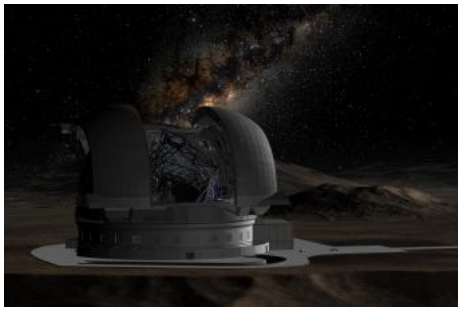


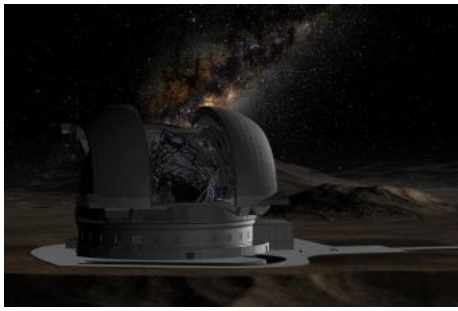
Ground-based astronomy in Belgium
ESO and the E-ELT

ESO Industry Day

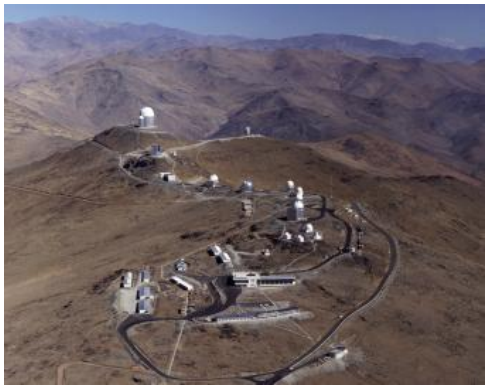
Belspo

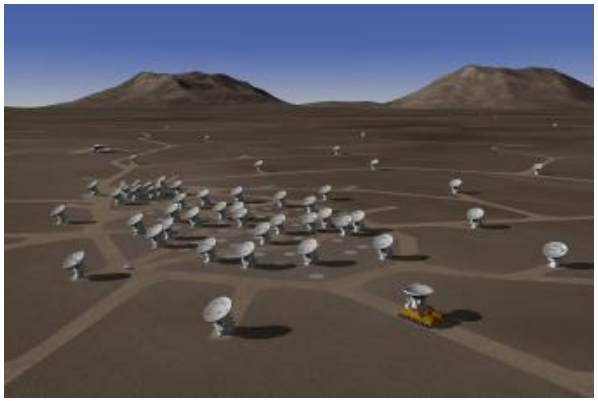
June 15, 2011

ESO, E-ELT

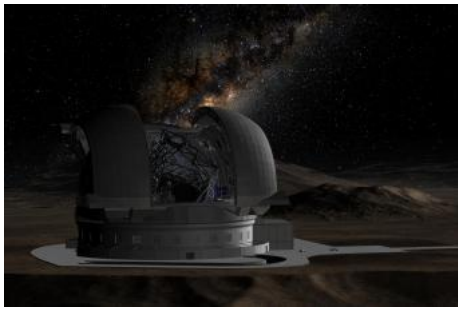


- ESO is for European astronomers what CERN is for European particle physicists.
- With La Silla and in particular Paranal (VLT), Europe has taken the lead in astronomy.
- Current project: ALMA.
- E-ELT is a logical next step: can be done, makes much sense.



