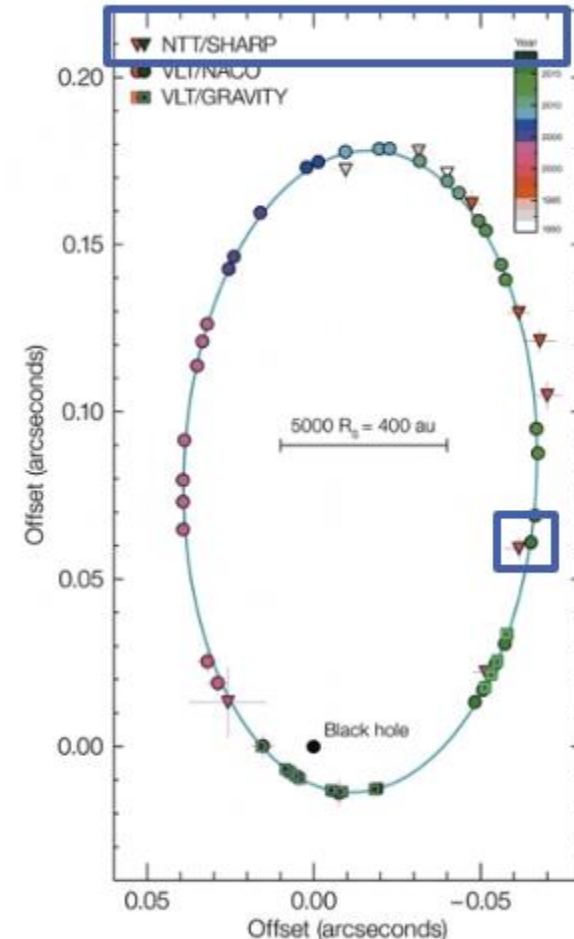


## 1. Stars orbiting the Milky Way supermassive black hole

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

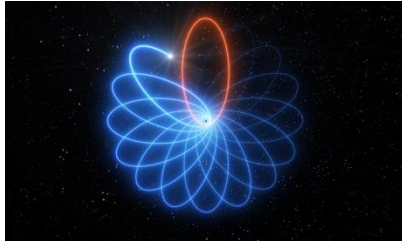
**Nobel prize in Physics in 2020**



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



# Top 10 Discoveries with ESO Telescopes



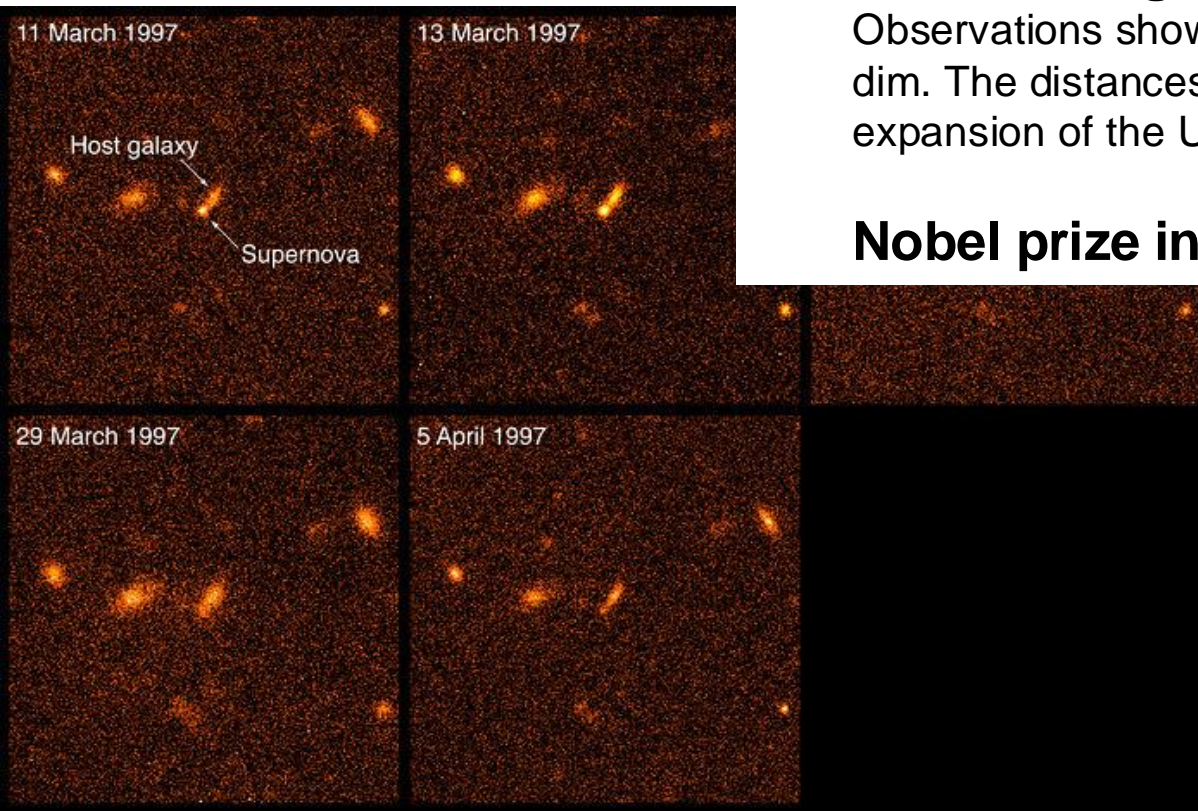
## 1. Stars orbiting the Milky Way supermassive black hole

