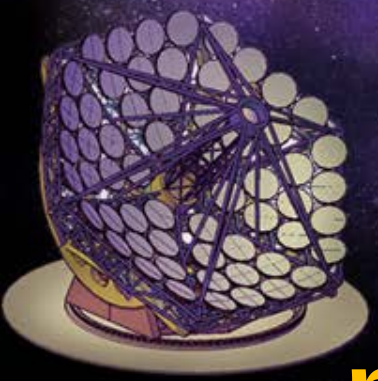
THE COLOSSUS

A 74m filled aperture interferometric telescope



Why 50–100m? The astronomy and non-astronomy case for Colossus

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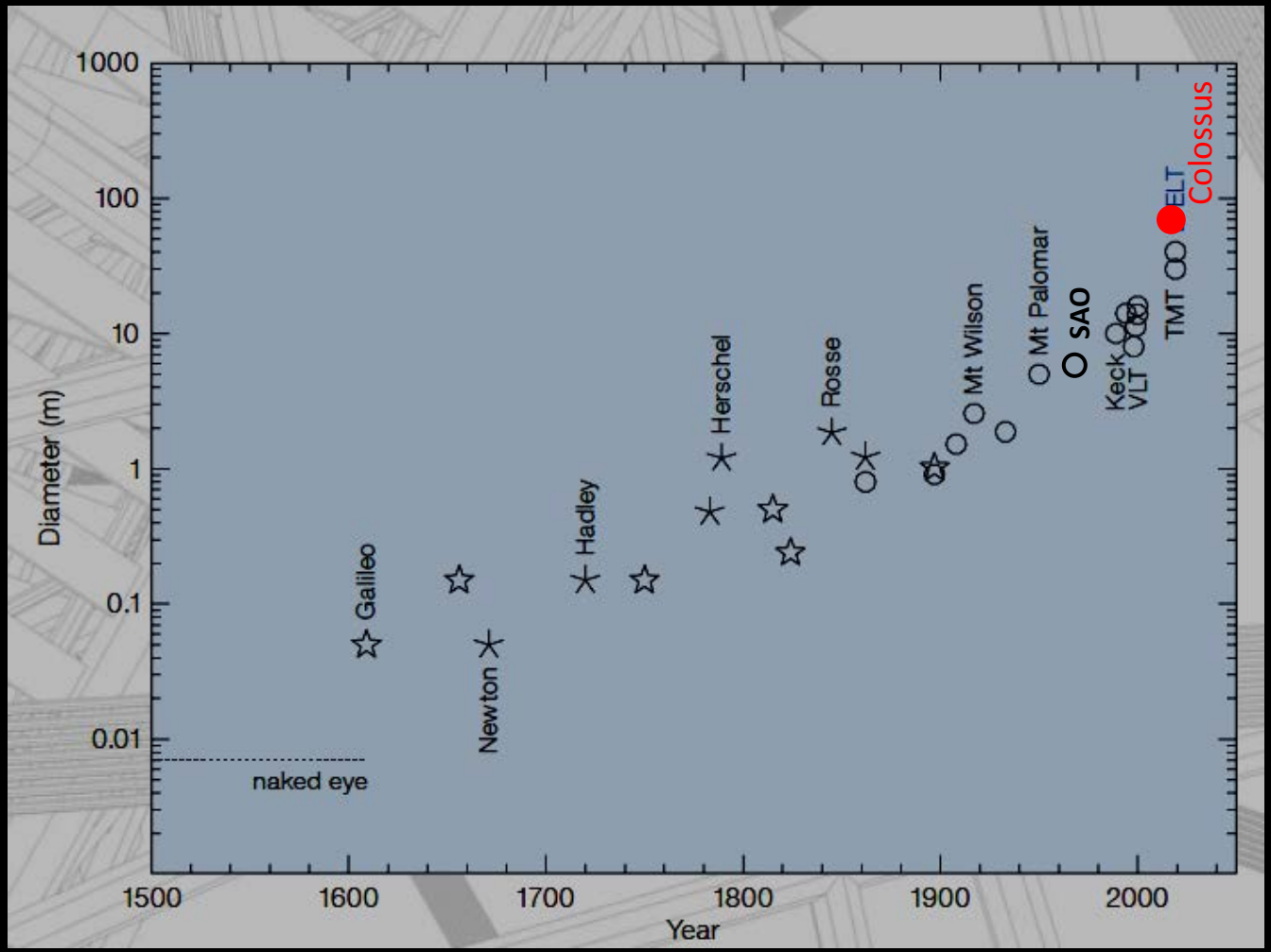
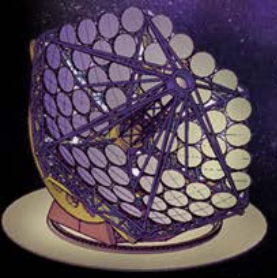
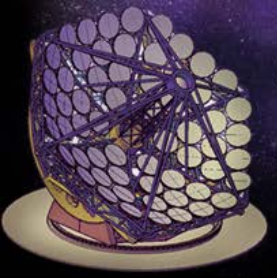
Telescope History





