INAF
ISTITUTO NAZIONALE
DI ASTROFISICA

INAF
Astrophisics

Our activities

- Promote astronomical research activities at the frontier
- Contribute to the development of new instrumentation for first-class ground-based telescopes (LBT, VLT, EELT)
- Together with Universities training the new generations of astronomers (courses, tutors, access to telescopes, research grants)
- Promote the dissemination of Astronomy (Museums, education and outreach activities)

INAF has a strategic vision

INAF PTA

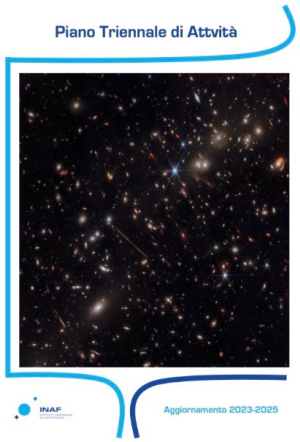
Home | Portale Schede INAF

Benvenuti nel portale relativo agli aggiornamenti annuali del Piano Triennale delle Attività INAF

Di seguito gli aggiormanenti annuali al PTA ed alcuni documenti di valenza generale

Piano Triennale delle Attività 2023-2025

Scarica i documenti relativi ad ognuna delle sezioni, oppure accedi al portale Schede Attività INAF.



Piano Triennale 2023-2025

Aggiornamento 2023 del Piano Triennale di Attività

Scarica il documento

Executive Summary

Executive Summary relativo al Piano Triennale Attività 2023-2025

Scarica il Documento

https://pta.inaf.it/

INAF has a strategic vision

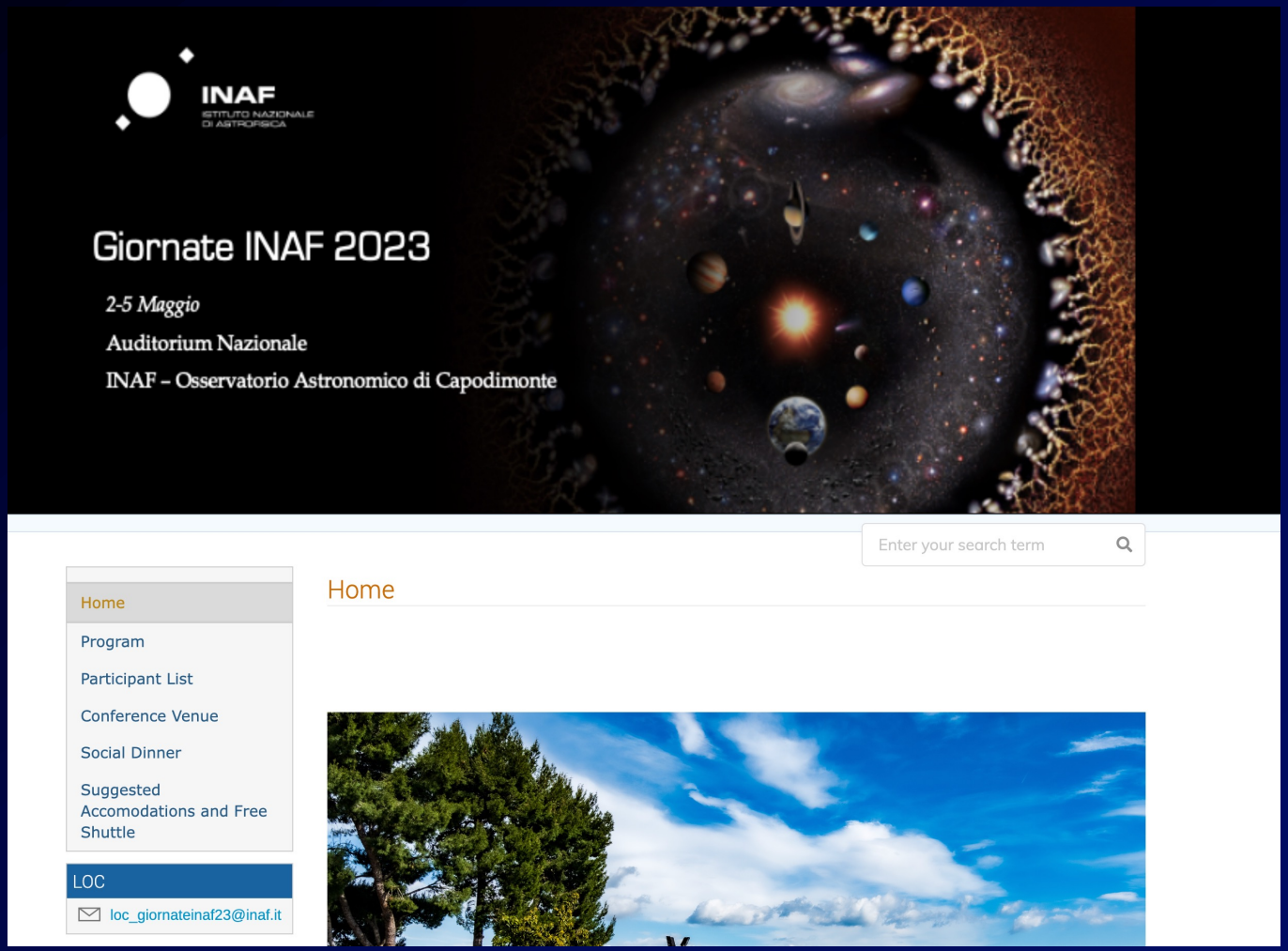
INAF Strategic Vision

Introduction

Astronomy is arguably the oldest of the natural sciences.
Over the course of human civilization, the sky has provided the means to measure time and the succession of the seasons, to guide the traveler, to understand our place in the Universe.
Astronomical knowledge was remarkably advanced in Babylon, Egypt and China thousands of years ago and developed through the centuries with Aristarcos and Tolomeus in Greece and Copernicus, Kepler and Galileo in Europe. It was in Italy with Galileo Galilei at the beginning of the 17th century that Astronomy and Physics were united, deriving mathematical predictions of celestial motions from assumed physical causes.
Astronomy led the scientific revolution, which continues to this day and has revealed that the sky visible to the naked eye is really just a hint of a vast and complex cosmos, within which

https://pta.inaf.it/

INAF annual meeting



https://indico.ict.inaf.it/event/2367/

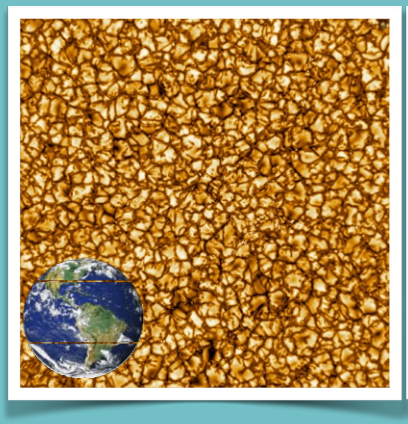
Basic Priorities

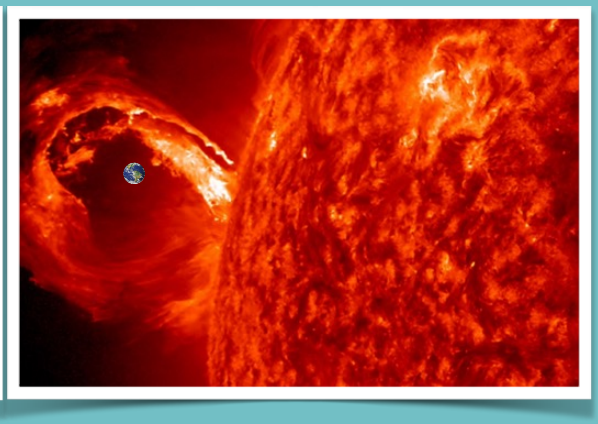
- Exploration of the solar system
- Planets and life around other stars
- Multi-messenger astrophysics
- Origin and evolution of the Universe
- Life cycle of stars
- Black holes and the violent Universe
- *Participation in the major international infrastructures of the future*

Exploration of the solar system

- Sun and heliosphere
  - Magnetic fields and solar flares
  - Solar wind and connection with the Sun
  - Effects on the Earth ("space-weather")

- Mercury and Sun-Planet Interaction
- Exploration of Mars
- Jupiter and its satellites



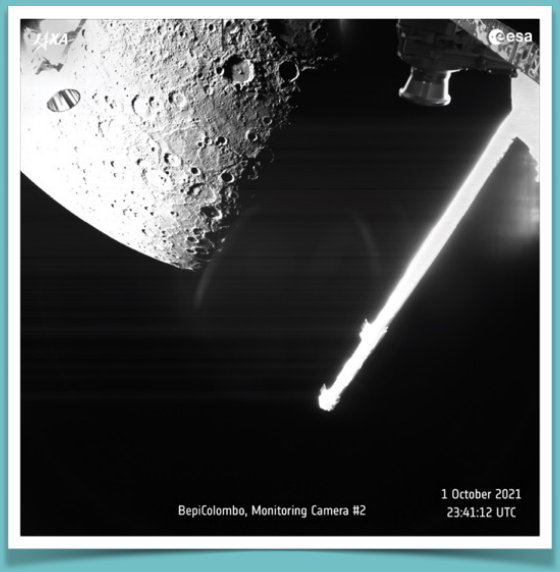


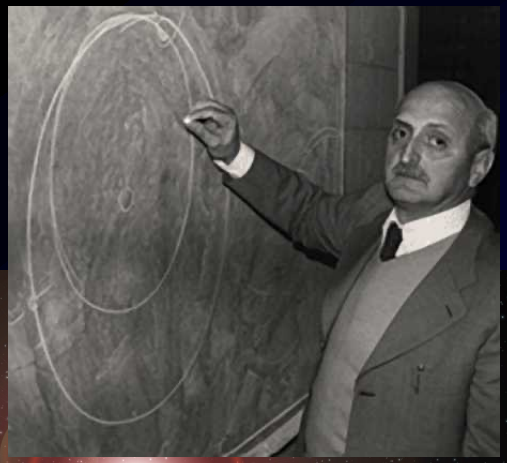
INAF
ISTITUTO NAZIONALE
DI ASTROFISICA

Rosetta mission 2004-2016

Exploration of the solar system

- Sun and heliosphere
- Mercury and Sun-Planet Interaction
  - BepiColombo Mission (2026)
- Exploration of Mars
- Jupiter and its satellites