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

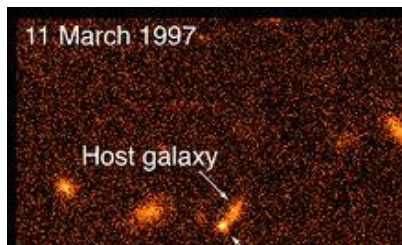
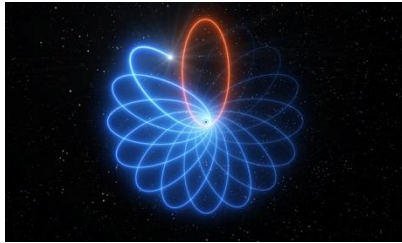
Observations show that, compared to their nearby twins, distant supernovae appear too dim. The distances to the supernovae must have increased, suggesting that the rate of expansion of the Universe must increase with time. Observations with NTT.

## Nobel prize in Physics in 2011



<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.

## 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 adhérents à l'Union Astronomique Internationale, par exemple,  
entraînerait de grandes complications et qu'il paraît 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 sus-  
mentionnés paraît indispensable pour en assurer le succès,

Emettent le vœu

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

*O. Heckmann*

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

*Albrecht Unsöld*

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

*P. Bourgeois*

Dr A. Couder  
Astronome de l'Observatoire de Paris

*A. Couder*

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

*A. Danjon*

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

*R.O. Redman*

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

*J.H. Oort*

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

*P.Th. Oosterhoff*

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

*P.J. van Rhijn*

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

*Bertil Lindblad*

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

*Knut Lundmark*

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

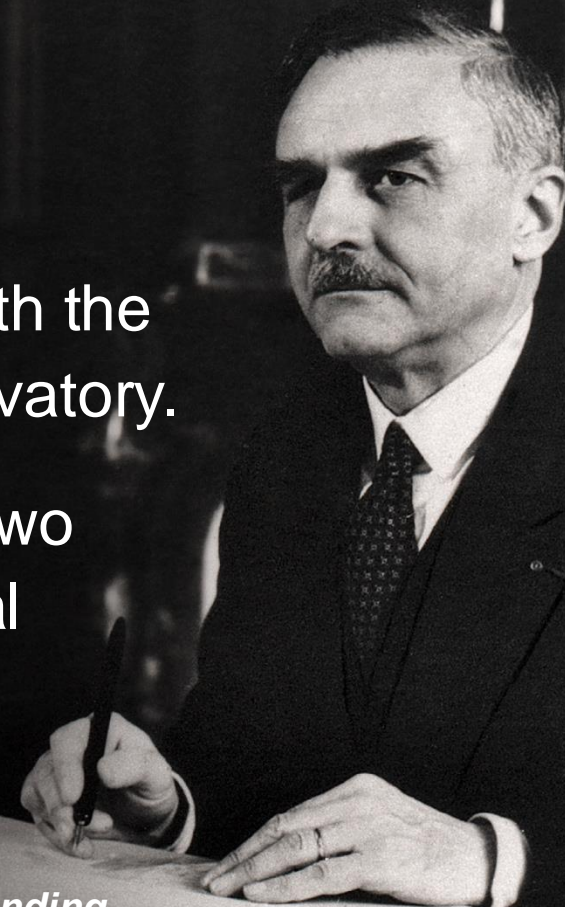
*K.G. Malmquist*

# 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.*



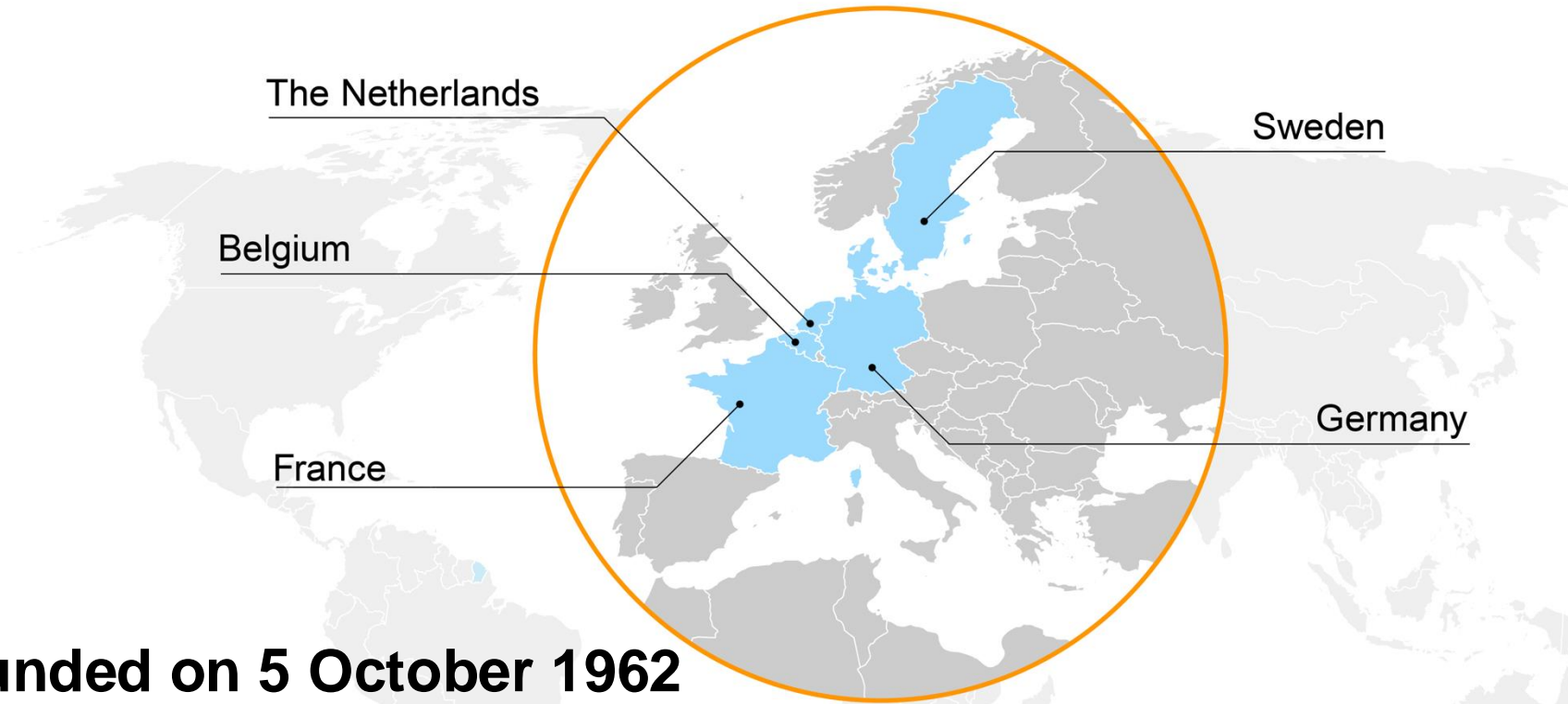


1956

*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.