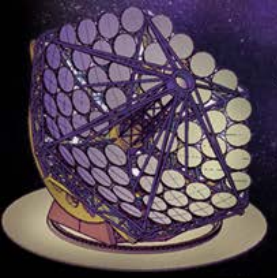
Science of TMT (30m)

- Fundamental physics and cosmology.
  - dark matter, dark energy, extreme objects., variation of fundamental constants
- The early Universe
  - cosmic reionization , first galaxies, IGM
- Galaxy formation and the intergalactic medium
- Extragalactic supermassive black holes
  - nearby galactic nuclei, beyond the local neighborhood, at very highh redshift
- Exploration of nearby galaxies
  - oldest stars in the Milky Way, isotope ratios
  - Local Group dwarf galaxies
  - Stellar astrophysics
  - star formation histories of nearby galaxies
- The formation of stars and planets
  - star formation, protoplanetary disks
- Exoplanets
  - Doppler detection, direct detection, planetary atmospheres
- Our Solar System
  - the outer Solar System
  - Jovian satellites



Science of E-ELT (39m)

- Exoplanets — Towards other Earths
- Fundamental Physics
- Black Holes
- Birth, Life and Death of Stars
- Stellar Content of Galaxies
- End of the Dark Ages — First Stars
- Seeds of Galaxies