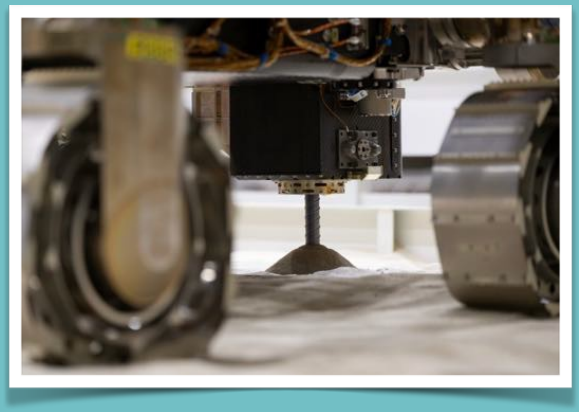


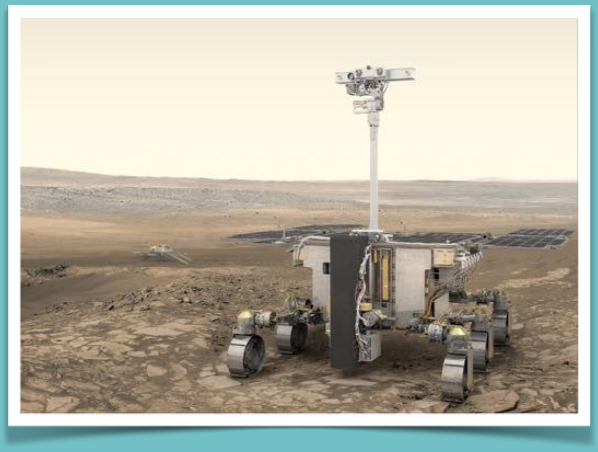


Bepicolombo Mission

Exploration of the solar system

- Sun and heliosphere
- Mercury and Sun-planet interaction
- Exploration of Mars
  - ExoMars: INAF-guided instruments
  - Political problems
  - Mars Sample Return (2031)
- Jupiter and its satellites



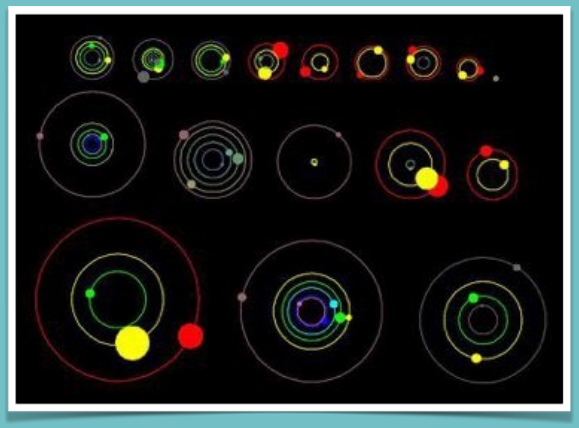


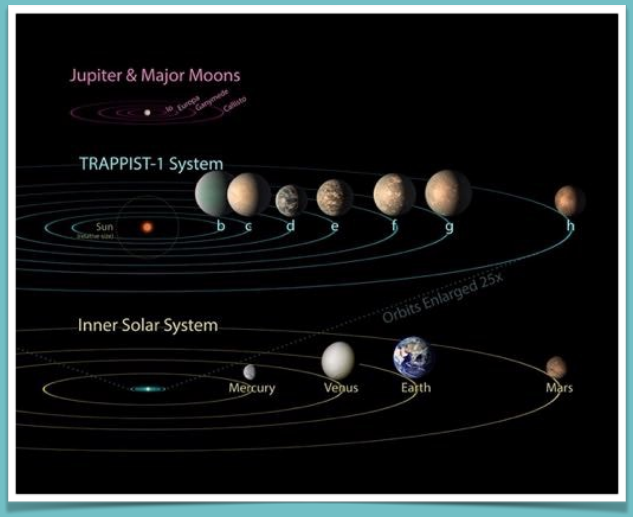
Exploration of the solar system

- Sun and heliosphere
- Mercury and Sun-planet interaction
- Exploration of Mars
- Jupiter and its satellites
  - Icy moons and the presence of water/life
  - JUICE mission
  - Italian and INAF participation

Planets and life around other stars

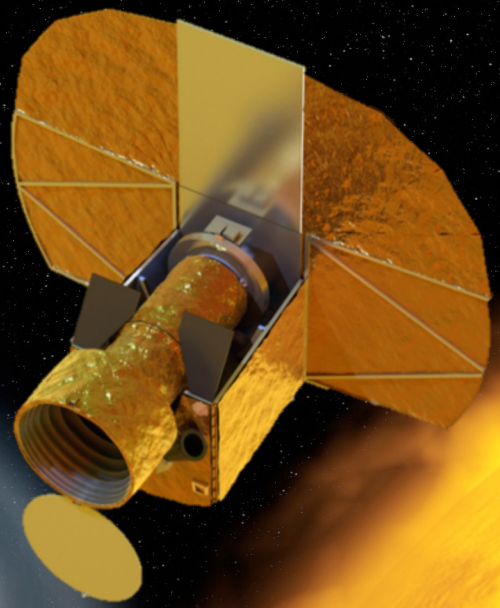
- Study of planetary systems
  - Exoplanets
  - Multiple exoplanet systems
- Atmospheres of exoplanets
- Processes that can give rise to life

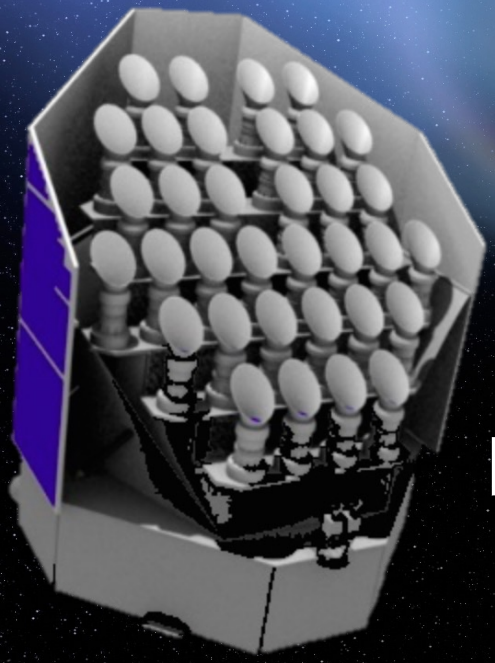




Hunting for extrasolar planets

CHEOPS
(2018)

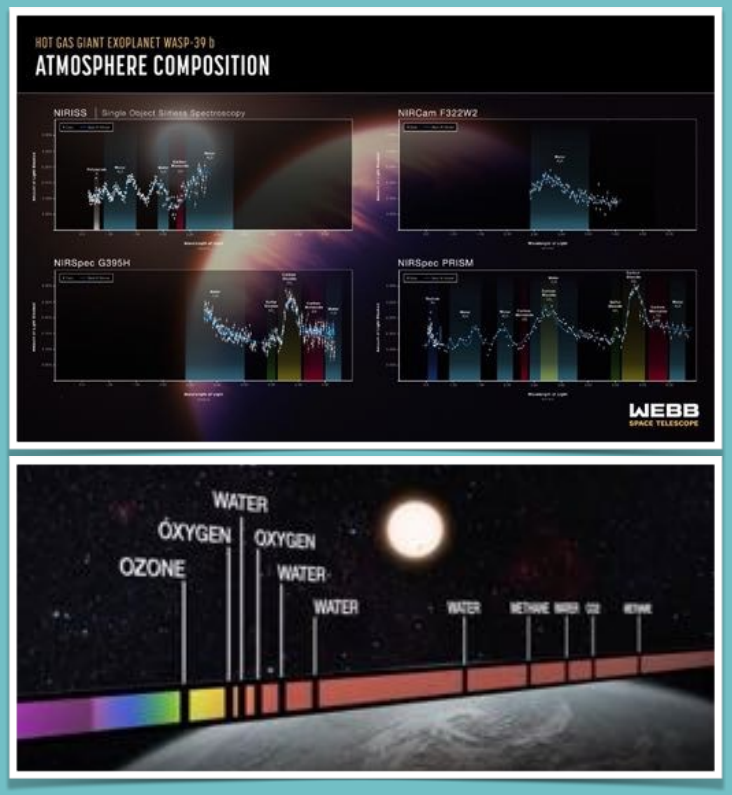




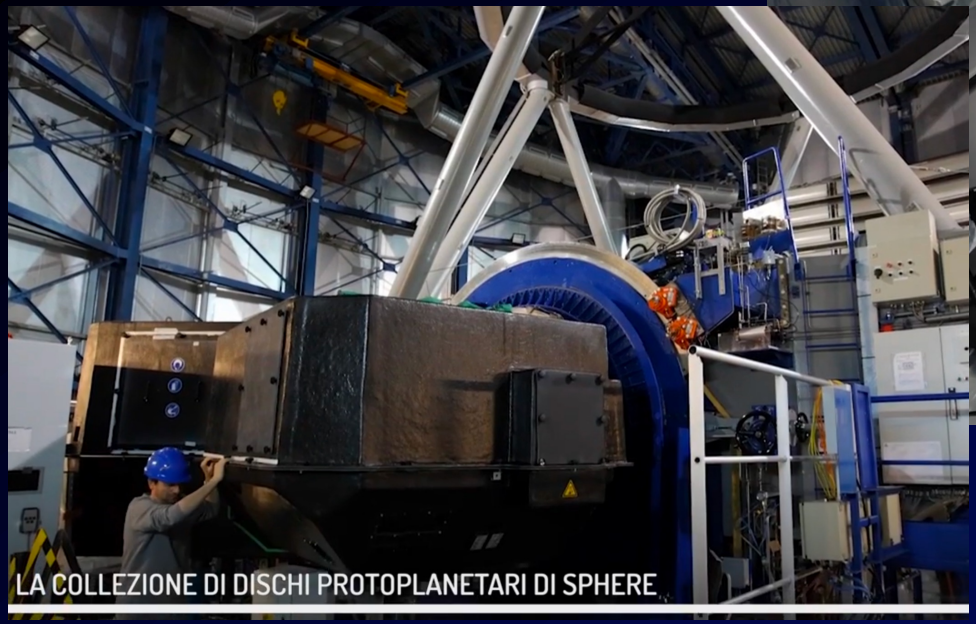
PLATO
(2026)

