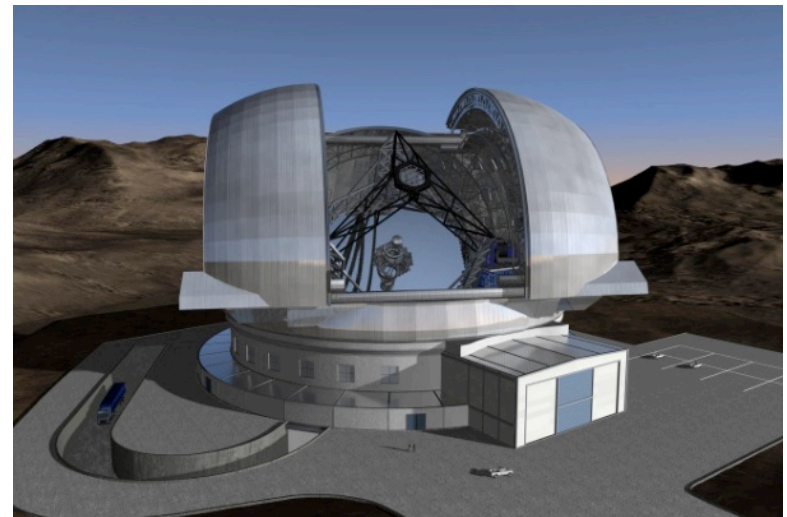
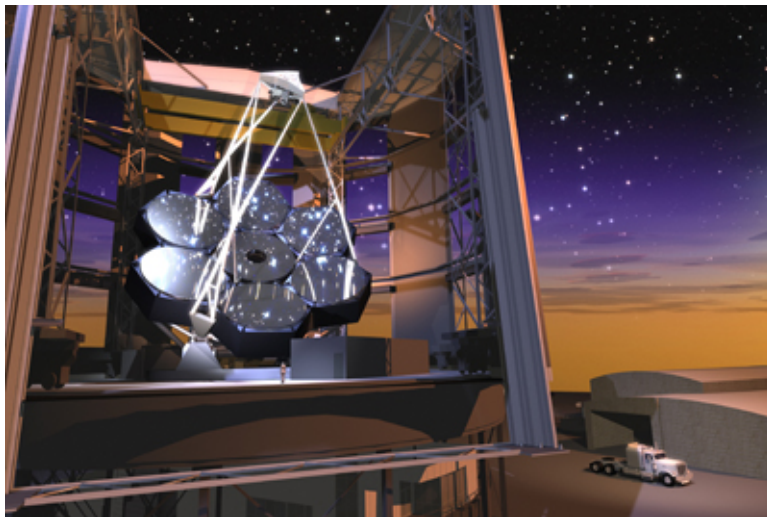


# JWST and the ELTs

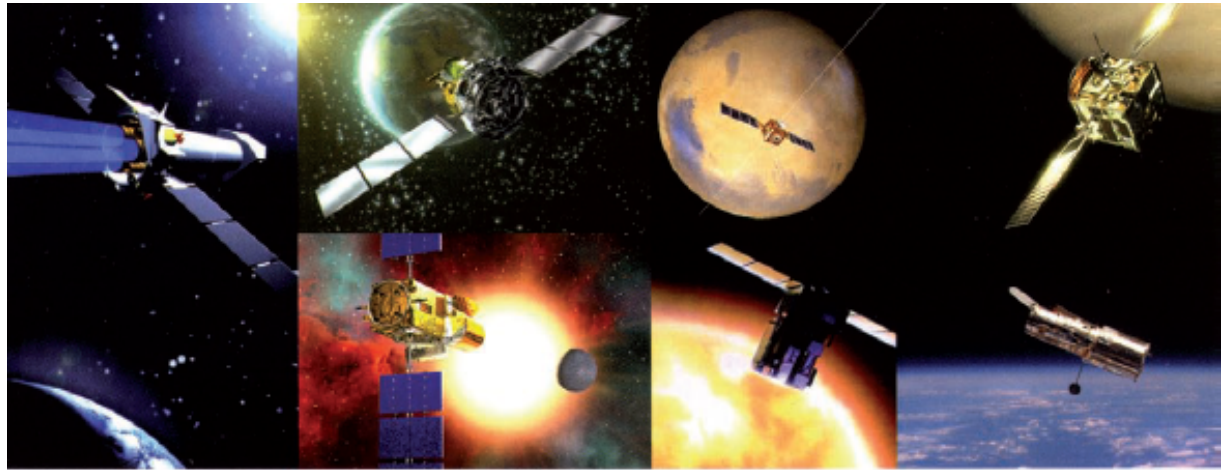
Bruno Leibundgut



# Astrophysics in a Golden Age

- Full coverage the of electro-magnetic spectrum
  - $10^{-8} \text{ eV} < E_\nu < 100 \text{ TeV}$
  - $10\text{m} > \lambda > 10^{-20}\text{m}$
  - MAGIC/HESS/VERITAS → Fermi/INTEGRAL → XMM/Chandra/Swift/Rossi XTE → Galex → HST → ground-based optical/IR → Spitzer/WISE → Herschel → WMAP/Planck → IRAM/JCMT/APEX/SMA/ALMA → radio telescopes/LOFAR
  - Large archive collections (e.g. ROSAT, ISO, ESO, HST, MAST)
- Astro-particles joining in
  - cosmic rays, neutrinos, gravitational waves, dark matter searches