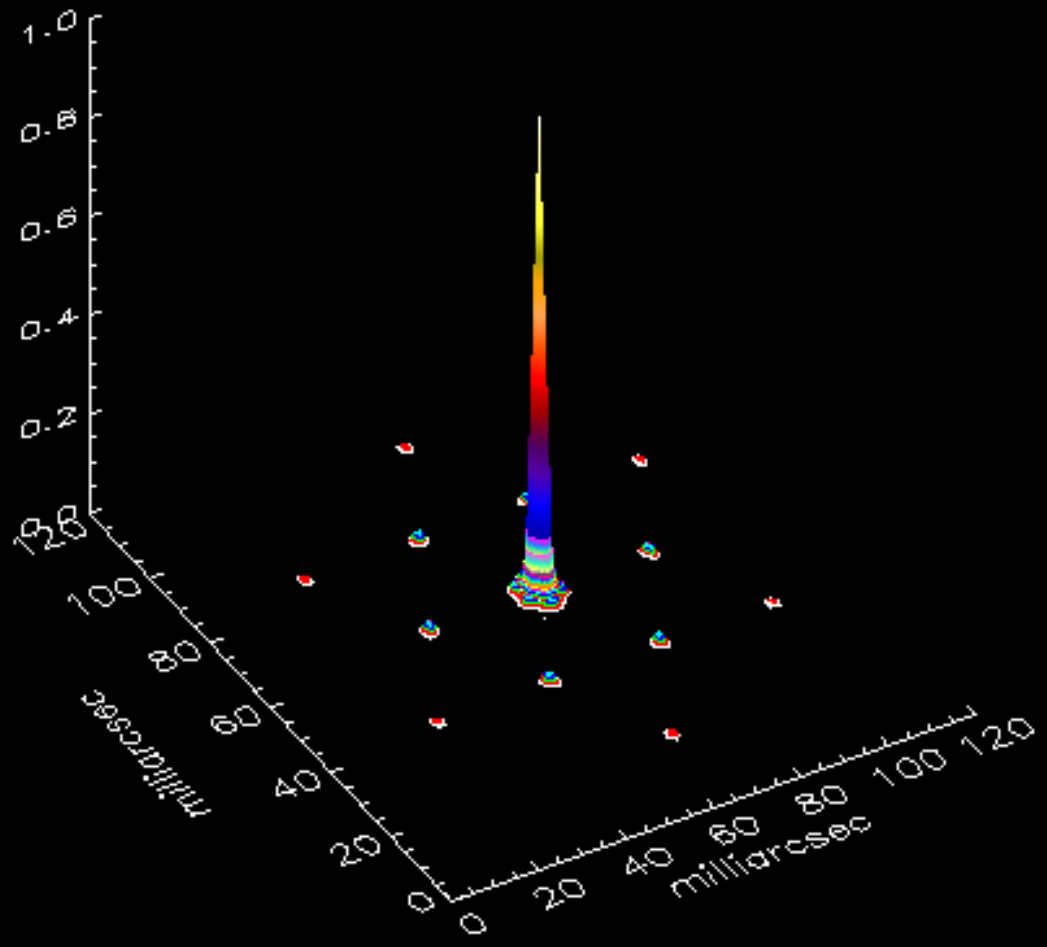
Science of Colossus (74m)

- Detecting habitable worlds
  - Extraterrestrial life
- Detecting extraterrestrial civilizations (Jeff)
  - Passive SETI
- Stars as Suns
  - Night-time solar physics
- Compact object environments
  - Black hole event horizon, QSOs, AGNs
- Monitoring Solar system colonization
  - Moon
- Near space environment
  - satellites, NEAs

Point Spread Function

- PSF of WLTs at 500nm
  - Colossus: 1.4 mas (60seg)
  - E-ELT: 2.6 mas (1000seg)
  - TMT: 3.4 mas (600seg)
  - GMT: 4.3 mas (7seg)

- Colossus advantages:
  - High resolution
  - High contrast
  - Large collecting area



Detecting habitable planets

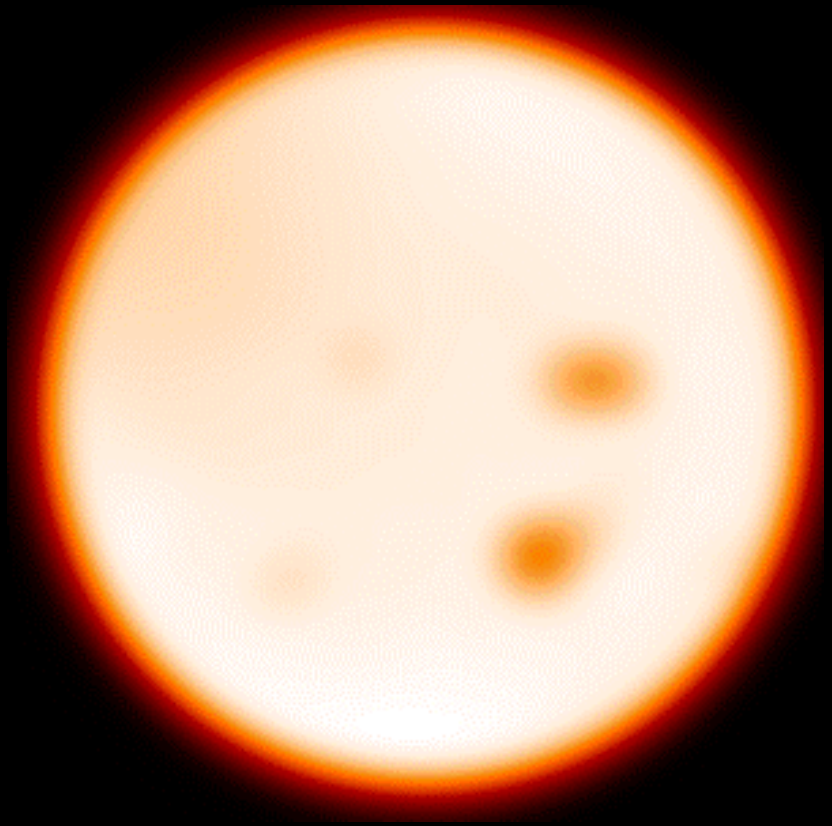
- Solar system at 50 ly (~13pc):

