

A photograph of three large, golden-brown pyramids in a desert landscape under a clear blue sky. The pyramids are arranged in a line, with the largest one in the center. The foreground is a sandy desert with some small rocks and shadows cast by the pyramids.

The Fundamental Role of Space Research

Roger-Maurice Bonnet

International Space Science Institute

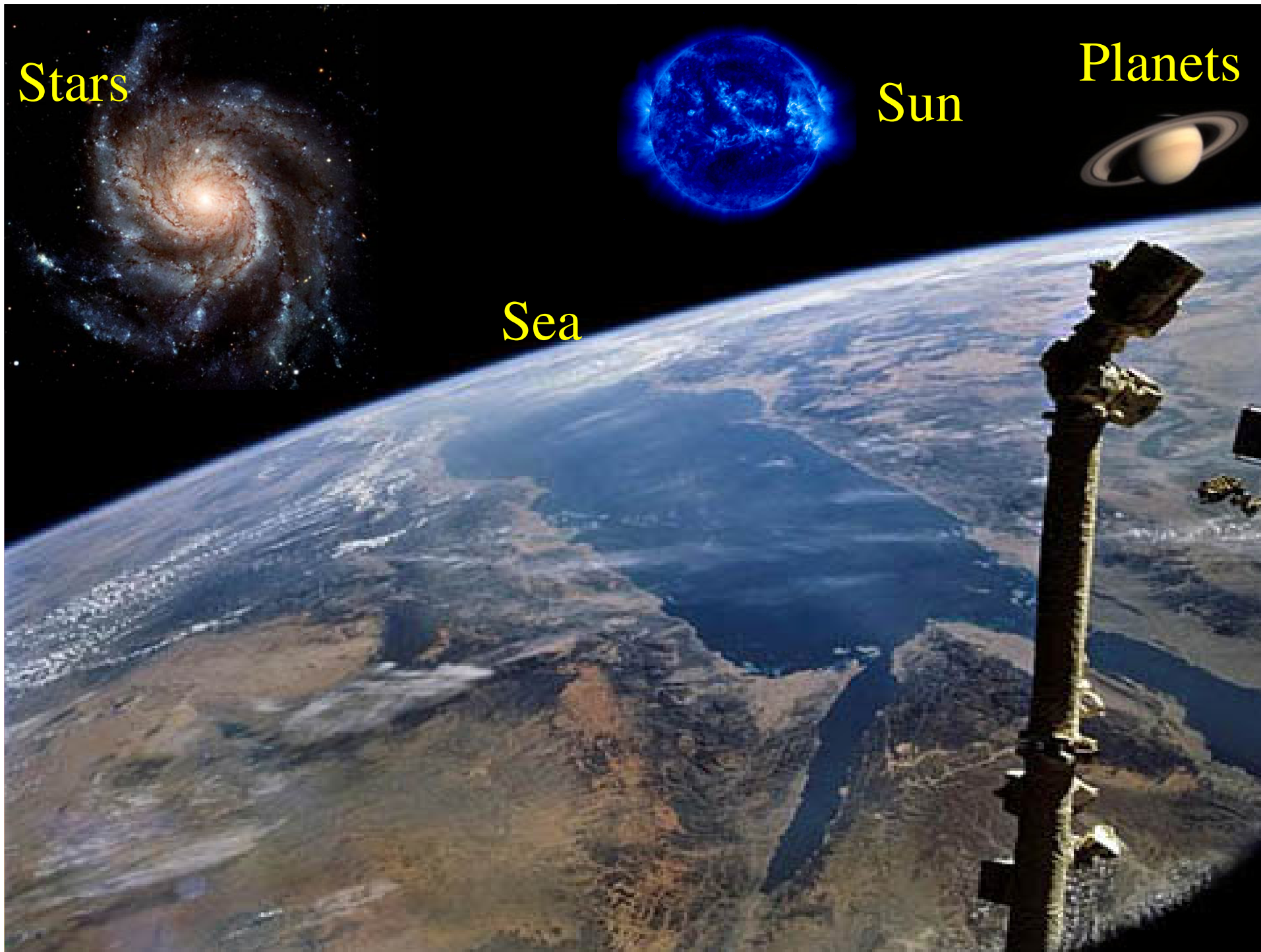
COSPAR

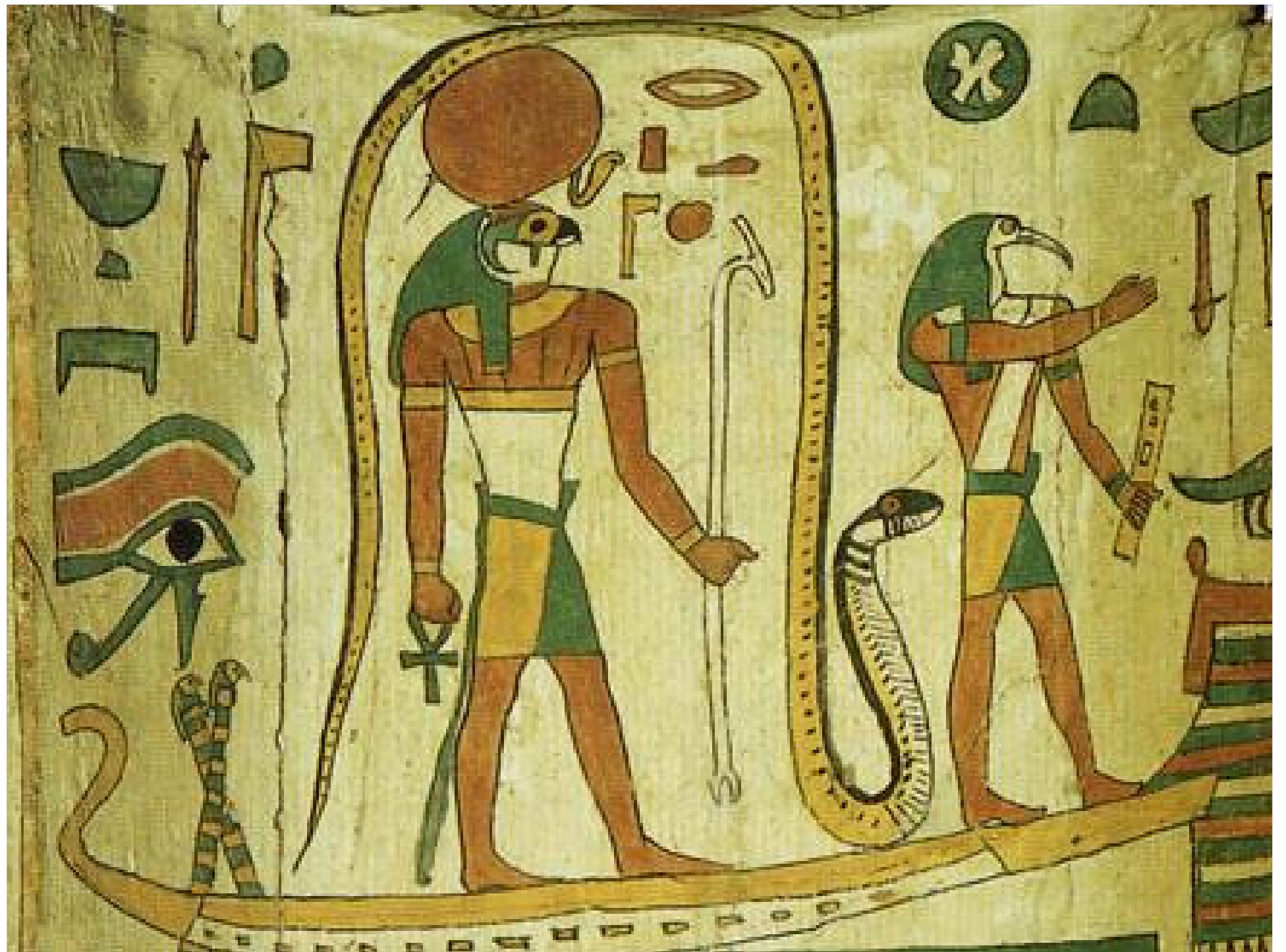
Stars

Planets

Sun

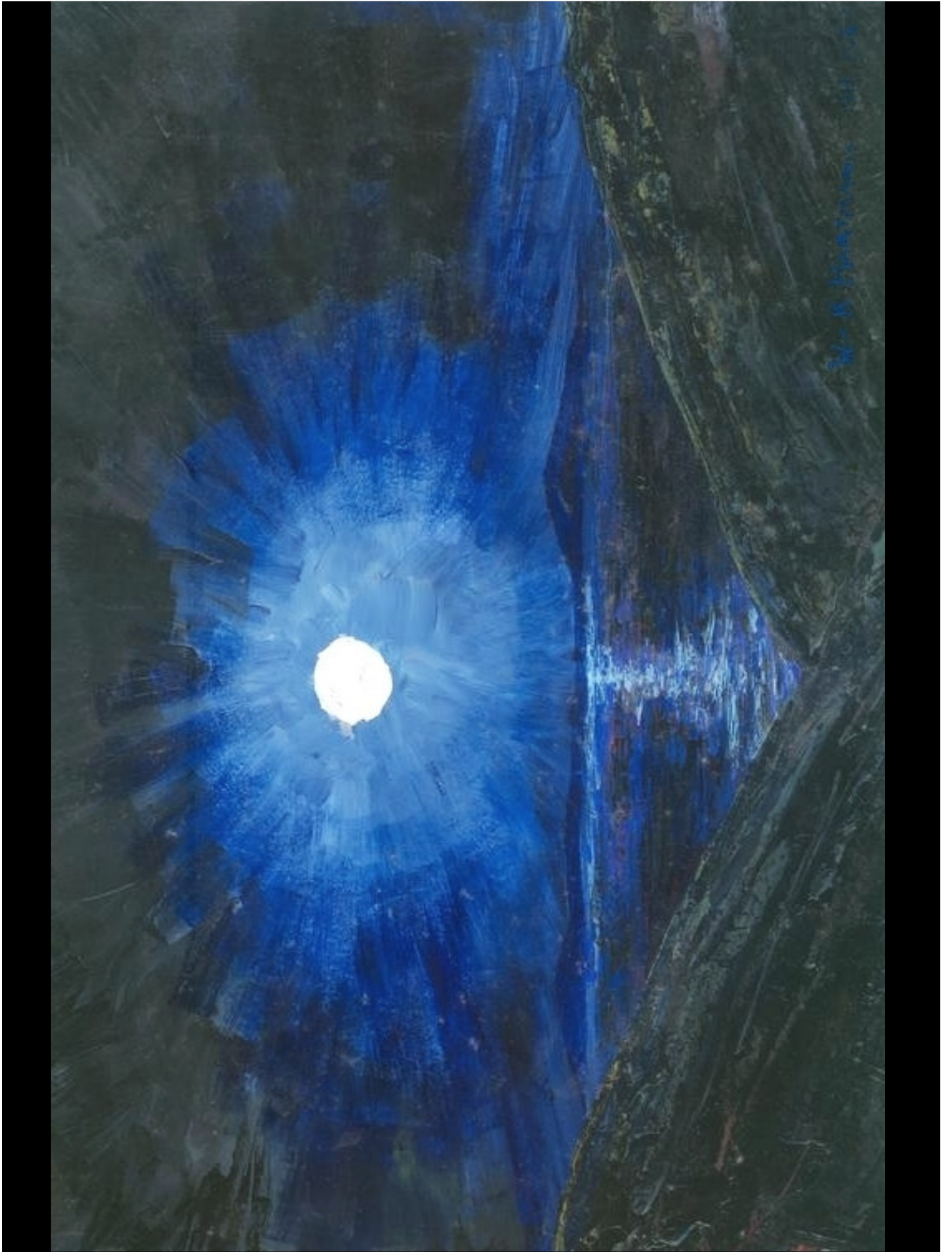
Sea



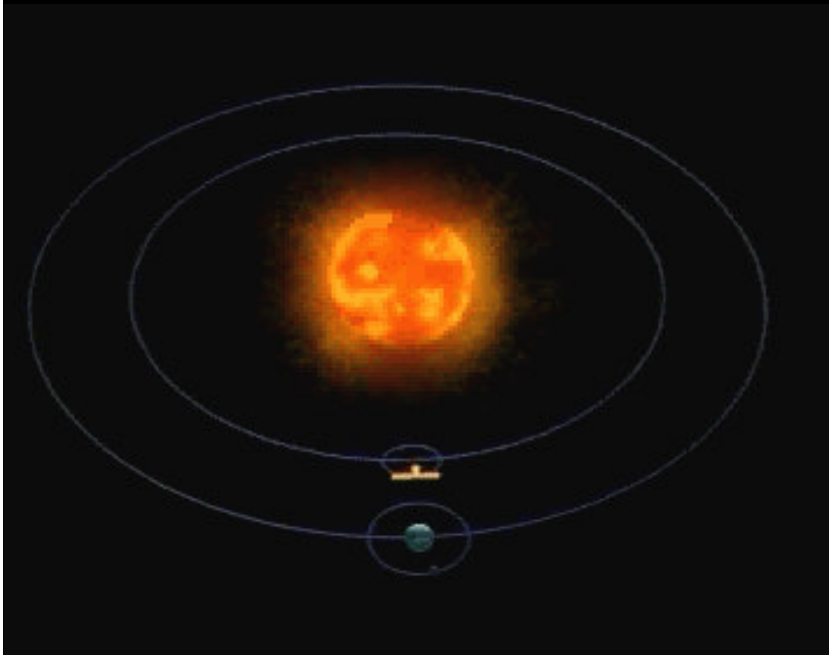




Amon-Rê,
God of the Universe



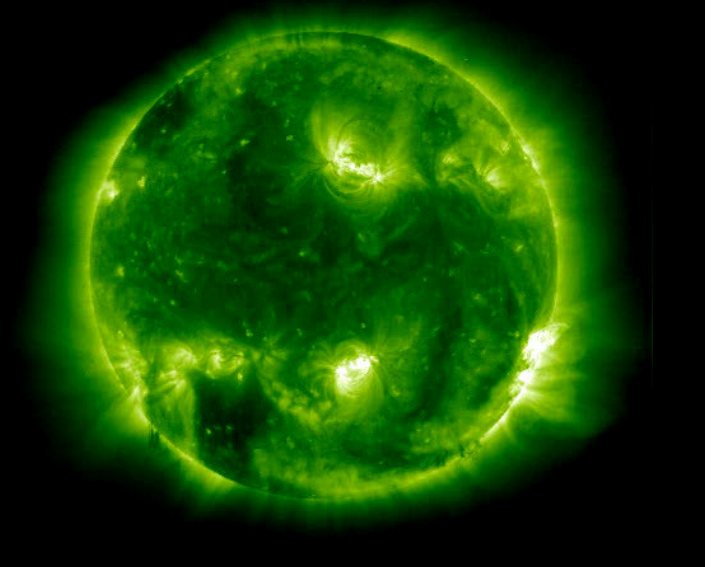
Where Apophis never wins



Lagrangian point L1



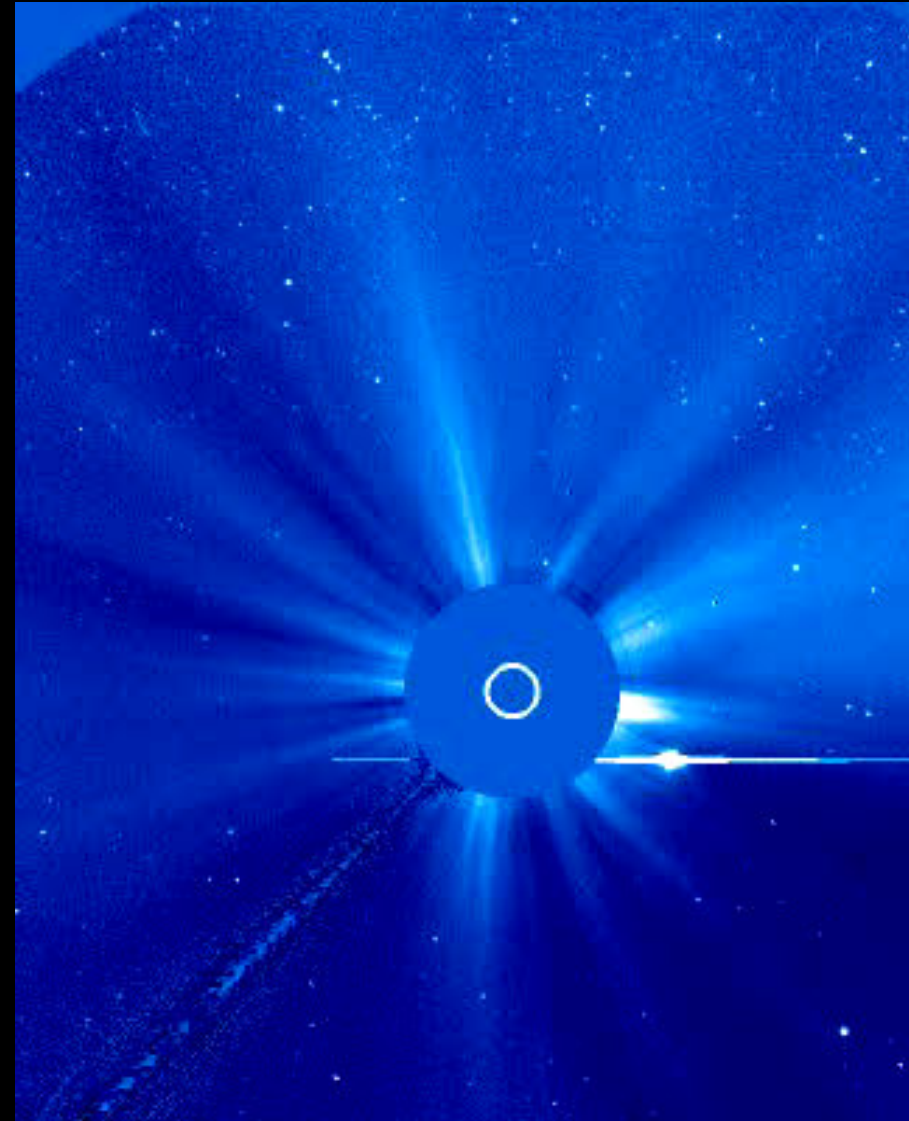
B. Lyot



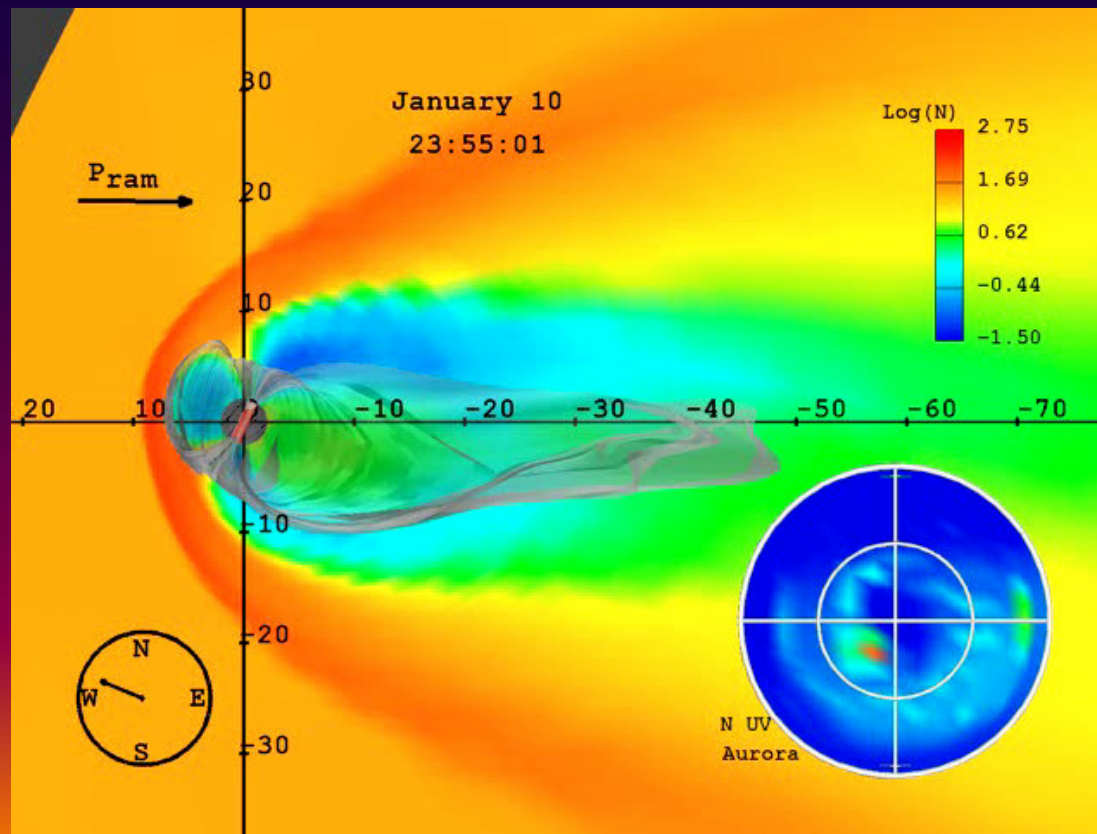
The Solar System Laboratory



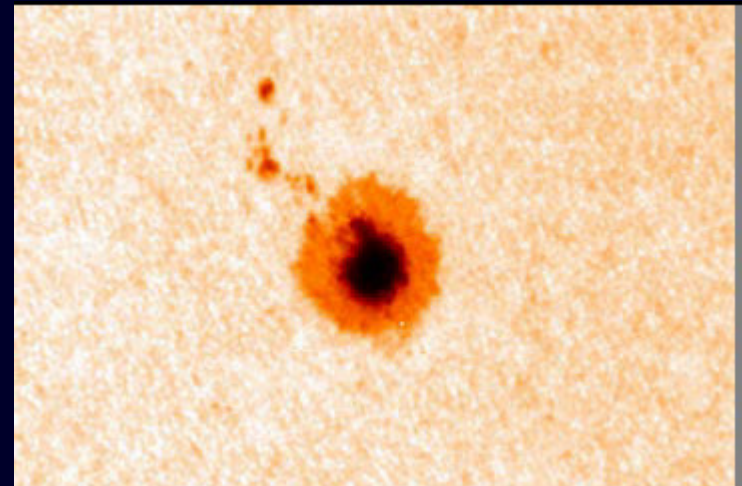
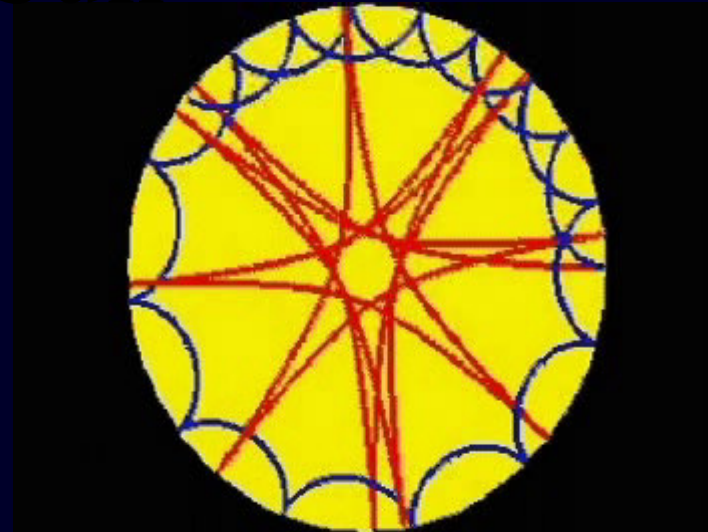
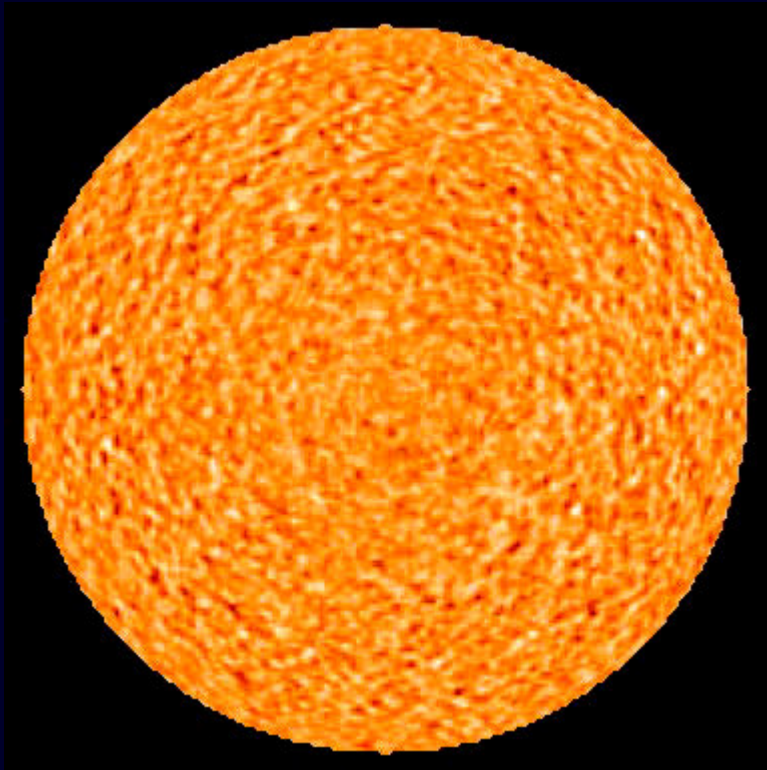
On 14 January 2002, Comet Machholz turned around the Sun and offered a unique demonstration of Ludwig Biermann's interpretation that the plasma tail of comets is structured by the solar wind and always directed opposite to the Sun.