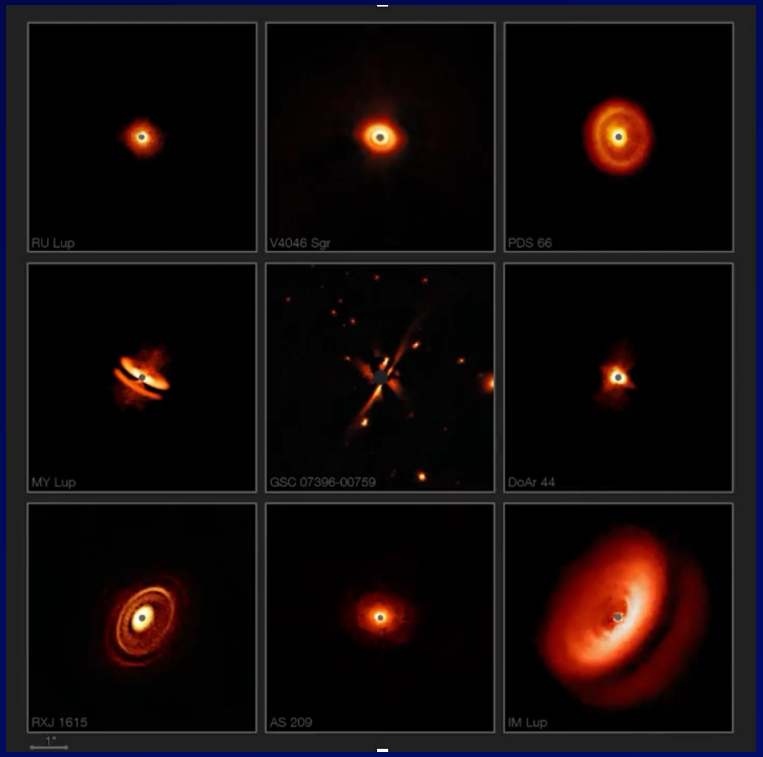
Planets and life around other stars

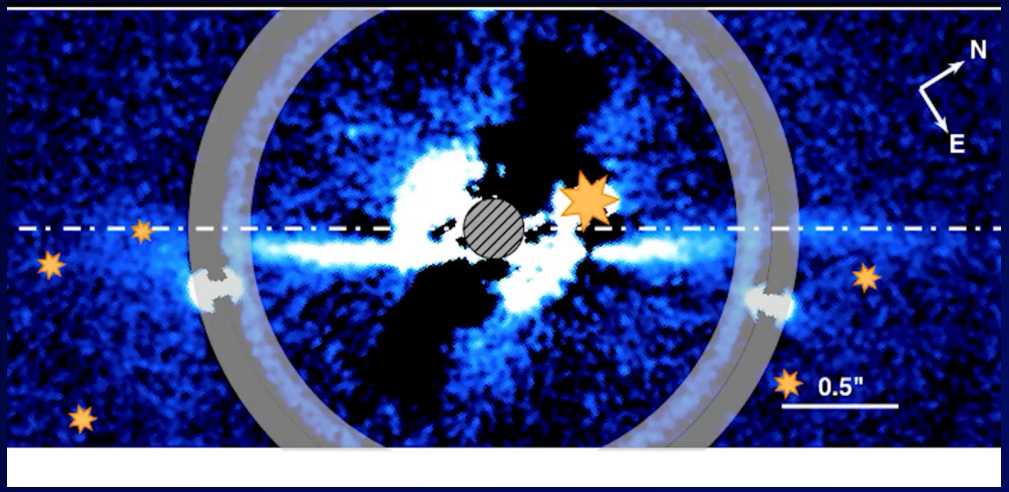
- Study of planetary systems
- Atmospheres of exoplanets
  - JWST to ELT
- Processes that can give rise to life



SPHERE instrument @ VLT

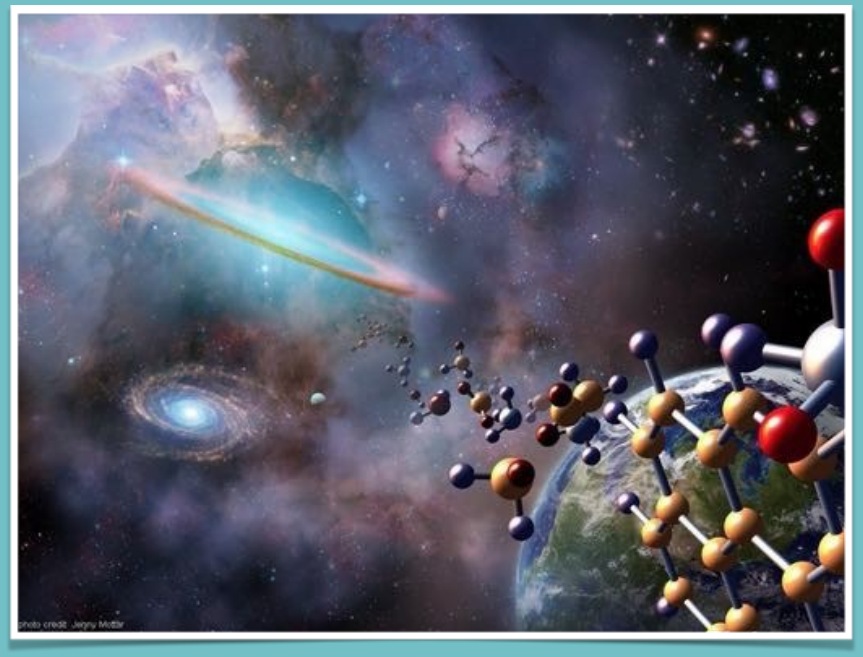






Planets and life around other stars

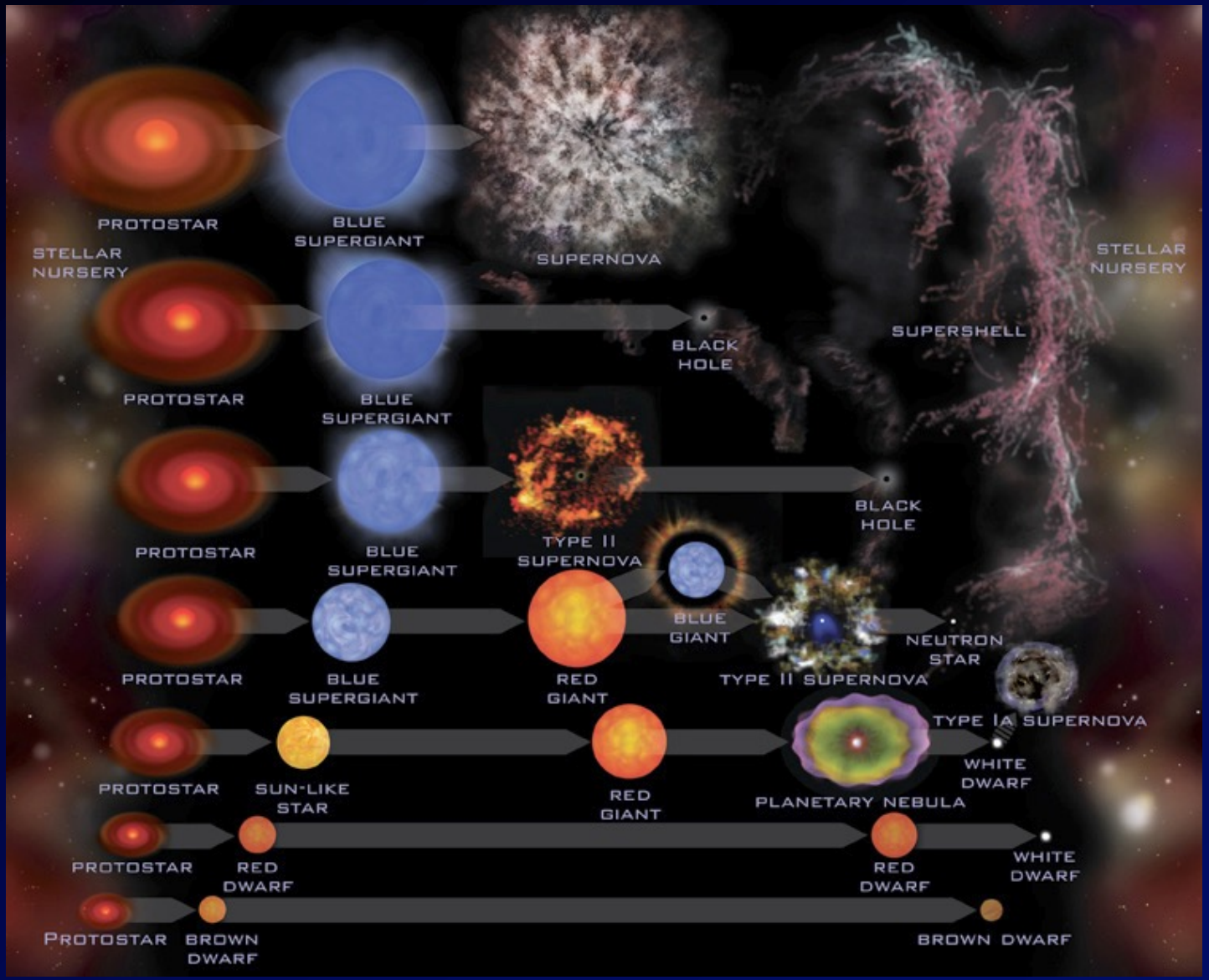
- Study of planetary systems
- Atmospheres of exoplanets
- Processes that can give rise to life
  - Organic molecules in space
  - Chemistry of planetary atmospheres
  - Laboratory studies