- Nearby planets in habitable zones
  - Detecting reflected light and thermal emission
  - Spectroscopy and spectropolarimetry of atmospheres and surfaces
  - Earth-like planets in HZ within 10pc

Stars as Suns: α Cen

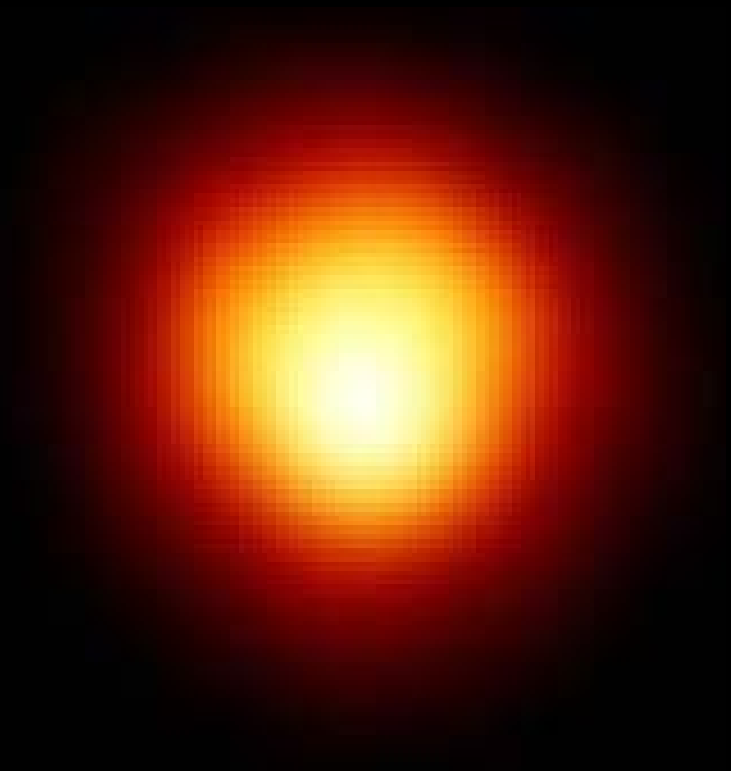
Sun (1AU, SOHO)

α Cen A (1.3pc, 8.5mas)