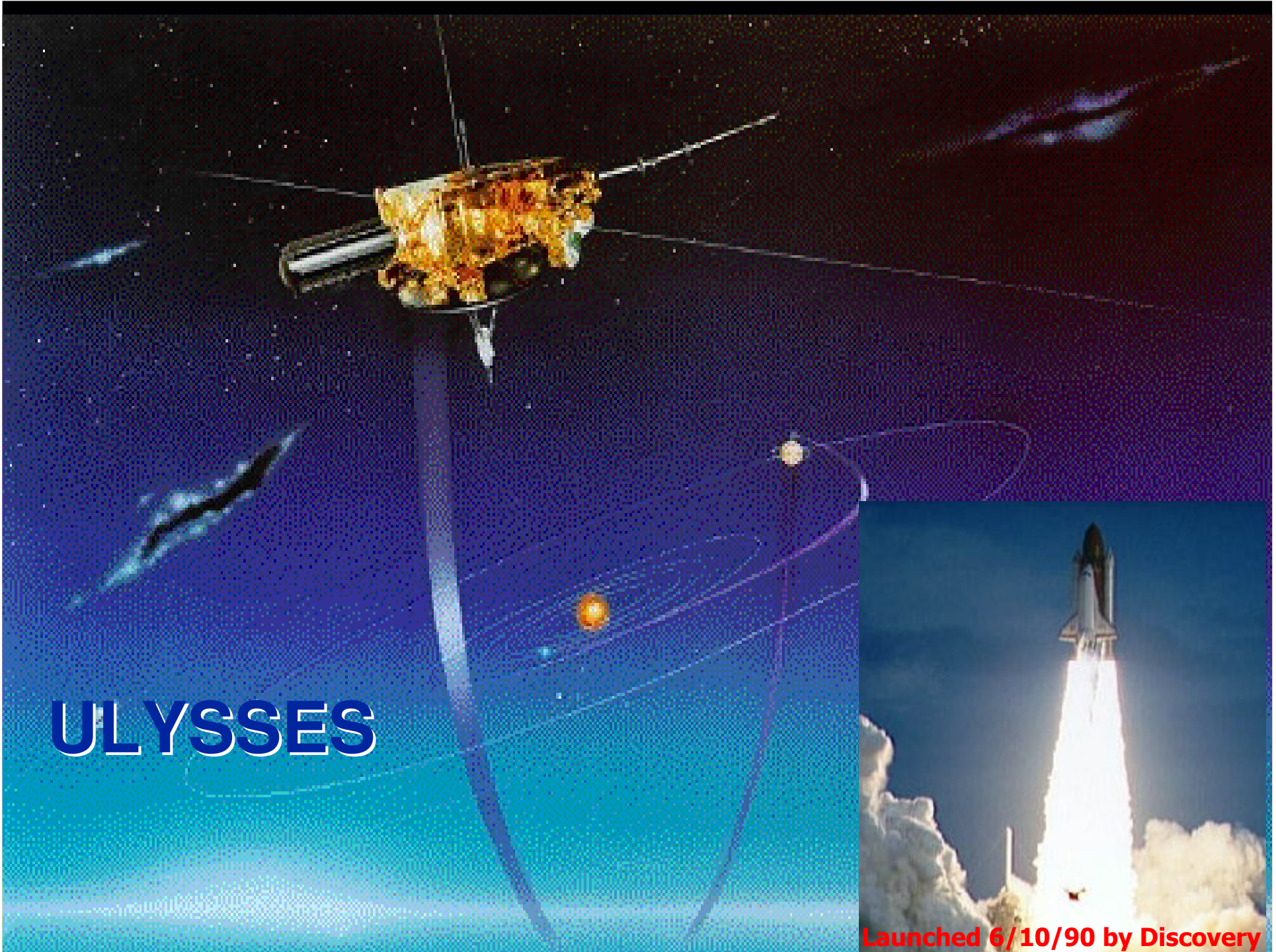


Amon Rê exerts its control



Helioseismology: “looking” inside the Sun





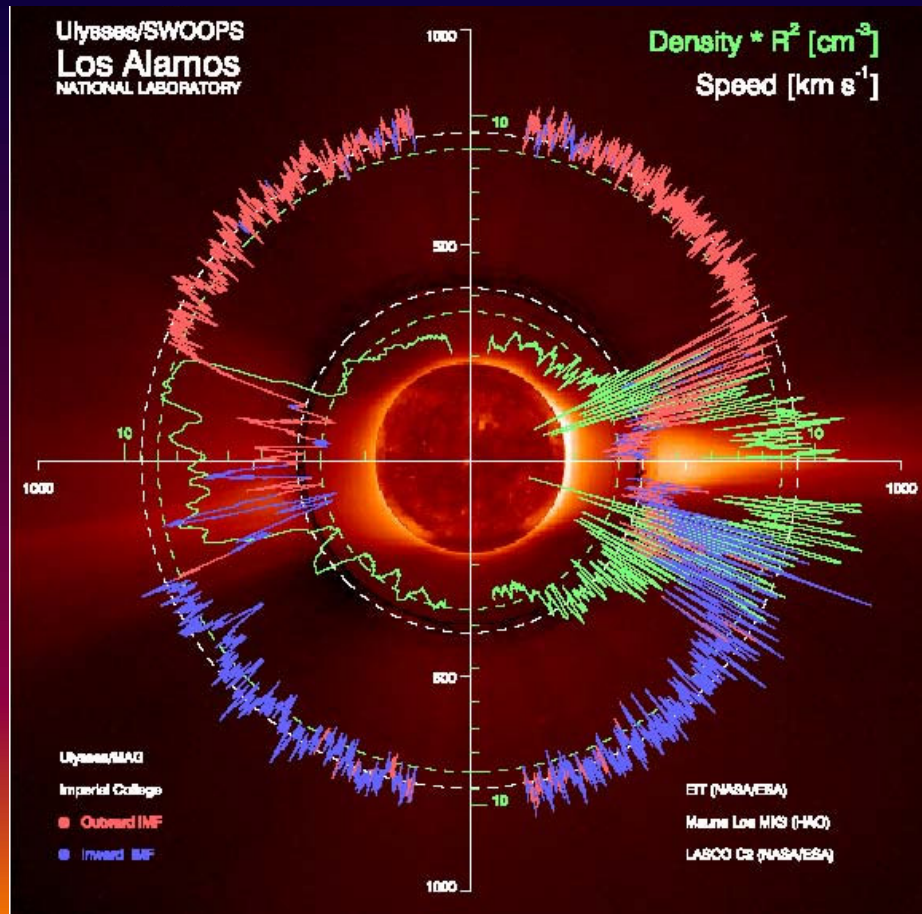
ULYSSES

Launched 6/10/90 by Discovery

A Unique view of the Heliosphere

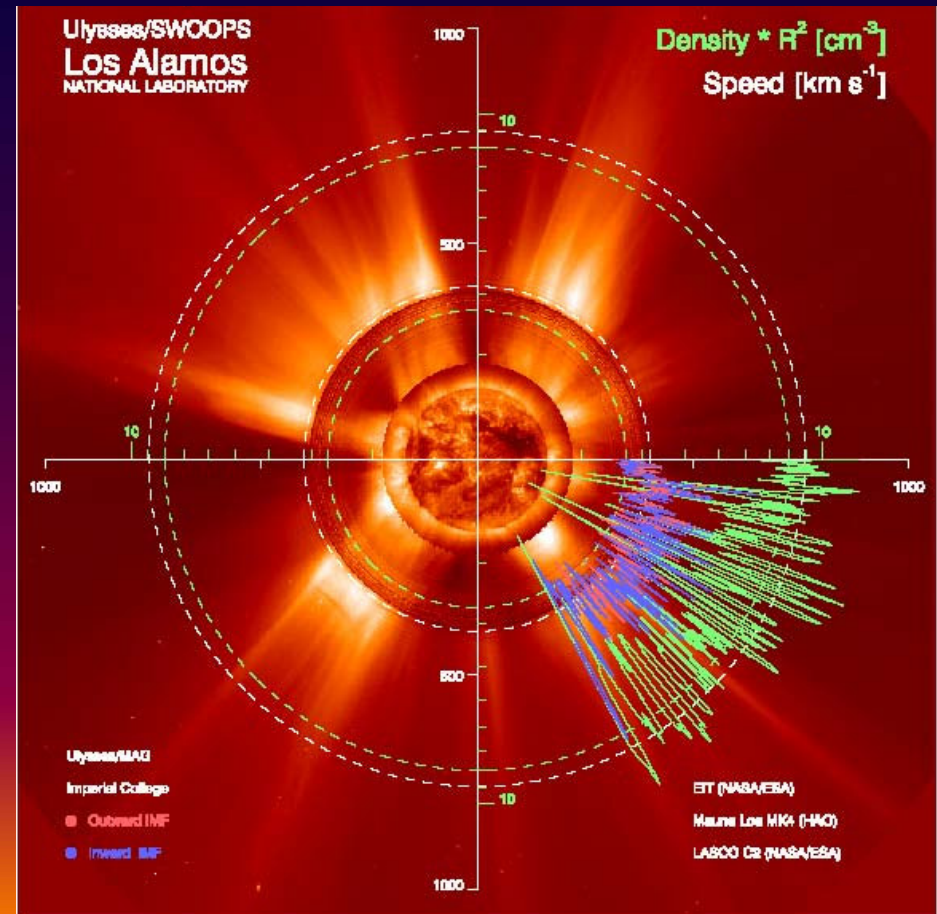
1992-1997

ULYSSES Orbit at solar minimum

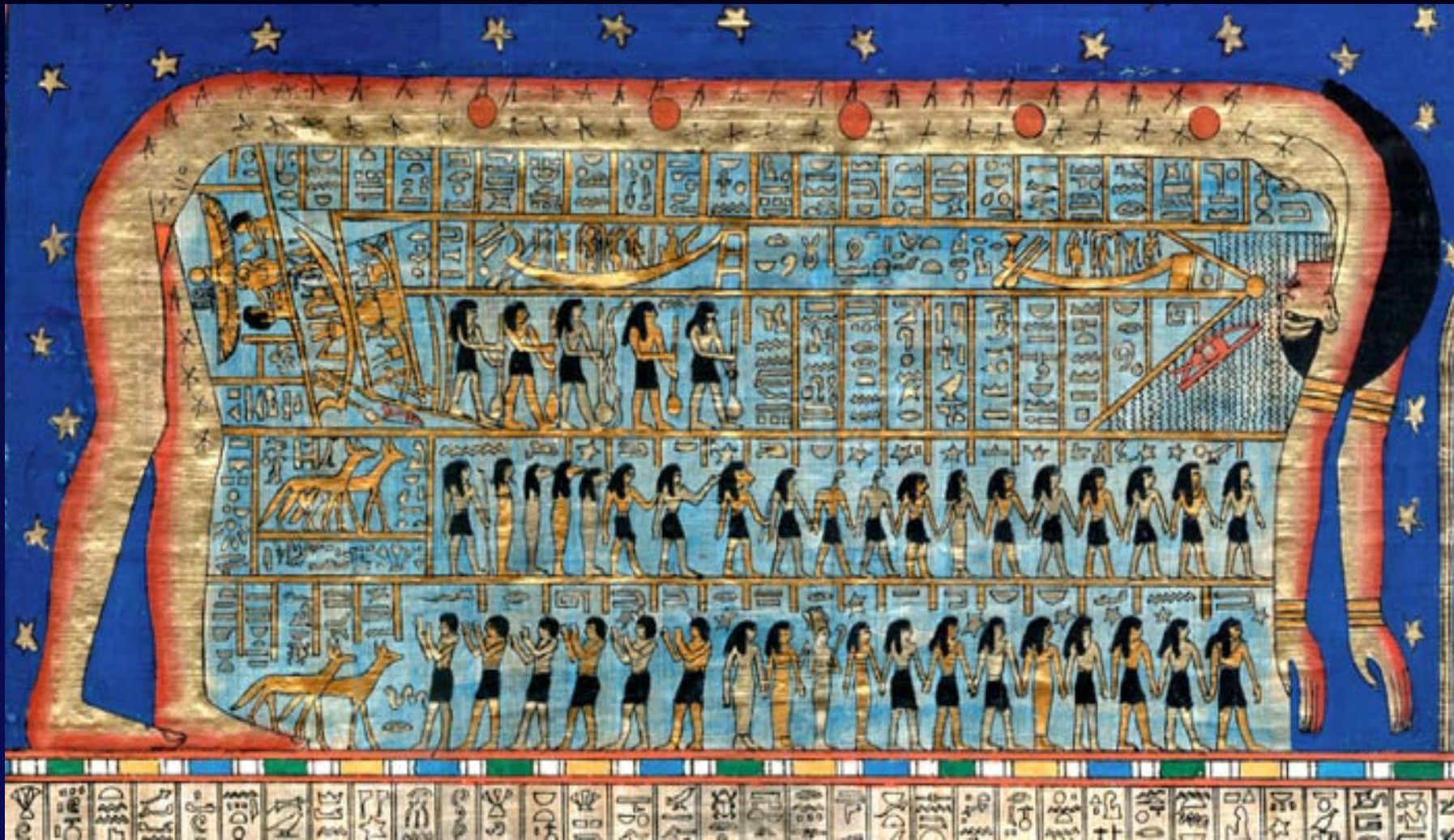


1998-2000

ULYSSES Orbit at solar maximum

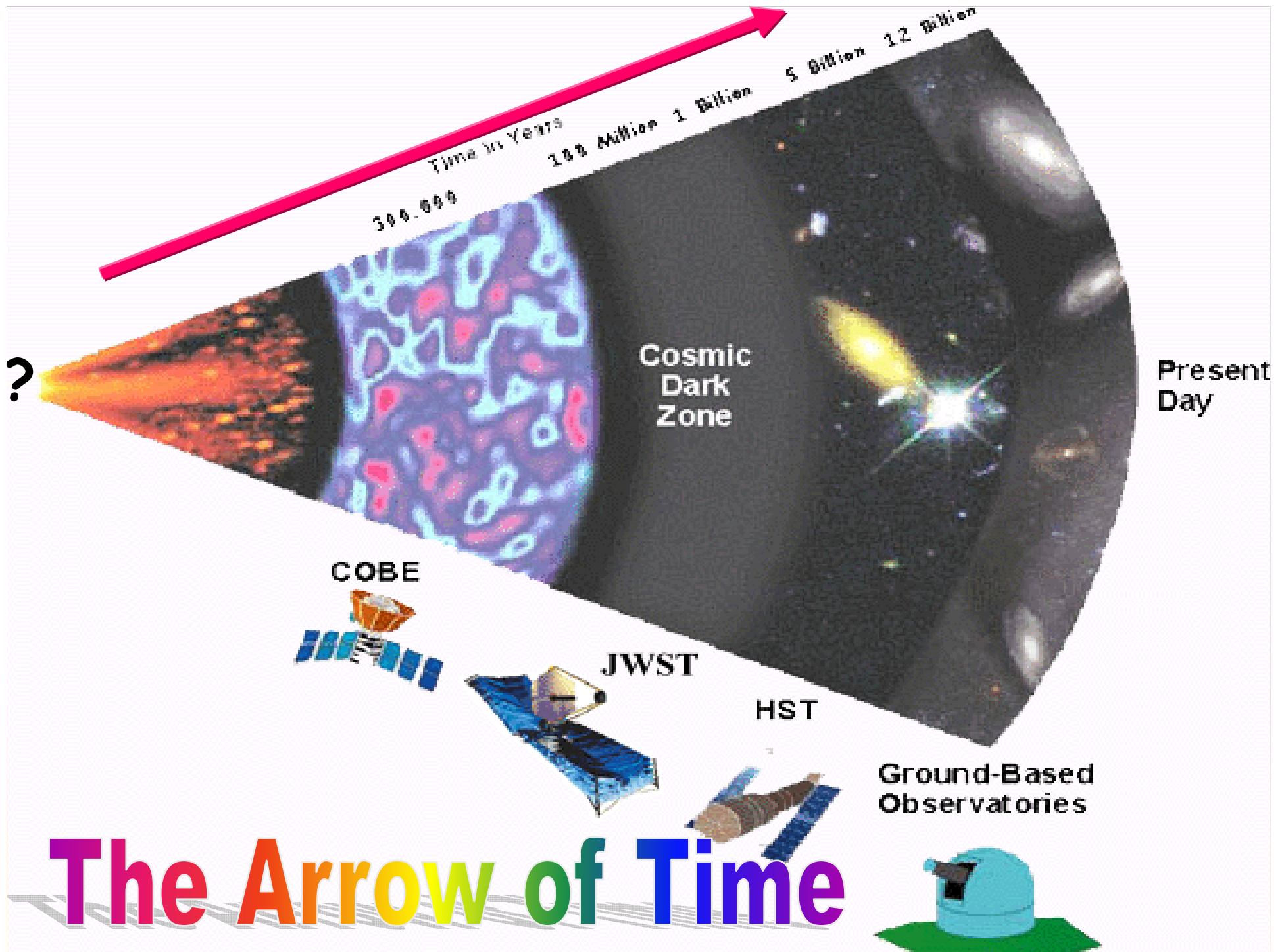


Celebrating Nout from Space

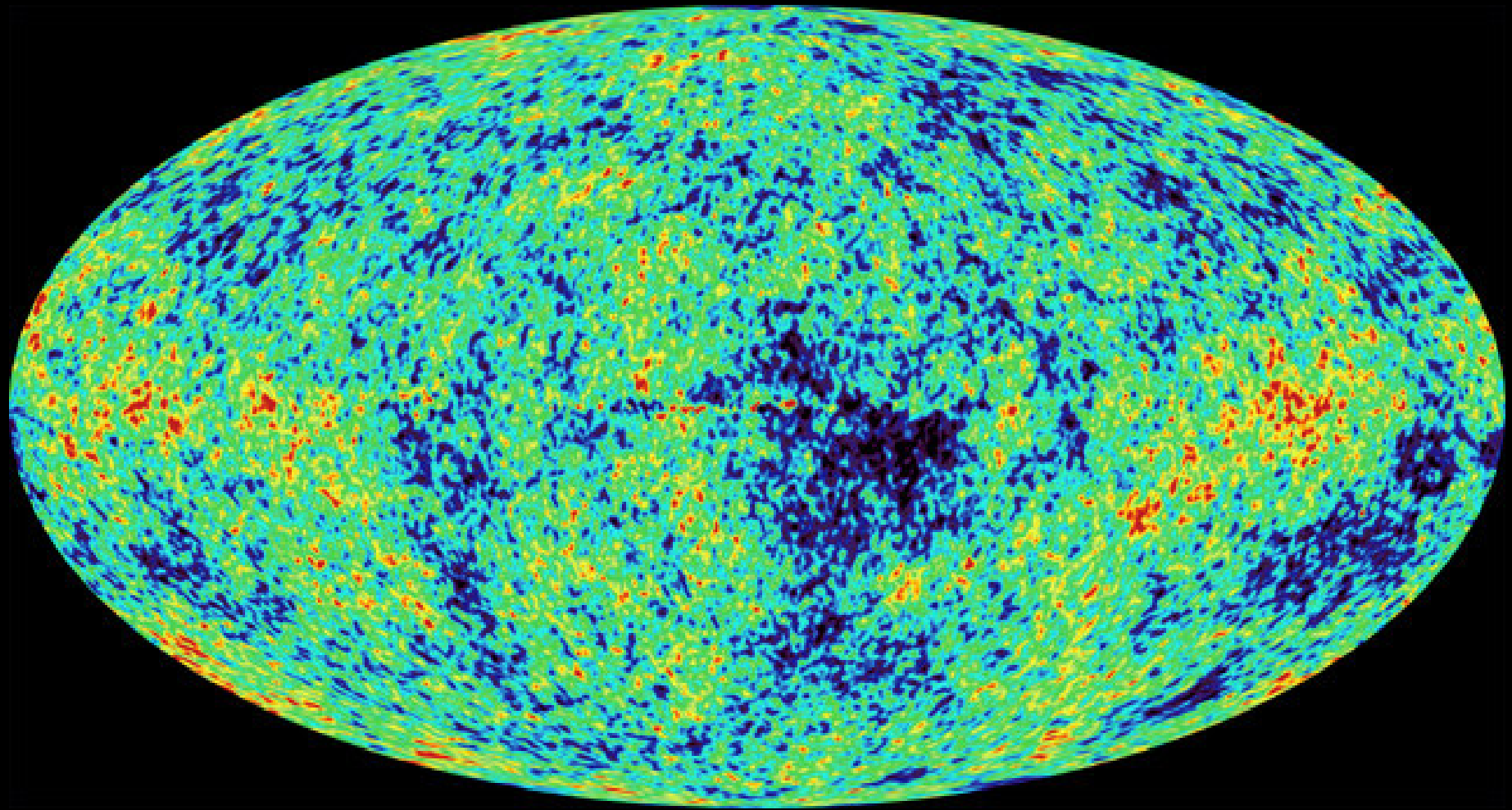


When space goes back in time



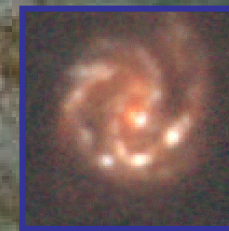
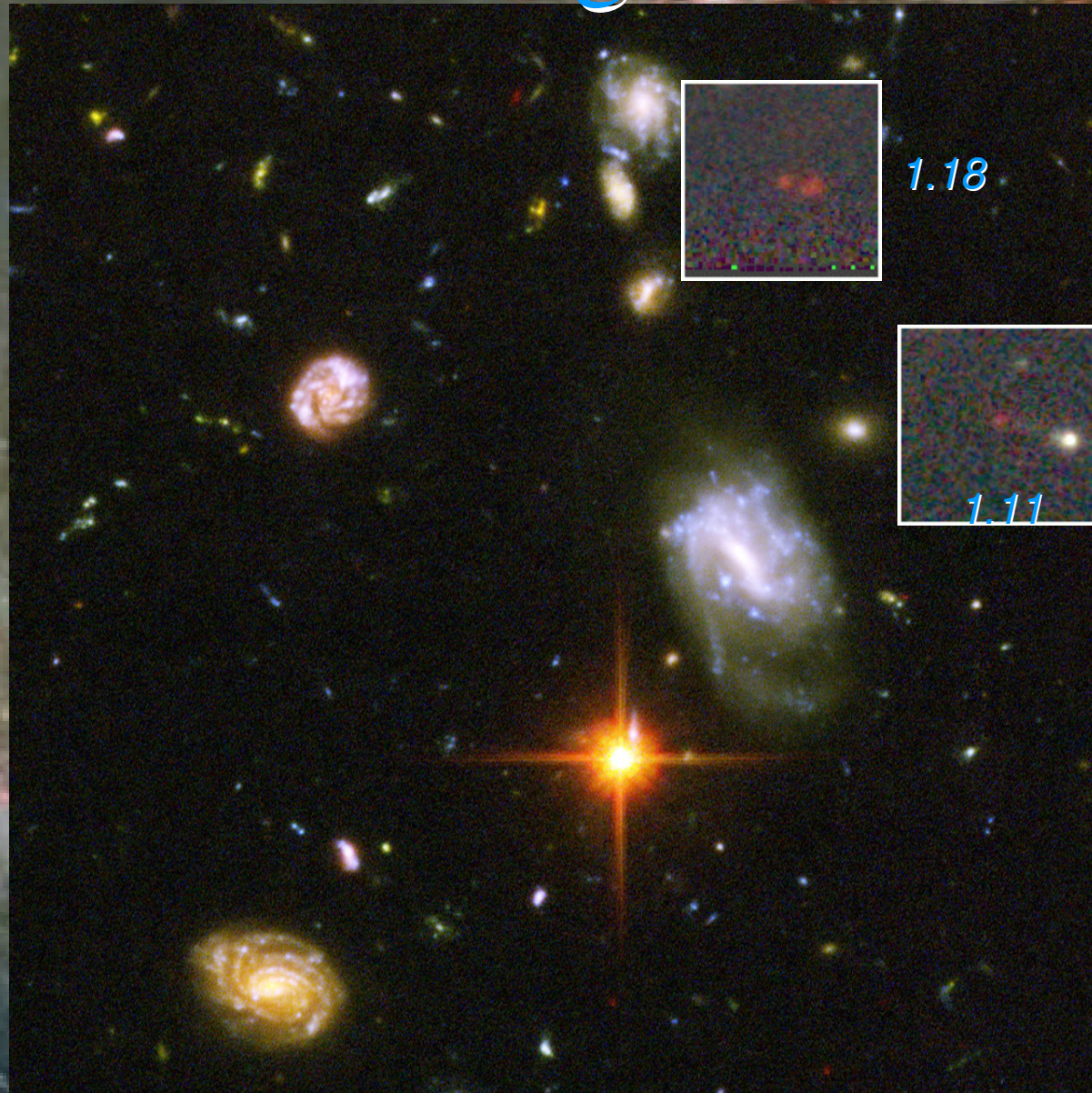


The oldest (first?) light