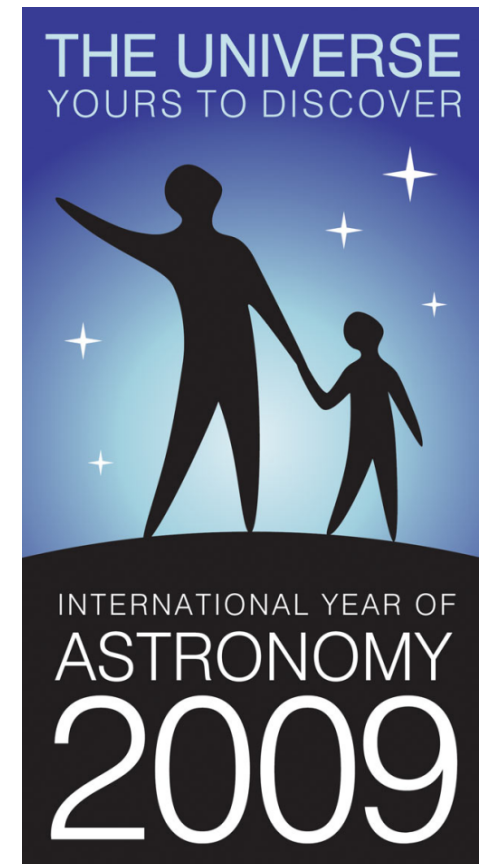
# Fantastic opportunities



Adapted from the Astronet  
Science Vision Report

# Astrophysics in a Golden Age

- International Year of Astronomy
  - Fantastic boost in the public
  - Increased awareness
  - Strong public support
  - Continued interest
    - Connected to the 'big' questions
    - Where do we come from?
    - What is our future?





# Exploring the Cosmic Frontiers

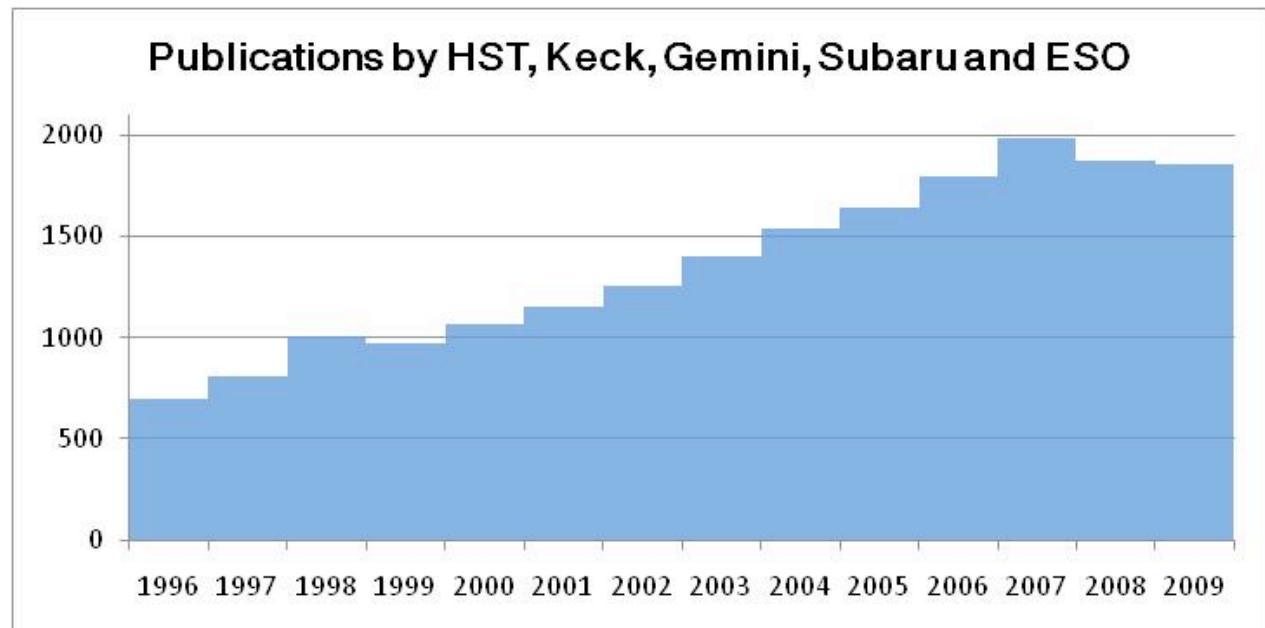
## Astrophysical Facilities for the 21<sup>st</sup> Century

- Conference in Berlin 2004
- Talks available at <http://www.mpifr-bonn.mpg.de/berlin04/program.html>
- Fantastic opportunities discussed
- What can be realized?
  - At that time OWL was still the ESO ELT project
  - XEUS/ConX → IXO
  - Darwin?
- What can we afford?