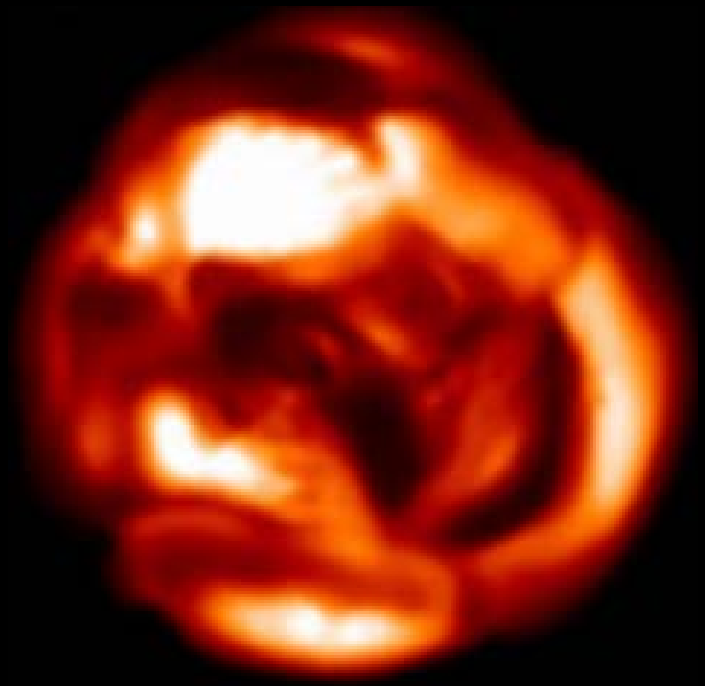


Stars as Suns: Betelgeuse

Hubble Space Telescope



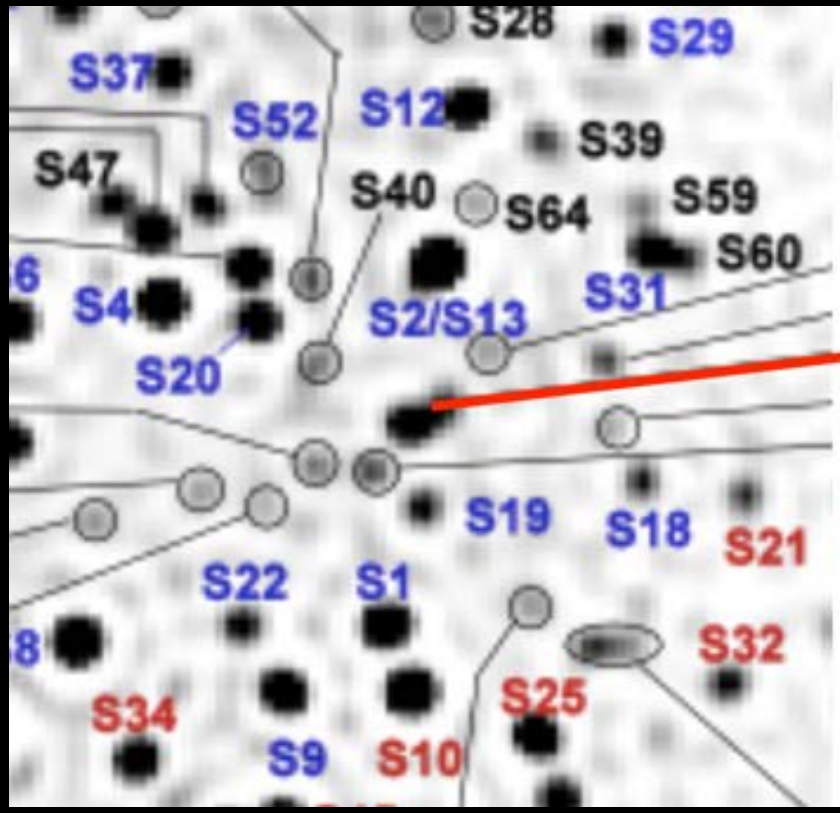
Colossus

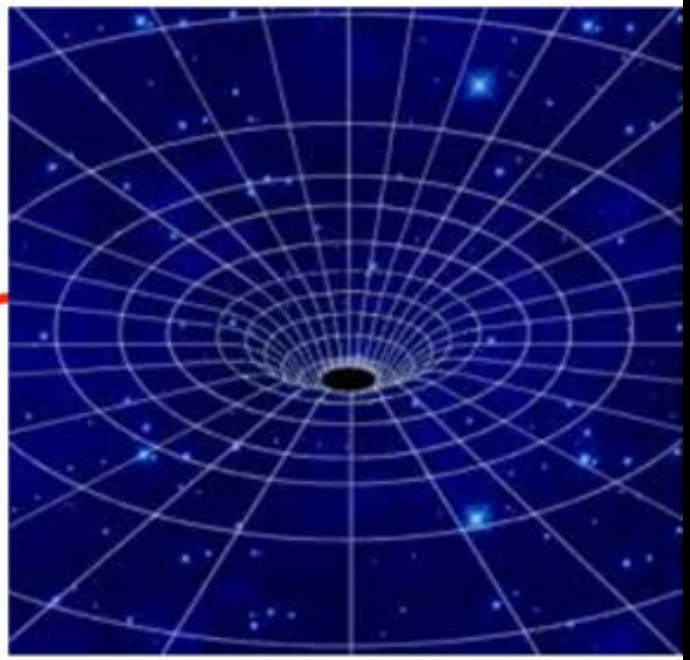