EUROPEAN SOUTHERN  
OBSERVATORY



ANNUAL REPORT  
1964

Hamburg-Bergedorf  
1965

1963

### 3. Convention between the Chilean Government and ESO

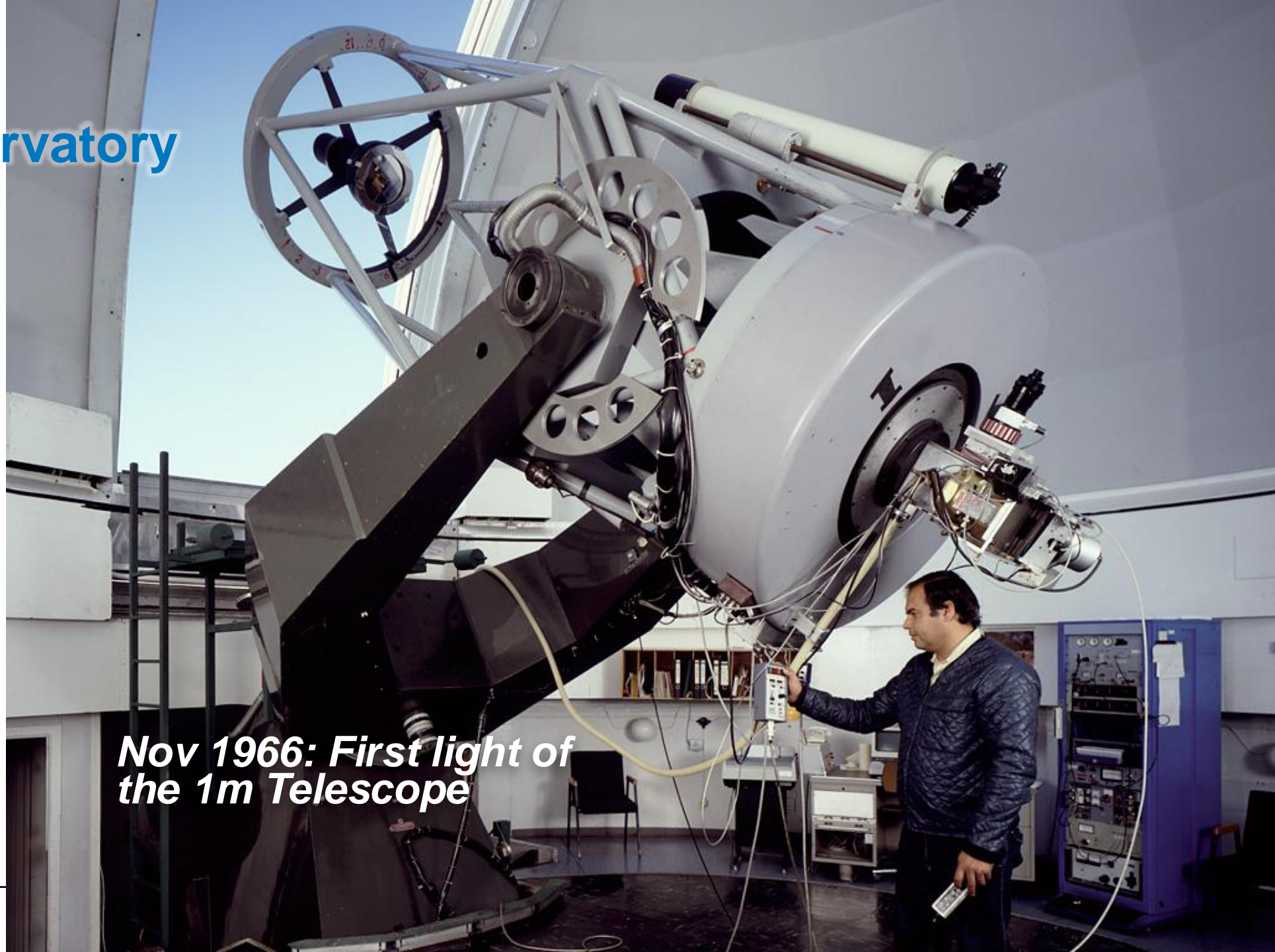
In order to facilitate international scientific activities the Swiss Government has granted to the European Organization for Nuclear Research / Organisation Européenne pour la Recherche Nucléaire (CERN) / certain immunities, preferences, and priorities in a special convention. ESO decided to aim at a 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