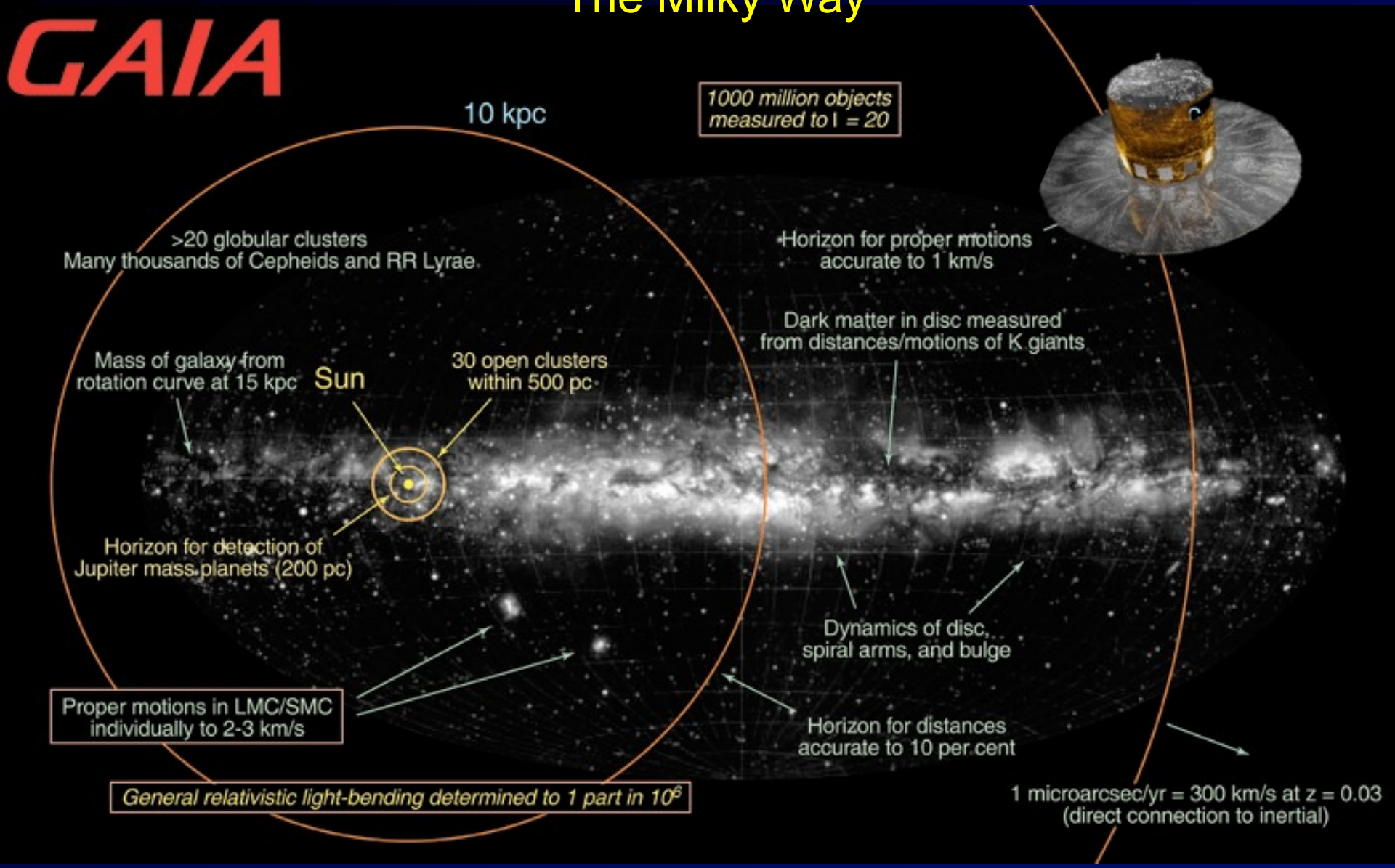
Life cycle of stars

- Mechanisms of star formation
  - From gas clouds to stars
  - Conditions for the formation of planets
- Fundamental physical processes in stars
- Explosions and compact remains

The evolution of stars

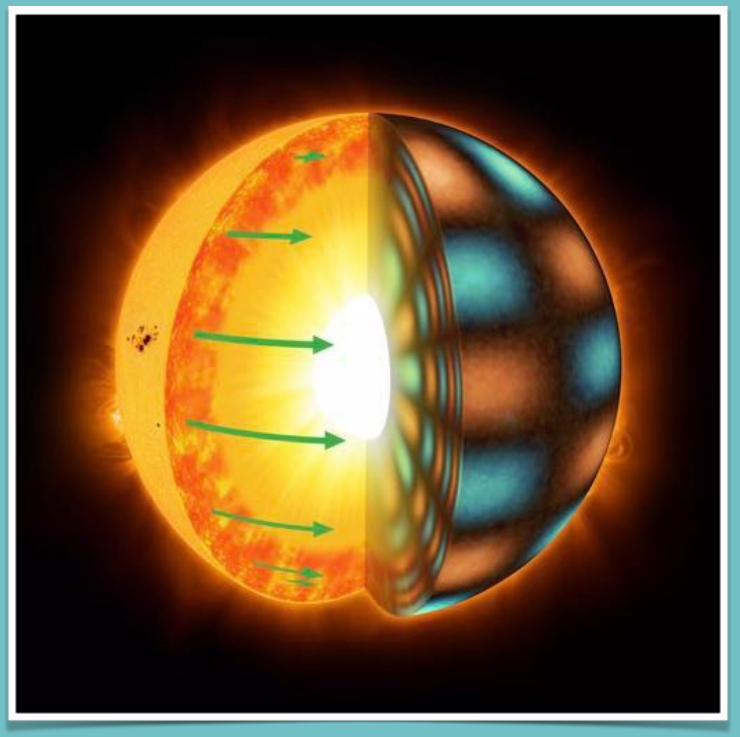


The Milky Way



Life cycle of stars

- Mechanisms of star formation
- Fundamental physical processes in stars
  - Convection, rotation, magnetic fields
  - Asteroseismology
- Explosions and compact remains