The first galaxies

Age of the Universe = 13.7 Md Y



6.33



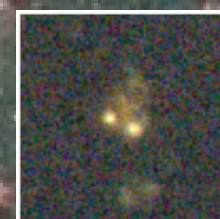
3.56



2.40



2.37



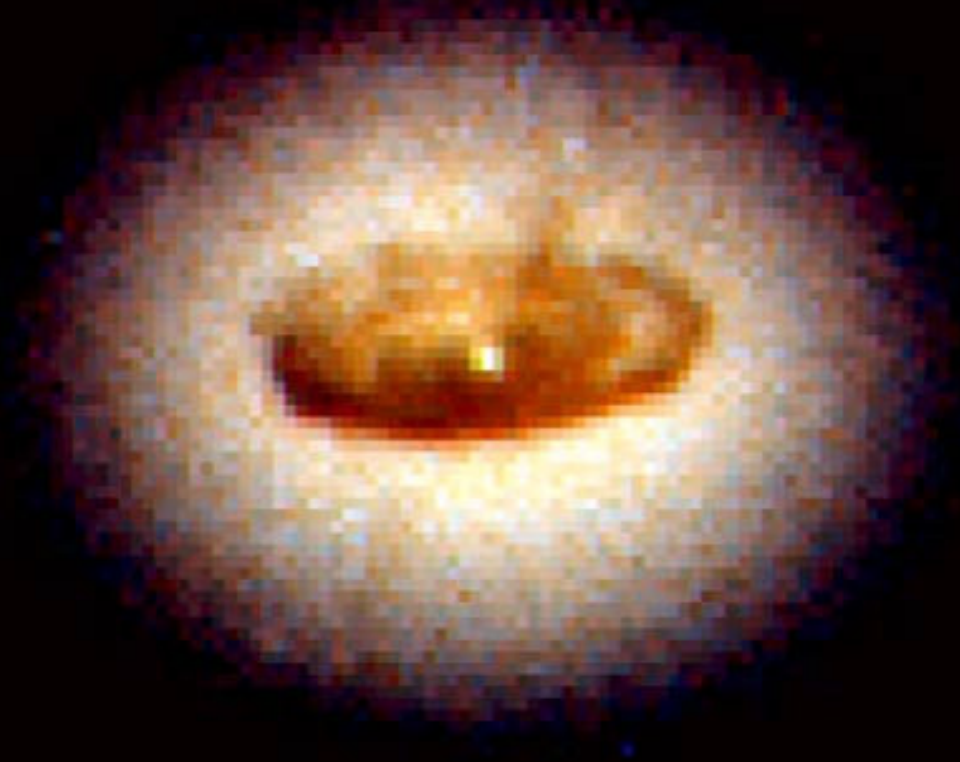
2.01

Crédit: Robert Williams. et al. (1997) STScI

Mapping Dark Matter

A deep-field astronomical image showing a vast field of galaxies. The background is a dark, deep purple and blue, filled with numerous small, distant galaxies. In the center, there is a prominent, bright, purple-hued galaxy cluster. Several bright, white stars are scattered throughout the field, with some showing prominent diffraction spikes. The overall scene is a rich, multi-colored representation of the universe's structure.