Simulations by Freytag (2002)

Black hole event horizon

- Galaxy BH: VLT 60mas, EH 0.01mas (also QSOs, AGNs)



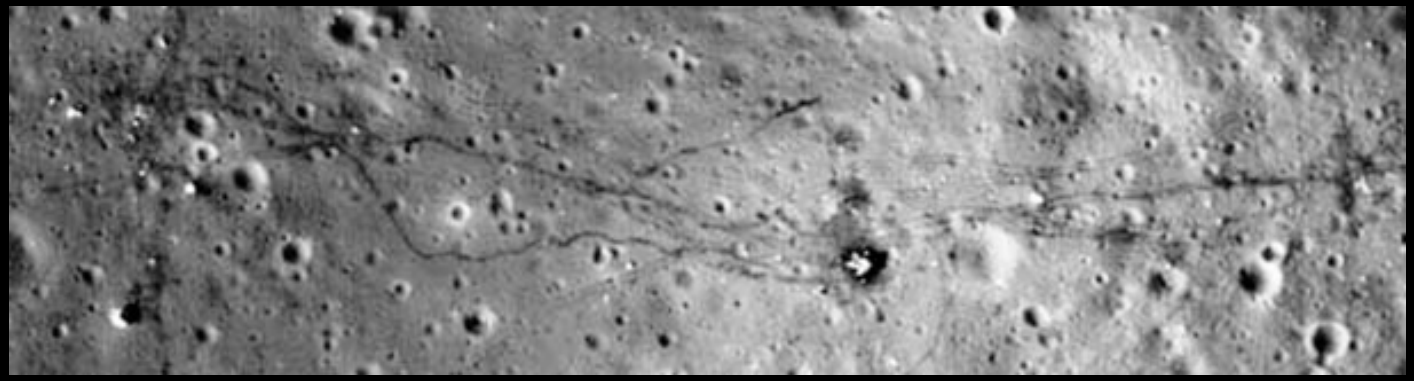


1000 mas
(Gillessen et al. 2008)