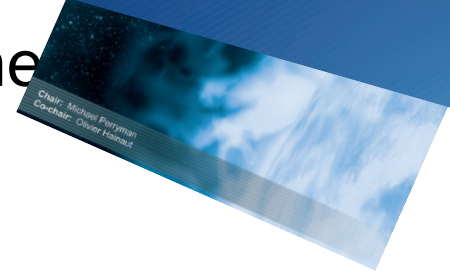
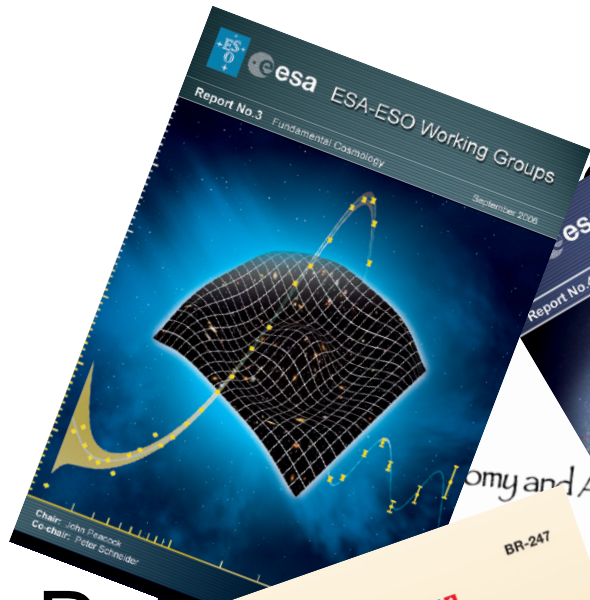
# Proven success

- ESO, Keck, Gemini, Subaru and HST contributed to nearly 1900 refereed papers together every year.
- Between 2000 and 2009 (when all were in operations) 15500 refereed papers have been published.

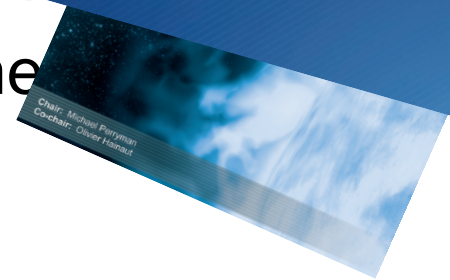


# Research themes

- Similar for most observatories
- Defined in several community fora
  - Astronet Science Vision and Roadmap
  - ESA Cosmic Vision initiative
  - National decadal surveys
  - Special publications
    - ESA-ESO working group reports
    - Specific fields (e.g. Connecting quarks with the Cosmos)







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# Science themes

- What matters in the universe?
- Planets, planets, planets
- How did stars and planets form?
- The Milky Way - our Home
- Our own black hole
- How do galaxies form and evolve?
- Fashions and other transients
- When opportunity knocks

# Synergies

- ALMA as partner of the ELTs
- 8m telescopes
- Surveys
- Archives

A conference to explore the synergies between ALMA and the upcoming giant optical/infrared telescopes

#### SOC

J. Afonso	R. Kudritzki	D. Silva
A. Blain	P. McCarthy	C. Steidel
R. Gilmozzi	K. Morita	A. Wootten
R. Hills	S. Shectman	

#### LOC

A. Calamida
M. Kissler-Patig
C. Stoffer
L. Testi



## ALMA and the ELTs

A deeper, finer view of the Universe  
24–27 March, 2009  
Garching, Germany

[www.eso.org/almaelt2009](http://www.eso.org/almaelt2009)



# The telescope landscape

- There are many large optical and infrared telescopes

Telescope diameter	In operation	Construction or Planned
$d > 10\text{m}$	4	
$7\text{m} < d < 10\text{m}$	9	LSST
$5\text{m} < d < 7\text{m}$	6	JWST
$3\text{m} < d < 5\text{m}$	16	VISTA, LAMOST, Discovery Telescope

- 3 telescope planned with  $d > 20\text{m}$



# Further complementarities

- Follow up of imaging surveys
  - UKIDSS, VST, VISTA, LSST/PanSTARRS
  - ESA Cosmic Vision → EUCLID/PLATO
- Follow up of sources detected at other wavelengths
  - Herschel, Fermi, XMM/Chandra, JWST, eROSITA
- ALMA/SMA follow-up/complement

# Status of the E-ELT



- Council decision on site pending
  - The site selection advisory committee presented a preference for Armazones
- Design Phase being finished
- Construction proposal to be presented to the ESO committees (STC, Finance, Council) in the second half of the year
- External review of the construction proposal (September)
- Construction proposal to be submitted to Council for decision at the December 2010 meeting

# ESO's goals for the next years

- Best science from La Silla Paranal Observatory
  - Second generation instruments (VLT/MLTI)
  - Key surveys with VST and VISTA
  - Long-term programs for unique science on La Silla
  - Prepare for ALMA science with APEX
- Deliver ALMA on time and budget
- Design world-leading E-ELT, and secure funding for construction and operations