Black Hole Astronomy



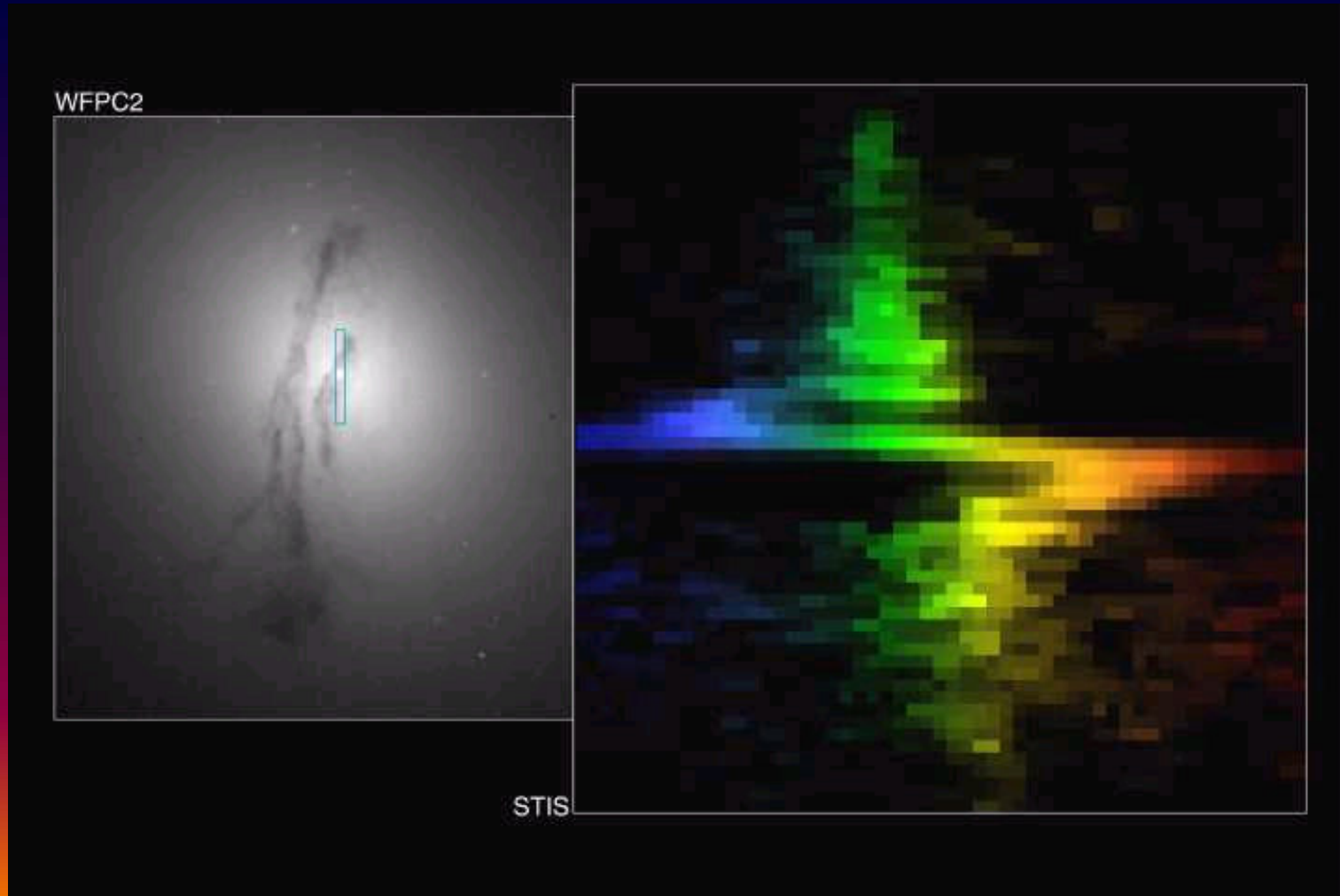
Core of Galaxy NGC4261

PRC95-47 · ST ScI OPO · December 4, 1995

H. Ford and L. Ferrarese (JHU), NASA

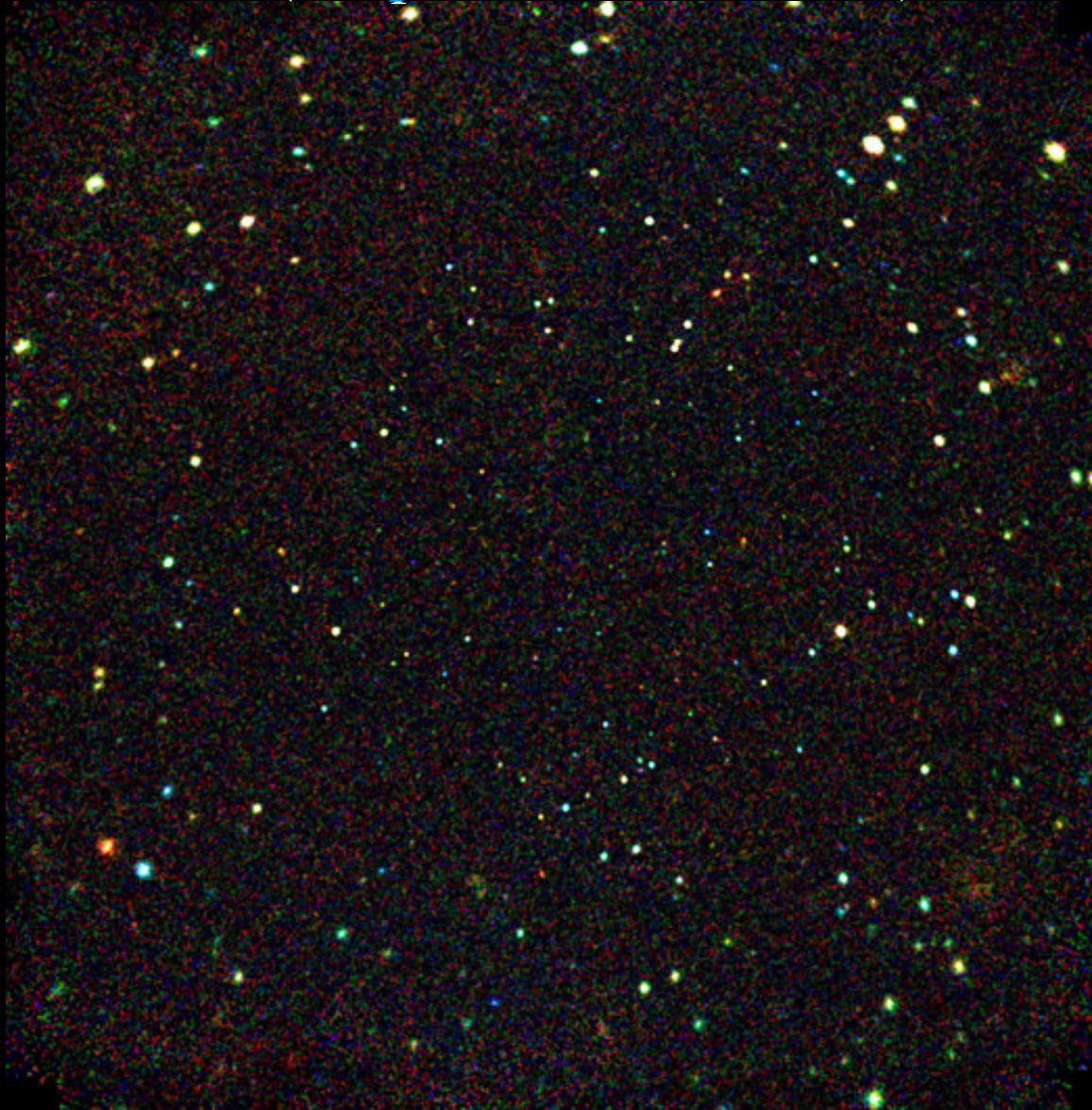
HST · WFPC2

Detecting Black Holes



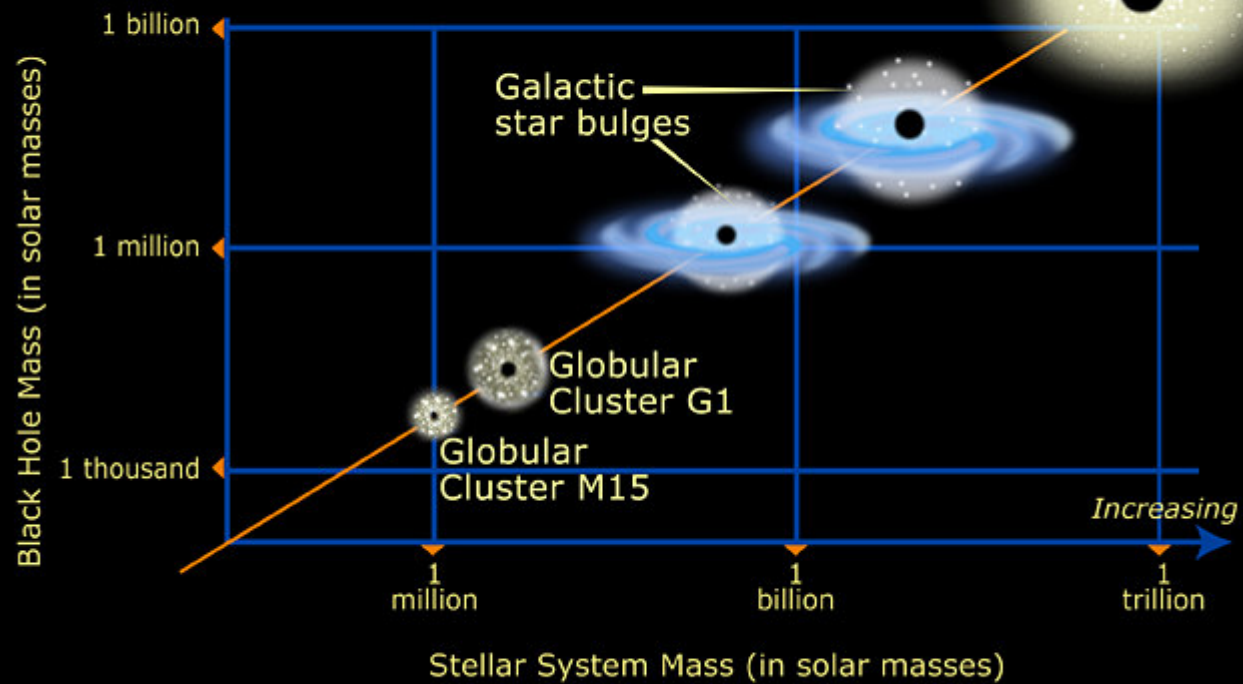
X rays are ideal to detect black holes

(Deep field from Chandra)



NGC 6093

Correlating Black Hole Mass to Stellar System Mass



Looking to and through dust



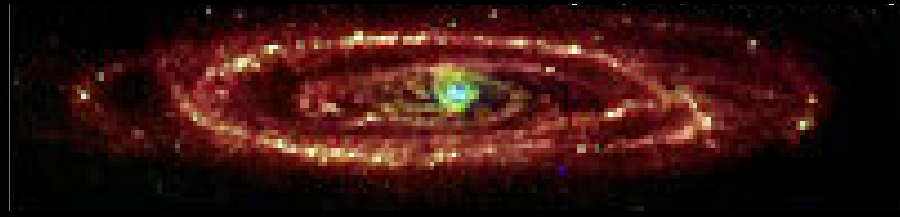
Visible



24 microns (Spitzer)

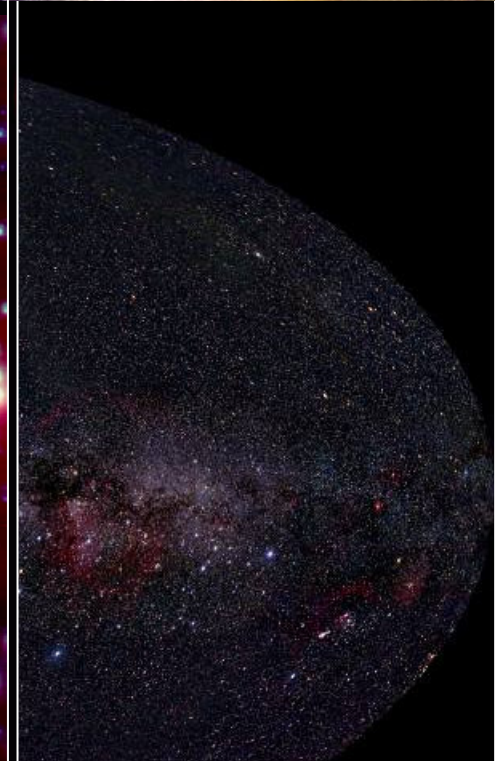
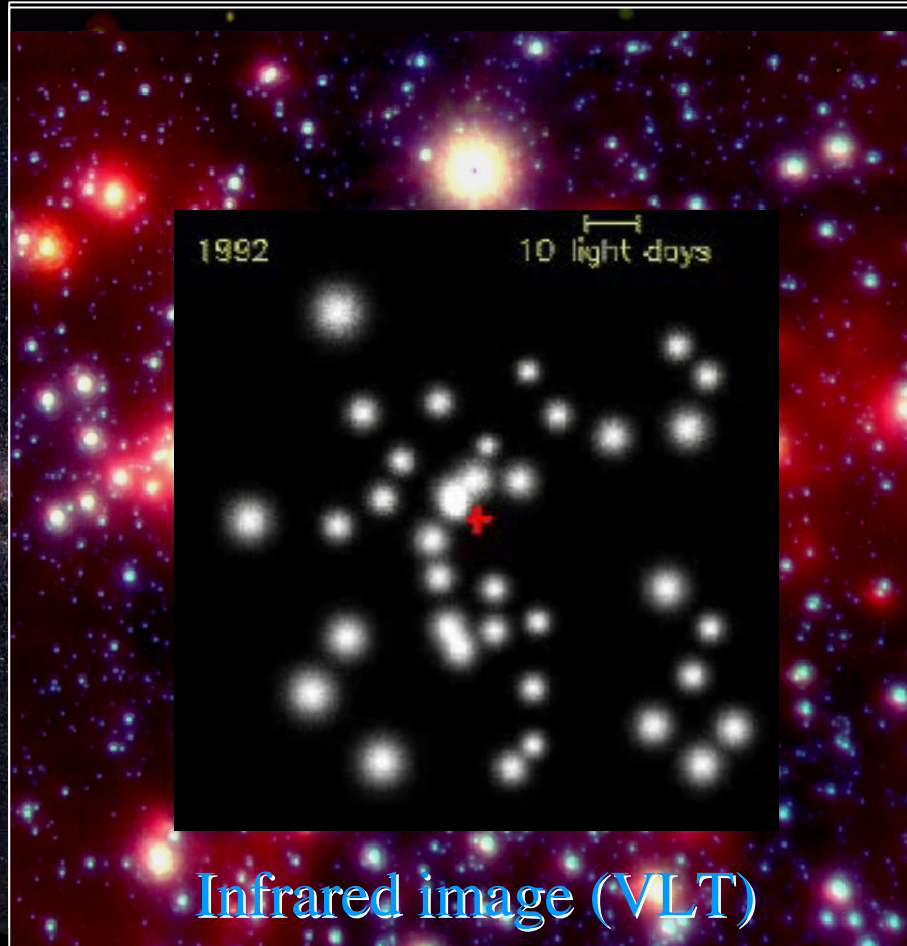


175 microns (ISO)



Combination 24+70+160 microns (Spitzer)

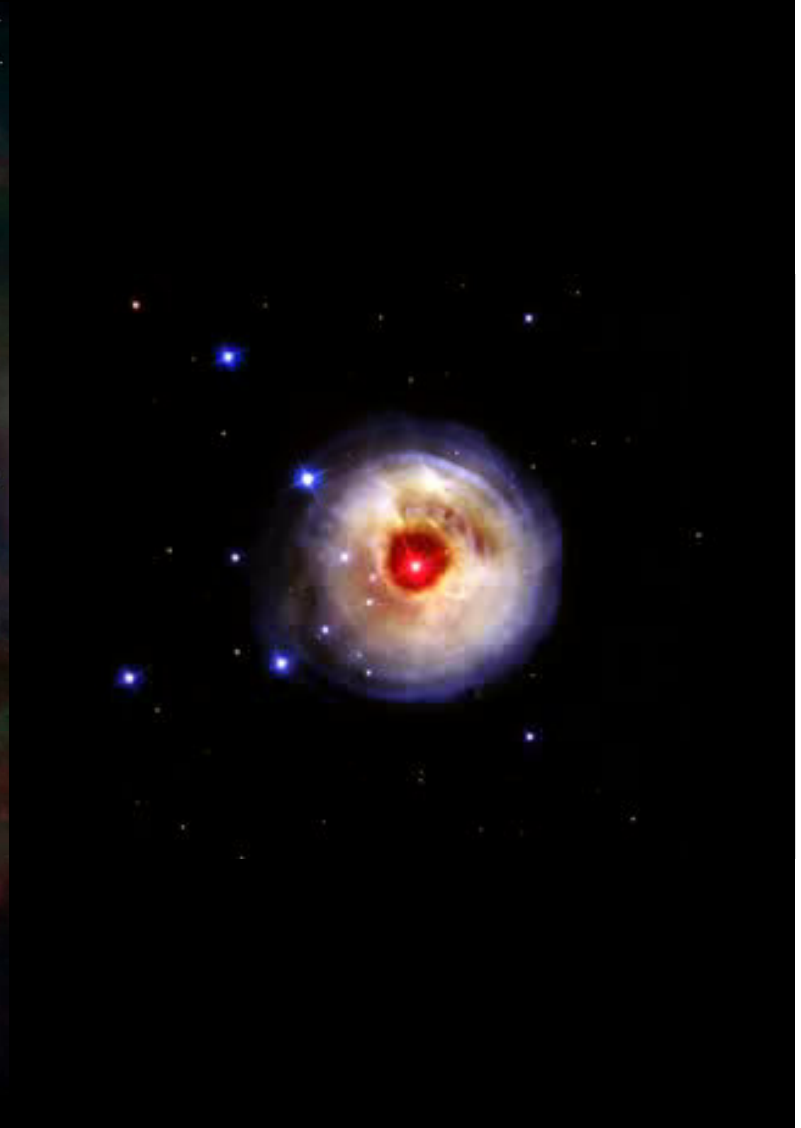
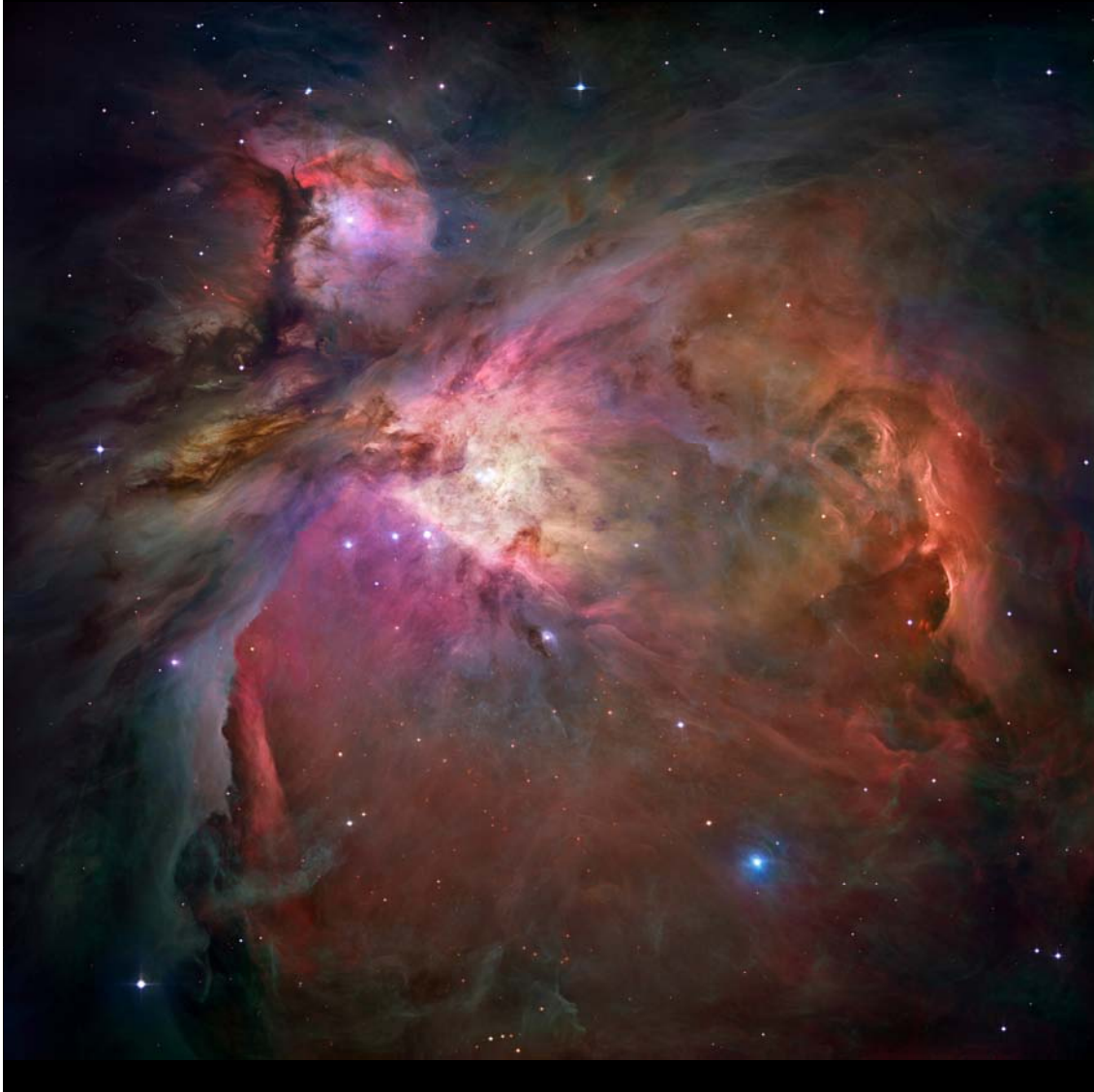
Power of multi spectral Observations: Our Milky Way's Black Hole