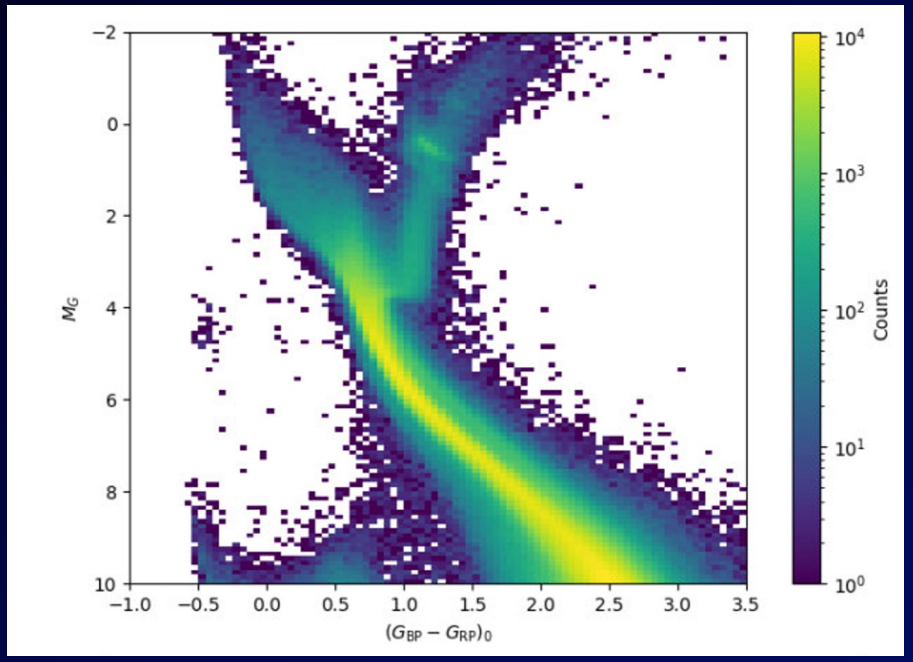


Theoretical isochrones

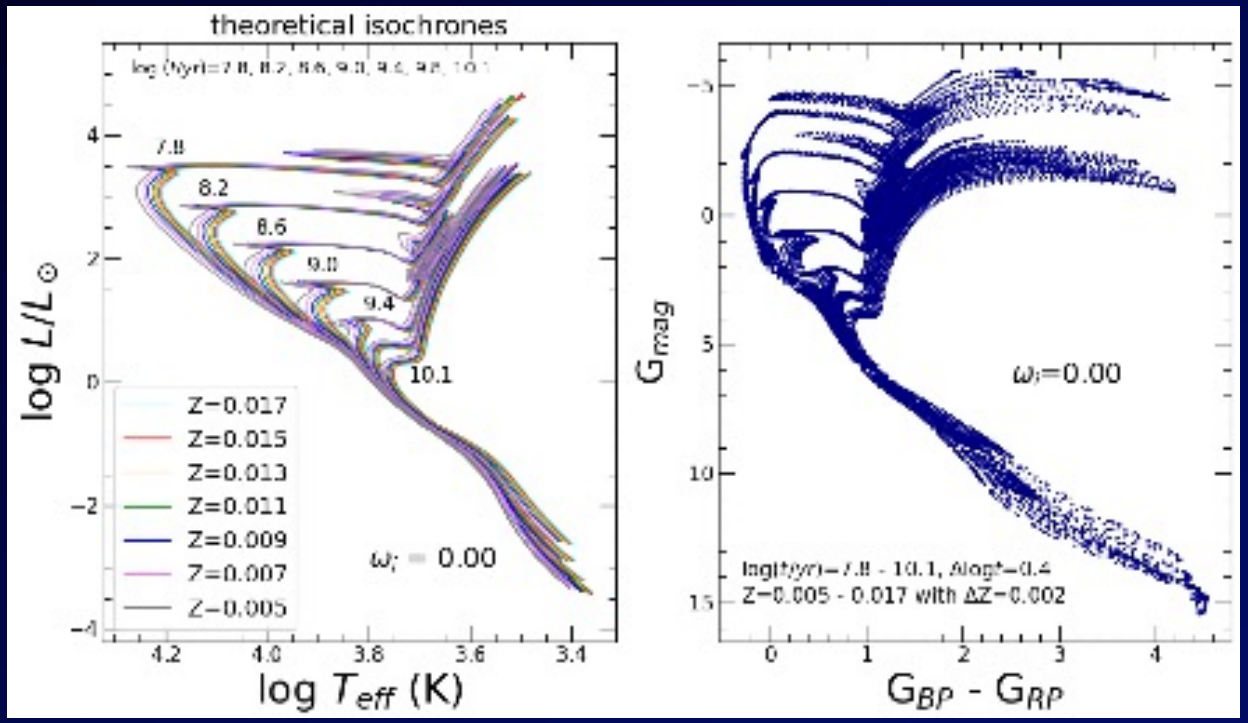
Helping understanding the

Star formation history

of the Milky WAY



GAIA photometry



PARSEC models

Life cycle of stars

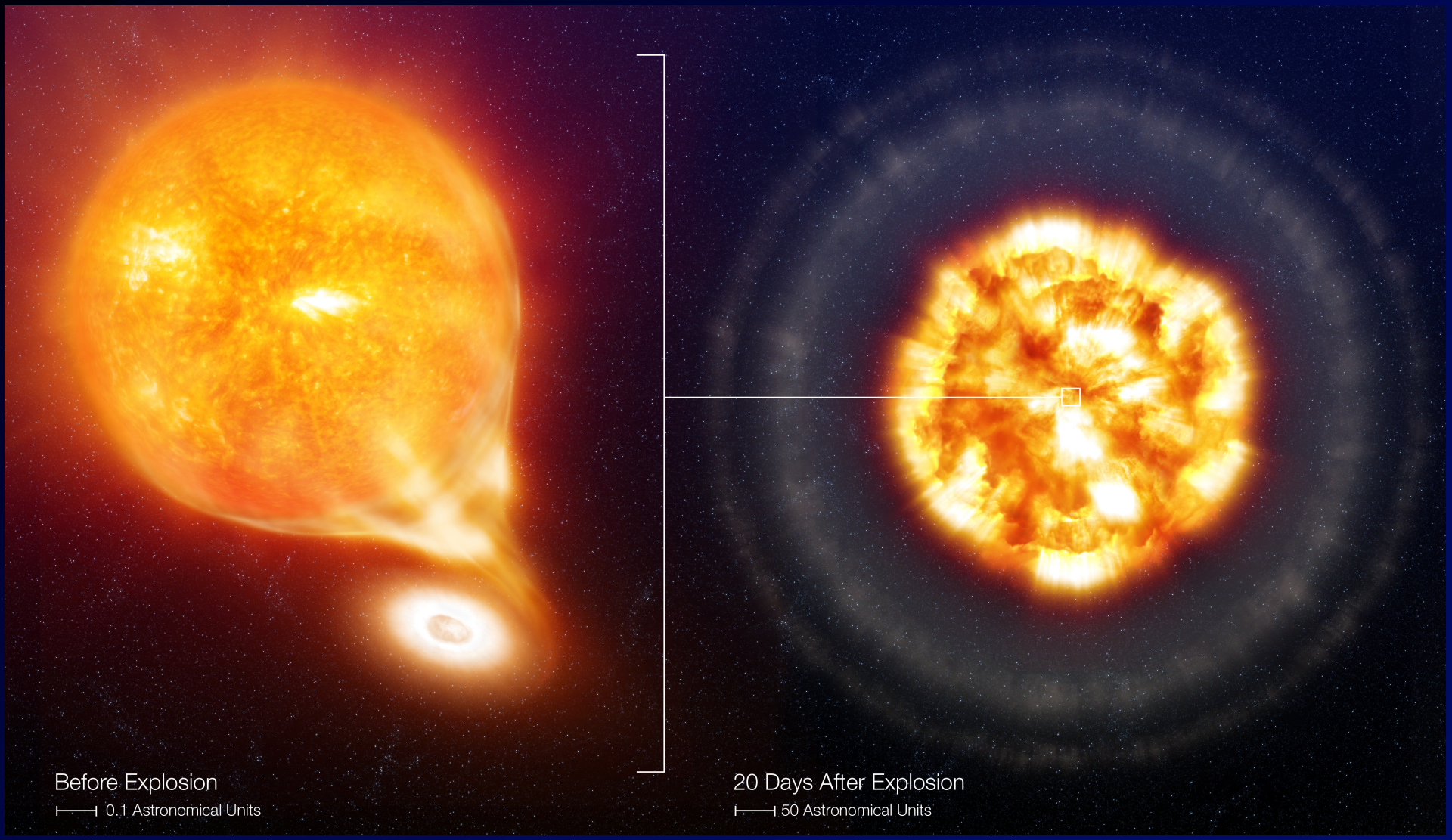
- Mechanisms of star formation
- Fundamental physical processes in stars

  Explosions and stellar remnants
  - From star to supernova to compact object
  - New types of star explosions

Supernova Explosions

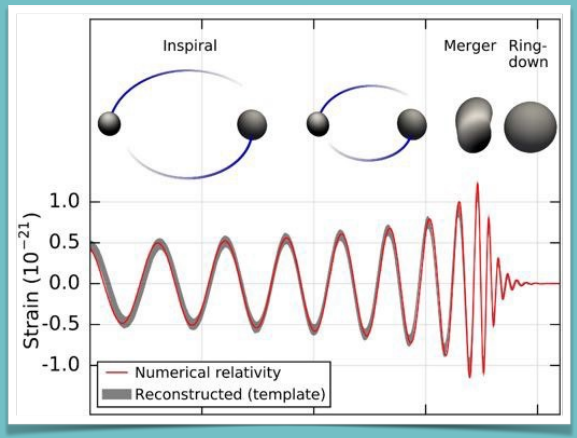
INAF
ISTITUTO NAZIONALE
DI ASTROFISICA

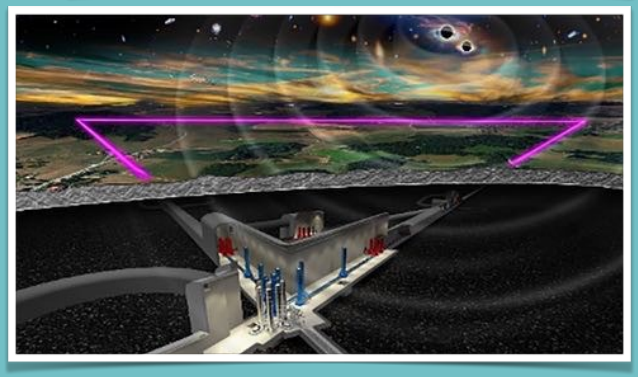
SN 2006X



Multi-messenger astrophysics

- Gravitational waves
  - Participation in the Einstein Telescope
- Electromagnetic counterparts
- Extra-galactic neutrinos
- Cosmic rays

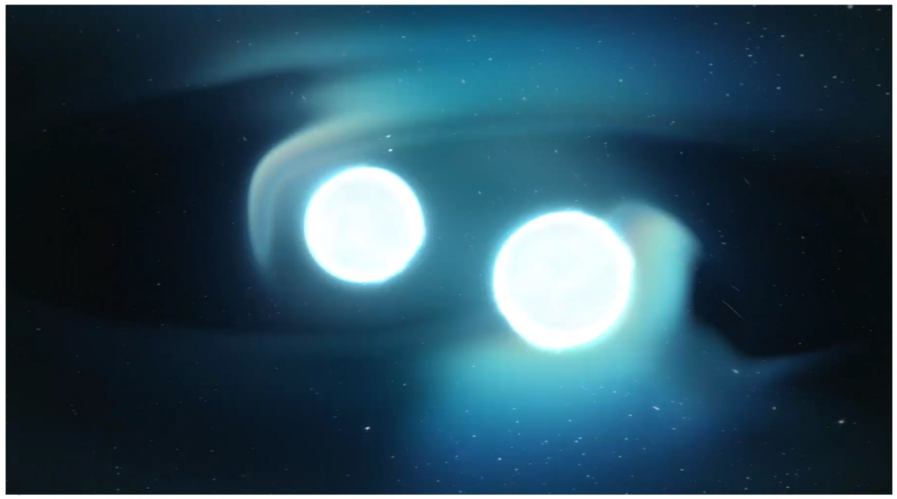


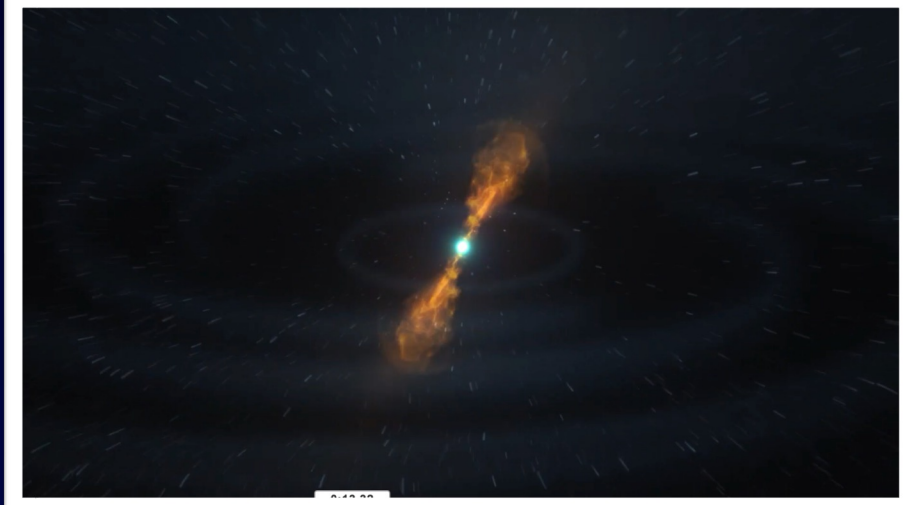


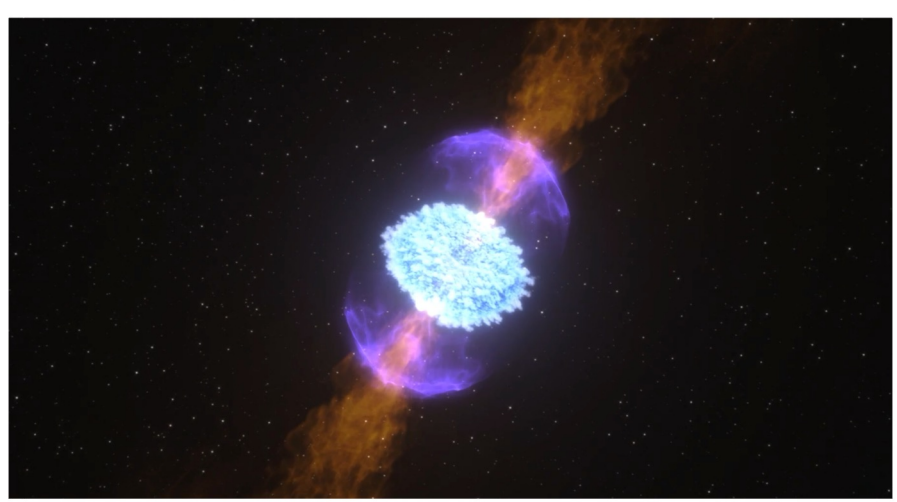
Multi-messenger astrophysics

- Gravitational waves
- Electromagnetic counterparts
  - Neutron star merger
  - Production of heavy chemical elements
- Extra-galactic neutrinos
- Cosmic rays