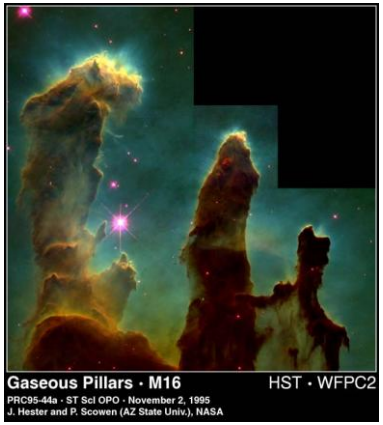


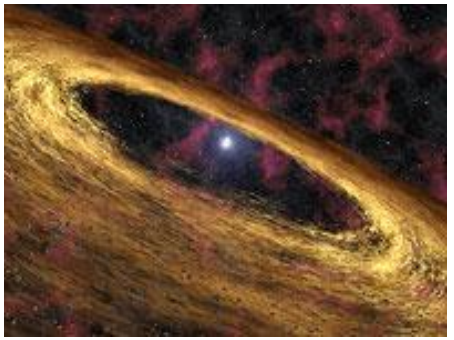
Astronomy now



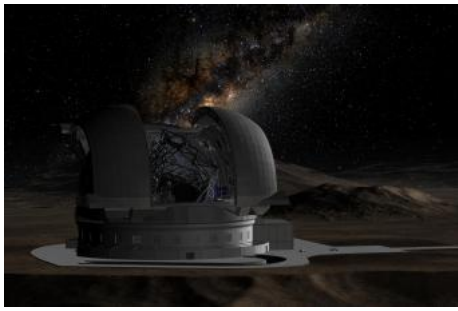
- 20th century discovers:
  - Evolution of cosmos
  - Evolution of stars
  - Evolution of planetary systems

- 21st century issues:
  - Origin of the Universe
  - Origin of galaxies
  - Origin of stars
  - Origin of planetary systems
  - Origin of Life

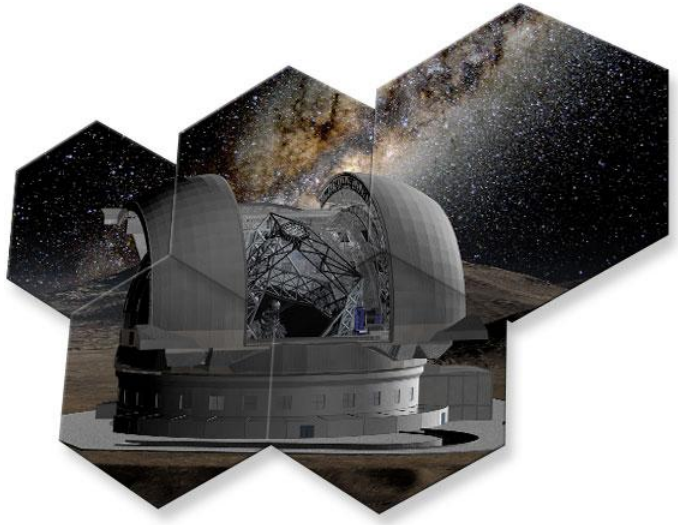




Progress in astronomy

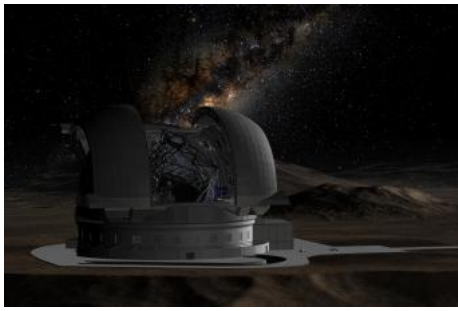


- Heavily relying on technology:
  - Opening new spectral windows (space)
  - Increasing telescope size
  - Improving detectors and instruments



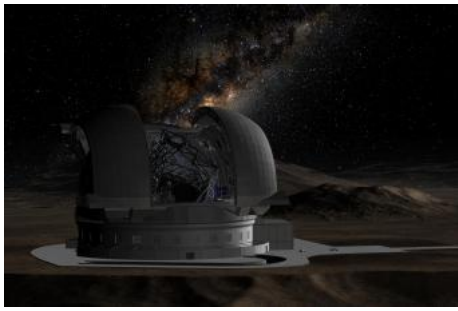
- Role of E-ELT: ultimate step in
  - Angular resolution (planet formation)
  - Sensitivity (deep universe)
  - …
  - Ready for the unexpected.

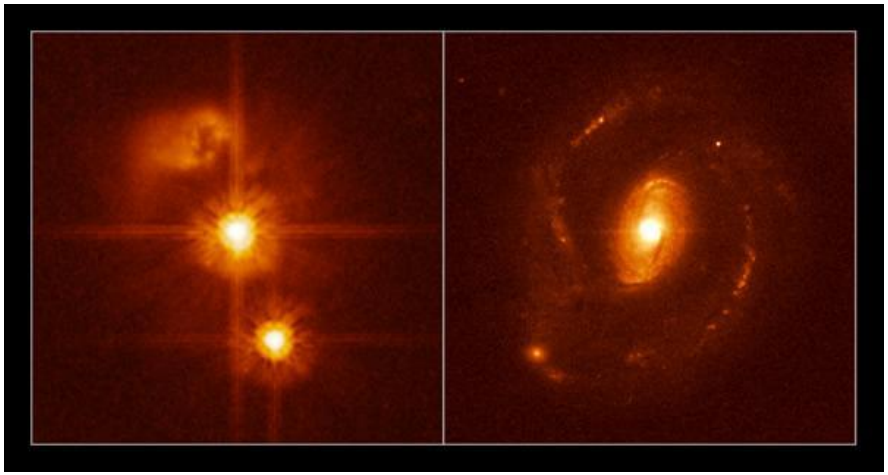
Belgium and ESO



- Belgium is one of the six founding members of ESO, which now has 14 and soon 15 or more.
- Our climate and low country has prevented us from investing in local facilities.
- Access to the best research infrastructure in the world, in a competitive European context, enables diverse forefront research in our universities and research institutes.