A 2.6 billion solar masses Black Hole
hidden in the dust

Credit: R. Genzel

From the Birth to the Death of stars

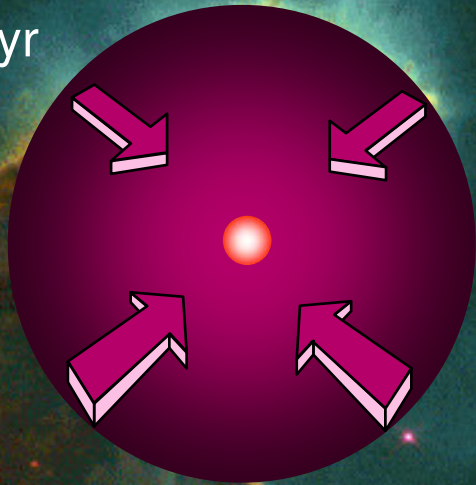


The Tarentula Nebula: a stars cradle



Formation of Stars and Planets

10^4 yr

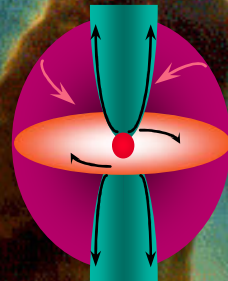


Collapsing cloud



10^6 yr

Disk & Jet

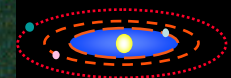


10^8 yr

Protoplanetary system

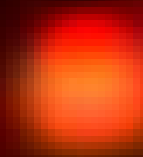


Planetary system

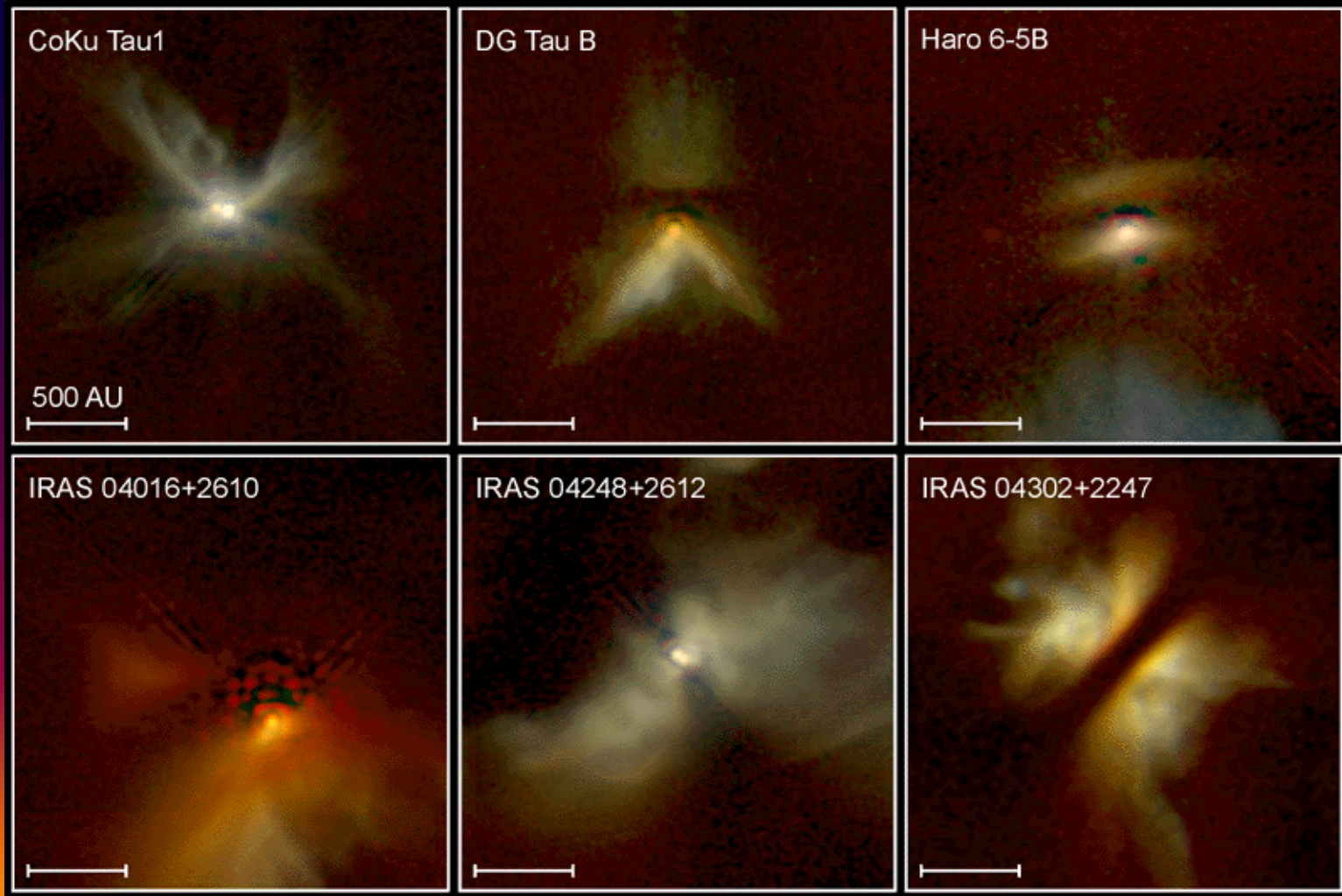


10^9 yr

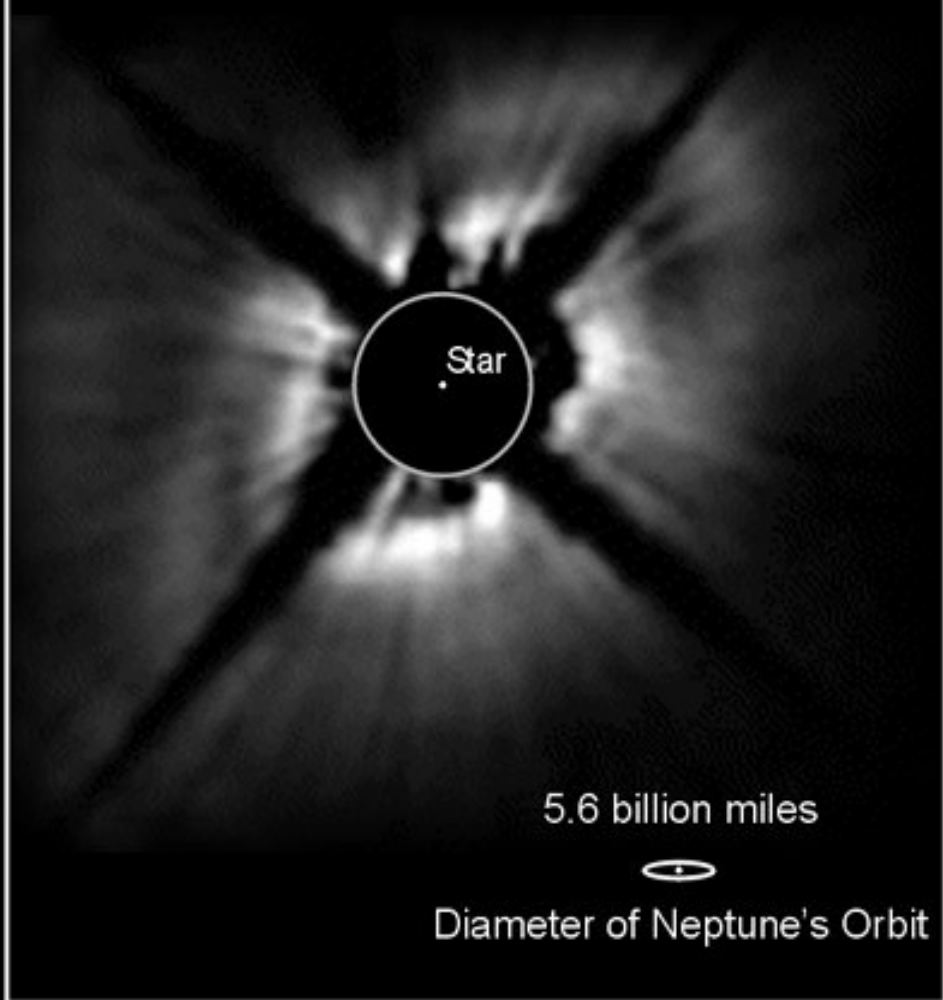
A baby Star



Just Dust and Gas

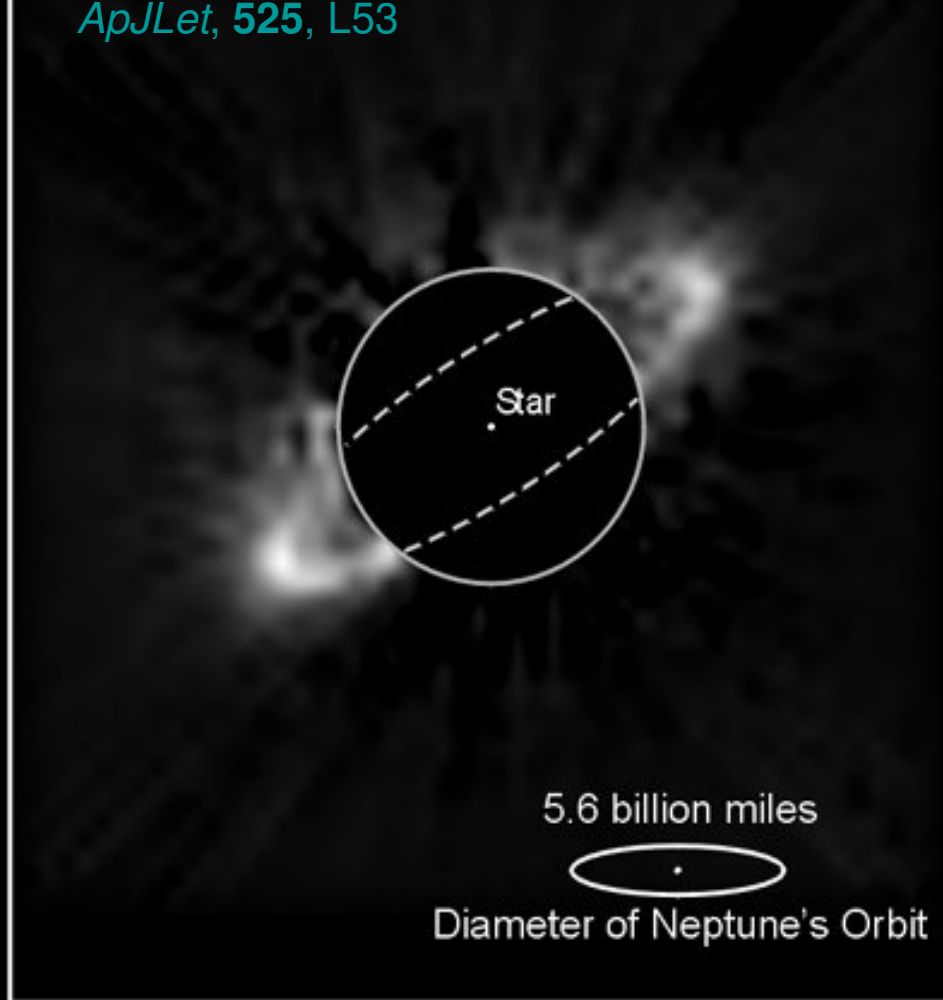


HD 141569



HR 4796A

Weinberger *et al.* 1999,
ApJLet, 525, L53



Dust Disks around Stars

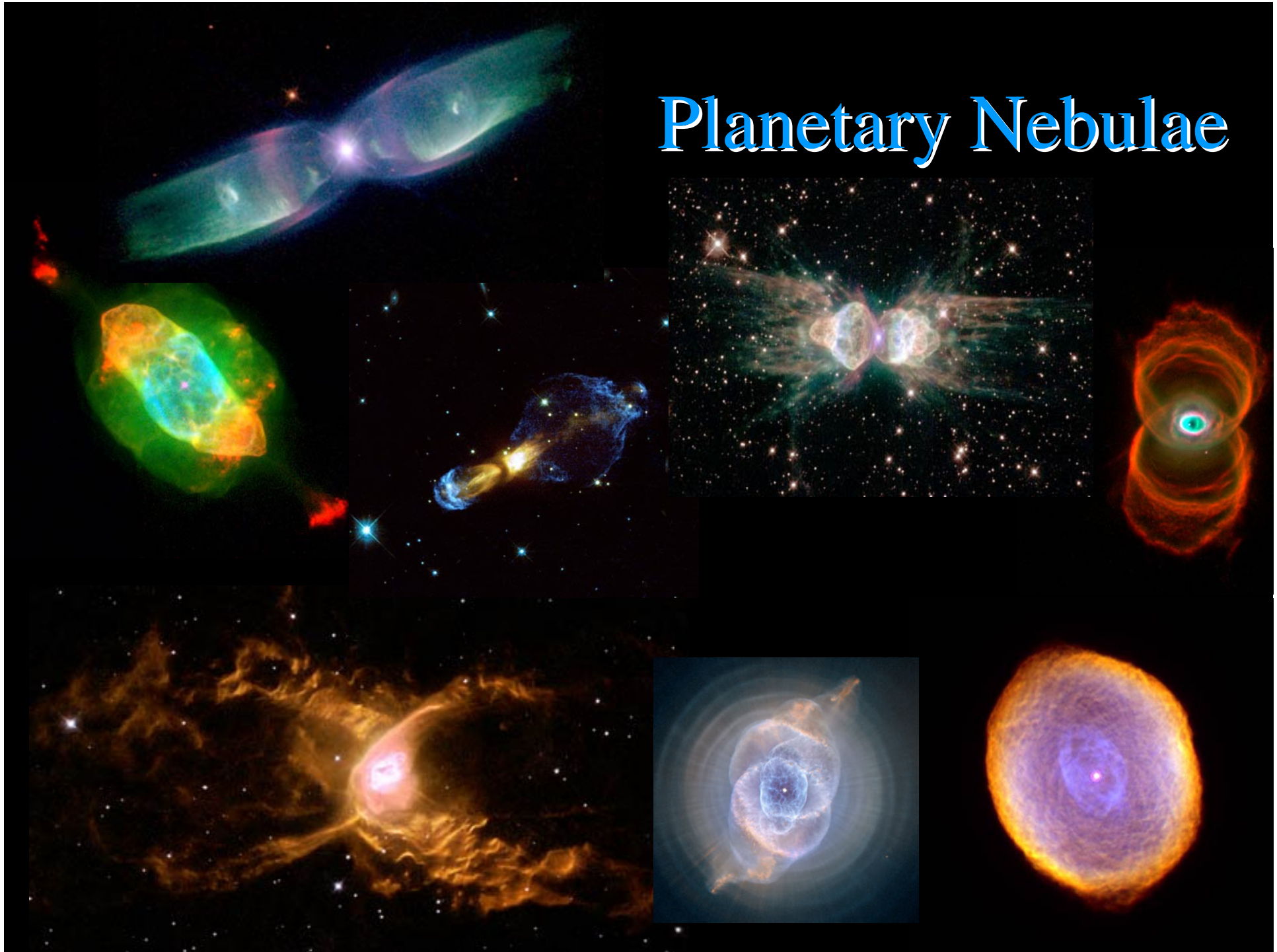
HST • NICMOS

PRC99-03 • STScI OPO • January 8, 1999
B. Smith (University of Hawaii), G. Schneider (University of Arizona),
E. Becklin and A. Weinberger (UCLA) and NASA

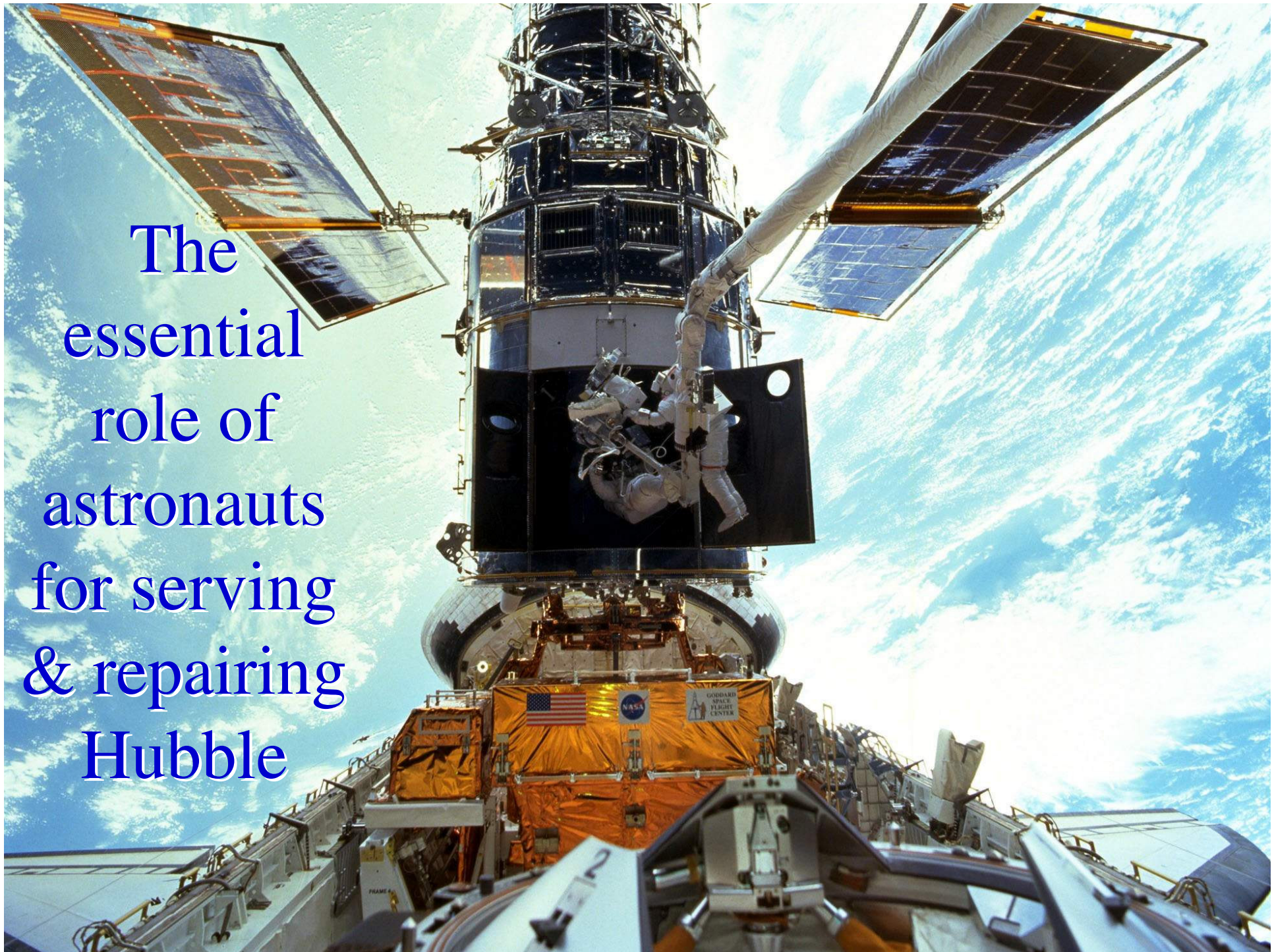
The Crab



Planetary Nebulae

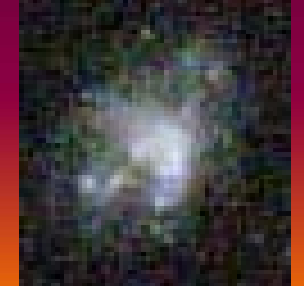
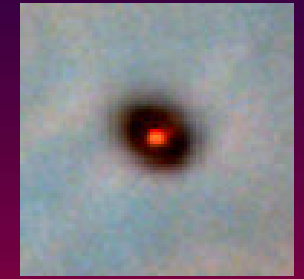
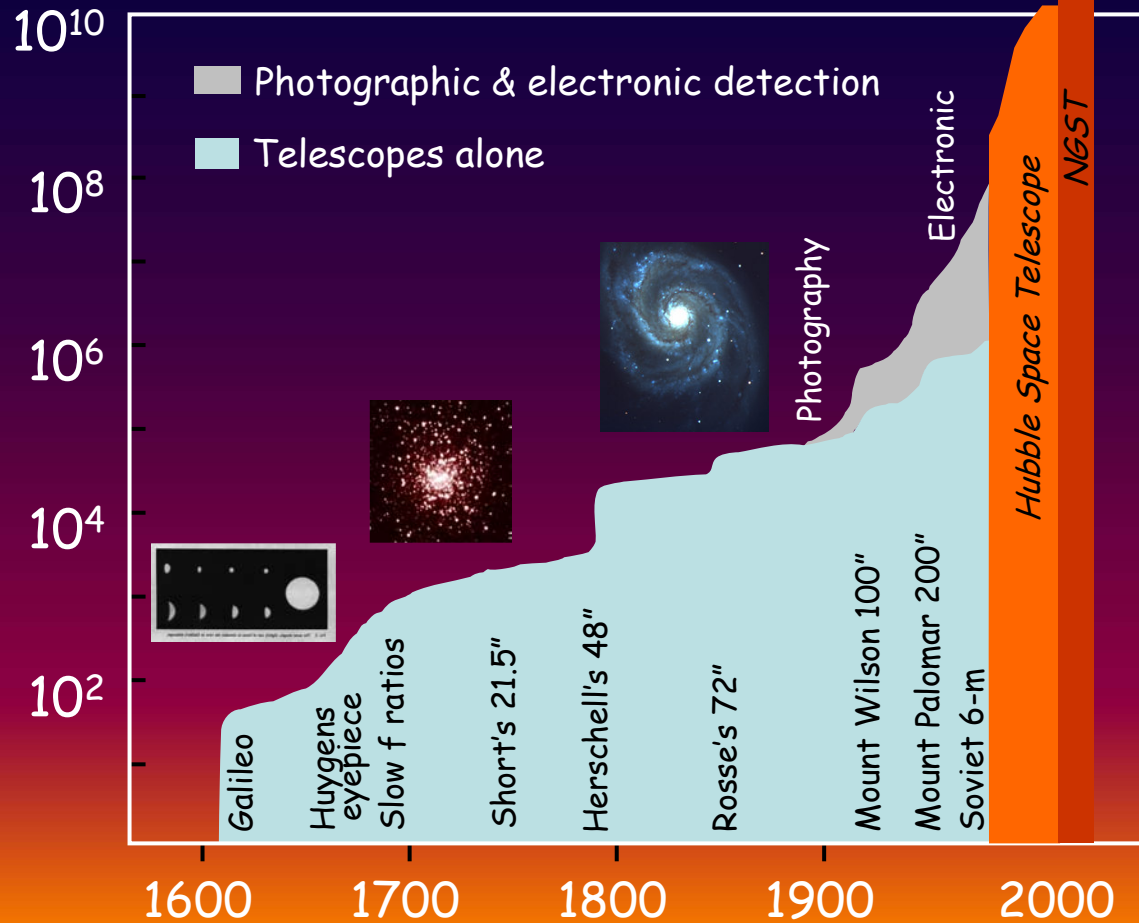