0.01 mas

Monitoring Moon colonization

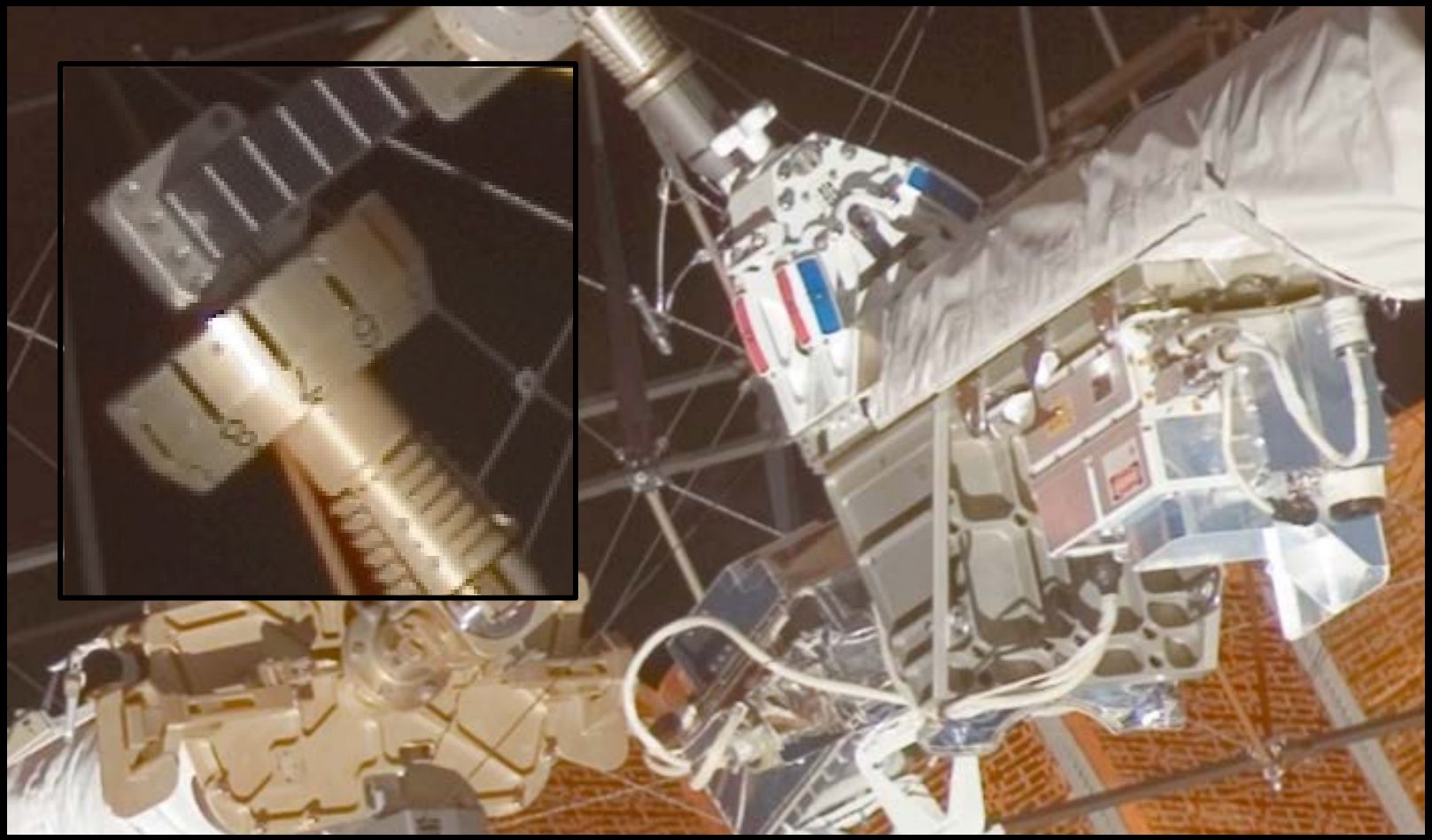
- Lunar Reconnaissance Orbiter Camera (NASA): 0.6m res

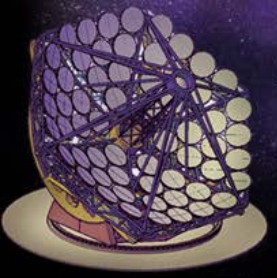


- Colossus: 2m res

Man-made objects in near space

- International Space Station (ISS): 2mm at 400km





Conclusions

- Colossus is an optimized telescope for high-contrast science
- Four areas where Colossus makes a revolution:
  - Near-Earth environment, including NEAs and PHAs
  - Inventory of near-solar (~10pc) stellar neighborhood (stars, exoplanets)
  - Inventory of civilizations in the solar neighborhood
  - Reveal(-ationary) views of compact cosmic environments (BH, QSO, AGN)