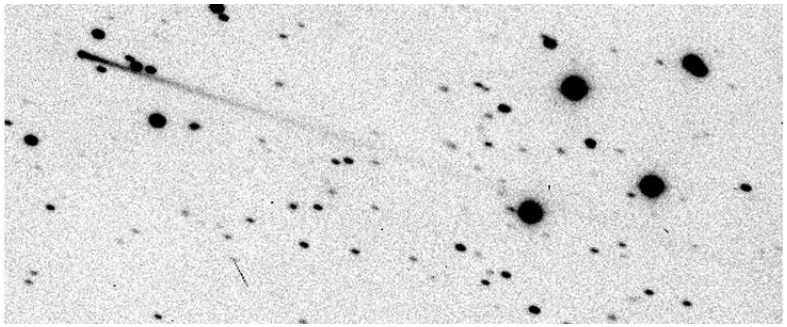
Belgium and ESO

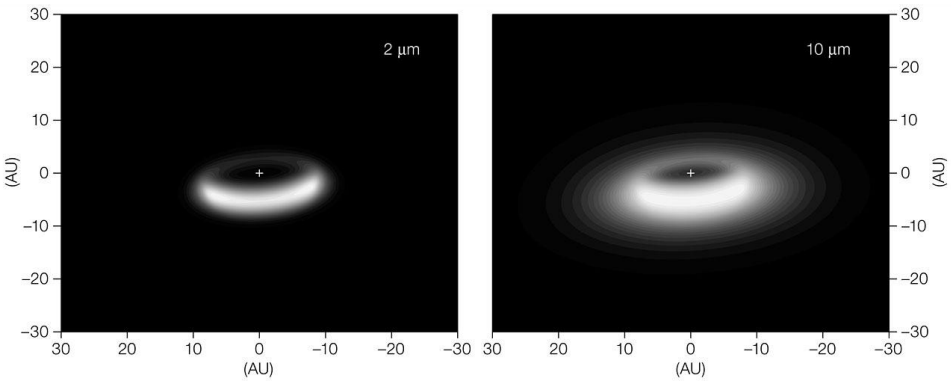




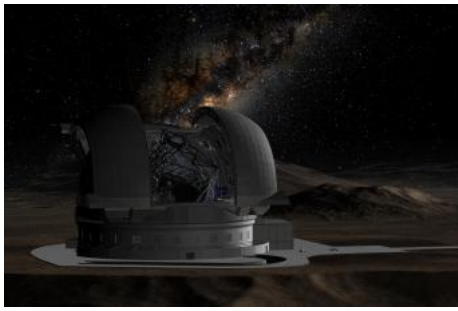
The Four Auxiliary Telescopes at Paranal