The
essential
role of
astronauts
for serving
& repairing
Hubble



Telescope Sensitivity & Discoveries

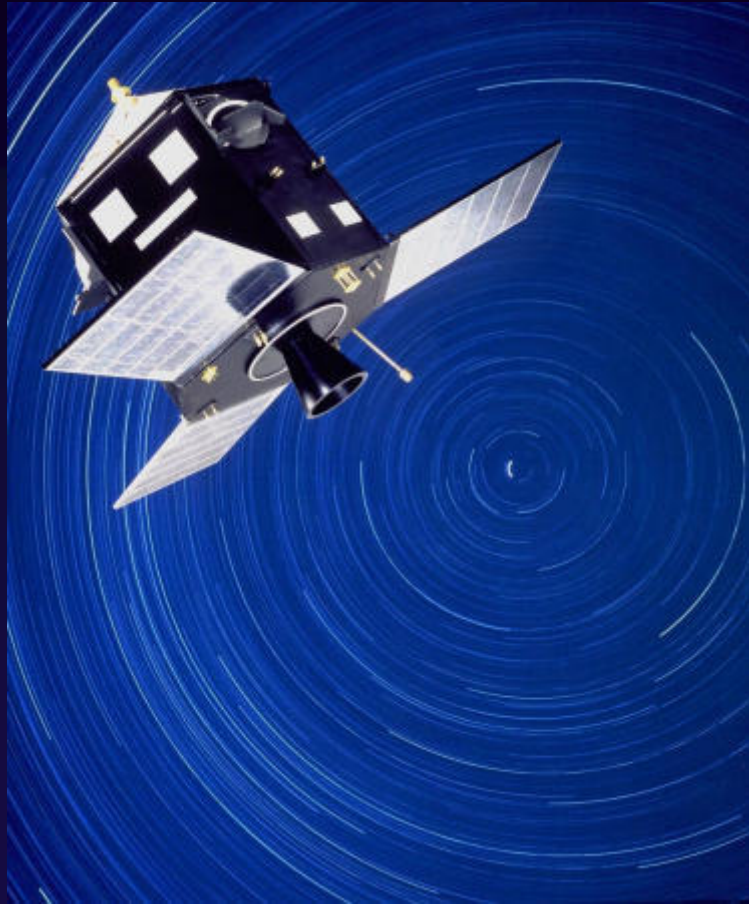
Sensitivity Improvement over the Eye



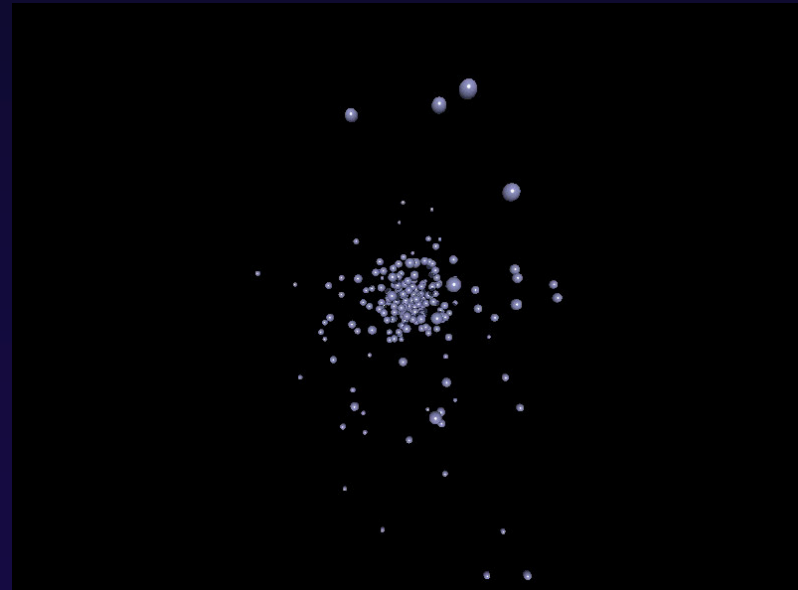
After *Cosmic Discovery*, M. Harwit

Year of observations

The astrometry revolution



Hipparcos: first
astrometry mission



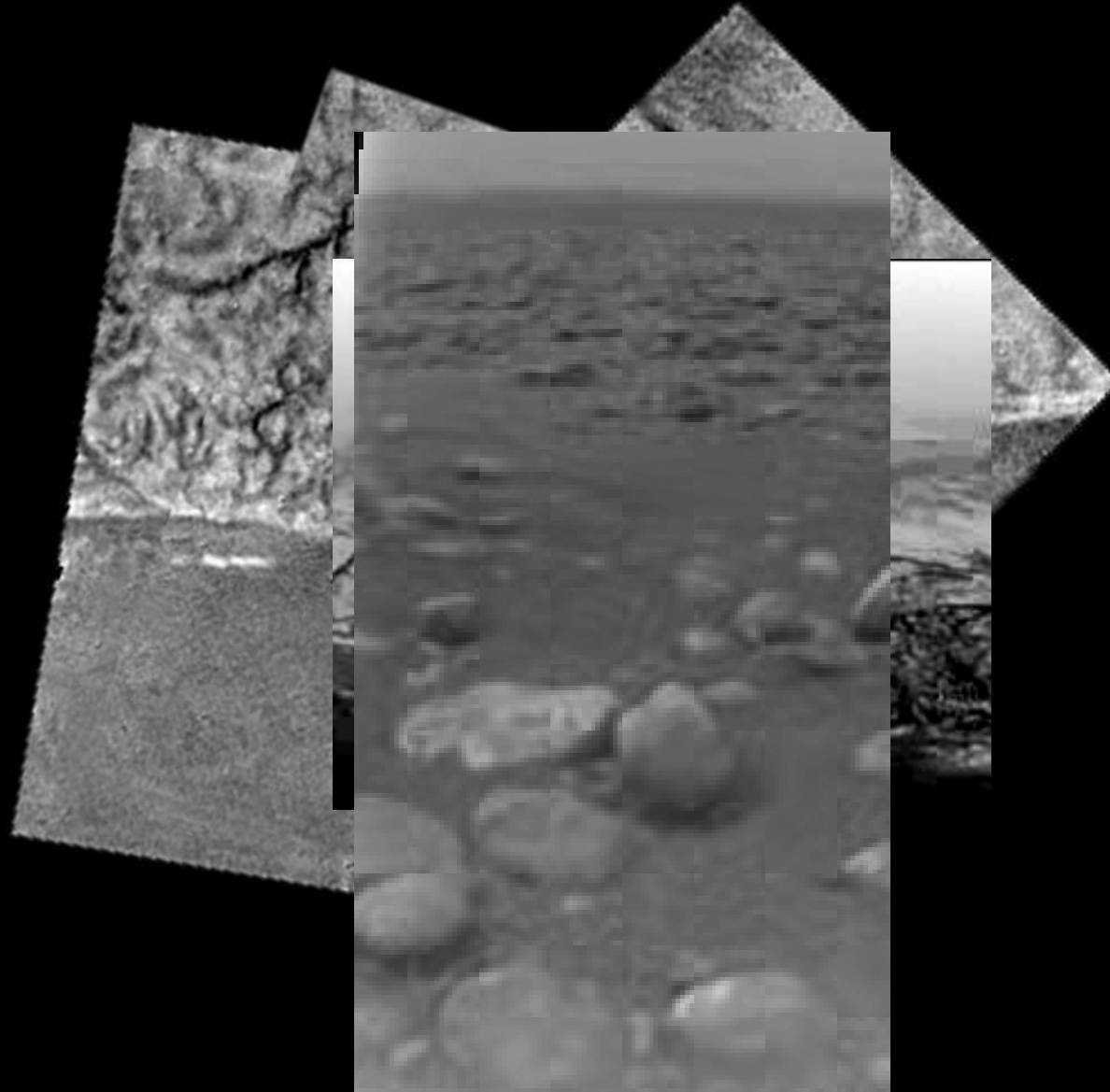
Exploring!



Discovering New Worlds



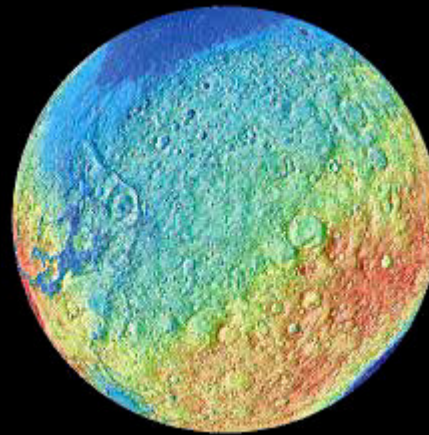
Huygens probe landing on Titan



Observing the invisible surfaces of Solar System objects



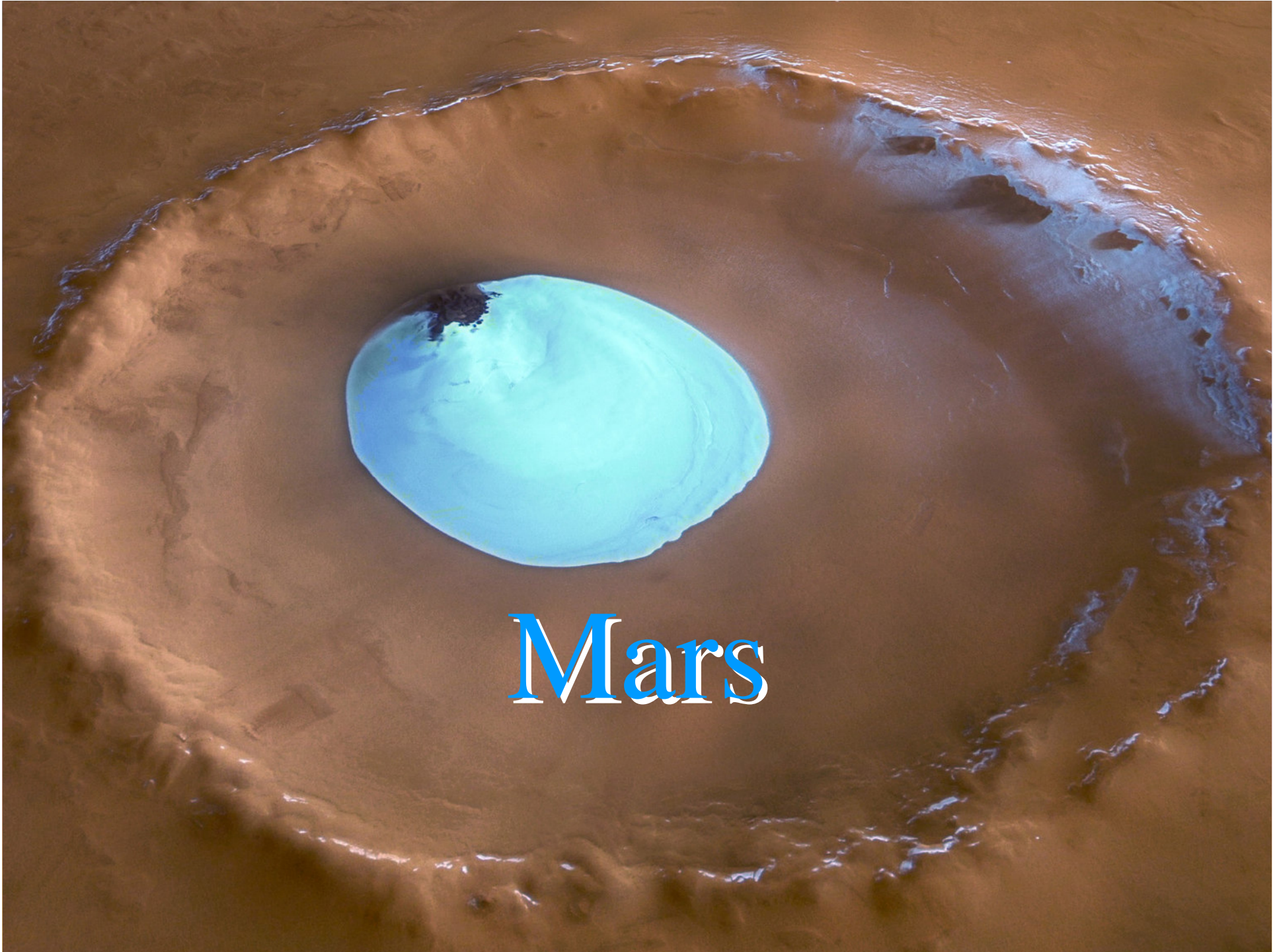
Venus



Mars



Halley's comet



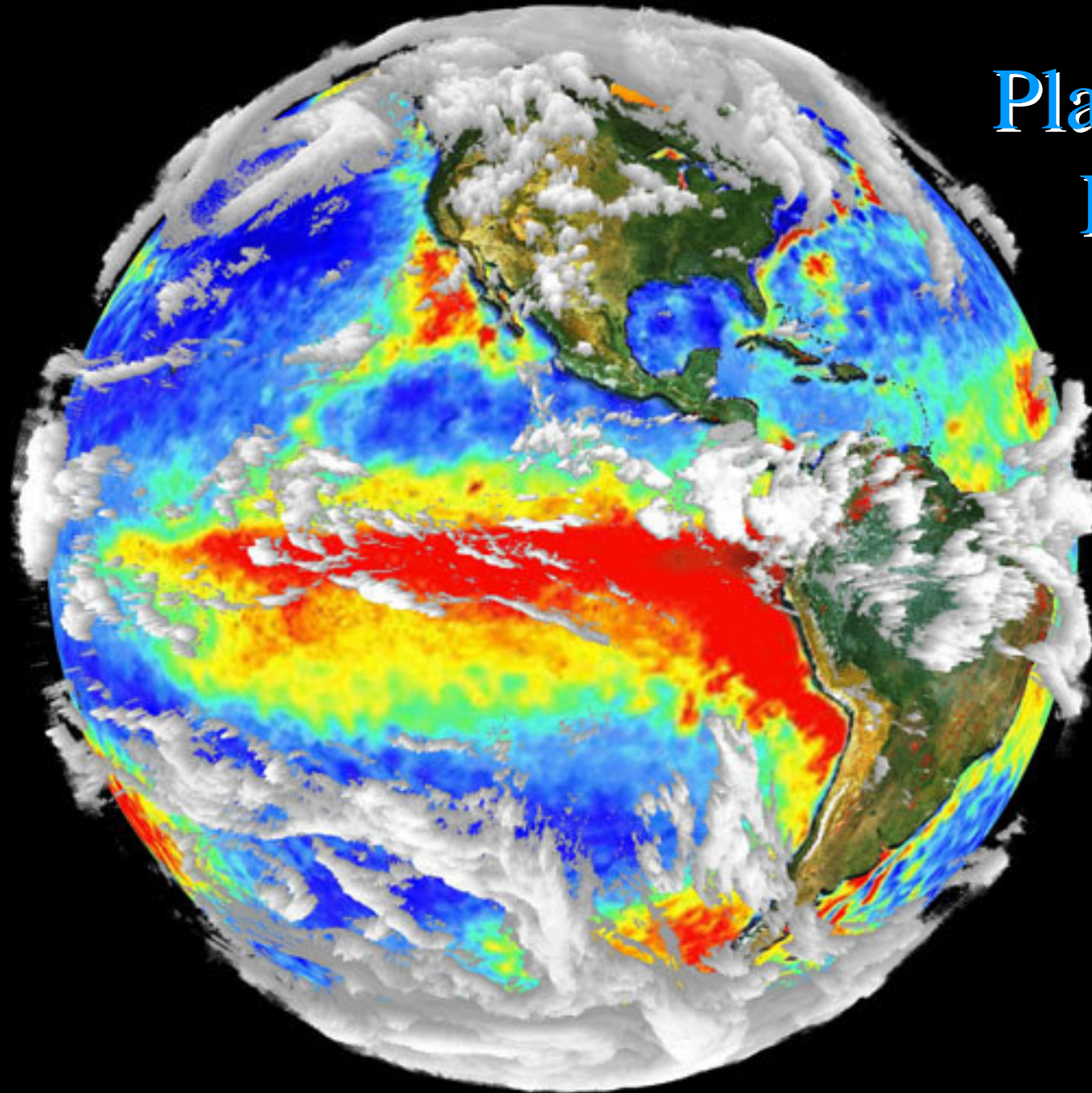






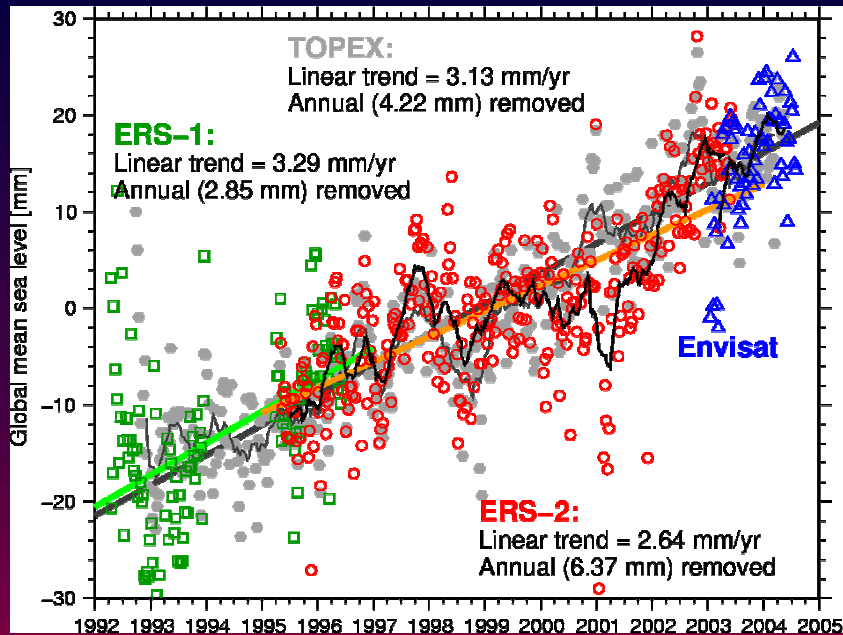


Planet of the Future?