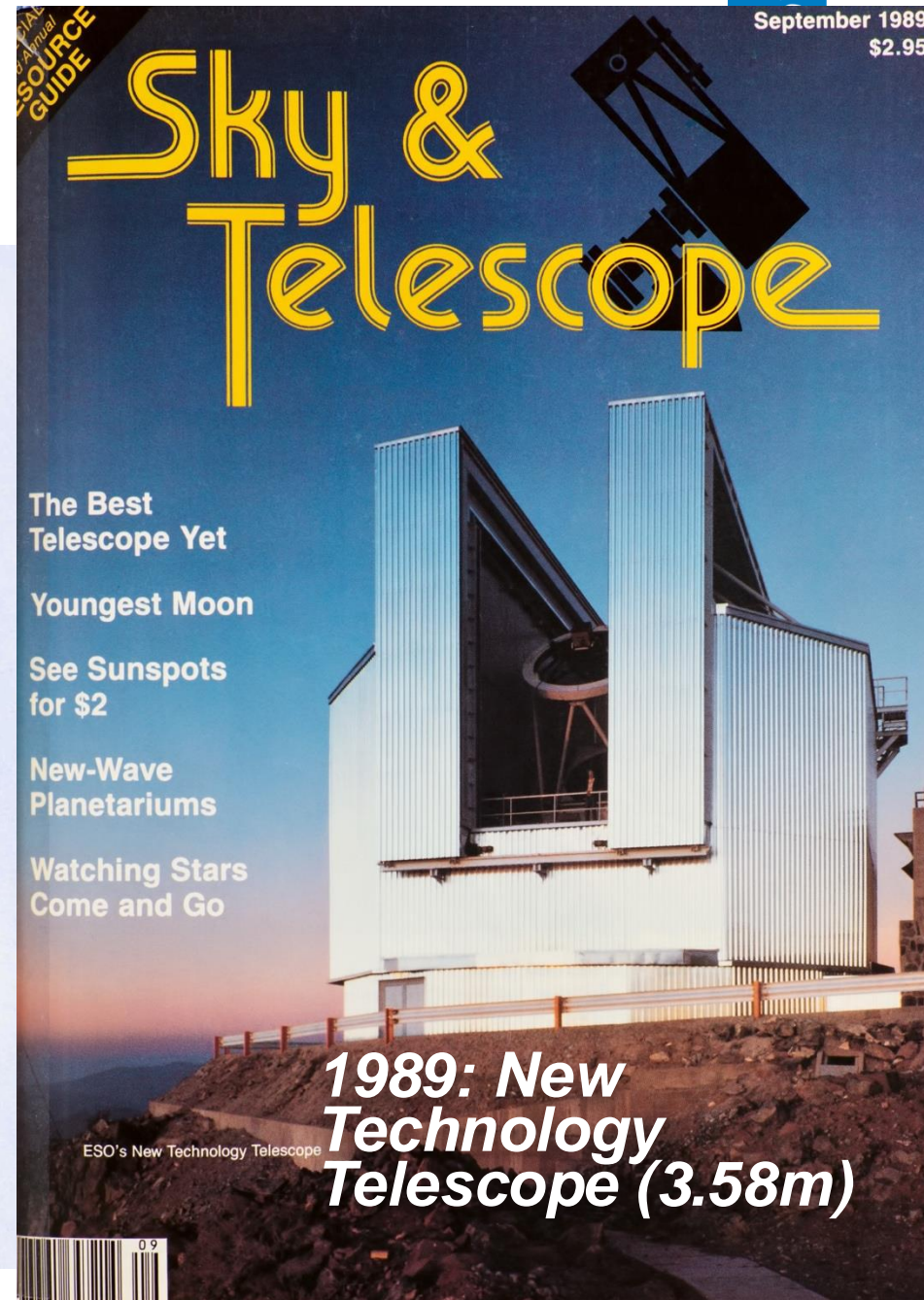


*Nov 1966: First light of  
the 1m Telescope*

# La Silla Observatory



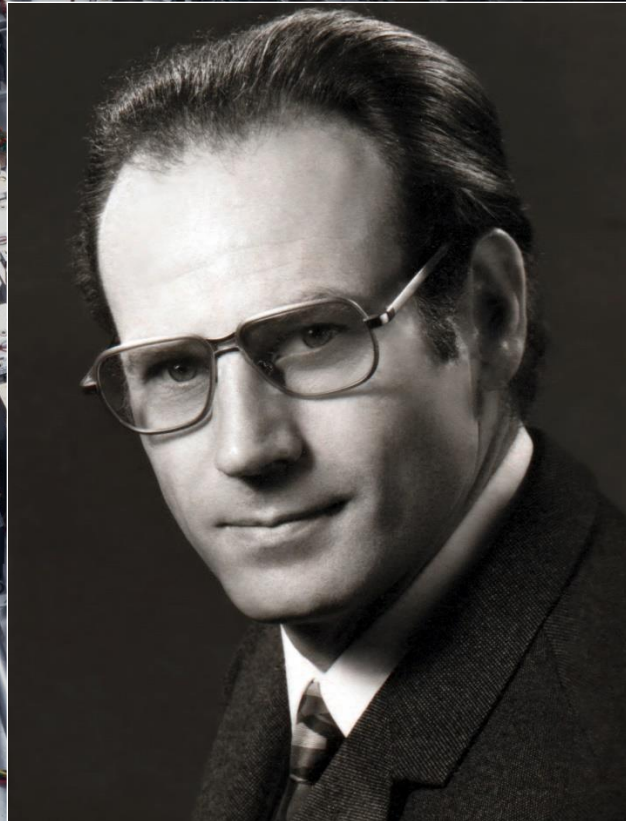
**1976: 3.6m Telescope**



**1989: New