ESO PR Photo 51c/06 (22 December 2006) © ESO

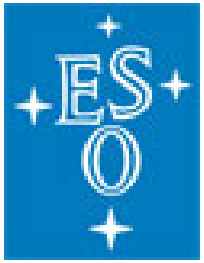


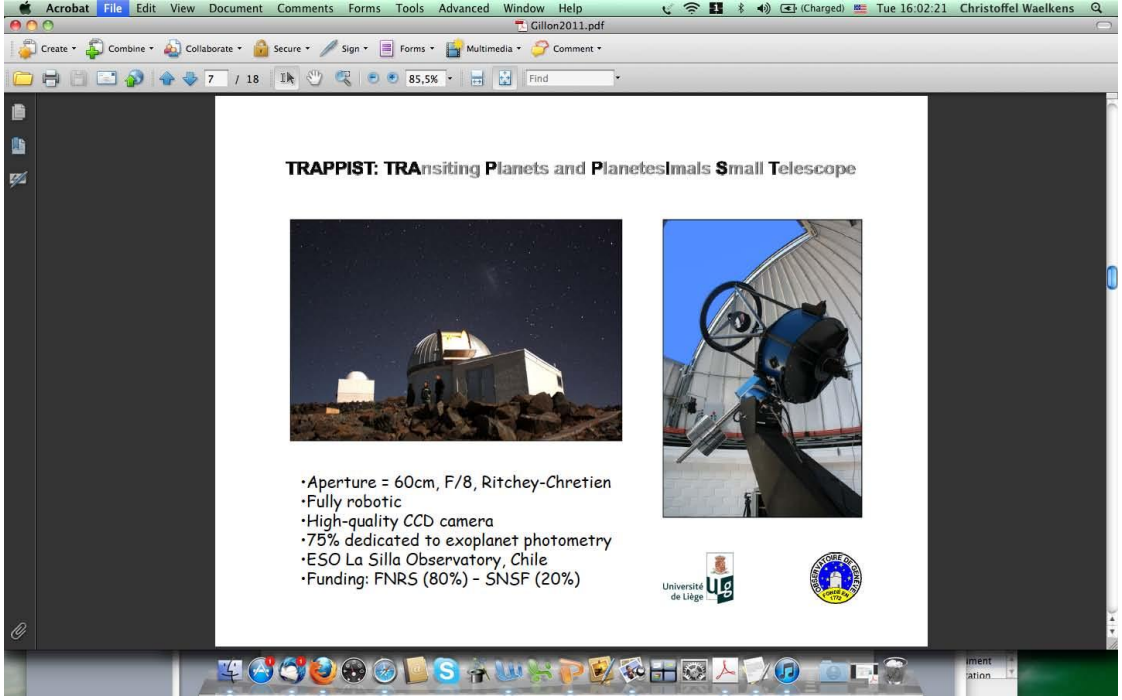


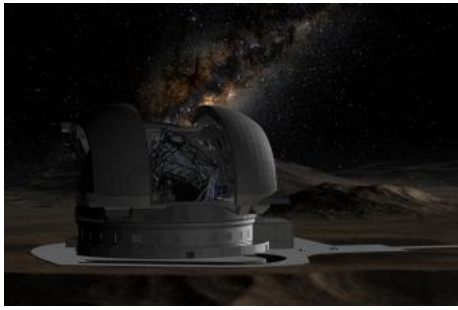
Ground-based astronomy and Belgium

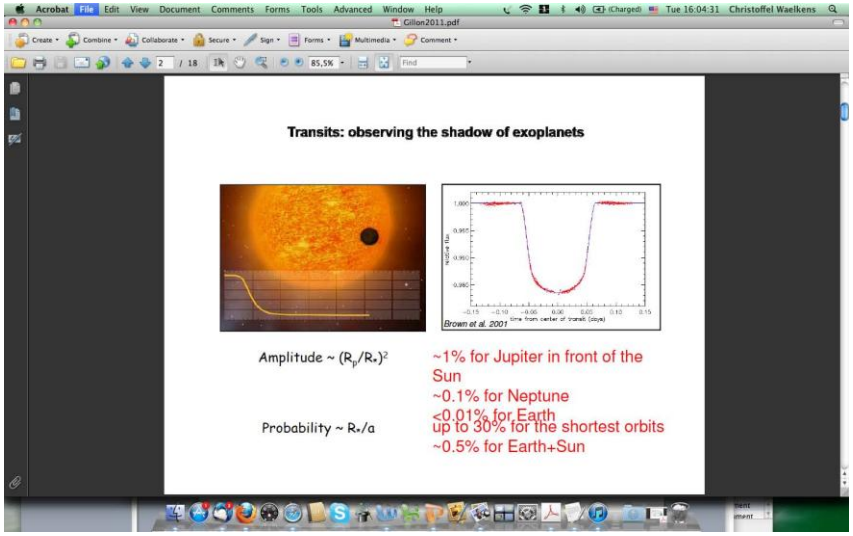


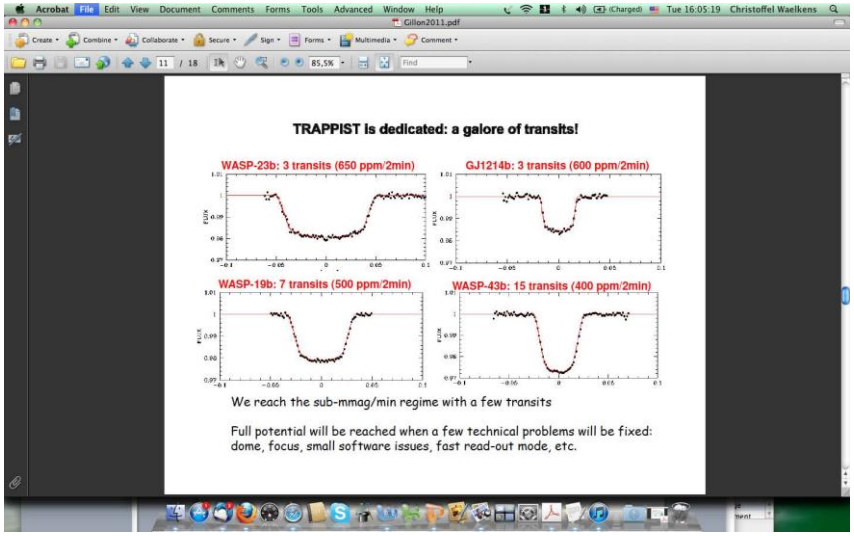
- Scientific return from ESO is excellent, and all research fields are well covered.
- National coordination in BNEC.
- For specific time-consuming programmes (monitoring of stars, transits of exoplanets, deep surveys) we have constructed dedicated smaller telescopes (Mercator, TRAPPIST; ILMT).



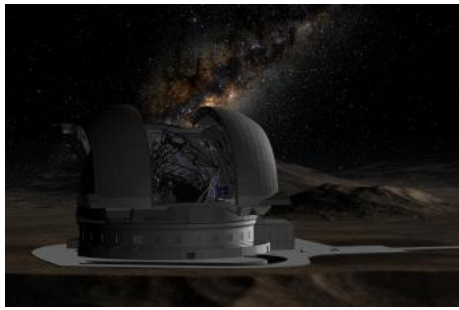

Gillon2011.pdf
TRAPPIST: TRAnsiting Planets and PlanetesImals Small Telescope
•Aperture = 60cm, F/8, Ritchey-Chretien
•Fully robotic
•High-quality CCD camera
•75% dedicated to exoplanet photometry