Geb

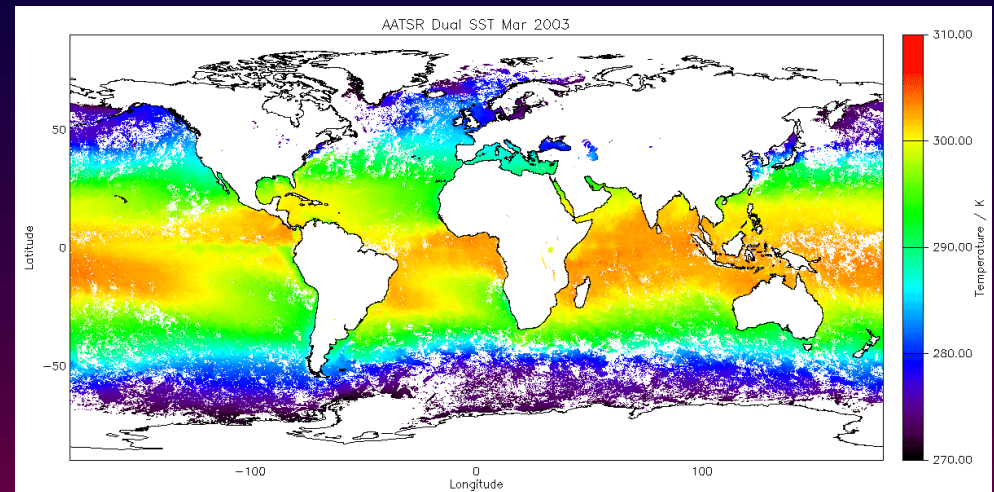
Mesuring the Earth's Fever



Sea Level rise

Altimetry measurements
Trend +3 mm/yr

Courtesy of Remko Scharroo,
NOAA, US

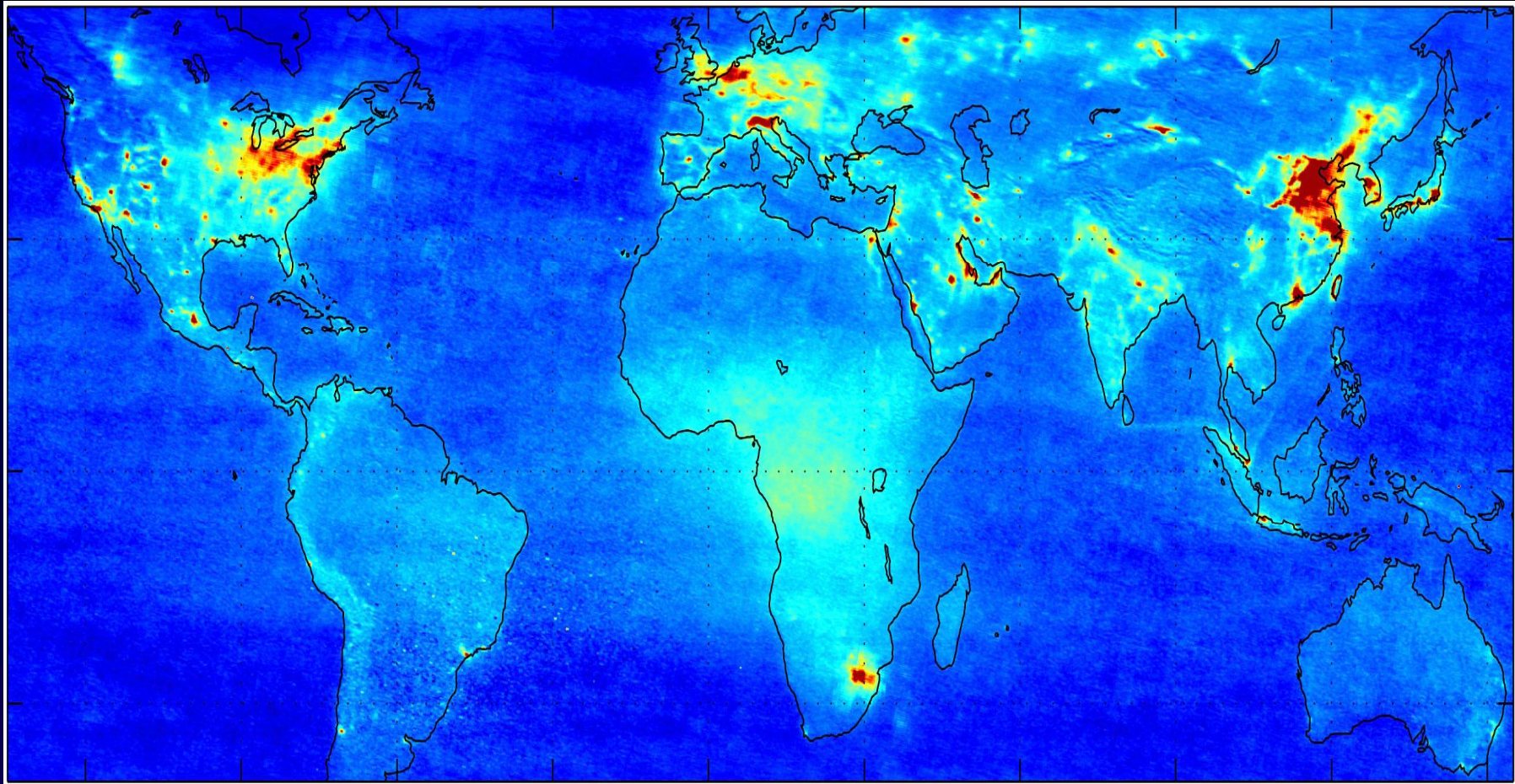


Sea Surface temperature rise

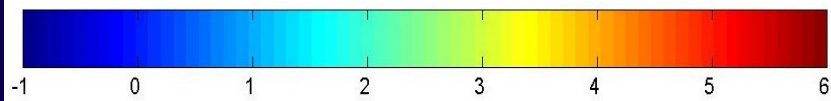
ATSR/AATSR measurements
Trend $0.13 \pm 0.03^\circ\text{C}/\text{decade}$

Courtesy of David Llewellyn Jones, Univ. Leicester, UK

Checking Anthropogenic Pollution



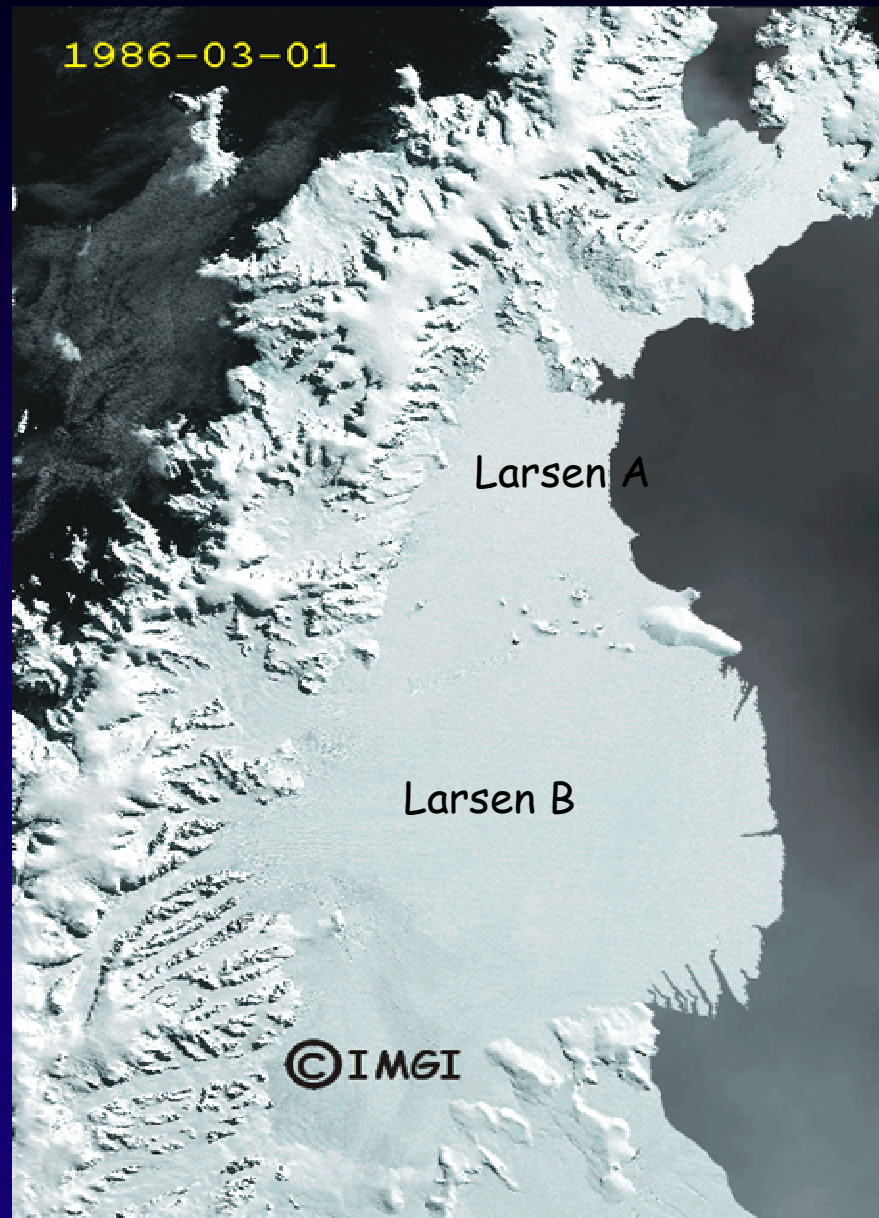
**NO₂ from SCIAMACHY
(Jan. 2003 - June 2004)**



1e15 molec/cm²

Courtesy of Steffen Beirle, Univ. Heidelberg, D

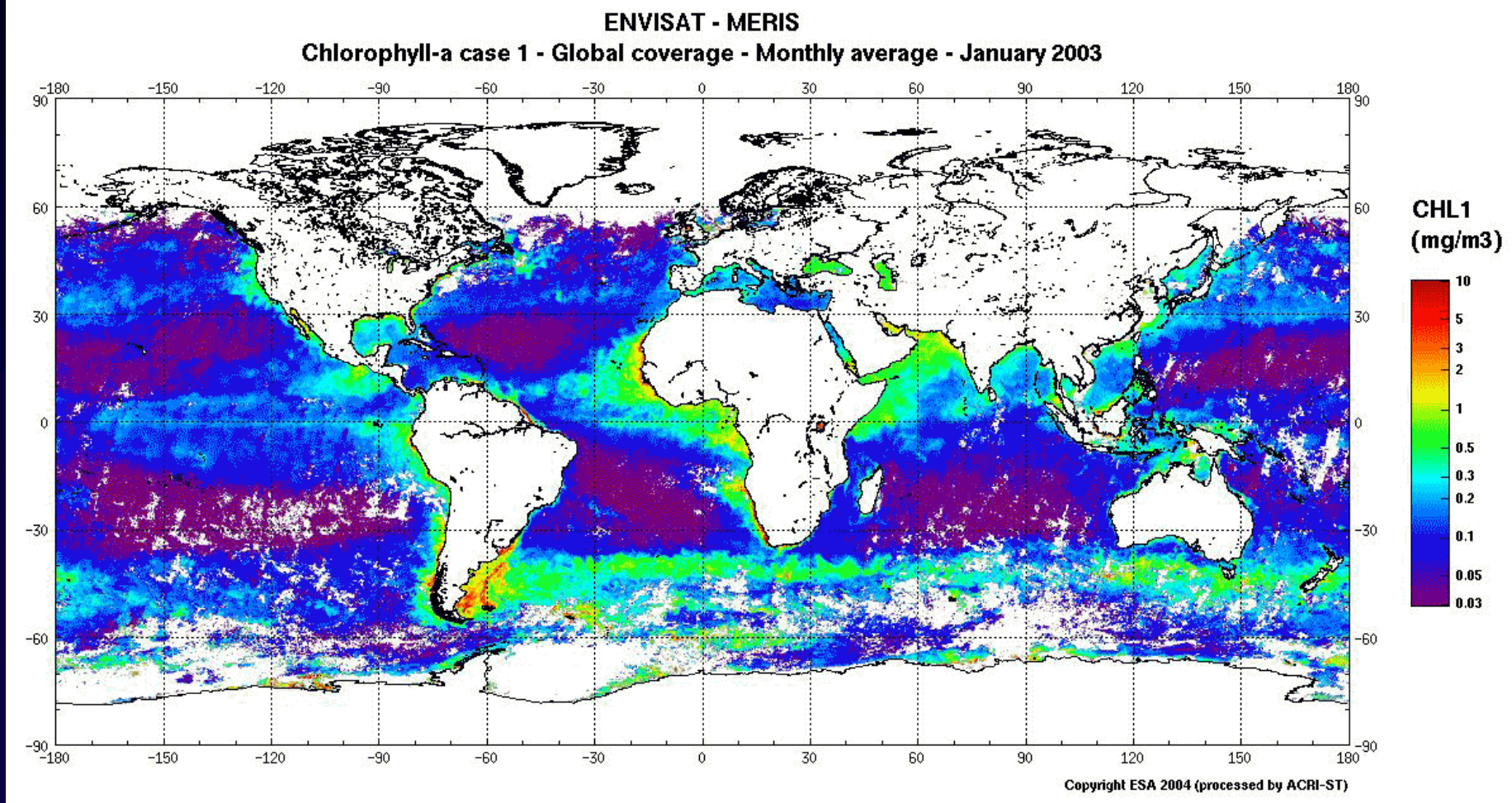
Vanishing Antarctica



Antarctica Ice sheet is melting off as observed by ESA's Envisat satellite from 1986 through to 2002

Global Chlorophyll concentration

Chlorophyll concentration is a measure of abundance of phytoplankton biomass, which has an important role in fixing CO₂ through photosynthesis.



Courtesy of ACRI, F

The Breathing of ETNA

Breathing Volcanoes

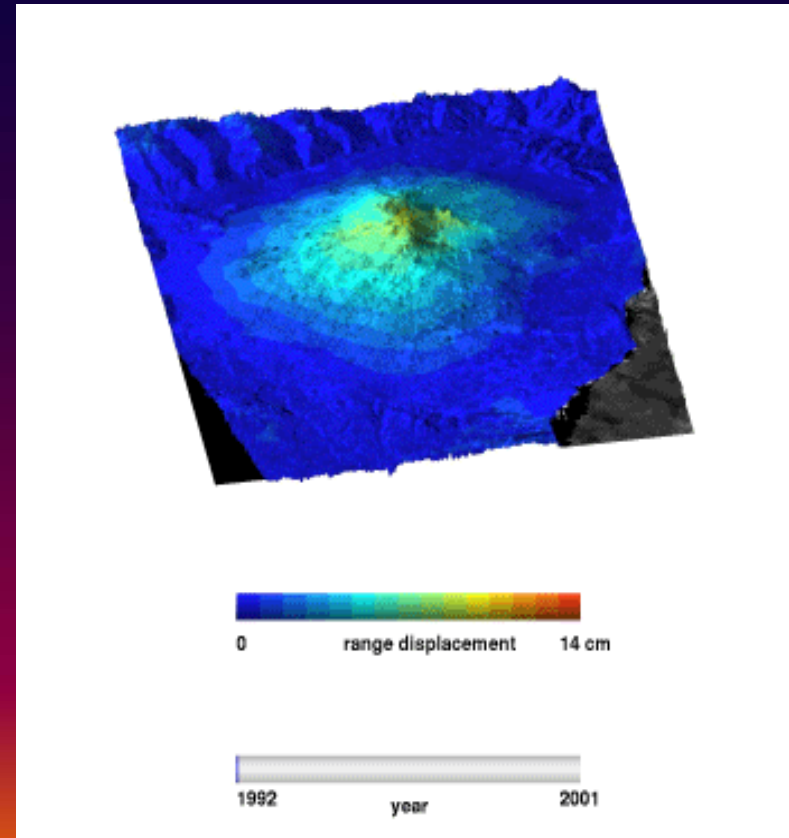
ERS SAR images spanning the period 1992-2000 have been used to reconstruct the line of sight deformations of Etna.

Inflation and deflation episodes are shown by changes in the color scale.

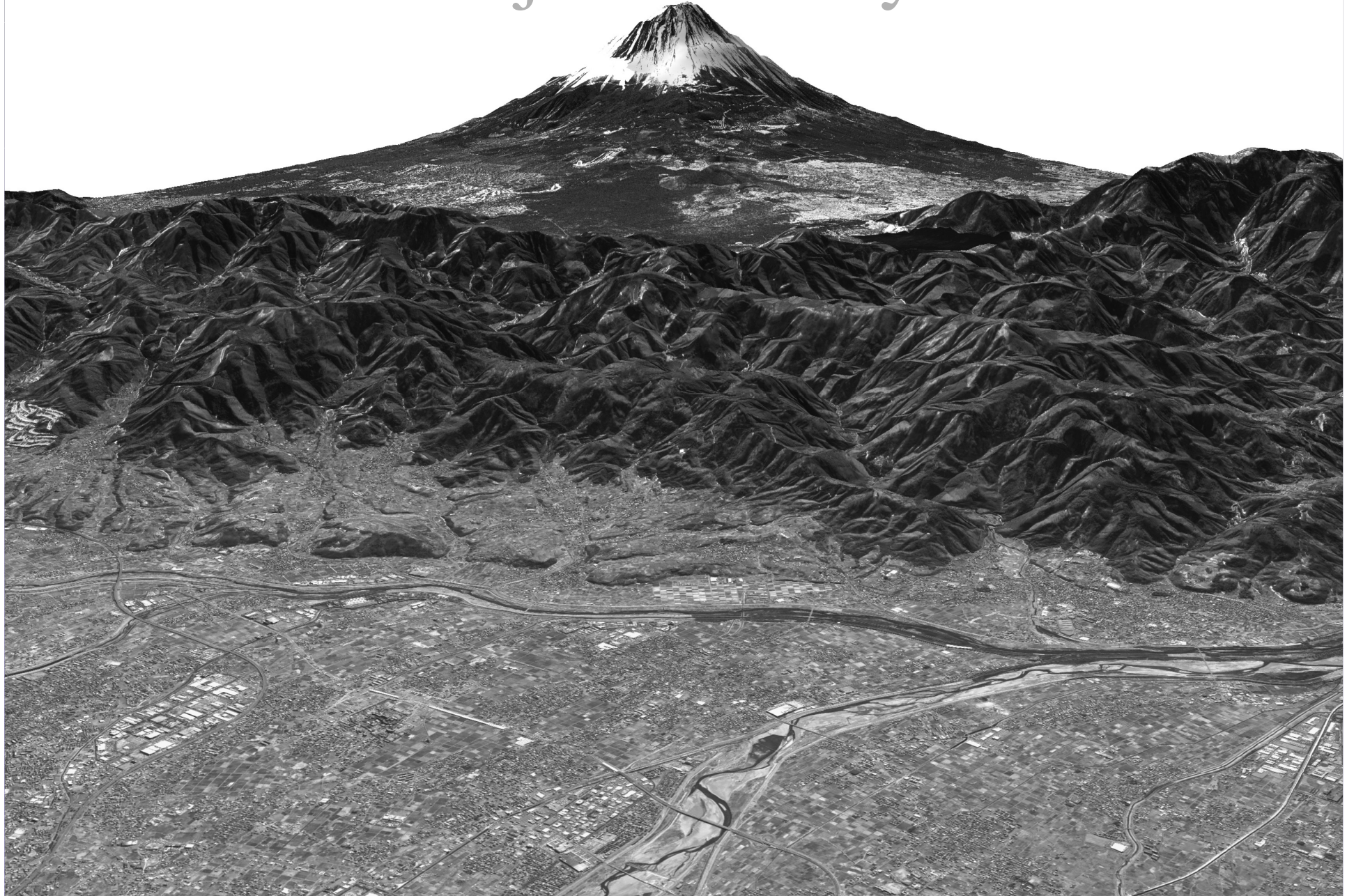
Work performed under ESA Category-1 project 1127