Technology Telescope (3.58m)**

# 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.

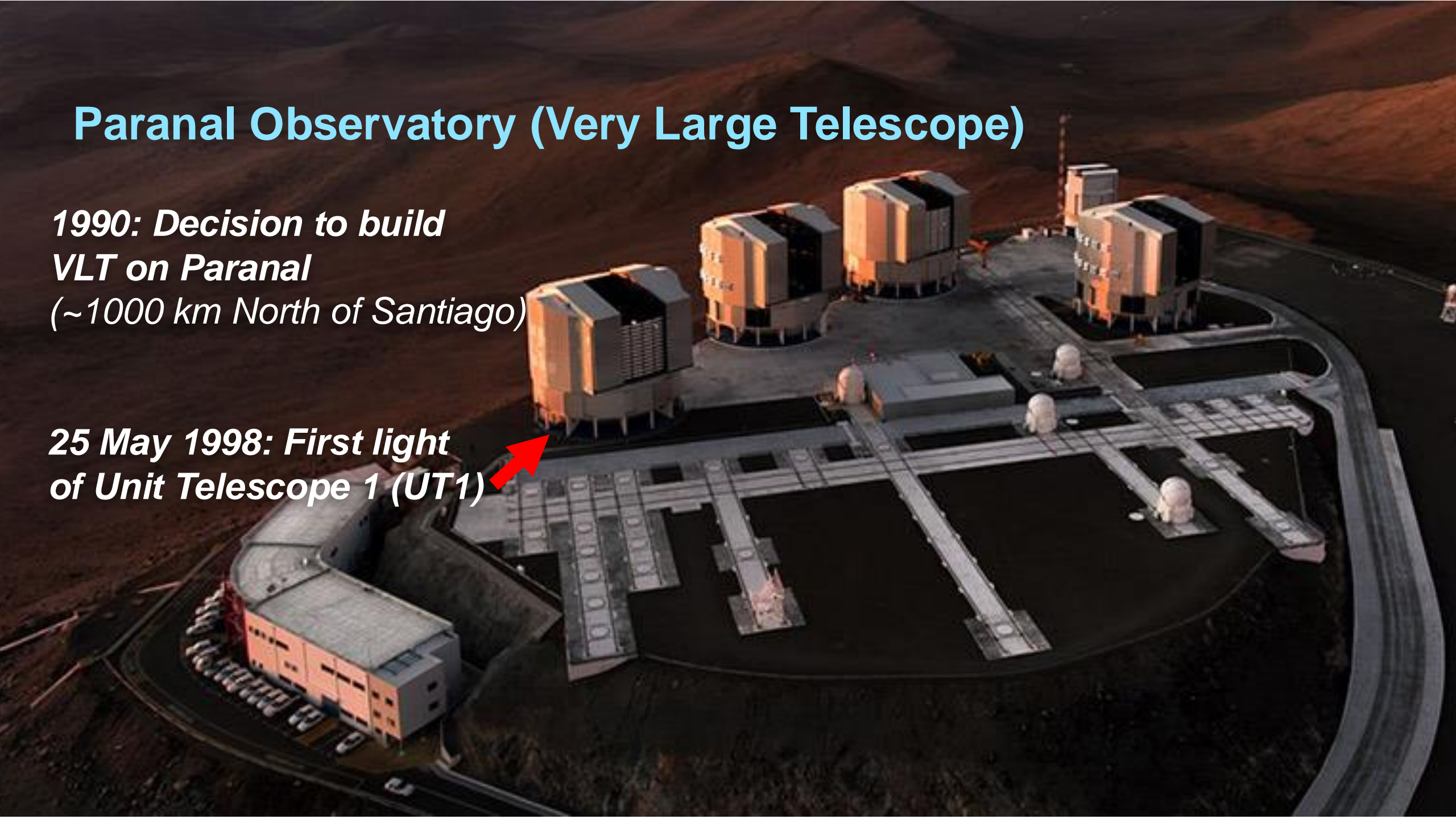
Today, **Active optics** is the backbone of large telescopes all over the world.