•ESO La Silla Observatory, Chile
•Funding: FNRS (80%) – SNSF (20%)
Université de Liège

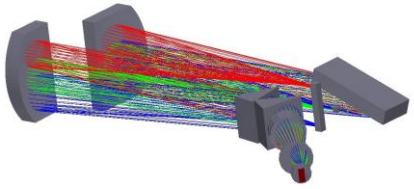


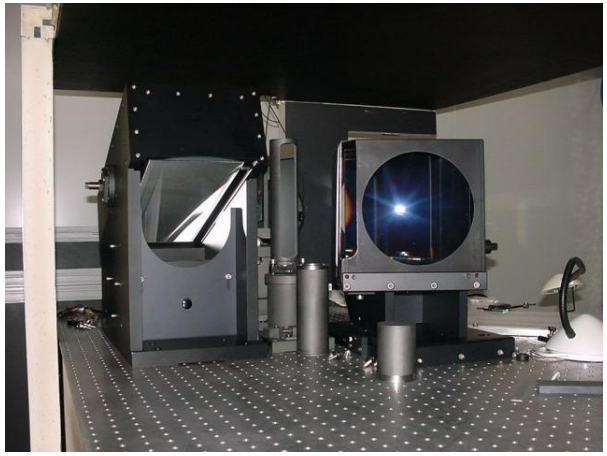

Gillon2011.pdf
Transits: observing the shadow of exoplanets
Brown et al. 2001
Amplitude ~ $(R_p/R_*)^2$
~1% for Jupiter in front of the Sun
~0.1% for Neptune
<0.01% for Earth
Probability ~ R_*/a
up to 30% for the shortest orbits
~0.5% for Earth+Sun


Gillon2011.pdf
TRAPPIST is dedicated: a galore of transits!
WASP-23b: 3 transits (650 ppm/2min)
GJ1214b: 3 transits (600 ppm/2min)
WASP-19b: 7 transits (500 ppm/2min)
WASP-43b: 15 transits (400 ppm/2min)
We reach the sub-mmag/min regime with a few transits
Full potential will be reached when a few technical problems will be fixed: dome, focus, small software issues, fast read-out mode, etc.