PI Paul Lundgren JPL, USA

CoI Riccardo Lanari CNR Napoli, Italy



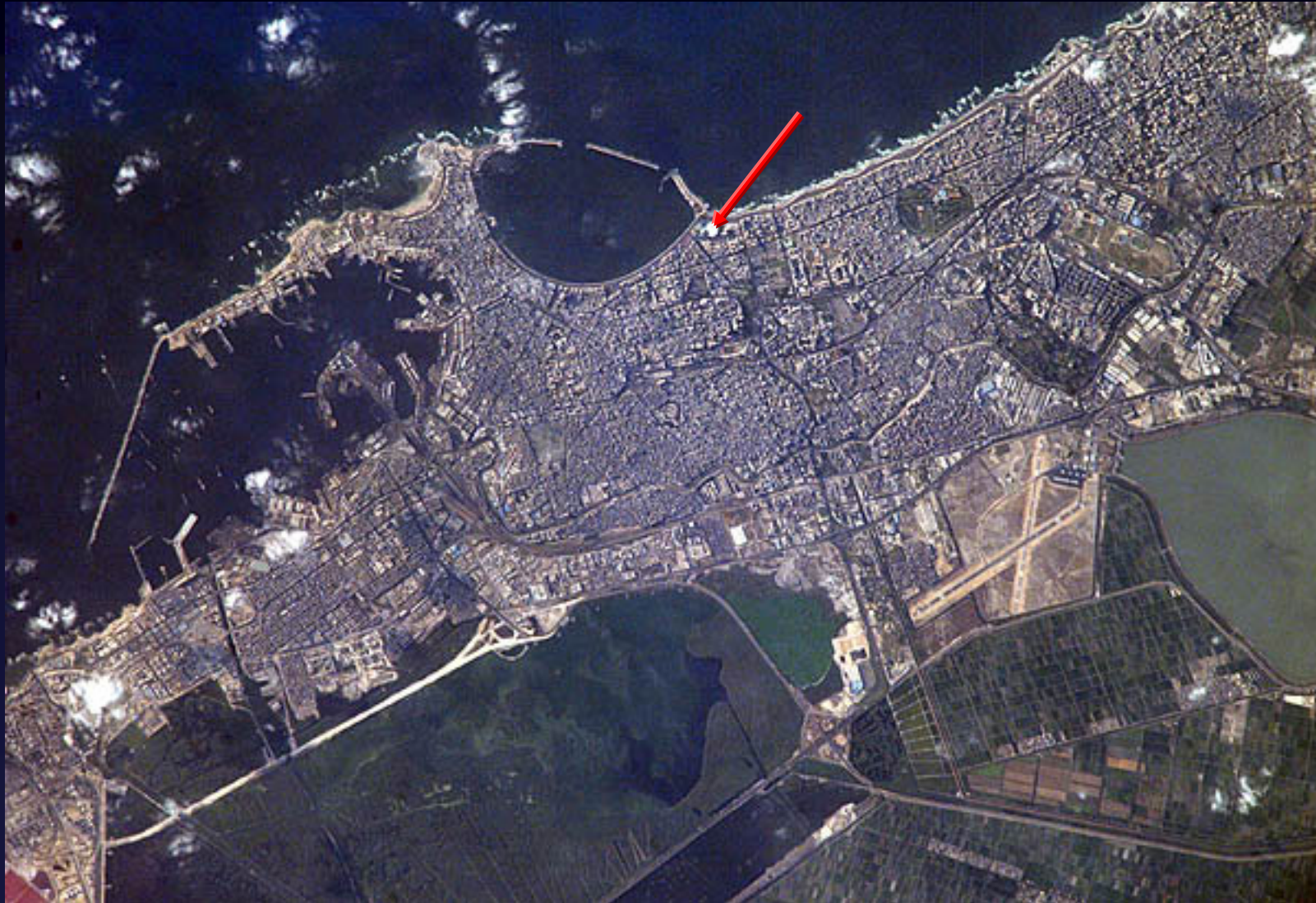
Mount Fuji as seen by ALOS



The Pyramids seen from 800km



“Here”, seen from 800km



Conclusion

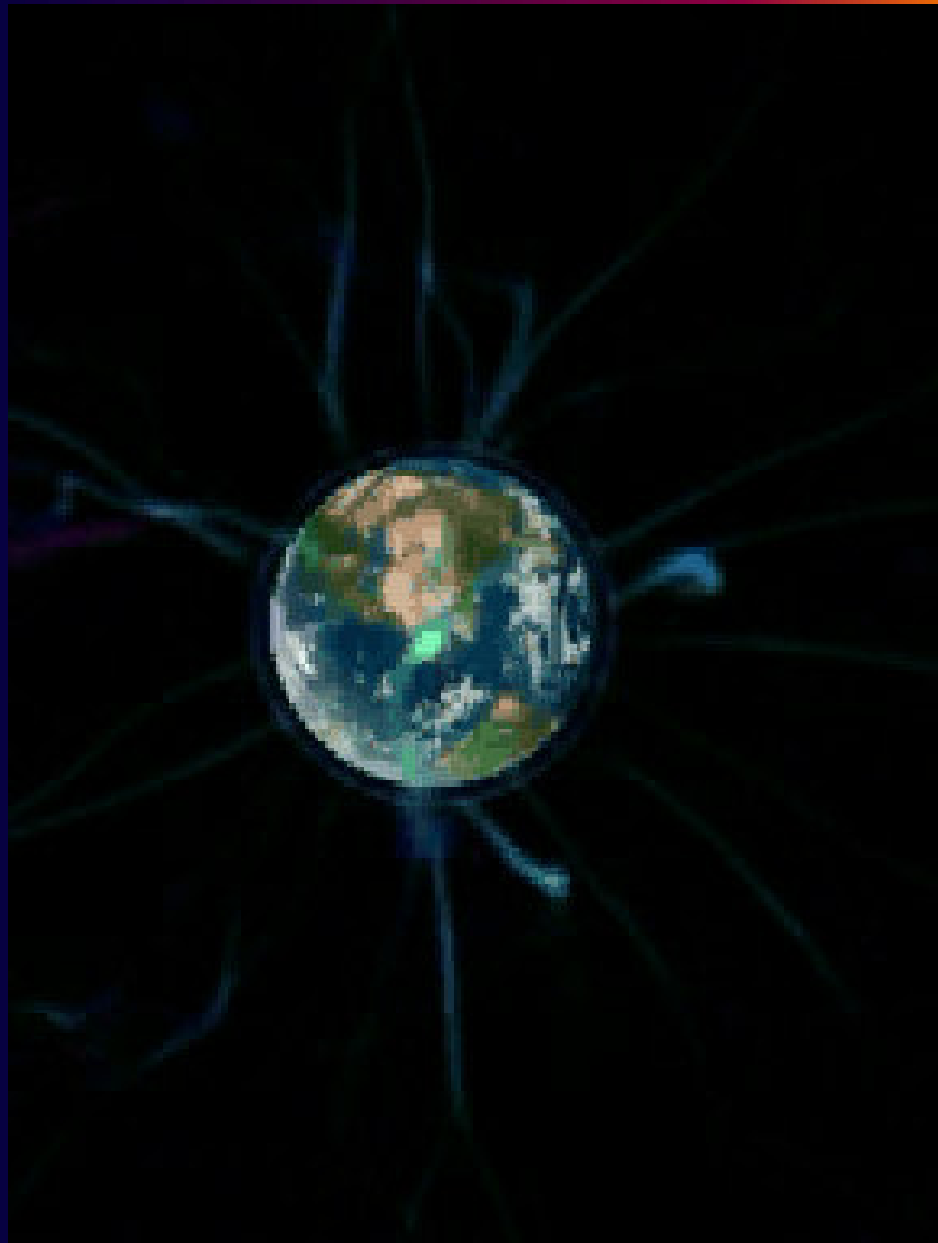
In the past 50 years, space research has changed our view of the sky above us, including our Sun, revealing phenomena hard or impossible to see otherwise. It has allowed the exploration of the Solar System, including all the planets plus comets and asteroids. Our Earth is constantly under surveillance. With satellites, we can observe its evolution both natural and anthropogenic.

Conclusion

This revolution in knowledge and understanding is unique in the history of science and humanity. It is of a peaceful nature, although the same techniques could be used to destroy our planet. All the people on Earth should benefit from this unique advancement in knowledge. In that respect, there was no better place to hold this conference than here in Alexandria close to the most famous library.

It is remarkable that Egypt has just joined COSPAR, the COmmittee on SPAce Research, forming its 46th member country. I would like to congratulate our Egyptian colleagues to be part of the COSPAR community and I welcome them.





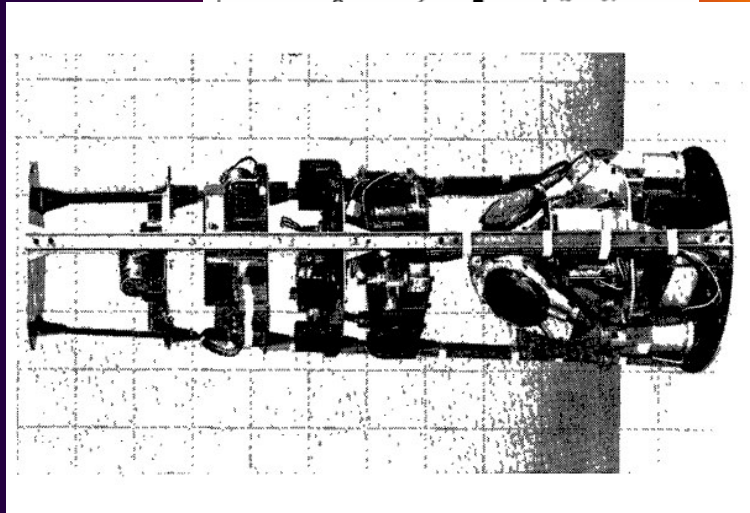
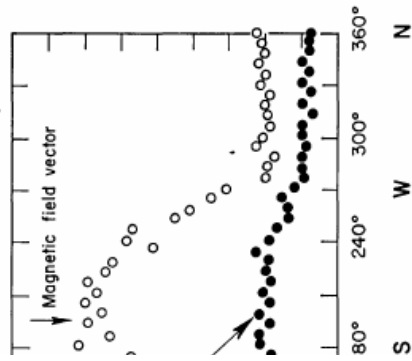
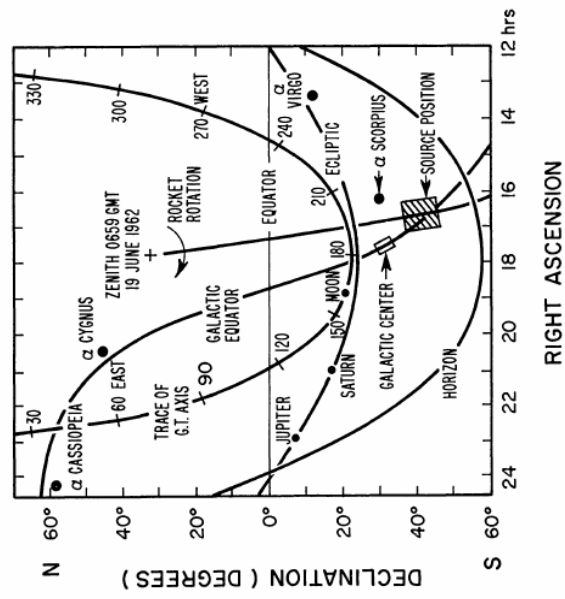


Fig.



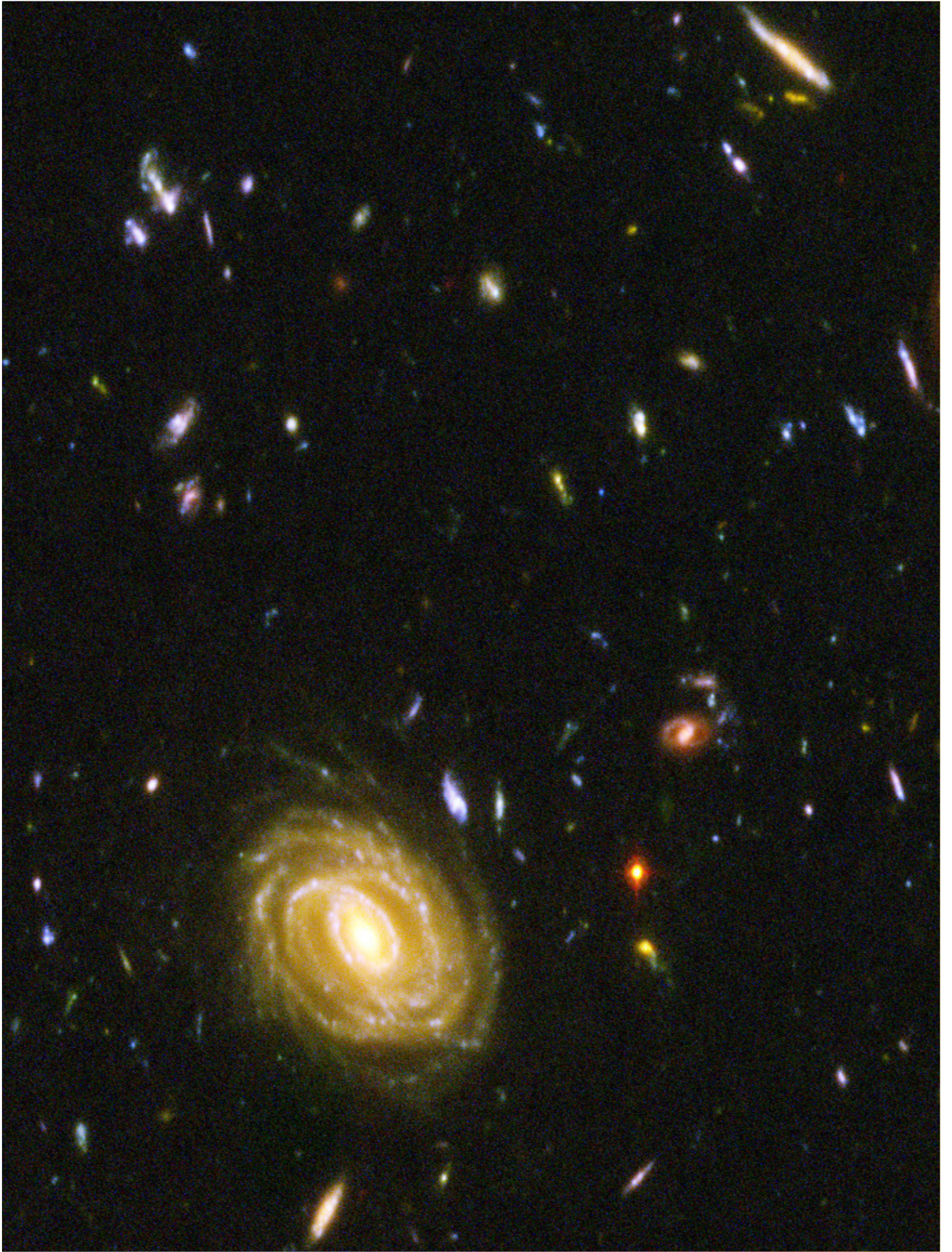
from Geiger counters flown during June 1962.



4. Map of celestial sphere showing location of source as determined from data of June 1962. The numbers listed along "Trace of G. T. axis" correspond to the azimuth angles given in Figure 3.

The Hubble Deep Field





The Pyramids seen from 800km



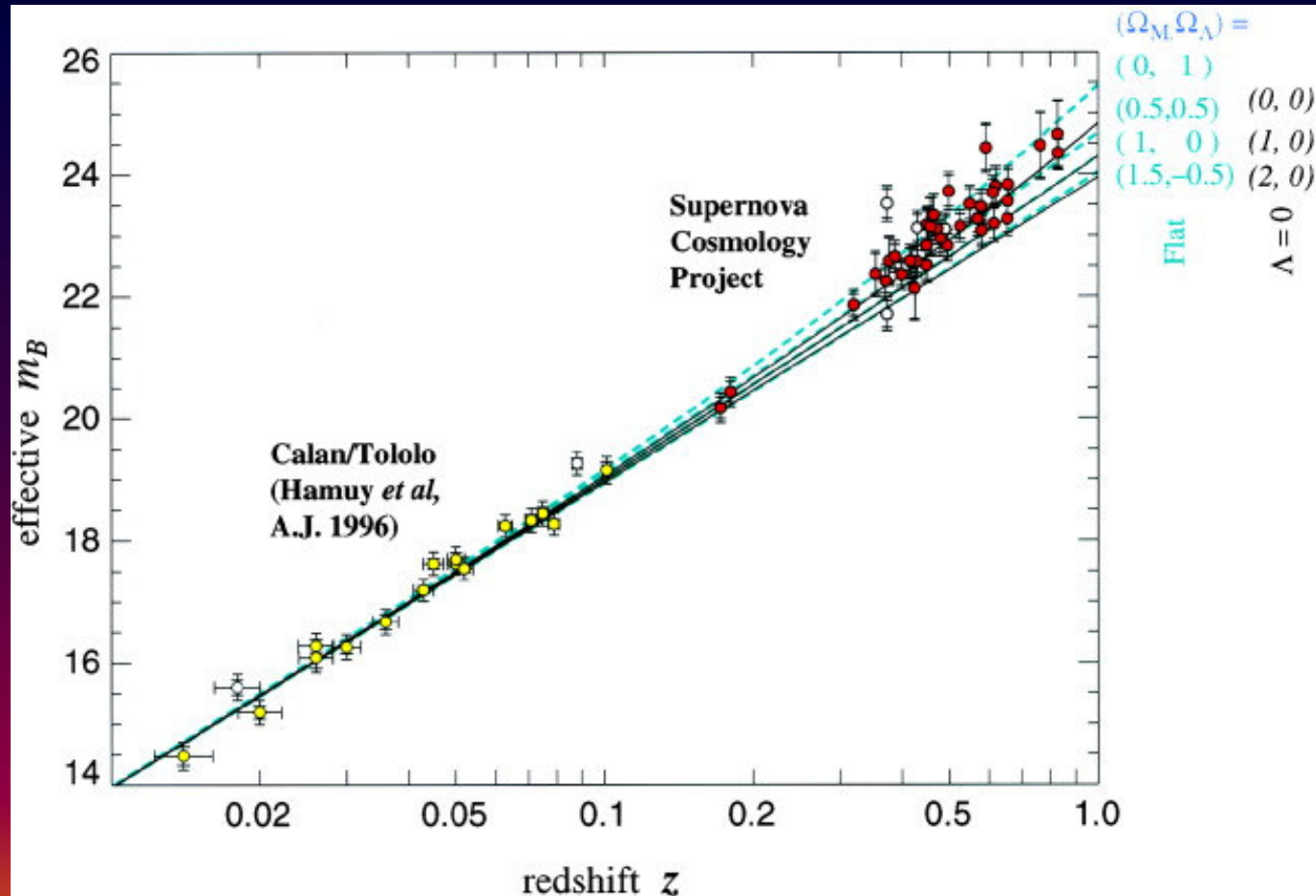
Apr 17 2002 23:59:32





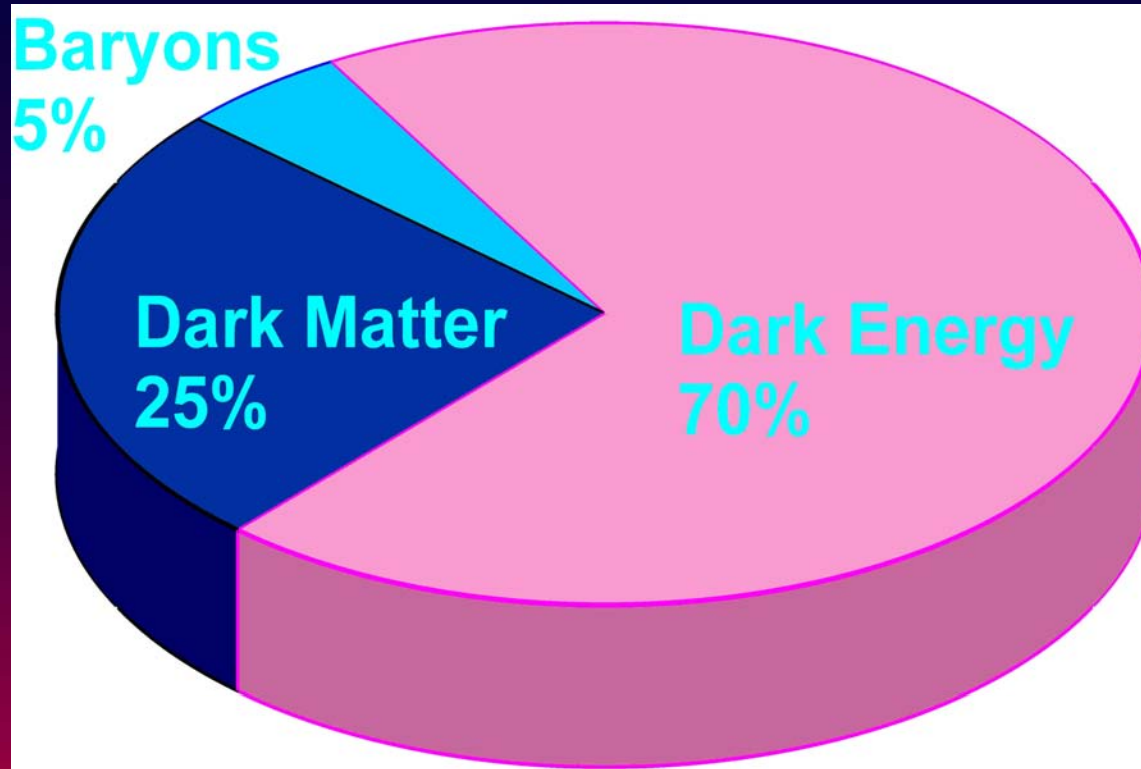


Accelerating universe



Acceleration started 5 Billions years ago

What does hold the World?



Where are we going?

Expanding for ever