*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)

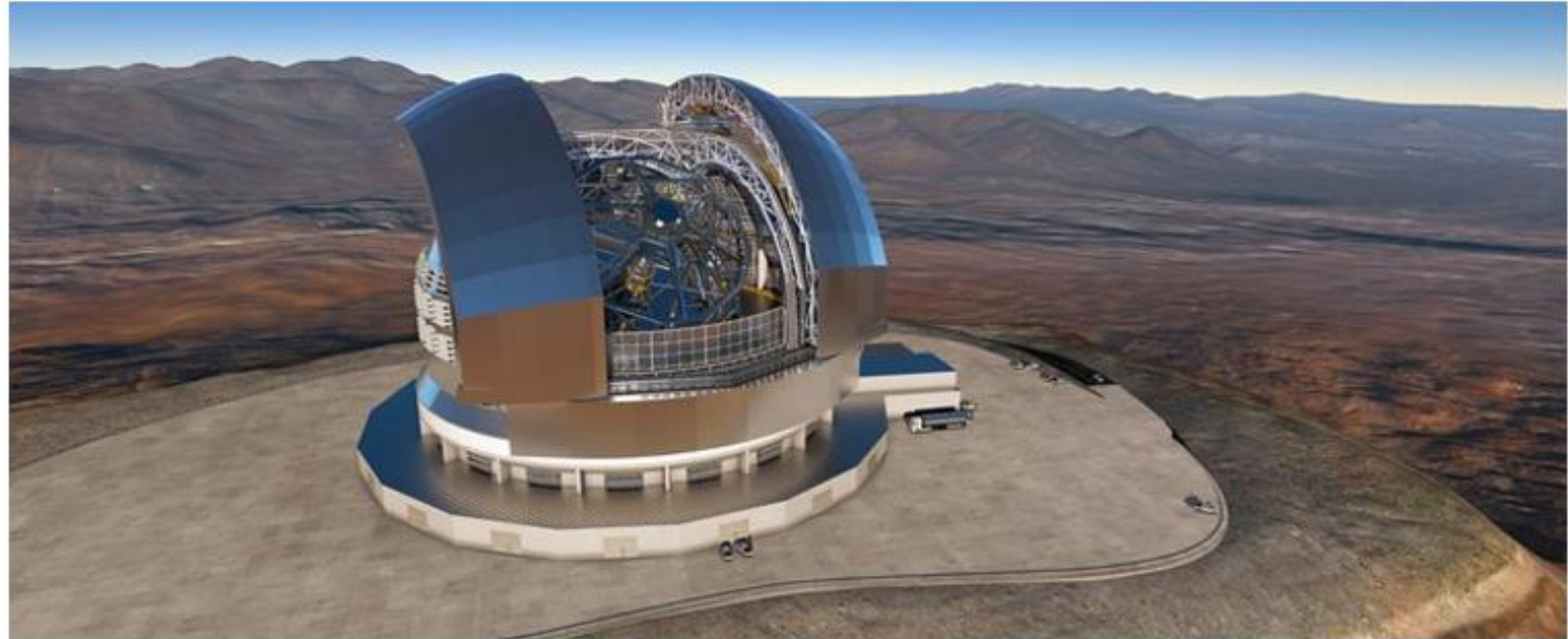
*ALMA: Partnership between ESO, NSF (USA),  
Canada, Japan, Taiwan and Chile*