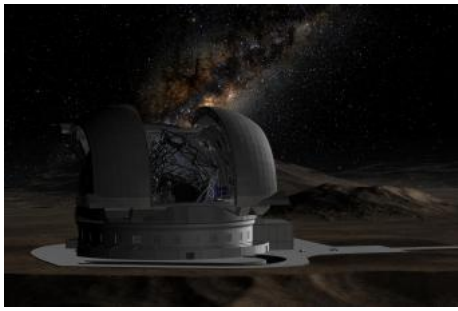
Mercator (La Palma)





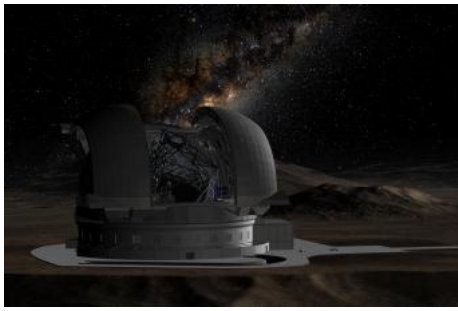


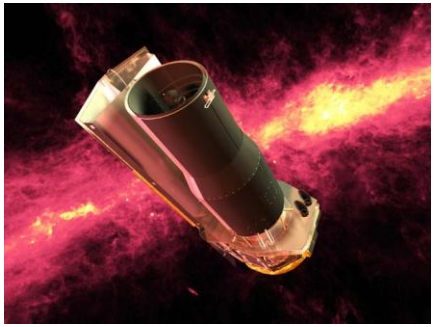
Ground-based versus space

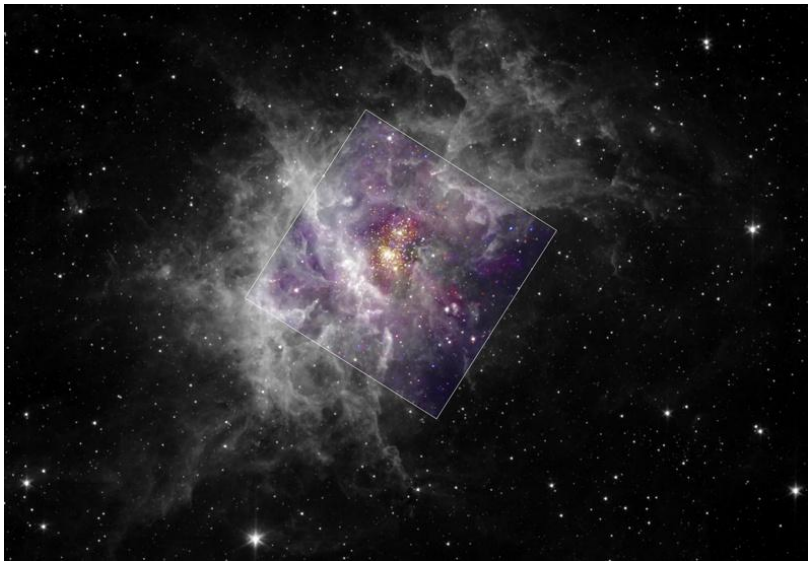


- There is (maybe) only one Universe.
- Space and Ground are complementary.
- In our country, the communities are the same.
- Our present structures allow us to benefit plainly from the complementarities.
- The industrial boundary conditions may differ somewhat.