Kilonova event GW170817

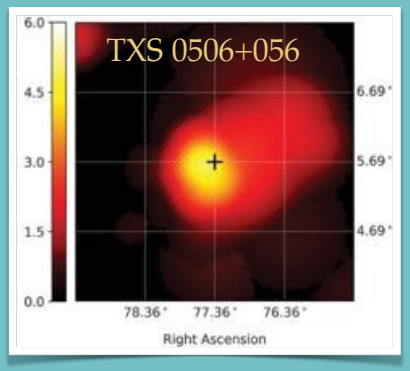


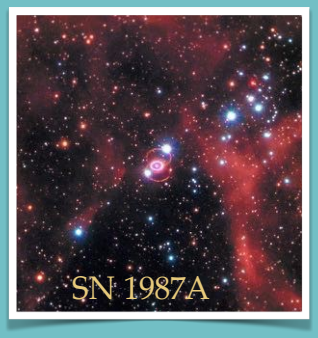


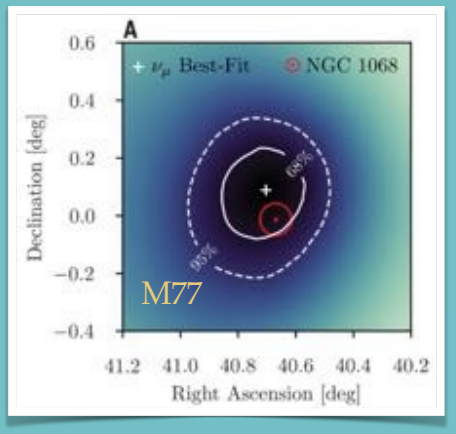


Multi-messenger astrophysics

- Gravitational waves
- Electromagnetic counterparts
- Extra-solar neutrinos
  - Supernovae
  - Active nuclei of galaxies
- Cosmic rays

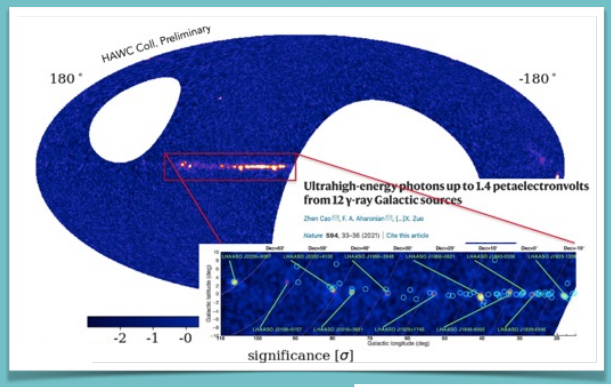






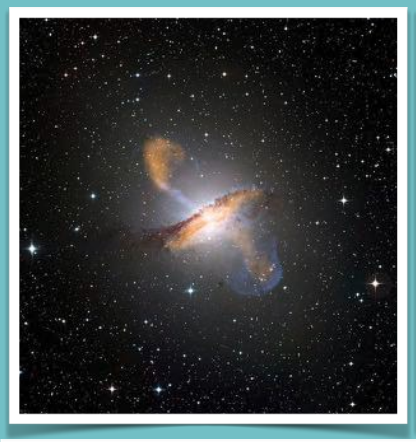
Multi-messenger astrophysics

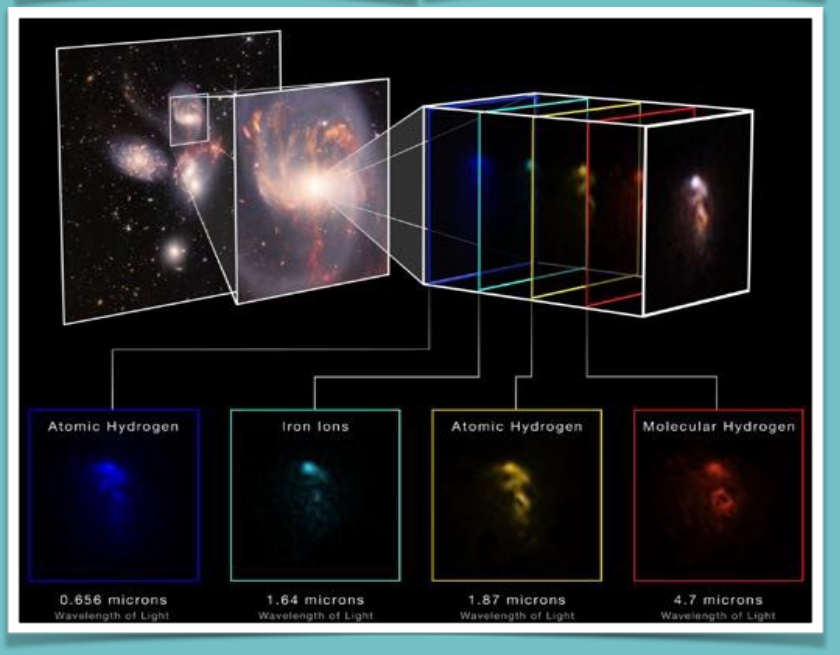
- Gravitational waves
- Electromagnetic counterparts
- Extra-galactic neutrinos
- Cosmic rays/very high energies
  - PeVatron
  - Supernova remnants
  - Very high energies: extragalactic



Origin and evolution of the Universe

- Formation and evolution of galaxies
  - Formation of supermassive black holes
  - Galaxy-central black hole interaction
- Large-scale structure
- Dark matter

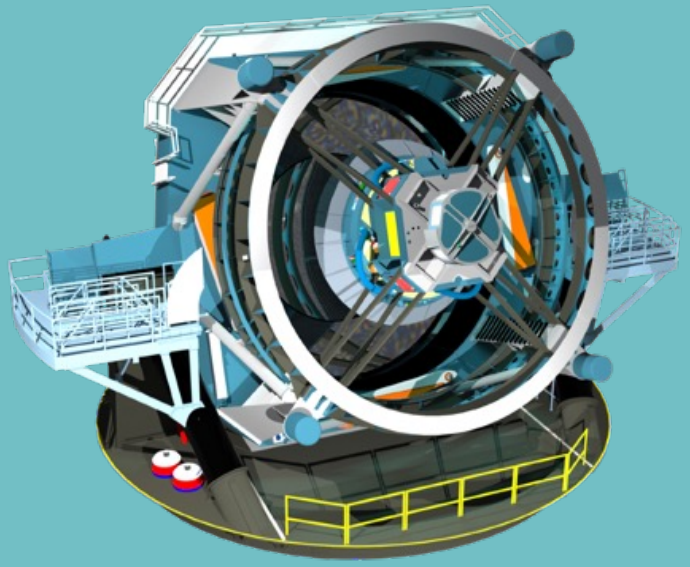




Nearby Galaxies

Origin and evolution of the Universe

- Formation and evolution of galaxies
- Large-scale structure
  - Euclid & Rubin-LSST
- Dark Matter



INAF
ISTITUTO NAZIONALE
DI ASTROFISICA

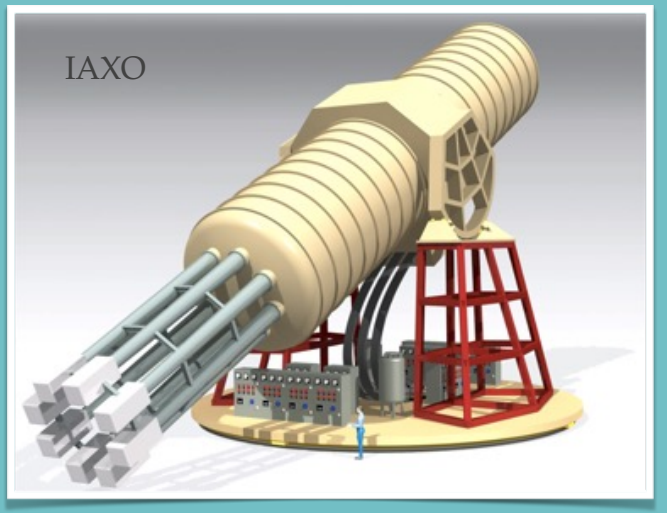
EUCLID ERO extragalactic images

Perseus cluster of galaxies

Perseus cluster of galaxies

Origin and evolution of the Universe

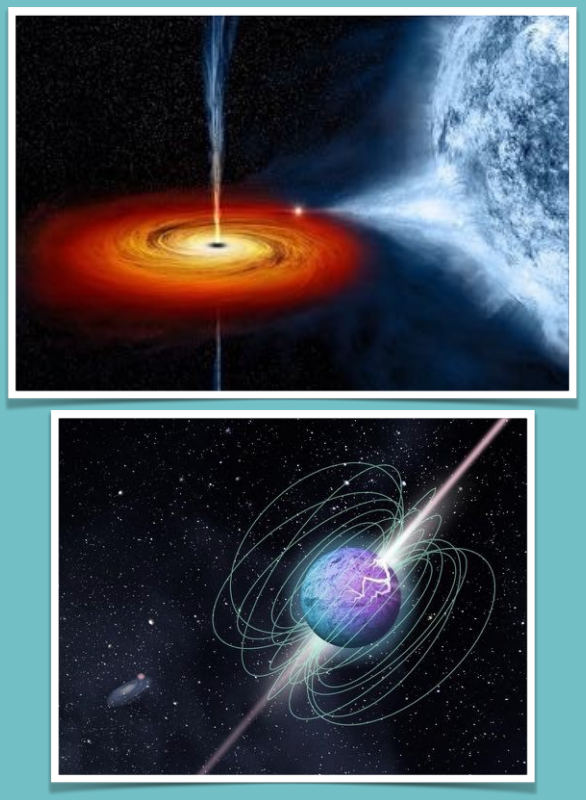
- Formation and evolution of galaxies
- Large-scale structure
- Dark matter



Black holes and the violent Universe

- Compact objects of stellar mass
  - Binary systems and relativistic jets
  - Pulsars and neutron stars
- Active Galactic Cores
- Effects of General Relativity
- Gamma-ray Bursts
- Ultra-energetic gamma-ray sources