*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

Swiss 1.2-metre  
Leonhard Euler  
telescope

ESO 1-metre  
Schmidt  
telescope

Danish  
1.54-metre  
telescope

ESO 1-metre  
telescope

Rapid Eye  
Mount  
telescope

MPG/ESO  
2.2-metre  
telescope

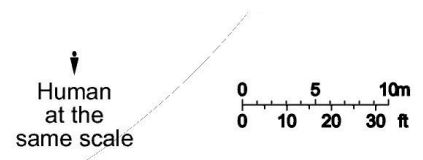
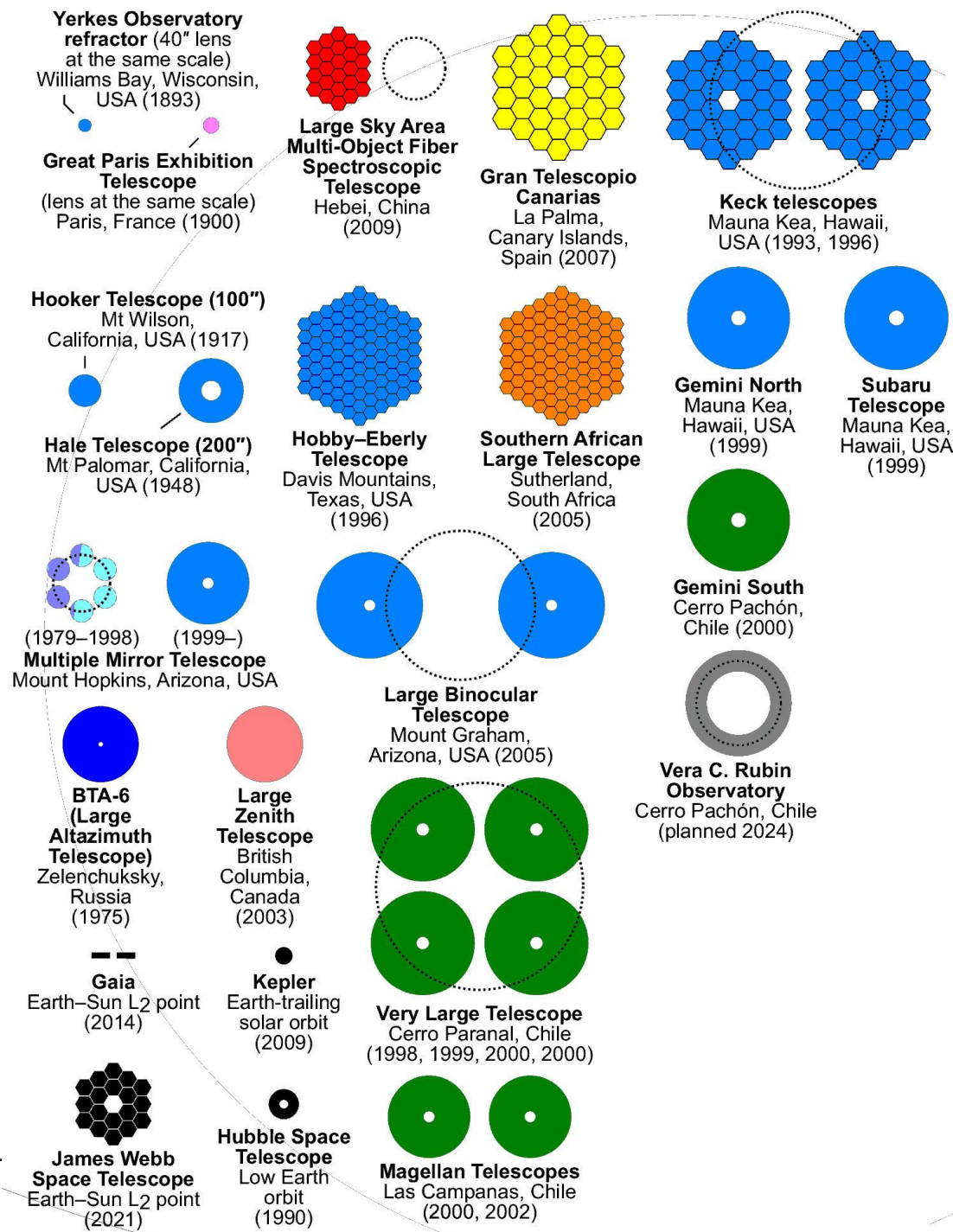
BlackGEM