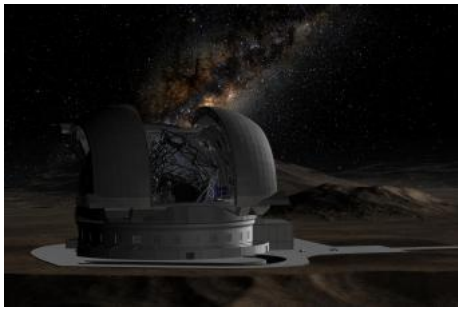
Ground versus Space

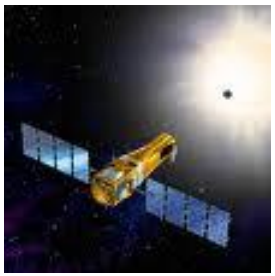


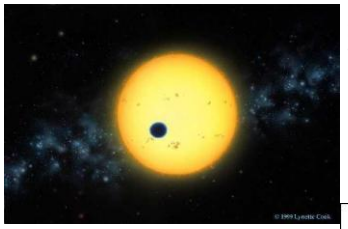


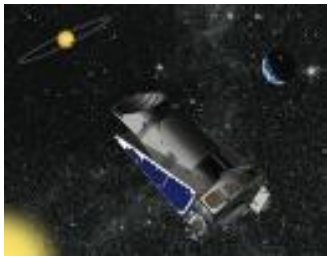


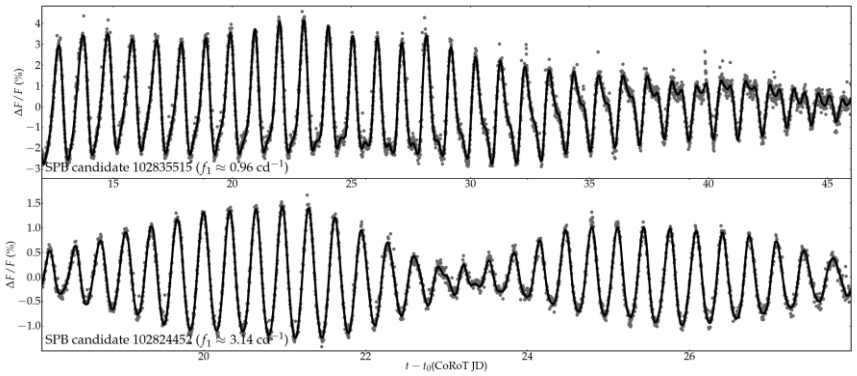
Ground versus space

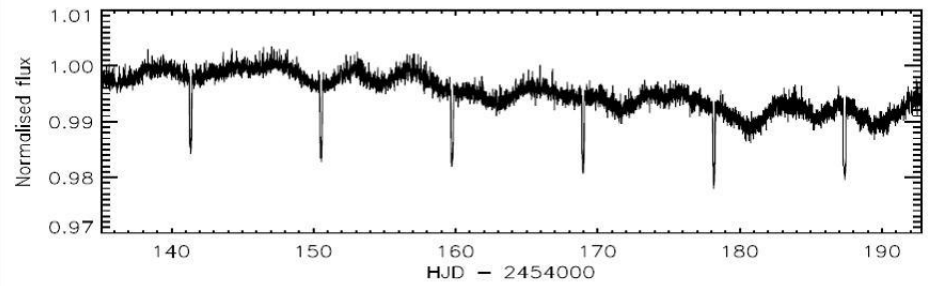


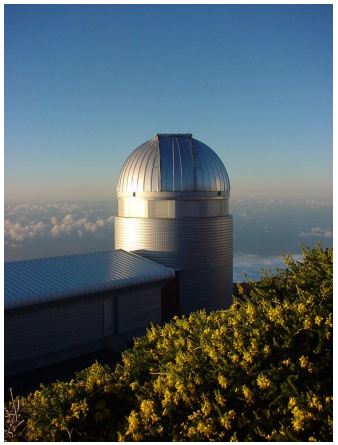




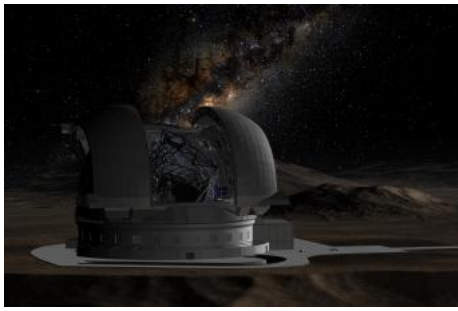


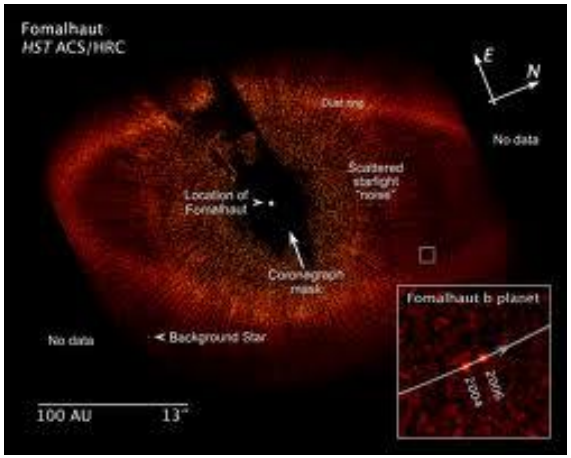






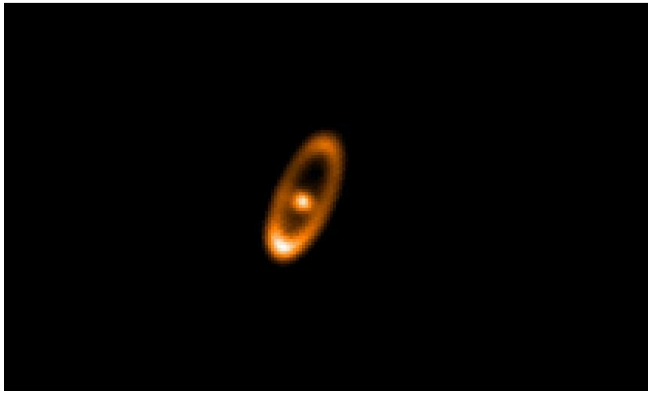
Ground versus Space

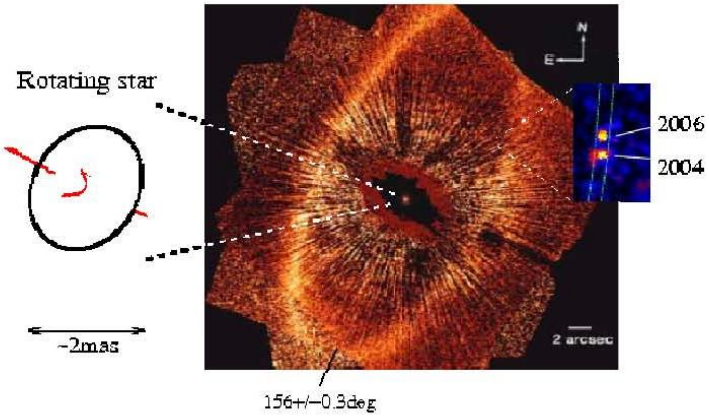




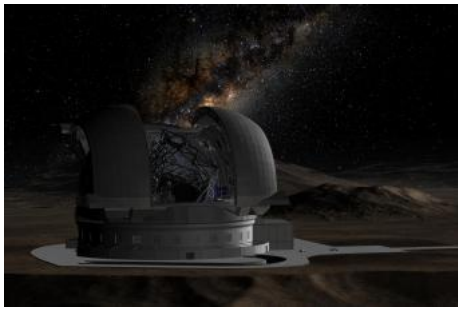
The Four Auxiliary Telescopes at Paranal

ESO PR Photo 51c/06 (22 December 2006) © ESO

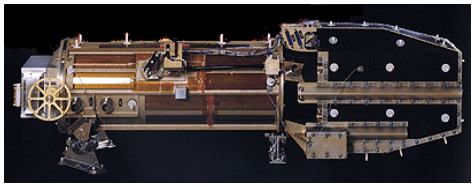


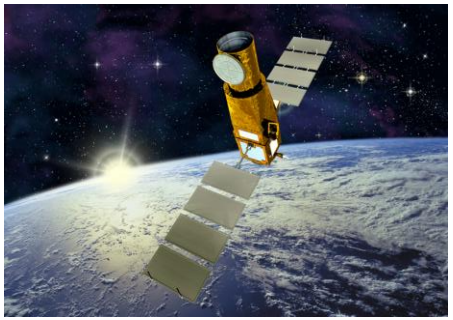


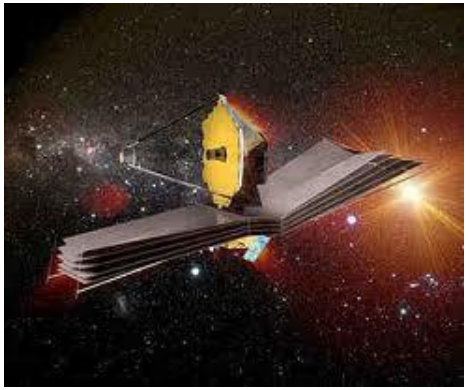
Instrument development



Science return from ESA has benefited enormously from the possibility to contribute to instruments with Prodex.

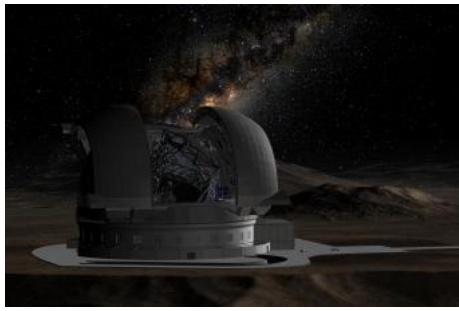






Why not the same for ESO??

E-ELT, ESO, and B



- E-ELT is essential in ESO's strategic plans:
  - The role of the organisation is to prepare the future, and to develop projects at a level no member state can do it alone.
  - Consolidating and building on frontline expertise, ahead of the others.
  - A next quantum step is still within reach for astronomy.
- The national situation:
  - Strong emphasis on ESO + a few dedicated other small projects.
  - Science return is OK; ESO driver for astronomy in B.
  - It could be better still if we contribute to instruments.
  - E-ELT science meets (and influences) our science goals.
  - ESO offers challenges in technology development.
  - Example of synergy of federal and regional levels.