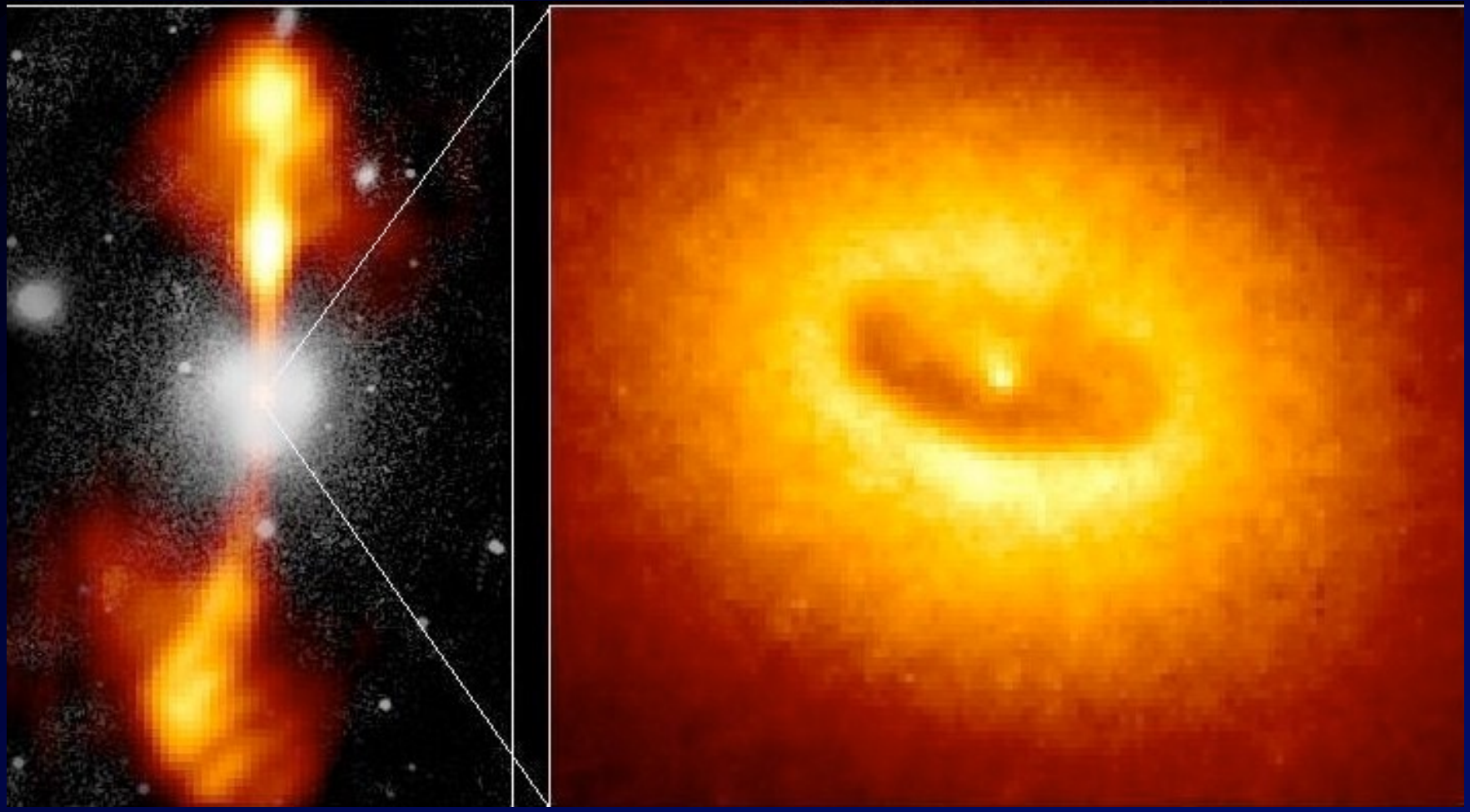
X-Polarization



Black holes and the violent Universe

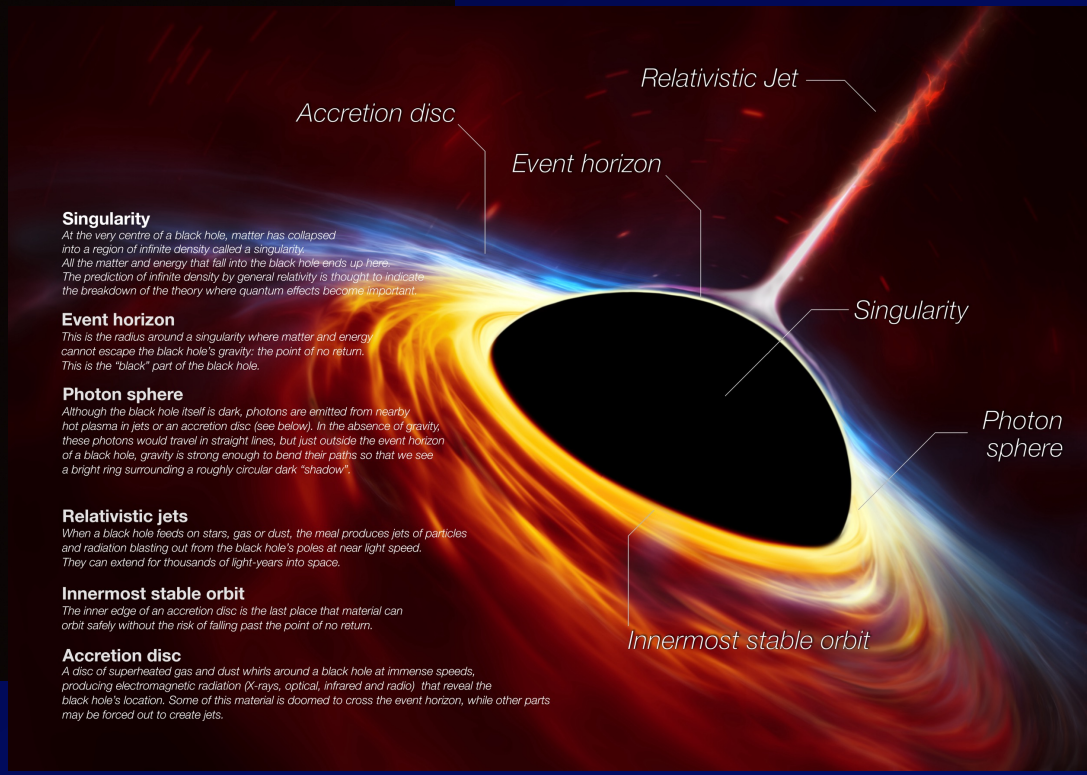
- Compact objects of stellar mass
- Active Galactic Nuclei
- Effects of General Relativity
- Gamma-ray Bursts
- Ultra-energetic gamma-ray sources
  - In our galaxy
  - From active galactic nuclei

Galaxies with Quasars and Black Holes



INAF
ISTITUTO NAZIONALE
DI ASTROFISICA

Black Holes



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.

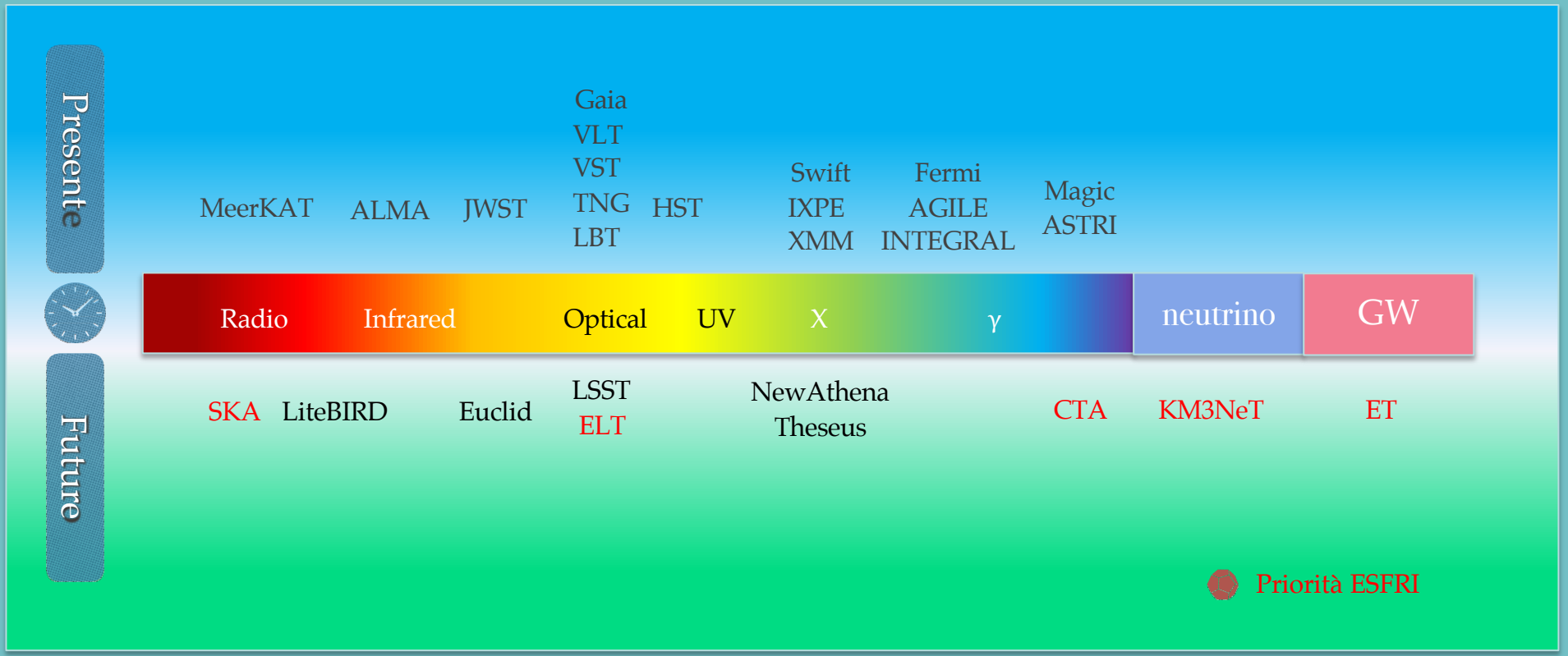
Photon sphere
Although the black hole itself is dark, photons are emitted from nearby hot plasma in jets or an accretion disc (see below). In the absence of gravity, these photons would travel in straight lines, but just outside the event horizon of a black hole, gravity is strong enough to bend their 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.