TRAnsiting Planets  
and Planetesimals  
Small Telescope –  
South

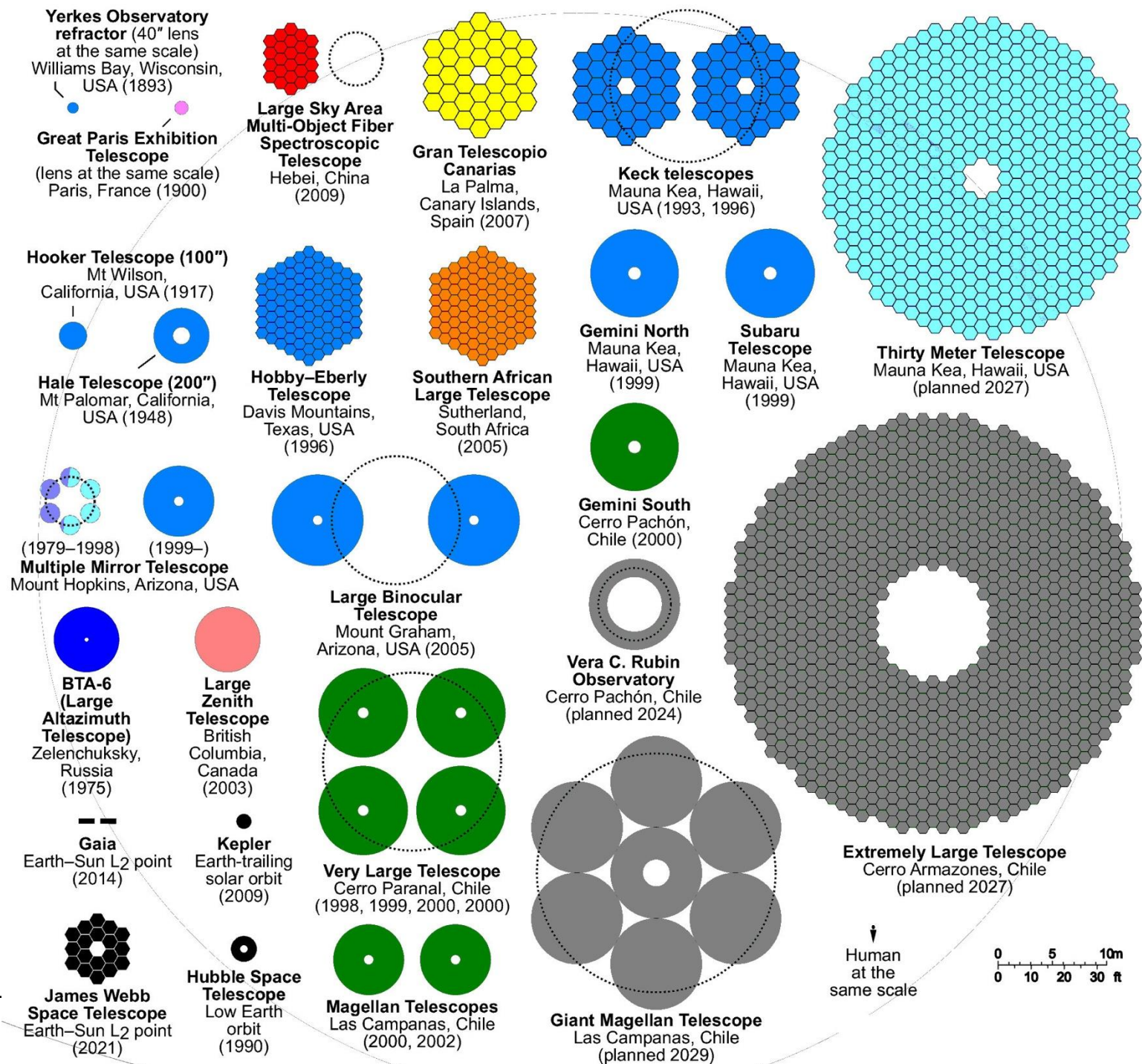
ExTrA

Télescope à Action  
Rapide pour les  
Objets Transitoires

Multi-site All-Sky  
CAmeRA







# ESO's Extremely Large Telescope (ELT) - 2028