Large international structures and instruments



The science of INAF

- Activities in the most important fields of astrophysics
- Observations from the ground and space, planetary exploration
- High-level involvement in international structures and instruments
- Understanding the Universe from the Solar System to the Boundaries of Space-Time

Observatory Staff

70 Astronomers

23 Technical and Administrative

35 Research Fellows and Fellows

14 PhD students in collaboration with the University

12 students in thesis

INAF
ISTITUTO NAZIONALE
DI ASTROFISICA

Paduan astronomers in 2024

INAF
ISTITUTO NAZIONALE
DI ASTROFISICA

Department of Physics and Astronomy

25 May 1968 Establishment of the first degree course in Astronomy in Italy

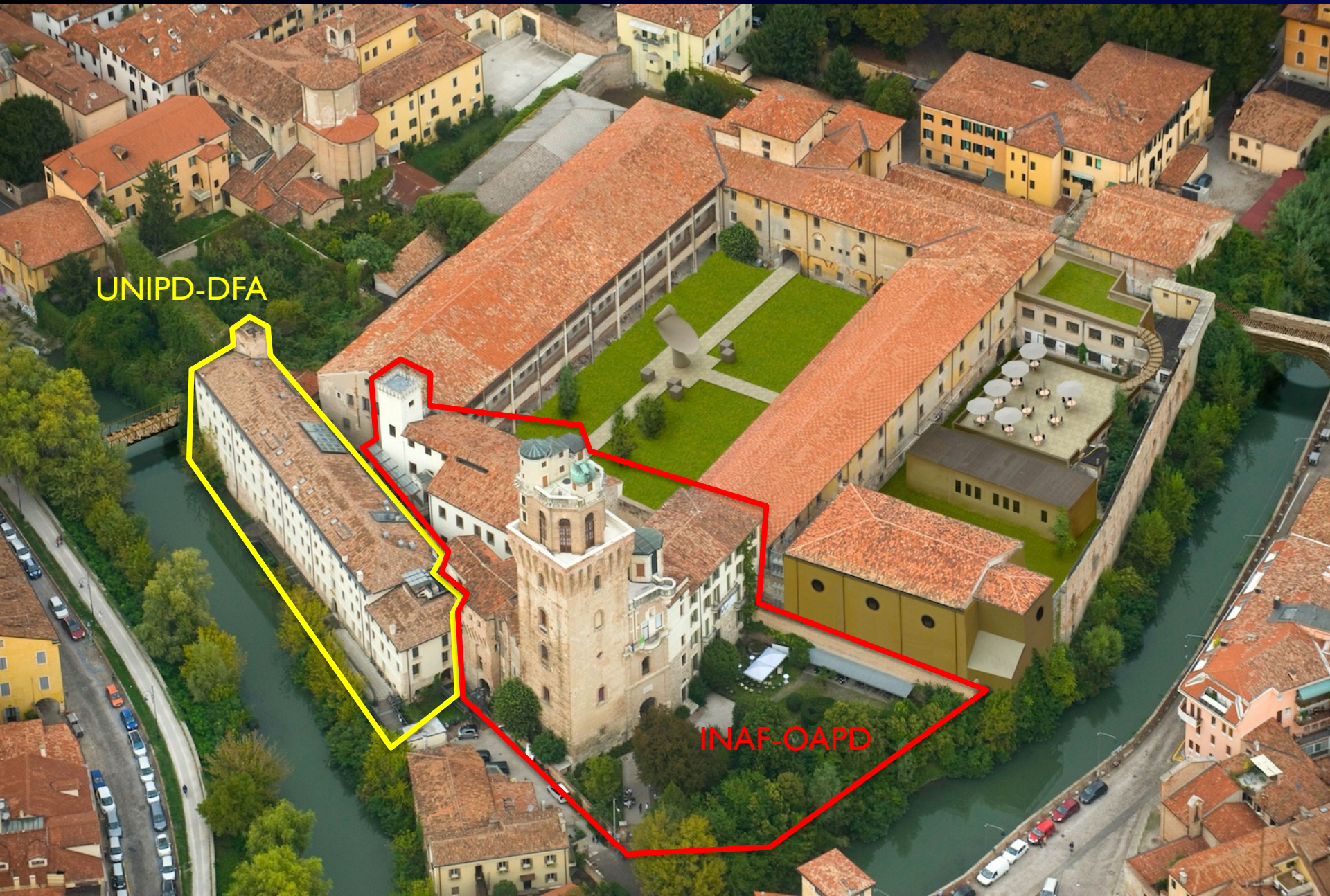
Astrophysics Sector
21 Professors/Researchers
24 Technical and Administrative

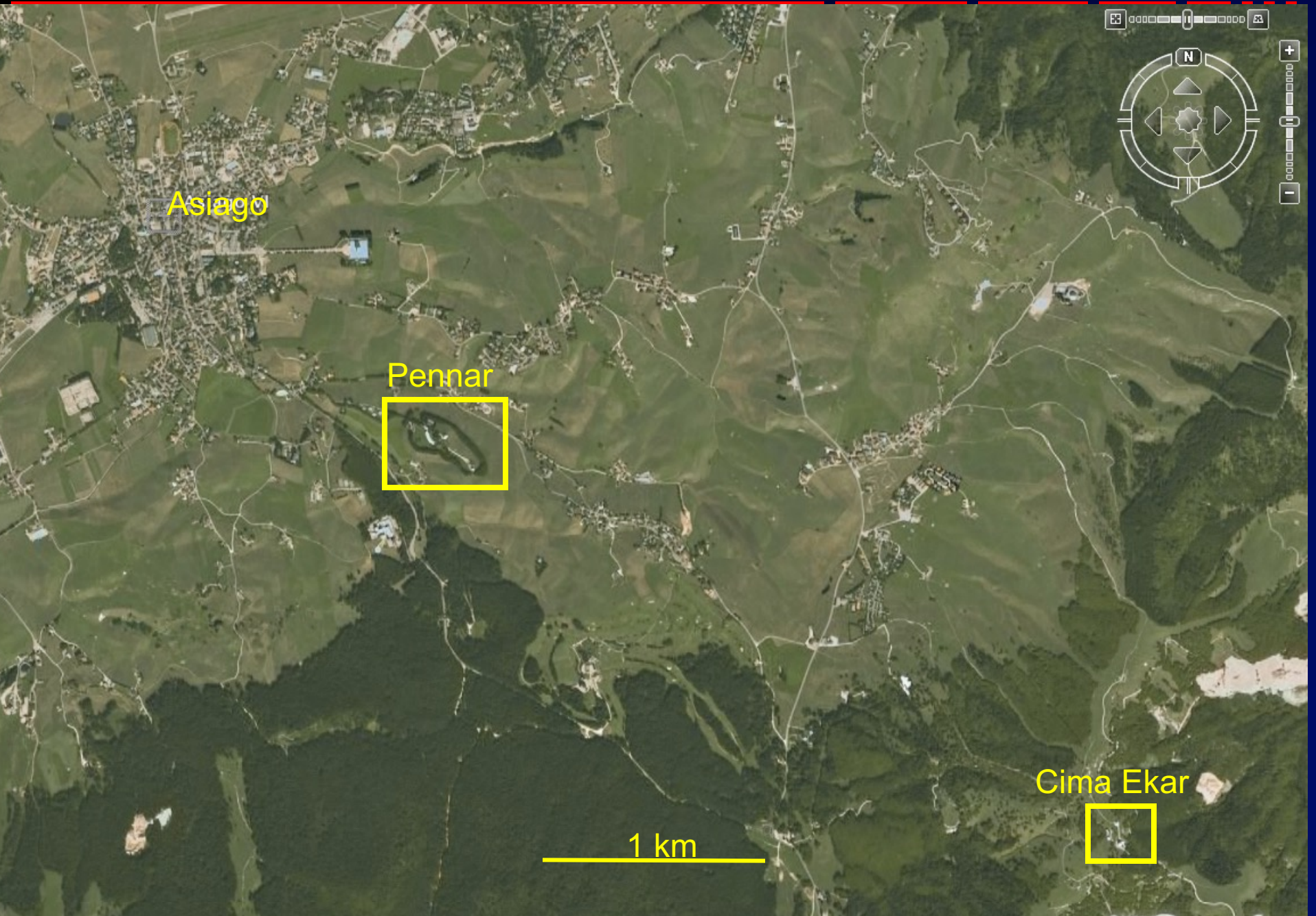
10-15 PostDocs or Research Fellows

40-50 new students per year

Since 1970 about 450 graduates

8-10 PhD students per year


UNIPD-DFA
INAF-OAPD


Asiago
Pennar
Cima Ekar
1 km
N

INAF
ISTITUTO NAZIONALE
DI ASTROFISICA

Asiago - Pennar

Aula
Meetings

122 cm telescope

Osservatorio
Università

Foresterie

Uffici

Foresterie e Divulgazione

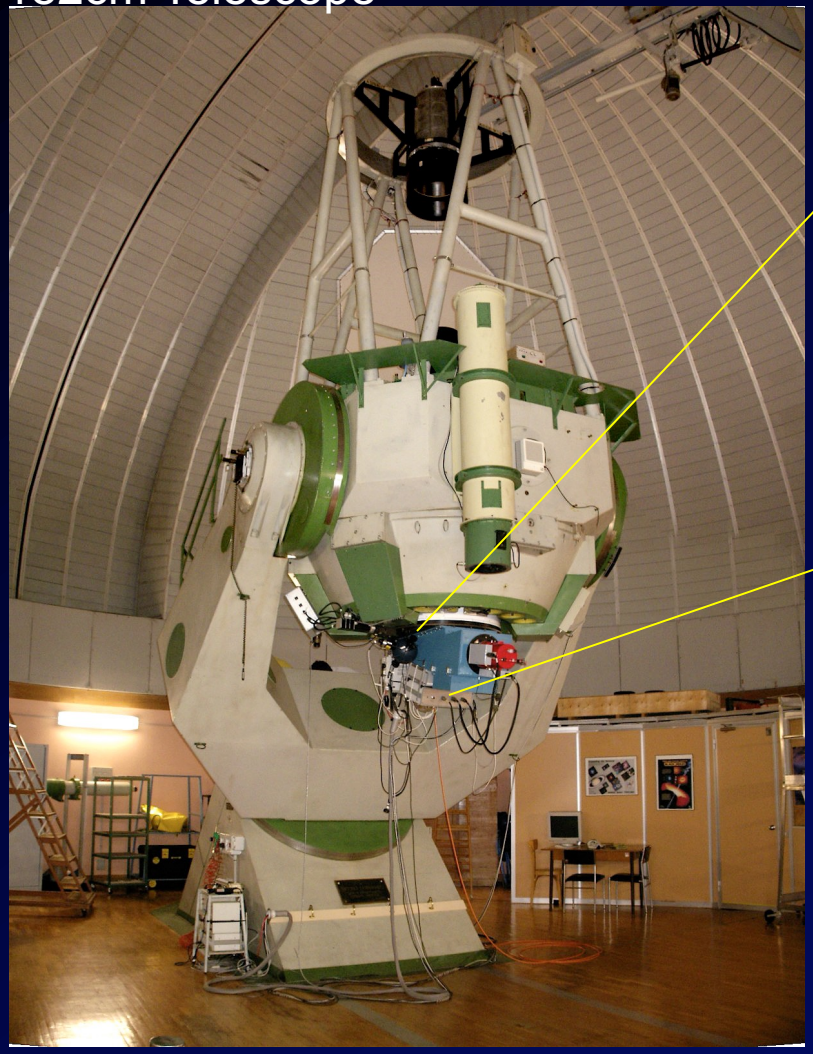
Asiago - Cima Ekar

Schmidt 67/92cm

182cm

Asiago - Cima Ekar

182cm Telescope



Schmidt 67/92cm